



EFFECT OF PLANT GROWTH REGULATORS ON GROWTH, YIELD AND YIELD ATTRIBUTES OF FRENCH BEAN (*Phaseolus vulgaris* L.) CV. ARKA KOMAL

D. RAJANI*, A. MANOHAR RAO, D. SRI HARI AND SURESH KUMAR KARNAM

Assistant professor, Dept. of Horticulture, Agricultural College, Palem, PJTSAU, Telangana

Date of Receipt: 06-10-2016

ABSTRACT

Date of Acceptance: 12-12-2016

A field experiment was conducted to study the effect of plant growth regulators on growth, flowering, yield and quality of French bean cv. Arka Komal at student's farm, College of Agriculture, Rajendranagar, Telangana. Different concentrations of the plant growth regulators viz., GA, NAA and CCC were sprayed at 20 and 40 days after sowing. The results showed that foliar spray of GA₃ @ 250 ppm increased number of branches, number of leaves, intermodal length and leaf area index resulting in increased number of pods per plant, pod length, weight of 10 pods which significantly increased the yield/plant and yield/ha.

KEYWORDS: French bean, GA₃, NAA, CCC

INTRODUCTION

French bean (*Phaseolus vulgaris* L.) is an important, highly nutritive leguminous vegetable crop grown in India. Despite high yield potential, the actual yields of French bean is low because of many physiological reasons such as reduced photosynthesis, bud abscission, bloom drop etc. (Kay, 1979). The use of plant growth promoters activate growth along the longitudinal axis, increase number of leaves, leaf area which subsequently contributes towards higher plant production and productivity. Plant growth retarding substances not only decreases plant height but also facilitates branching, early flowering and yield. The present investigation was therefore undertaken to determine the effect of plant growth regulators on growth, yield and yield attributes of French bean cv. Arka Komal.

MATERIALS AND METHODS

The experiment was conducted at Students farm, College of Agriculture, Rajendranagar, Telangana during October to January 2010, in Randomized Block Design with three replications. The French bean variety selected for the study was Arka Komal. The seeds were sown at a depth of five cm and spaced 50 cm between the rows and 30 cm within the row. The experiment comprised of 10 treatments including water spray as control. The treatments were Gibberellic Acid (GA₃) @150 ppm, 200 ppm and 250 ppm, Naphthelene Acetic Acid (NAA) @10 ppm, 15 ppm and 20 ppm and Cycocel (CCC) @250 ppm,

300 ppm and 350 ppm. Different concentrations of the plant growth regulators were sprayed at 20 and 40 days after sowing. The observations on growth, yield and yield attributes were recorded from five randomly selected plants. The data was statistically analyzed as per the method described by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

Foliar spray of GA₃ 250 ppm recorded more plant height (55.66 cm) compared to its lower concentrations as well as NAA, Cycocel and control (water spray) (Table 1). The increase in plant height could be attributed to enhancement of cell division and cell elongation in the growing portion of plants (Pandita *et al.*, 1980). Minimum plant height of 26.66 cm was recorded in treatment with Cycocel 350 ppm. The reduced plant height could be due to reduction in cell expansion and synthesis of diffusible endogenous growth substances (Cathey, 1964). These results are in conformity with the results reported by Kokare *et al.* (2006) in okra, Rajendra Prasad and Srihari (2008) in okra, Sharma and Lashkari (2009) in cluster bean.

Maximum number of branches per plant (15.08) was recorded with foliar spray of GA₃ 250 ppm which was on par with GA₃ 200 ppm (14.00) (Table 1), which could be due to rapid cell division and cell elongation in growing portion of plants and increased uptake of nutrients which might have resulted in maximum plant height, leading to the production of more number of branches. Minimum

*Corresponding author, E-mail: rajani.horti@gmail.com

Effect of plant growth regulators on french bean yield attributes

Table 1. Effect of plant growth regulators on growth attributes of French bean cv. Arka Komal

Treatments	Plant height (cm)	Number of branches per plant	Number of leaves per plant	Leaf area Index
GA ₃ 150 ppm	40.66	13.00	38.00	0.701
GA ₃ 200 ppm	53.16	14.00	42.00	0.738
GA ₃ 250 ppm	55.66	15.08	46.50	0.790
NAA 10 ppm	28.50	10.00	27.00	0.604
NAA 15 ppm	33.00	10.54	29.33	0.616
NAA 20 ppm	33.25	12.68	36.00	0.690
CCC 250 ppm	31.00	9.50	27.00	0.520
CCC 300 ppm	30.00	11.62	32.00	0.500
CCC 350 ppm	26.66	11.75	34.00	0.564
Control (water spray)	31.75	9.99	30.00	0.410
SE(m)	1.50	0.68	1.58	0.003
CD (P=0.05)	4.56	2.03	4.74	0.010

Table 2. Effect of plant growth regulators on yield and yield attributes of French bean cv. Arka Komal

Treatments	Number of pods/plant	Pod length (cm)	Pod diameter (cm)	Weight of 10 pods (g)	Yield per plant (g)	Yield per ha (q)
GA ₃ 150 ppm	12.31	11.20	0.98	48.83	59.77	33.44
GA ₃ 200 ppm	12.23	11.43	1.02	49.56	61.41	35.54
GA ₃ 250 ppm	12.53	11.68	1.06	52.33	67.21	40.44
NAA 10 ppm	10.72	10.26	0.96	43.06	45.90	31.96
NAA 15 ppm	11.91	10.53	0.98	46.20	54.74	32.18
NAA 20 ppm	12.01	10.85	1.04	47.16	57.46	34.44
CCC 250 ppm	10.51	10.30	0.98	35.26	37.50	28.18
CCC 300 ppm	11.46	9.60	1.04	36.23	41.96	30.10
CCC 350 ppm	11.91	9.41	1.07	42.00	49.10	33.29
Control (water spray)	10.02	10.37	1.02	37.33	37.18	28.10
SE(m)	0.08	0.14	0.015	1.65	0.50	1.79
CD (P=0.05)	0.26	0.43	0.046	4.95	1.52	5.37

number of branches (9.50) was recorded in treatment with Cycocel 250 ppm.

The highest number of leaves per plant (46.50) was recorded in treatment with GA₃ 250 ppm. Minimum number of leaves per plant was recorded in treatment with NAA 10 ppm and Cycocel 25 ppm (27.00) (Table 1). The increase in number of leaves by the application of GA₃ could be due to delayed senescence that could be attributed to mobilization of metabolites to the leaves. This may be the reason of maintenance of higher number of leaves up to the maturity of the plant. These results are in conformity with the results reported by Kokare *et al.* (2006) in okra, Sharma and Lashkari (2009) in clusterbean.

Foliar spray of GA₃ 250 ppm recorded maximum leaf area index (0.790) (Table 1) and lower leaf area index (0.410) was recorded with control (water spray). These results are in conformity with the results obtained by Nawalagatti *et al.* (2008) in French bean.

The maximum number of pods per plant (12.53) was obtained with GA₃ 250 ppm which was on par with GA₃ 200 ppm (12.31) (Table 2). This might be due to the fact that GA₃ at higher concentrations recorded increased number of branches and fruiting points, which lead to better utilization of sunlight and higher current photosynthesis which resulted developing more number of pods per plant. Among the treatments studied control had recorded minimum number of pods per plant (10.02).

Maximum pod length (11.68 cm) was recorded in treatment with GA₃ 250 ppm which was on par with GA₃ 200 ppm (11.43 cm) (Table 2). Application of GA₃ at higher concentrations might have promoted rapid cell division and increased elongation of individual cell that resulted in increase in pod length. These results are in conformity with Pandey *et al.* (2004) in garden pea, Rai *et al.* (2004) in French bean and Panchbhai *et al.* (2005) in spine gourd. Foliar spray of Cycocel 350 ppm recorded minimum pod length (9.41 cm) (Table 2).

Maximum pod diameter (1.07 cm) was recorded in treatment with Cycocel 350 ppm. Lesser pod diameter (0.96 cm) was recorded in treatment with NAA 10 ppm (Table 2). The increase in pod diameter by the application of Cycocel might be due to retarded cell elongation. These findings are in conformity with Kokare *et al.* (2006) in okra.

Among the different plant growth regulators treatment with GA₃ 250 ppm recorded maximum weight of 10 pods (52.33 g) (Table 2). This might be due to increased size of photosynthetic apparatus in terms of leaf area and leaf area index which increased assimilation rate contributing for better pod weight. Lower weight of 10 pods (35.26 g) was recorded in treatment with Cycocel 250 ppm.

Application of GA₃ 250 ppm recorded significantly increased yield/plant (67.21 g/plant) and yield/ha (40.44 q/ha) compared to its lower concentrations, other plant growth regulators and control (yield/plant (37.18 g/plant) and yield/ha (28.10 q/ha)) (Table 2). This significant improvement in yield could be due to increased net photosynthetic rate by increase in number of branches, number of leaves and leaf area index which might have resulted in increased number of pods, pod length and pod diameter resulting in increased pod yield per plant and pod yield per ha. Similar results were reported by Medhi (2000) in French bean, Pandey *et al.* (2004) in garden pea, Nawalagatti *et al.* (2008) in French bean. Whereas control (water spray) had recorded lower yield/plant (37.18 g/plant) and yield/ha (28.10 g/ha).

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Effect of plant grown regulators on french bean yield attributes

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