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Effect of Pinching, GA_3 and NAA on Growth and Flowering on Fenugreek (*Trigonella foenum-graecum* L.) cv. Pant Ragini

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ABSTRACT

An experiment entitled effect of pinching, GA_3 and NAA on growth and flowering of fenugreek (*Trigonella foenum-graecum* L.) *cv*. Pant Ragini under Garhwal Hills was carried out during 2020-21 at Department of Horticulture, H.N.B. Garhwal University, Srinagar (Garhwal), Uttarakhand with 18 treatments combination, comprising two seed soaking S_0 (control) and S_1 (GA_3 50 ppm) with three stages of spraying of GA_3 and NAA G_0(Control), G_1(GA_3 50 ppm) and G_2(NAA 50 ppm) and three stages of pinching P_0(Control), P_1(Single pinching at 45 DAS) and P_2(Double pinching at 60 DAS). These treatments were replicated thrice in factorial randomized block design (FRBD) and analyzed. Treatment with seed soaking S_0 (GA_3 50 ppm) and spraying of plant growth regulators G_1 (GA_3 50 ppm) recorded minimum days taken to first germination, significant maximum plant height, number of primary branches and days to taken to first and 50 % flowering. Significant maximum plant height and days taken to first and 50 % flower inhiation were recorded with treatment P_0 (control). Double pinching at 60 DAS (P_2) recorded significant maximum number of branches/plant and days taken to first germination.

Key Words: Fenugreek, Growth Regulators, Flowering and Pinching.

INTRODUCTION

Fenugreek (*Trigonella foenum-graecum* L.) is an annual spice herb belonging to the Papilionaceae subfamily of the Leguminaceae family. It is also known as Methi. Methi is a self-pollinated legume and diploid with a chromosome number of 2n = 16. Fenugreek holds enormous importance in human beings' lives as food and medicine are valued not only as a spice but also as a potential source of diosgenin. It is cultivated globally and thrives in warm temperate and tropical areas, demonstrating adaptability to semi-arid conditions and tolerance to mild salinity. India is the world largest producer, consumer and exporter of spices so it is known as the Land of Spices. Fenugreek plays a crucial role in Indian agriculture, ranking as the third most important seed spice after coriander and cumin. In India, fenugreek grown on approximately 156 thousand ha, with a production of 241 thousand Mt and a productivity of 1.54 Mt/ha. (Anonymous, 2021).

Pinching is a technique used to manipulate canopy structure, typically accomplished by removing the growing tip. This action redirects the movement of auxin from the apical part of the plant to lower regions, which stimulates the development of lateral branches. This in turn increases the potential podding points on the plant, thereby enhancing the number of fruits produced per plant. Effective management of cutting or pinching practices significantly impacts the growth and yield attributes in fenugreek, Krishnaveni *et al* (2014). Plant growth substances play a crucial role in various physiological processes that regulate the growth and development of crops. Changes in endogenous hormone levels, influenced by both biotic and abiotic stress factors, have a significant impact on

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crop growth. GA_3 plays a pivotal role in plant growth regulators, known for enhancing the photosynthesis process and inhibiting the action of the protein DELLA, which restricts cell proliferation and expansion. Additionally, foliar application of GA_3 and NAA has emerged as a pivotal avenue for achieving remarkable enhancements in physiological efficiency, particularly the photosynthetic capacity of plants. The application of these substances improves germination, longitudinal growth, increases the number of branches, encourages early flower initiation, enhances fruit set and ultimately leads to higher yields. Humidi *et al* (2005), Ghodrat and Rousta (2012), Nelson and Steber (2016) and Singh *et al* (2017).

MATERIALS AND METHODS

This field experiment was conducted at the Horticultural Research Centre, Chauras Campus, Department of Horticulture, H.N.B. Garhwal University, Srinagar (Garhwal), Uttarakhand during the *rabi* season of 2020-21. The experiment was laid out in a Factorial Randomized Block Design with three replications. The experiment consisted of two seed soaking levels *viz.,* control (S_0) and GA_3 50 ppm(S_1), spraying of PGRs with three levels *viz.,* control (G_0), GA_3 50 ppm(G_1) and NAA 50 ppm(G_2) and three pinching levels *viz.,* no pinching (P_0), single pinching at 45 days (P_1) and double pinching at 60 days after sowing (P_2). The seeds were sown manually in rows at a spacing of 20 cm and plants to plants 10 cm. Before soaking, the seeds of fenugreek were first cleaned to remove the broken and other foreign materials and then soaked in GA_3 50 ppm for 8-10 hr. at room temperature. Then the seeds were dried at room temperature. The plant growth regulators *i.e.,* GA_3 50 ppm and NAA 50 ppm were spraying at 30 and 60 days after sowing with the help of hand sprayer. The pinching was done by removing the apical buds manually without causing damage to the plant parts. The data were recorded on growth and flowering parameters *viz*., days taken to first germination, plant height (30 DAS, 60 DAS and at harvest), number of branches per plant (30 DAS, and at harvest), days taken to first flowering and days taken to 50 % flowering. The data were analysed according to the procedure of analysis of FRBD with three replications suggested by Panse and Sukhatme (1985). The significance of the treatments was tested through F test at 5 per cent level of significance. The critical difference CD was calculated to assess the significance of difference among the different treatments.

RESULTS AND DISCUSSION

Effect of seed soaking

The result of the effect of pinching, GA_3 and NAA revealed that treatments significantly affected all characters. Data (Table 1) from seed soaking treatments showed that treatment S_1 (GA_3 50 ppm) had the minimum days taken to first germination (4.81 days), whereas treatment S_0 (control) had the maximum days taken to first germination (8.80 days). Significantly maximum plant height at 30, 60 DAS and at harvest (5.34, 18.00 and 98.28 cm) and number of primary branches at 30 DAS and at harvest (2.31 and 10.46) were observed in treatment S_1 (GA_3 50 ppm), whereas minimum plant height at 30, 60 DAS and at harvest (5.16, 17.47 and 83.50 cm) and number of primary branches at 30 DAS and at harvest (1.85 and 8.12) were observed in treatment S_0 (control). The data (Table 2) revealed that treatments significantly minimum days taken to first flowering (75.24) and days taken to 50 % flowering (81.81) were observed in treatment S_1 (GA_3 50 ppm), whereas maximum days taken to first and 50% flowering (87.71 and 89.43 days) were observed in treatment S_0(control).

The treated seeds were evaluated for their improvement in growth and early flowering parameters, using untreated seeds as a control. The increase in field emergence may be attributed to higher metabolic activity before sowing, induced by pre-sowing seed treatment, which prepares the seeds for immediate germination upon planting. Gibberellic acid facilitates seed germination by breaking dormancy, stimulating enzyme production and enhancing cell elongation and division. It increases cell wall extensibility, which is a critical factor in seed germination. Renowned for its growth-promoting properties, gibberellic acid significantly enhances the germination process. The results obtained align with previous research conducted by various scientists on various crops, indicating similar findings by Khan

and Chaudhry (2006), Sundareswaran (2011), Datta (2012), Tania *et al* (2015) and Tavelu *et al* (2018).

Effect of plant growth regulators

The data (Table 1) revealed that treatments significantly affected to all characters. Regarding spraying of GA_3 and NAA treatments it was found that, treatment G_1 (GA_3 50 ppm) had the minimum (4.81) days taken to first germination, whereas treatment G_0 (control) had the maximum days taken to first germination (7.84 d). Significantly maximum plant height at 30, 60 DAS and at harvest (5.57, 18.30 and 95.28 cm) and number of primary branches at 30 DAS and at harvest (2.31 and 10.46) were observed in treatment G_1 (GA_3 50 ppm), whereas minimum plant height at 30, 60 DAS and at harvest (4.91, 17.03 and 84.07 cm) and number of primary branches at 30 DAS and at harvest (1.71 and 7.86) were observed in treatment G_0 (control). The data (Table 2) revealed that treatments significantly affected to all characters. Minimum days taken to first flowering (75.61) and days taken to 50 % flowering (81.17) were observed in treatment G_1 (GA_3 50 ppm), whereas maximum days taken to first and 50 % flowering (89.56 and 89.61) were observed in treatment G_0 (control).

The growth and flowering parameters were comparatively better with treatment G_1 (GA_3 50 ppm) compared to the other treatments. This increase in growth attributes germination of seed and plant height could be due to the typical action of gibberellins. Gibberellic acid has been found to increase cell wall activity thus, creating water diffusion pressure deficit which results in water uptake, thereby causing cell elongation (Bisht *et al,* 2018). GA_3 increases the primary and secondary branches by inhibiting auxins responsible for apical dominance. It stimulates lateral growth by redirecting metabolites to auxiliary buds. GA_3 improves flower development through enhanced cell division, enlargement and increased photosynthate production. Similar result was reported by Vasudevan *et al* (2008), Bairva *et al* (2012), Krishnaveni *et al* (2014) and Reddy and Hore (2020).

Effect of pinching

The data (Table1) revealed that treatments significantly affected to all characters. Data from pinching treatments showed that treatment P_1 (Single pinching at 45 DAS) had the minimum days taken to first germination (5.67), whereas treatment P_0 (control) had the maximum days taken to first germination (8.09). Maximum plant height at 30 DAS, 60 DAS and at harvest (6.47, 19.40 and 95.56 cm) were observed in treatment P_0 (control), whereas minimum plant height at 30 DAS, 60 DAS and at harvest (4.57, 16.43 and 83.53 cm) were observed in treatment P_2 (Double pinching at 60 DAS). Maximum number of primary branches at 30 DAS and at harvest (2.24 and 10.60), whereas minimum number of primary branches at 30 DAS and at harvest (1.89 and 7.74) was observed in treatment P_0 (control). The data (Table 2) minimum days taken to first flowering (78.63) and days taken to 50 % flowering (81.00) were observed in treatment P_0 (control), whereas maximum days taken to first flowering (85.97) and days taken to 50 % flowering (90.86) were P_2 (double pinching at 60 DAS).

The effect of pinching on growth and flowering parameters indicated that the plant height and flowering inhiation was considerably decreased with the increased number of pinching treatments, mainly due to the removal of apical meristematic tissue, while plants without pinching continued their vegetative growth using stored food material. Similar results were reported by Vasudevan *et al* (2008). Maximum number of branches were observed with treatment P_2 (double pinching at 60 DAS). This might be due to the fact that the double pinching provided sufficient time for the regeneration of vegetative parts and enhanced the development of lateral productive branches as well as a flowering. These changes influenced the plant parts by maintaining the source-sink relationship of nutrients. This could be attributed to the pinched plants producing a greater number of branches per plant. Similar results were reported by Vasudevan *et al* (2008), Krishnaveni *et al* (2014), Lakshmi *et al* (2016), Saini and Baloda (2016,) Sowmya *et al* (2017) and Kauser *et al* (2018) in fenugreek.

Table 1. Effect of pinching, GA_3 and NAA on days taken to first germination, plant height (cm) and number of primary branches per plant of fenugreek cv. Pant Ragini.

Treatment	Days taken to first germination	Plant height (cm)			Number of primary branches	
		30 DAS	60 DAS	At harvest	30 DAS	At harvest
Seed Soaking						
S_0 (Control)	8.80	5.16	17.47	83.50	1.85	8.12
S_1 (GA_3 50 ppm)	4.81	5.34	18.00	98.28	2.31	10.46
SEm±	0.06	0.04	0.14	0.67	0.02	0.07
CD at 0.05%	0.18	0.12	0.39	1.92	0.04	0.19
Spraying of PGRs						
G_0 (Control)	7.84	4.91	17.03	84.07	1.71	7.86
G_1 (GA_3 50 ppm)	4.81	5.57	18.30	95.28	2.31	10.46
G_2 (NAA 50 ppm)	6.12	5.34	17.90	93.32	2.23	9.52
SEm±	0.08	0.05	0.17	0.82	0.02	0.08
CD at 0.05%	0.22	0.15	0.48	2.35	0.05	0.24
Pinching						
P_0 (Control)	8.09	6.47	19.40	95.56	1.89	7.74
P_1 (Single pinching at 45 DAS)	6.67	4.71	17.37	93.57	2.11	9.53
P_2 (Double pinching at 60 DAS)	5.67	4.57	16.43	83.53	2.24	10.60
SEm±	0.08	0.05	0.17	0.82	0.02	0.08
CD at 0.05%	0.22	0.15	0.48	2.35	0.05	0.24

CONCLUSION

The study revealed that the application of pinching, GA_3 and NAA significantly influenced the growth and encourage early flowering inhiation of fenugreek. The application of seed soaking and foliar application of GA_3 at 50 ppm, along with double pinching treatment might be attributed to their function in stimulating metabolic activities and hormonal regulation.

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Table 2. Effect of pinching, GA_3 and NAA on days taken to first flowering and days taken to 50% flowering of fenugreek cv. Pant Ragini.

Treatment	Days taken to first flowering	Days taken to 50 % flowering
Seed Soaking		
S_0 (Control)	87.71	89.43
S_1 (GA_3 50 ppm)	75.24	81.81
SEm±	0.63	0.65
CD at 0.05%	1.79	1.86
Spraying of PGRs		
G_0 (Control)	89.56	89.61
G_1 (GA_3 50 ppm)	75.61	81.17
G_2 (NAA 50 ppm)	79.28	86.08
SEm±	0.77	0.80
CD at 0.05%	2.20	2.28
Pinching		
P_0 (Control)	78.63	81.00
P_1 (Single pinching at 45 DAS)	79.83	85.00
P_2 (Double pinching at 60 DAS)	85.97	90.86
SEm±	0.77	0.80
CD at 0.05%	2.20	2.28

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