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Response of Gibberellins on Plant Growth and Yield Parameters in Lentil (*Lens culinaris* L.) under Rainfed Area of Uttarakhand

Devashish Singh Rawat[1*] and Siddharth Shankar Bhatt[2]
[1]Scholar, S. G. R. R. (P.G) College, Dehradun
[2]Assistant Professor, S. G. R. R. University, Dehradun
*Correspondent Email Id: devashish.singh119@gmail.com

ABSTRACT
Phytohormones plays an important and crucial role in enhancing production and productivity of agricultural crops. Lentil (Lens culinaris L.) is a major crop of Uttarakhand which not only enhances production but also seems to increase nutritive value to human diets. Gibberellins have nurtured yield and quality of produce with their tendency of changing the metabolism pattern of growth and development further enhancing the yield and productivity of plant. Gibberellins have not only enhanced theiryield but also affected quantitative characters. Growth parameters like plant height (46.50 cm), number of branches (11.20), number of leaves (15.50) and leaf area (26.50 cm^2) were highest with the spray GA$_3$@50 ppm. The data also indicated that the yield attributing parameter i.e., number of flowers per plant (48.67), number of pods per plant (44.20) and yield (13.20q/ha) were obtained highest with same treatment i.e., GA$_3$ @ 50 ppm.
Keywords: *GA3, Lentil, No. of pods, Plant height, Yield.*

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INTRODUCTION

Lentil (*Lens culinaris* L.) is an important rabi season pulse crop of the IndianSubcontinent, the Middle East, North America, North Africa and West Asia [5]. It is an old world legume andis probably one of the first plant species to be domesticated [1]. Lentil has the ability to grow underwater stress conditions and survive under high range of drought and cold [3];that are the main attributeswhich make this an important and unique crop [2]. Lentil (*Lens culinaris* L.) is a highly nutritious and reliable food source with complex carbohydrates, proteins, fiber, micronutrients such as iron and vitamins A and B. Its grains are high in sulfur-containing amino acids, lentil proteins can fulfill the daily essential amino acid requirements without the need for consuming animal proteins. It is an economical plant protein source that can be used to feed people in developing countries. Lentil also helps in atmospheric nitrogen fixation into the soil, thereby reducing the demand for nitrogenous fertilizers and the depletion of inorganic nitrogen from the soil. However, the croprequires some amount of nitrogen for early growth of the crop till the symbiosis becomes effective [10].

The term phytohormones cover the broad category of organic compounds other than nutrients. A large number of synthetic compounds exhibit phytohormones- like activity and marketed for commercial use, particularly, GA_3, Auxin etc. The impact of phytohormones in manipulating physiological processes in crop production include germination, vigor, nutrient uptake from soil, photosynthesis, respiration, partitioning of assimilate, growth

suppression, defoliation and postharvest ripening [6]. These are main factors affecting of lentil grain production. Time of gibberellin acidapplication affected pod width and length, weight of 100seeds, and seed yield, but not numbers of internodes, leaves, and branches. The highest seed yield was obtained when application occurredat flowering. There was a 21 per cent seed yield increase over controls whenapplication was at 42 days postemergence compared with a 61 per cent increasefor an application at flowering [8].

MATERIAL AND METHODS

The present investigation was done during the winter season of 2018-19 at Crop Research Centre, S. G. R. R. (PG) College, Dehradun, Uttarakhand, India. Field trial was carried out in sandy loam soil with neutral pH.The experiment was laid out in Randomized Block Design with seven treatmentswith three replications. The recommended dose of fertilizers applied according to farmer's practice *i.e.*, 25:100:60 kg N, P_2O_5 and K_2O/ha, respectively.Experiment included seven treatments*viz.*, T_1 (GA_3 @ 10ppm), T_2 (GA_3 @ 200ppm), T_3 (GA_3 @ 30ppm), T_4 (GA_3 @ 40ppm), T_5 (GA_3 @ 50ppm), T_6 (GA_3 @ 100ppm) and T_7 (Control).Lentil seed treated with Rhizobium. Lentil variety VL Masoor-129 wassown during second week of November, 2018 with 30× 20 cm spacing.For the data collection five plants were randomly selected from each plot. The growth parameters *viz.*, plant height (cm), number of branches, number of leaves and leaf area (cm^2) were recorded at 45 days after sowing.Yieldparameters *viz.,* number of flowers were recorded during flowering, whereas pods per plant and yield (q/ha) were recorded at the time of harvesting. The crop was harvested during last week of February, 2019. The data was subjected to analysis of variance (ANOVA) using method given by Panse and Sukhatme [9].

RESULTS AND DISCUSSION

The data (Table 1) indicates that plant growth parameters *viz.*, plant height, number of branches, number of leaves and leaf areawere recorded maximum (46.50 cm, 11.20, 153.33 and 26.50 cm^2, respectively) with the application of GA_3 at 50 ppm, whereas plant height, number of branches, number of leaves and leaf area were recorded minimum (40.40 cm, 8.20, 85.33 and 20.50 cm^2, respectively) under control *i.e.* without GA_3. Plant height increases with GA_3 application because GA_3 helps in cell elongation.Number of branches directly correlated with plant height and number of leaves also correlated with number of branches, hence all growth parameters were improved under GA_3 treatment [8]. Data also indicated that plant growth parameters increasing with GA_3 concentration at 50 ppm but GA_3 at 100 ppm showed less plant height as compared to GA_3 at 50 ppm.It may be due to the toxic effect of GA_3at higher concentration (100 ppm).

Table 1: Effect of GA_3 on growth and yield parameters in lentil

Parameters	Plant Height (cm)	Number of Branches	No. of Leaves per plant	Leaf Area (cm^2)	No. of flowers per plant	No. of Pods per plant	Yield (q/ha)
$GA_3$10ppm	42.10	9.30	93.33	20.02	40.33	36.20	10.80
GA_3 20ppm	43.10	9.50	120.37	20.50	44.67	39.00	11.10
GA_3 30ppm	44.20	10.10	133.33	20.40	45.00	40.50	11.50
GA_3 40ppm	45.60	10.90	136.67	21.60	46.67	42.20	12.10
GA_3 50ppm	46.50	11.20	153.33	26.50	48.67	44.20	13.20
$GA_3$100ppm	43.80	8.50	86.67	24.20	46.67	43.20	12.50
Control	40.40	8.20	85.33	20.50	40.33	35.50	10.20
CD at 0.05	0.23	0.45	19.33	1.25	0.67	1.85	1.54
SEM±	0.08	0.15	6.45	0.42	0.23	0.63	0.53
CV	6.24	11.52	13.50	13.24	12.67	11.02	11.98

Data presented in table1 shows that yield parameters *viz.*, number of flowers, number of pods and yield were obtained maximum (48.67, 44.20 and 13.20q/ha, respectively) with the application of GA_3 at 50 ppm, whereas number of flowers, number of pods and yield were minimum (40.33, 35.50 and 10.20q/ha, respectively) under control *i.e.* without GA_3. GA_3 helps in flowering, retention of flowers, seed size and pod length that's why the yield parameters maximum under GA_3 treatments [4, 8]. Data also indicated that plant growth

parameters increasing with GA_3 concentration at 50 ppm but GA_3 at 100 ppm showed less plant height as compared to GA_3 at 50 ppm. It may be due to the toxic effect of GA_3 at higher concentration (100 ppm).

CONCLUSION

Present investigation reveals that the application of GA_3 50 ppm gave better result in growth and yield of lentil.Higher concentration of GA_3 (100ppm) may be toxic to the lentil plant that's why the performance of lentil was comparatively inferior as compared to application of GA_3 (50ppm). Hence, according to present investigation we suggest that GA_3 at 50ppm is best for the agro-climatic conditions of Uttrakhand region.

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