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EFFECT OF GA_3 AND NAA ON GROWTH AND QUALITY OF GARDEN *PEA* (*PISUM SATIVUM* L.) CV. ARKEL

M. SINGH[1], S. A. JOHN[1], S. ROUT[2]* AND S. S. PATRA[2]

[1]Department of Biological Sciences,
Sam Higginbottom Institute of Agriculture Technology and Sciences, Allahabad - 211 007, Uttar Pradesh, INDIA
[2]School of Forestry and Environment,
Sam Higginbottom Institute of Agriculture Technology and Sciences, Allahabad - 211 007, Uttar Pradesh, INDIA
e-mail: sandeeprout1988@gmail.com

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***Corresponding author**

ABSTRACT

The experiment was conducted during rabi season 2014-2015 in pots at the Department of Biological Sciences, SHIATS, Allahabad to study the effect of GA_3 (50, 100, 150, 200 ppm) and NAA (15, 25, 35, 45 ppm) on Garden pea (*Pisum sativum* L.). The plant growth regulators were applied as foliar application at 15 and 45 days after sowing. Looking to the result, it was noticed that the morphological and yield characters showed significant increments with the foliar spray of 200 ppm gibberellic acid (GA_3) plant height (41 cm), number of leaves (36.6/ plant), number of branches (8.2/plant), flower at 50 DAS (8.2/plant), number of pods (14.7/plant), number of seed (8.5/pod), pod length (8.8 cm), 100 seed weight (24.8 g). The physiological character was significantly increase chlorophyll a (1.914 mg/g) and b (1.983mg/g), total chlorophyll (3.894 mg/g fresh weight) and caroteinod (3.293 mg/g fresh weight) and the quality character like protein (245 mg/g) and carbohydrate (643 mg/g) as compared to control. Therefore it may be concluded that foliar application of GA_3 at 200 ppm can be recommended to Garden pea grower for obtaining better growth and yield of Garden pea.

INTRODUCTION

Pea (*Pisum sativum* L.) is one of the most important leguminous crop with a life cycle of one year. It is a cool-season crop grown in many parts of the world. Pea contains approximately digestive protein (22.6%), carbohydrates (62.1%), fat (1.8%), minerals (calcium, iron etc.) and vitamins (riboflavin, thiamin's etc.) (Kent and Endres, 2003). Plant growth regulators play an important role in producing high value horticultural crops and increasing the yield (Emongor, 1997). To meet the increased demand for food grain of rapidly growing population, there are many yield boosting agronomic techniques like application of certain plant growth regulators which needs due attention. Now a day's plant growth regulators have been tried to increases the growth and ultimately yield. The application of GA_3 increased plant height, number of pods per plant, pod seed weight, yield per plot in garden pea (Pandey *et al.*, 2004; Chaurasiy *et al.*, 2014; Mulagund *et al.*, 2015). Garden pea was found to show a quick growth, higher yield and quality when treated plant growth regulators especially GA_3 and NAA (Kumar *et al.*, 2014). Keeping in view the above facts the present experiment was undertaken to find out the effect of appropriate concentration of GA_3 and NAA for better growth, yield and quality of Garden pea under the Allahabad climatic condition of Uttar Pradesh.

MATERIALS AND METHODS

The experiment was conducted at the Department of Biological Sciences, Sam Higginbottom Institute of Agriculture Technology & Sciences, Allahabad on Gardern pea (*Pisum sativum* L.) *CV.* Arkel during rabi season of 2014-2015. The experiment treatments consisted of plant growth regulators which were foliar sprayed twice at 15 and 45 days after sowing, with GA_3 (50, 100, 15, 200 ppm), NAA (15, 25, 35, 45 ppm) and a control. Data were recorded at 20, 40 and 60 days after sowing for growth measurements; plant height, branches number, leaves number and number of flowers at 50 DAS. For yield parameters Pods were collected at 65, 70 days after sowing for yield measurements (length of pod per plant, pods number per plant, seeds number per pod, 100 seeds weight). Biochemical analysis including protein, carbohydrates and Chlorophyll was determined according to Lichtenthaler and Wellburn (1983). Total soluble protein was determined in seeds (one gram dry weight) using the method of Lowry *et al.*, (1951). The soluble protein concentration was calculated from the standard curve according to Read and Northcote (1981). Total soluble carbohydrates were determined by Anthrone method. The data obtained from the experiment was statistically analysed by appropriate procedure to completely randomized design (CRD) as described by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

Effect of GA_3 and NAA on growth parameters of Garden pea

The result of the present experiment indicates that foliar application of GA_3 and NAA significantly increased the growth, yield and quality parameters of Garden Pea. Application of growth regulators significantly increased plant growth over

Table 1: Effect of GA_3 and NAA on growth parameters of Garden pea

S. No.	Treatments	Plant Height (cm)	No. of Branches/ plant	No. of Leaves/ plant	No. Flowers/ plant at 50 DAS	Length of pods/ plant (cm)	No. of pod/ plant	No. of seeds/ pod	100 seed weight (g)
1	Control	20.4	6.1	26.5	6.6	7.9	11.6	7.5	19.9
2	GA_3 @ 50 ppm	31.5	7.2	32.4	7.4	8.2	12.2	7.7	20.5
3	GA_3 @ 100 ppm	32.4	7.2	33.1	7.6	8.3	12.5	7.8	21.0
4	GA_3 @ 150 ppm	32.6	7.8	34.4	7.7	8.7	13.7	7.8	24.3
5	GA_3 @ 200 ppm	41.0	8.2	36.6	8.2	8.8	14.7	8.5	24.8
6	NAA @ 15 ppm	25.4	6.4	27.5	7.2	7.9	12.6	7.7	20.0
7	NAA @ 25 ppm	26.4	6.5	29.5	7.2	8.0	13.0	7.7	21.2
8	NAA @ 35 ppm	29.4	6.6	30.6	7.4	8.1	13.6	7.8	21.8
9	NAA @ 45 ppm	30.5	6.8	31.3	7.4	8.1	13.9	7.8	22.0
	C. D. (P = 0.05)	8.086	0.812	3.214	0.507	0.177	0.806	0.482	1.777

Table 2: Effect of GA_3 and NAA on quality parameters in Garden pea

S. No.	Treatments	Chl. a (mg/g)	Chl. b (mg/g)	Total chl. (mg/g)	Carotenoid (mg/g)	Total Protein (mg/g)	Total Carbohydrate (mg/g)
1	Control	1.660	0.744	2.404	1.903	209	584
2	GA_3 @ 50 ppm	1.814	1.101	2.195	1.513	219	614
3	GA_3 @ 100 ppm	1.760	1.389	3.149	2.903	226	622
4	GA_3 @ 150 ppm	1.820	1.830	3.650	3.123	240	637
5	GA_3 @ 200 ppm	1.914	1.983	3.894	3.293	245	643
6	NAA @ 15 ppm	1.783	1.814	3.597	3.001	215	601
7	NAA @ 25 ppm	1.753	1.626	3.379	2.789	210	612
8	NAA @ 35 ppm	1.878	1.582	3.426	2.932	224	617
9	NAA @ 45 ppm	1.840	1.629	3.469	3.112	226	624
	C. D. (P = 0.05)	0.133	0.143	0.276	0.020	13.08	0.130

the control. The data in Table 1 clearly indicated that when plants were sprayed with different concentration of GA_3 and NAA, the highest plant height (41.0 cm), number of branches per plant (8.2), number of leaves (36.6), number of flower at 50 DAS (7.2), length of pod per plants (8.8 cm), number of pod per plants (14.7), number of seeds per pod (8.5) and 100 seed weight (24.8 g) recorded in GA_3 at 200 ppm spraying followed by GA_3 at 150 ppm, 100 ppm, 50 ppm. In case of NAA spraying the highest plant height (30.5 cm), number of branches per plant (6.8), number of leaves (31.3), number of pod per plants (13.9) and 100 seed weight (22.0 g) recorded in NAA at 45 ppm. But in case of number of flower at 50 DAS (7.4), length of pod per plants (8.1cm), numbers of seeds per pod (7.8) were recorded in NAA at 45 ppm and NAA 35 ppm respectively. The superiority in the growth parameters of different treatments over the control due to the foliar application of GA_3 and NAA, the possible reason for the increase in the growth parameters was due to the physiological effects of auxins and gibberellins on growth parameters of the plants e.g. cell elongation and division, increase in photosynthetic activity, better food accumulation the similar result were reported by Deotale *et al.,* (1998) in soybean and obtained highest values for plant height, number of leaves per plant, number of branches per plant with 200 ppm GA_3, and number of flowers at 50 DAS is significant showed by GA_3 at 200 ppm followed by NAA at 45 ppm.

Data in Table 1 showed that application of growth regulators significantly increased yield parameters comparing with control and GA_3 at 200 ppm recorded the highest values for yield parameters. Application of GA_3 at 200 ppm showed significant increase in length of pod per plant, number of pod per plant, number of seed per pod, 100 seeds weight. The findings of the experiments are in one line with the observation of Estruch *et al*. (1989) who reported that growth regulators may function in sucrose assimilation. Pereto *et al*. (1988) are also reported that GA_3 are particularly important in development. Similar records were also found by Natesh *et al*. (2005) in Chilli.

Effect of GA_3 and NAA on quality parameters

The result in Table 2 showed significant variation in the treatments from the control due the effect of GA_3 and NAA on quality parameters. Maximum Chl. a (1.914 mg/g), Chl. b (1.983 mg/g), total chlorophyll concentration (3.650 mg/g) and carotenoid (3.293 mg/g), Total protein (245 mg/g), Total carbohydrate (643 mg/g) in the GA_3 at 200 ppm. The result was in agreement with Nejad *et al*. (2013) who suggested that foliar application of GA_3 increased Chl a, and Chl b and other pigments in tomato. Significant increased in the total protein were noticed with GA_3 at 200 ppm .The result were in agreement with Mishrinky *et al*. (1990) in Peas. This may be due to the reduction of lipid perodixation and improvement of the total soluble protein. In case total soluble carbohydrates concentration were found to be in agreement Vadigeri *et al*., (2001) as reported in Cucumber. GA_3 has simulation effect on the carbohydrate in Garden Pea. Maximum Chl. a (1.878 mg/g) were obtained in NAA 35 ppm, Chl. b (1.62 9mg/g), total chlorophyll concentration (mg/g) and carotenoid (3.112 mg/g), Total protein (226mg/g), Total carbohydrate (624 mg/g)

were resulted in NAA at 45 ppm. This may be due to greater photosynthesis and better growth. Similar trend were also observed by Kumar *et al.* (2014). These observation are also in close conformity with the report of Doijode, (1977).

From the present investigation in was concluded that the foliar application of GA_3 at 200 ppm showed significant effect on growth and quality parameters on the Garden Pea under Allahabad climatic condition, Uttar Pradesh

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