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EFFECT OF PINCHING AND PLANT GROWTH REGULATORS ON GROWTH AND FLOWERING IN FENUGREEK (*TRIGONELLA FOENUM-GRAECUM* L.)

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Abstract

The effect of pinching and plant growth regulators on growth and flowering of fenugreek cv. APHU Methi-1 was studied during rabi season of 2013-14 at Vegetable Research Station, Rajendranagar, Hyderabad, India. The treatments consisted of pinching as one factor with four pinching treatments *viz*., no pinching (P_0), single pinching at 25 DAS (P_1), single pinching at 45 DAS (P_2), double pinching at 25 and 45 DAS (P_3) and application of plant growth regulators as another factor containing five treatments *viz*., control (water spray) (G_0), 50 ppm GA_3 (G_1), 75 ppm GA_3 (G_2), 50 ppm NAA (G_3) and 75 ppm NAA (G_4). Significantly maximum plant height and early flower initiation were recorded with no pinching (P_0) treatment. Single pinching at 25 DAS (P_1) recorded significantly maximum number of branches and number of flowers. Maximum fresh weight and dry weight at 30 DAS were observed with single pinching at 45 DAS (P_2). At 60 and 90 DAS maximum fresh and dry weights were observed with double pinching at 25 and 45 DAS (P_3). Among the growth regulators, foliar spraying of GA_3 50 ppm (G_1) thrice (25, 45 and 65 DAS) resulted in best performance of the parameters like plant height, number of branches, fresh weight, dry weight and number of flowersper plant. Early flower initiation was observed with application of GA_3 75 ppm (G_2). Among the interactions between pinching and plant growth regulators, the treatment combination of no pinching with application of GA_3 50 ppm (P_0G_1) resulted in maximum plant height. Maximum number of branches and number of flowers were recorded with single pinching at 25 DAS and application of GA_3 50 ppm (P_1G_1).

Key words: Fenugreek, pinching, GA_3, NAA, growth, flowering.

Introduction

Fenugreek (*Trigonella foenum-graecum* L.) is a commercially important annual spice crop grown almost in every part of the country. It is used as condiment, leafy vegetable, seed, green fodder and green manure crop. It is rich in proteins, iron, calcium, vitamin A, B_2 and C. Seeds have strong aroma and are bitter in taste. It reduces blood cholesterol and blood sugar levels. It adds flavor and also act as a nutritive food. The value added products of fenugreek such as fenugreek powder and oleoresins are exported. Inspite of great utility and importance as spice, leafy vegetable, medicinal and cosmetic value, a little attention has been paid to evolve suitable package of practices for profitable cultivation of fenugreek. Cutting management or pinching practice greatly influences the growth and yield attributes in fenugreek (Baboo, 1997). Cutting of herbage at early stages of growth induces uniformity in growth, flowering and seed setting in fenugreek (Pandita and Randhawa, 1994). Research findings showed that growth regulators also play an important role in increasing the growth and productivity of many crops. The role of plant growth regulators in enhancing the production and quality of crops has long been recognized and now this low cost technology has emerged as a boon for enhancing the production at an unprecedented rate. Gibberellins (GA_3) have been used in increasing stalk length and vegetative growth, flower initiation, increasing fruit size, hastening maturity and improving fruit quality in horticultural crops. Gibberellins play an important role in enhancing the growth and flowering in fenugreek (Pariari *et al*., 2007). The role of NAA in enhancing the growth and yield attributes in fenugreek has been reported by Alagukannan and Vijay Kumar (1999). Keeping in view the importance of plant growth regulators and pinching in improving the growth and yield of fenugreek, the present investigation was undertaken.

Materials and Methods

The present study was conducted at Vegetable Research Station, Rajendranagar, Hyderabad (India) during *rabi* season of 2013-14 with fenugreek cv. APHU Methi-1. The experiment was carried out with 3 replications in a factorial Randomized Block Design and consisted of four pinching treatments *viz*., no pinching (P_0), single pinching at 25 days after sowing (P_1), single pinching at 45 days after sowing (P_2), double pinching at 25 and 45 days after sowing (P_3) and five plant growth regulator treatments *viz*., control (water spray) (G_0), 50 ppm GA_3 (G_1), 75 ppm GA_3 (G_2), 50 ppm NAA (G_3) and 75 ppm NAA (G_4). The seeds were line sown manually in rows at a spacing of 30 cm and the plants were thinned to 10 cm at 20 DAS. Pinching was done manually without causing damage to the plant parts. The plant growth regulators prepared in desired stock solution were sprayed thrice at 25, 45 and 65 DAS. A uniform basal dose of 25 kg N/ha, 20 kg P_2O_5/ha and 20 kg K_2O/ha was applied in the form of urea, single super phosphate and muriate of potash, respectively. Need based plant protection measures were taken. The data was recorded on growth and flowering parameters *viz*., plant height (cm), number of branches per plant and fresh and dry weight per plant (g) (at 30,60 and 90 DAS), number of days taken to flower initiation and number of flowers per plant.

Results and Discussion

The data recorded on plant height (cm) at 30, 60 and 60 DAS (table 1 revealed that at 30 DAS, significantly maximum plant height (13.95 cm) was recorded with no pinching (P_0) and was found to be on par with pinching at 45 DAS (P_2), which recorded 13.67 cm. The minimum plant height (12.05 cm) was recorded with double pinching at 25 and 45 DAS (P_3). Significantly maximum plant height (13.73 cm) was recorded with GA_3 50 ppm (G_1) and was found to be on par with GA_3 75 ppm (G_2), which recorded 13.36 cm and NAA 50 ppm (G_3), which recorded 13.34 cm. The minimum plant height (12.55 cm) was recorded with control (G_0) and was on par with application of NAA 75 ppm (G_4), which recorded 13.10 cm. The data on interaction between pinching and plant growth regulators was found to be non significant. At 60 DAS, significantly maximum plant height (36.05 cm) was recorded with no pinching (P_0). The minimum plant height (31.17 cm) was recorded with double pinching at 25 and 45 DAS (P_3) and was on par with pinching at 45 DAS (P_2), which recorded 32.67 cm. Among growth regulators treatments, significantly maximum plant height (35.38 cm) was recorded with GA_3 50 ppm (G_1) and was found to be on par with NAA 50 ppm (G_3), which recorded 34.07 cm and GA_3 75 ppm (G_2), which recorded 33.66 cm. The minimum plant height (31.76 cm) was recorded with control (G_0) and was on par with NAA 75 ppm (G_4), which recorded 32.62 cm. The data on interaction between pinching and plant growth regulators was found to be non significant. The data on plant height of fenugreek at 90 DAS were found to be significantly influenced by pinching effects and growth regulator treatments. Significantly maximum plant height (47.21 cm) was recorded with no pinching (P_0). The minimum plant height (42.43 cm) was recorded with double pinching at 25 and 45 DAS (P_3). Significantly maximum plant height (46.39 cm) was recorded with GA_3 50 ppm (G_1). The minimum plant height (42.70 cm) was recorded with control (G0) and was on par with NAA 75 ppm (G_4), which recorded 43.52 cm. The data on interaction between pinching and plant growth regulators on plant height at 90 DAS were found to be significant. The treatment combination of no pinching with GA_3 50 ppm (P_0G_1) recorded maximum plant height (50.60 cm) and was found to be on par with combination of no pinching and NAA 50 ppm (P_0G_3) which recorded 48.88 cm. Minimum plant height (41.64 cm) was recorded with treatment combination of double pinching at 25 and 45 DAS with control (P_3G_0). It clearly indicates that the plant height was considerably decreased with increased number of pinching treatments, which could be due to suppressed root and shoot growth. This might also be due to the fact that as there was no pinching shock received, plants continued their vegetative growth using its stored food material which otherwise could be lost by successive pinching treatments. These findings are in agreement with the findings of Datta *et al*. (2005) and Kumar and Singh (2007) in fenugreek. The plant height was increased with no pinching and the present result is in line with the findings of Vasudevan *et al*. (2008) in fenugreek. Overall improvement in growth with the application of plant growth regulators could be ascribed to its pivotal role in several physiological and biochemical processes which are of vital importance for growth and development of the plant. The promotion of growth due to GA_3 applications has been attributed to increase plasticity of the cell wall followed by hydrolysis of starch to sugars which lowers the water potential of cell, resulting in the entry of water into the cell causing elongation. These osmotic driven responses under the influence of gibberellins might have attributed to increase in photosynthetic activity, accelerated translocation and efficiency of utilizing photosynthetic products, thus resulting in increased cell elongation and rapid cell division in the growing portion. The result is supported by Gour *et al*. (2009) in fenugreek and Singh *et al*. (2012) in coriander.

The data recorded on number of branches of fenugreek at different stages of plant growth is presented in table 2. At 30 DAS, maximum number of branches per plant (4.17) was recorded with pinching at 25 DAS (P_1) and was found to be on par with double pinching at 25 and 45 DAS (P_3), which recorded 4.16 and pinching at 45 DAS (P_2), which recorded 4.05. The minimum number of branches per plant (3.70) was recorded with no pinching (P_0). Significantly maximum number of branches per plant (4.16) was recorded with GA_3 50 ppm (G_1) and was found to be on par with GA_3 75 ppm (G_2), which recorded 4.06 and NAA 50 ppm (G_3), which recorded 4.03. The minimum number of branches per plant (3.88) was recorded with control (G_0) and was on par with NAA 75 ppm (G_4), which recorded 3.96 and GA_3 75 ppm (G_3), which recorded 4.03. The data on interaction between pinching and plant growth regulators was found to be non significant. At 60 DAS, significantly maximum number of branches per plant (6.30) was recorded with pinching at 25 DAS (P_1) and was found to be on par with double pinching at 25 and 45 DAS (P_3) which recorded 6.28 and pinching at 45 DAS (P_2), which recorded 6.21. The minimum number of branches per plant (5.70) was recorded with no pinching (P_0). Significantly maximum number of branches per plant (6.51) was recorded with GA_3 50 ppm (G_1). The minimum number of branches per plant (5.83) was recorded with control (G_0). The treatment combination of pinching at 25 DAS with GA_3 50 ppm (P_1G_1) had recorded maximum number of branches per plant (6.93) and was found to be on par with pinching at 45 DAS with GA_3 50 ppm (P_2G_1) which recorded 6.80. Minimum number of branches (5.60) was recorded with treatment combination of no pinching with control (P_0G_0) and no pinching with NAA 75 ppm (P_0G_4) and was found to be on par with no pinching with GA_3 75 ppm (P_0G_2), which recorded 5.73, no pinching with GA_3 50 ppm (P_0G_1), which recorded 5.80, no pinching with NAA 50 ppm (P_0G_3), which recorded 5.80, pinching at 25 DAS with control (P_1G_0) which recorded 5.86 and pinching at 45 DAS with control (P_2G_0), which recorded 5.86. Significantly maximum number of branches per plant (6.33) at 90 DAS was recorded with pinching at 25 DAS (P_1) and was found to be on par with double pinching at 25 and 45 DAS (P_3), which recorded 6.30 and pinching at 45 DAS (P_2), which recorded 6.26. The minimum number of branches per plant (5.71) was recorded with no pinching (P_0). Significantly maximum number of branches per plant (6.52) was recorded with GA_3 50 ppm (G_1). The minimum number of branches per plant (5.85) was recorded with control (G_0). Among the interactions, the treatment combination of pinching at 25 DAS with GA_3 50 ppm (P_1G_1) had recorded maximum number of branches per plant (6.97) and was on par (6.80) with pinching at 45 DAS with GA_3 50 ppm (P_2G_1). Minimum number of branches (5.60) was recorded with treatment combination of no pinching with control (P_0G_0) and no pinching with NAA 75 ppm (P_0G_4). The data clearly indicated that the number of branches increased up to single pinching (cutting) and decreased in subsequent pinchings. This may be due to pinching effect of apical buds, which resulted in production of more branches and restriction to vertical growth initially on account of effective translocation of hormones, particularly auxins which are being diverted to the potential and tertiary shoot buds which in normal conditions remain dormant. Number of branches decreased with increase in the age of plant and cutting treatments. Activating the lateral dormant buds by arresting the terminal growth through pinching of apical bud would have facilitated the significant increase in number of branches. These results are in conformity with Tehlan and Thakral (2008) in fenugreek. In the present experiment, plants treated with plant growth regulators resulted in more number of branches per plant that could be attributed to enhanced physiological activities. GA_3 50 ppm recorded significantly maximum plant height. The increase in vegetative growth might be due to stimulation of cell division and cell elongation, while increasing plasticity of cell wall and formation of energy rich phosphates (Salisbury and Ross, 1992).

The data recorded on fresh weight of fenugreek as influenced by pinching, plant growth regulators and their interaction at different stages of plant growth is presented in table 3. At 30 DAS significantly maximum fresh weight per plant (3.16 g) was recorded with pinching at 45 DAS (P_2). The minimum fresh weight per plant (2.86 g) was recorded with double pinching at 25 and 45 DAS (P_3) and was found to be on par with pinching at 25 DAS (P_1) which recorded 2.90 g. GA3 50 ppm (G_1) recorded significantly maximum fresh weight per plant (3.16 g). Minimum fresh weight per plant (2.88 g) was recorded with control (G_0) and was on par (2.90 g) with NAA 75 ppm (G_4). The interaction between pinching and plant growth regulators was found to be non significant. At 60 DAS, significantly maximum fresh weight per plant (36.95 g) was recorded with double pinching at 25 and 45 DAS (P_3) and was found to be on par with pinching at 25 DAS (P_1), which recorded 36.71 g. The minimum fresh weight per plant (25.86 g) was recorded with no pinching (P_0). The data was found to be non significant due to plant growth regulators and interaction between pinching and plant growth regulators. At 90 DAS, maximum fresh weight per plant (95.69 g) was recorded with double

Table 1: Effect of pinching and plant growth regulators on plant height (cm) at 30, 60 and 90 days after sowing (DAS) in fenugreek cv. APHU Methi-1.

Treatments	30 DAS						60 DAS						90 DAS					
	G_0	G_1	G_2	G_3	G_4	Mean	G_0	G_1	G_2	G_3	G_4	Mean	G_0	G_1	G_2	G_3	G_4	Mean
P_0	13.82	14.08	14.03	13.98	13.87	13.95	23.39	28.01	26.77	27.20	24.90	26.05	44.74	50.60	46.93	48.88	44.91	47.21
P_1	11.39	13.62	13.02	13.02	12.65	12.74	21.83	26.98	24.30	24.44	22.91	24.09	42.40	46.40	43.53	44.08	43.78	44.04
P_2	12.94	13.96	13.87	13.84	13.74	13.67	21.75	23.72	22.44	23.08	22.37	22.67	42.03	45.14	43.38	44.02	43.22	43.56
P_3	12.06	13.28	12.54	12.53	12.12	12.05	20.07	22.80	21.15	21.55	20.30	21.17	41.64	43.42	42.24	42.66	42.17	42.43
Mean	12.55	13.73	13.36	13.34	13.10		21.76	25.38	23.66	24.07	22.62		42.70	46.39	44.02	44.91	43.52	
	P	**G**	**P×G**				**P**	**G**	**P×G**				**P**	**G**	**P×G**			
S.Em±	0.17	0.19	0.39				0.55	0.62	1.23				0.37	0.42	0.83			
CD 5%	0.50	0.56	NS				1.58	1.76	NS				1.07	1.20	2.40			

P_0: No pinching
P_1: Single pinching at 25 DAS
P_2: Single pinching at 45 DAS
P_3: Double pinching at 25 and 45 DAS

G_0: Control (Water spray)
G_1: GA_3 50 ppm
G_2: GA_3 75 ppm
G_3: NAA 50 ppm
G_4: NAA 75 ppm

Table 2 : Effect of pinching and plant growth regulators on number of branches per plant at 30, 60 and 90 days after sowing (DAS) in fenugreek cv. APHU Methi-1.

Treatments	30 DAS						60 DAS						90 DAS					
	G_0	G_1	G_2	G_3	G_4	Mean	G_0	G_1	G_2	G_3	G_4	Mean	G_0	G_1	G_2	G_3	G_4	Mean
P_0	3.60	3.66	3.80	3.80	3.66	3.70	5.60	5.80	5.73	5.80	5.60	5.70	5.60	5.80	5.77	5.80	5.60	5.71
P_1	4.00	4.40	4.13	4.20	4.13	4.17	5.86	6.93	6.53	6.26	5.93	6.30	5.95	6.97	6.53	6.28	5.93	6.33
P_2	3.86	4.26	4.20	4.00	3.93	4.05	5.86	6.80	6.20	6.13	6.06	6.21	5.86	6.80	6.20	6.14	6.3	6.26
P_3	4.06	4.33	4.13	4.13	4.13	4.16	6.00	6.53	6.33	6.13	6.40	6.28	6.00	6.53	6.44	6.13	6.40	6.30
Mean	3.88	4.16	4.06	4.03	3.96		5.83	6.51	6.20	6.08	6.00		5.85	6.52	6.23	6.08	6.05	
	P	**G**	**P×G**				**P**	**G**	**P×G**				**P**	**G**	**P×G**			
S.Em±	0.04	0.05	0.10				0.04	0.05	0.10				0.03	0.04	0.08			
CD 5%	0.13	0.15	NS				0.13	0.15	0.31				0.10	0.11	0.23			

P_0: No pinching
P_1: Single pinching at 25 DAS
P_2: Single pinching at 45 DAS
P_3: Double pinching at 25 and 45 DAS

G_0: Control (Water spray)
G_1: GA3 50 ppm
G_2: GA3 75 ppm
G_3: NAA 50 ppm
G_4: NAA 75 ppm

Table 3 : Effect of pinching and plant growth regulators on fresh weight per plant (g) at 30, 60 and 90 days after sowing (DAS) in fenugreek cv. APHU Methi-1.

Treatments	30 DAS						60 DAS						90 DAS					
	G_0	G_1	G_2	G_3	G_4	Mean	G_0	G_1	G_2	G_3	G_4	Mean	G_0	G_1	G_2	G_3	G_4	Mean
P_0	2.97	3.15	3.05	3.07	2.93	3.03	25.23	26.71	25.66	26.16	25.54	25.86	84.61	86.70	84.94	85.31	84.75	85.26
P_1	2.75	3.17	2.94	2.82	2.79	2.90	36.57	37.18	36.20	37.12	36.47	36.71	94.63	96.04	95.10	95.39	95.03	95.24
P_2	3.10	3.24	3.14	3.21	3.13	3.16	26.58	27.97	27.15	26.73	27.59	27.20	85.52	86.03	84.62	85.87	84.72	85.35
P_3	2.72	3.06	2.96	2.81	2.74	2.86	37.29	37.21	37.11	36.92	36.19	36.95	94.87	96.74	96.17	95.34	95.34	95.69
Mean	2.88	3.16	3.02	2.98	2.90		31.42	32.27	31.53	31.73	31.45		89.90	91.38	90.21	90.48	89.96	
	P	**G**	**P×G**				**P**	**G**	**P×G**				**P**	**G**	**P×G**			
S.Em±	0.03	0.03	0.06				0.27	0.30	0.61				0.30	0.34	0.68			
CD 5%	0.08	0.09	NS				0.78	NS	NS				0.87	0.98	NS			

P_0: No pinching
P_1: Single pinching at 25 DAS
P_2: Single pinching at 45 DAS
P_3: Double pinching at 25 and 45 DAS

G_0: Control (Water spray)
G_1: GA3 50 ppm
G_2: GA3 75 ppm
G_3: NAA 50 ppm
G_4: NAA 75 ppm

Table 4 : Effect of pinching and plant growth regulators on dry weight per plant (g) at 30, 60 and 90 days after sowing (DAS) in fenugreek cv. APHU Methi-1.

Treatments	30 DAS						60 DAS						90 DAS					
	G_0	G_1	G_2	G_3	G_4	Mean	G_0	G_1	G_2	G_3	G_4	Mean	G_0	G_1	G_2	G_3	G_4	Mean
P_0	0.33	0.51	0.52	0.49	0.34	0.44	7.98	8.35	8.04	8.16	8.08	8.12	16.68	17.34	17.19	17.29	17.16	17.13
P_1	0.33	0.50	0.44	0.41	0.42	0.42	7.99	8.31	8.33	8.35	8.18	8.23	17.96	18.11	18.12	18.06	17.65	17.98
P_2	0.42	0.53	0.51	0.50	0.46	0.48	8.07	8.30	8.13	8.24	8.07	8.16	16.73	17.77	17.28	17.47	17.37	17.32
P_3	0.37	0.44	0.43	0.40	0.40	0.41	8.10	8.34	8.30	8.31	8.18	8.25	17.77	18.24	18.18	18.22	17.98	18.08
Mean	0.36	0.49	0.47	0.45	0.41		8.04	8.32	8.20	8.27	8.13		17.28	17.87	17.69	17.76	17.54	
	P	**G**	**P×G**				**P**	**G**	**P×G**				**P**	**G**	**P×G**			
S.Em±	0.02	0.02	0.05				0.07	0.08	0.16				0.11	0.12	0.25			
CD 5%	NS	0.07	NS				NS	NS	NS				0.32	0.36	NS			

P_0: No pinching
P_1: Single pinching at 25 DAS
P_2: Single pinching at 45 DAS
P_3: Double pinching at 25 and 45 DAS

G_0: Control (Water spray)
G_1: GA3 50 ppm
G_2: GA3 75 ppm
G_3: NAA 50 ppm
G_4: NAA 75 ppm

Table 5 : Effect of pinching and plant growth regulators on number of days taken to flower initiation and number of flowers per plant in fenugreek cv. APHU Methi-1.

Treatments	Number of days taken to flower initiation						Number of flowers per plant					
	G_0	G_1	G_2	G_3	G_4	Mean	G_0	G_1	G_2	G_3	G_4	Mean
P_0	35.06	34.86	33.73	34.93	34.60	34.64	20.63	23.00	21.33	21.83	21.00	21.56
P_1	37.13	36.66	36.80	37.00	37.13	36.94	20.96	23.70	22.60	23.46	22.13	22.57
P_2	35.00	35.40	35.06	34.73	35.26	35.09	20.96	23.20	21.86	23.00	21.50	22.10
P_3	36.26	36.46	36.46	36.73	36.33	36.45	19.80	22.30	20.50	21.20	19.96	20.75
Mean	35.86	35.85	35.51	35.85	35.83		20.59	23.05	21.57	22.37	21.15	
	P	G	P×G				P	G	P×G			
S.Em±	0.19	0.22	0.43				0.15	0.17	0.34			
CD 5%	0.55	NS	NS				0.43	NS	0.96			

P_0: No pinching
P_1: Single pinching at 25 DAS
P_2: Single pinching at 45 DAS
P_3: Double pinching at 25 and 45 DAS

G_0: Control (Water spray)
G_1: GA3 50 ppm
G_2: GA3 75 ppm
G_3: NAA 50 ppm
G_4: NAA 75 ppm

pinching at 25 and 45 DAS (P_3) and was found to be on par with pinching at 25 DAS (P_1), which recorded 95.24 g. The minimum fresh weight per plant (85.26 g) was recorded with no pinching (P_0) and was found to be on par with pinching at 45 DAS (P_2), which recorded 85.35 g. Significantly maximum fresh weight per plant (91.38 g) was recorded with GA_3 50 ppm (G_1) and was found to be on par with NAA 50 ppm (G_3), which recorded 90.48 g. The minimum fresh weight per plant (89.90 g) was recorded with control (G_0) and was on par with NAA 75 ppm (G_4) which recorded 89.96 g, GA_3 75 ppm (G_2), which recorded 90.21 g and NAA 50 ppm (G_3), which recorded 90.48 g. The data on interaction between pinching and plant growth regulators was found to be non significant. It clearly showed that the fresh weight at 30 DAS was minimum (2.86 g) and gradually increased to the maximum of 36.95 g at 60 DAS which indicates that the vegetative growth of single pinching encouraged the growth that reached to the maximum giving rise to more number of branches and higher foliage and recorded maximum fresh weight. The fresh weight per plant at 90 DAS was found to be maximum (95.69 g) with double pinching at 25 and 45 DAS (P_3) and was on par with single pinching at 25 DAS (P_1), which recorded 95.24 g which indicates that increase in number of pinching induces more number of branches which produce more number of leaves in the treatment which might have produced and translocated more photosynthates resulting in higher growth attributes *viz.,* number of branches there by more fresh weight in fenugreek. The 50 ppm GA_3 treatment was found to be more effective for influencing the vegetative growth of fenugreek as evaluated by plant height and number of branches per plant at 30, 60 and 90 DAS. These results are in line with the findings of Singh *et al.* (2012) in coriander.

The data on dry weight per plant of fenugreek at 30 DAS influenced by pinching effects was found to be non significant (table 4). However, significantly maximum dry weight per plant (0.49 g) was recorded with GA3 50 ppm (G_1) and was found to be on par with GA_3 75 ppm (G_2), which recorded 0.47 g and NAA 50 ppm (G_3), which recorded 0.45 g. The minimum dry weight per plant (0.36 g) was recorded with control (G_0) and was on par with NAA 75 ppm (G_4), which recorded 0.41 g. The data on interaction between pinching and plant growth regulators was found to be non significant. The data on dry weight per plant of fenugreek at 60 DAS were found to be non significant as influenced by pinching effects, plant growth regulators and interaction between pinching and plant growth regulators. At 90 DAS, significantly maximum dry weight per plant (18.08 g) was recorded with double pinching at 25 and 45 DAS (P_3) and was found to be on par with pinching at 25 DAS (P_1), which recorded 17.98 g. The minimum dry weight per plant (17.13 g) was recorded with no pinching (P_0) and was on par with pinching at 45 DAS (P_2), which recorded 17.32 g. Significantly maximum dry weight per plant (17.87 g) was recorded by GA_3 50 ppm (G_1) and was found to be on par with NAA 50 ppm (G_3), which recorded 17.76 g. The minimum dry weight per plant (17.28 g) was recorded with control (G_0) and was on par with NAA 75 ppm (G_4), which recorded 17.54 g. The data on

interaction between pinching and plant growth regulators was found to be non significant. The dry weight per plant at 90 DAS was found to be maximum (18.08 g) with double pinching at 25 and 45 DAS (P_3) and was on par with single pinching at 25 DAS (P_1), which recorded 17.98 g, which indicates that number of pinching treatments induce more number of branches which produce more number of leaves thereby increase in the dry weight of fenugreek. Similar results were reported by Sharangi *et al*. (2005) in fenugreek. Gibberellins activate the growth mechanism by efficient photosynthetic activity thereby increasing carbohydrate accumulation and thus dry weight contents (Yadav and Sreenath, 1975).

Data pertaining to number of days taken to flower initiation and number of flowers per plant of fenugreek as influenced by pinching and plant growth regulators presented in Table 5 reveals that significantly least number of days (34.64) for flowering was recorded with no pinching (P0) and was on par (35.09) with pinching at 45 DAS (P_2). More number of days to flowering (36.94) was recorded with pinching at 25 DAS (P_1) and it was found to be on par with double pinching at 25 and 45 DAS (P_3), which recorded 36.45. The number of days taken to flower initiation of fenugreek was not significantly influenced by plant growth regulators and interaction between pinching and application of plant growth regulators. Significantly maximum number of flowers per plant (22.57) was recorded with pinching at 25 DAS (P_1) and was found to be on par (22.10) with pinching at 45 DAS (P_2). The minimum number of flowers per plant (20.75) was recorded with double pinching at 25 and 45 DAS (P_3). Significantly maximum number of flowers per plant (23.05) was recorded with GA_3 50 ppm (G_1). The minimum number of flowers per plant (20.59) was recorded with control (G_0). The data on interaction between pinching and plant growth regulators on number of flowers per plant of fenugreek was found to be non significant. Similar findings were reported with Tehlan and Thakral (2008) in coriander. The more number of pinchings (double pinching) could not produce more number of flowers per plant which might be due to lower number of branches compared to less pinching treatments (single pinching) as good vegetative growth is essential for profuse flowering. Maximum number of branches was produced by GA_3 50 ppm (G_1), which would have resulted in maximum number of flowers per plant. This also indicates the involvement of GA_3 in transition of vegetative apices to floral apices.

On the basis of present research findings, it could be concluded that the pinching treatments and application of plant growth regulators influenced the growth and flowering of fenugreek cv. APHU Methi-1. Among the treatments, single pinching at 25 DAS and foliar spray of GA_3 50 ppm at 25, 45 and 65 DAS proved advantageous for maximum growth and flowering in fenugreek.

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