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Effect of gibberellic acid on growth and seed yield in fenugreek (*Trigonella foenum-graecum* L.)

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Abstract

Fenugreek (*Trigonella foenum-graecum* L.) locally known as 'Methi' belonging to the family Leguminosae and sub family Papilionaceae. Application of plant growth regulators (PGRs) may play an important role in proper flowering, fruit setting, synchronize maturity, ripening and thereby increase in the physiochemical efficiency and yield of the crops. The present investigation was carried on Rabi-2022 cv. Co-2 at the Horticultural Research Farm, Sardar Patel University, Balaghat (M.P.). The experiment was laid out in a Randomized Block Design (RBD) with six treatments in three replications. The plant growth regulator gibberellic acid (GA₃) with different concentrations (0, 25, 50 and 75, 100 and 125) was used for the experiment. The data revealed that among the all six treatments of GA₃ 100 ppm application is very effective for plant height, number of branches per plant, panicle length and 1000 seed weight. GA₃ 75 ppm application is effective for enhancement of days to 50% flowering, number of pods per plant, number of seeds per pod, number of seeds per plant, seed yield per plant (g) and seed yield per ha (kg) in fenugreek cv Co-2. GA₃ 75 ppm application is very effective for enhancement of vegetative and yield traits in fenugreek cv. Co-2.

Keywords: Fenugreek (*Trigonella foenum-graecum* L.), gibberellic acid, growth, yield attributes

Introduction

Fenugreek (*Trigonella foenum-graecum* L.) locally known as 'Methi' belonging to the family Leguminosae and sub family Papilionaceae. This crop is native to an area extending from Iran to northern India and widely cultivated in China, India, Egypt, Ethiopia, Morocco, Ukraine, Greece, Turkey, etc. with 80 species (Danesh Talab *et al.*, 2014) [4]. In India, Haryana, Uttar Pradesh and Uttarakhand the important states for fenugreek under irrigated conditions. It is also cultivated in the states of West Bengal, Madhya Pradesh, Bihar, Orissa, Karnataka and Andhra Pradesh to a limited extent mostly under supplementary or without irrigation. In of its large-scale cultivation in India, the productivity of these crops is low, mainly due to the paucity of high yielding varieties, inadequate access of the good seeds to the growers and lack of improved management practices. Fenugreek leaves and seeds are consumed in different countries around the world for different purposes such as medicinal uses, making food, roasted grain as coffee-substitute, controlling insects in grain storages, and perfume industries (Mehrafarin *et al.*, 2011) [7]. It is also 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, B₂ 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 (Krishnaveni *et al.*, 2014) [6]. This plant is used in therapy atherosclerosis (Nandini *et al.*, 2007) [8], rheumatism, sugar lowering (Gupta *et al.*, 2009) [5], blood lipids lowering (Xue *et al.*, 2007) [13], appetizer and contain antioxidant activity (Birjees Bukhar *et al.*, 2008) [3]. In spite 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. The production of fenugreek as vegetable and/or seed purpose can be increased remarkable using phytohormone like Gibberellins (GAs). Therefore, the present investigation was designed to find out the effect and suitable dose of GA₃ for increasing the yield potential in fenugreek.

Materials and Methods

The experiment was conducted at the Horticultural Research Farm, Sardar Patel University, Balaghat (M.P.) on Rabi-2021 cv. Co-2. The experiment was laid out in a Randomized Block Design (RBD) with six treatments in three replications. The plant growth regulator gibberellic acid (GA_3) with different concentrations (0, 25, 50 and 75, 100 and 125) was used for the experiment. The morphological and yield parameters i.e. plant height (cm) at 45, 60, 75 DAS and at harvest, number of branches per plant, days to 50% flowering, number of pods per plant, number of seeds per pod, number of seeds per plant, pod length (cm), weight of 1000 seeds (g), seed yield per plant (g) and seed yield per ha (kg) were recorded.

Result and Discussion

The result of effect of different treatment in fenugreek is presented in Table 1. At 45 DAS maximum plant height (27.67 cm) was recorded in the treatment T_4 i.e. GA_3 75 ppm, followed by treatment T_5 i.e. GA_3 100ppm (27.10 cm) with mean of 24.47 cm. However minimum plant height (20.70cm) was recorded in treatment T_1 i. e. control. At 60 DAS, maximum plant height (48.20 cm) was recorded in the treatment T_6 i.e. GA_3 125 ppm followed by treatment T_5 i.e. GA_3 100ppm (46.60 cm) with mean of 45.15cm. However minimum plant height (42.20cm) was recorded in treatment T_1 i. e. control. At 75 DAS, maximum plant height (61.50 cm) was recorded in the treatment T_5 i.e. GA_3 100 ppm, followed by treatment T_4 GA_3 i.e. 75ppm ((58.33 cm) with mean of 56.65cm. However, minimum plant height (51.33 cm) was recorded in treatment T_1 i.e. control. At harvest, maximum plant height (67.90 cm) was recorded in the treatment T_5 i.e. GA_3 100 ppm, followed by treatment T_4 GA_3 i.e. 75ppm ((66.57 cm) with mean of 62.73cm. However, minimum plant height (56.17 cm) was recorded in treatment T_1 i.e. control. Similar findings were reported by Purbey and Sen (2005)^[9], Tania *et al.* (2015)^[11] and Reddy P.P and Hore J.K. (2020)^[10].

Days to 50% flowering maximum (42.67) was taken by treatment T_1 i.e. control with mean of 39.78 whereas, minimum (37.00) in treatment T_4 i. e. GA_3 75ppm followed by treatment T_3 i. e. GA_3 50ppm (37.67). Similar result was reported by Krishnaveni *et al.* (2014)^[6].

The maximum number of branches per plant (6.70) was recorded in the treatment T_5 i.e. GA_3 100ppm, followed by treatment T_4 i.e. GA_3 75 ppm (6.00) with mean of 5.22 whereas, minimum (4.52) in treatment T_1 i. e. control. The increase in number of primary and secondary branches due to GA_3 might be due to antagonizing action of auxins responsible for the apical dominance and there by suppressing

terminal bud growth, that the accumulated metabolites get translocated towards the auxilliary buds and these resulting in stimulation of laterals Similar result was reported by Vasudevan *et al.* (2008)^[12], Bairva *et al.* (2012)^[2], Krishnaveni *et al.* (2014)^[6] and Alam and Shahin, M. D. (2018)^[1].

Maximum number of pods per plant (55.60) was recorded in the treatment T_4 i. e. GA_3 75 ppm, followed by treatment T_5 i.e. GA_3 100ppm (49.47) with mean of 44.27 whereas, minimum (29.80) in treatment T_1 i. e. control. The increase in number of pods per plant could be attributed due to the increase in the number of both primary and secondary branches per plant with gibberellic acid. Similar result reported by Vasudevan *et al.* (2008)^[12] and Alam and Shahin, M. D. (2018)^[1].

Maximum number of seed per pod (18.60) was recorded in the treatment T_4 i. e. GA_3 75 ppm, followed by treatment T_5 i. e. GA_3 100ppm (18.20) with mean of 17.20 whereas, minimum (8.10) in treatment T_1 i.e. control. Similar result reported by Alam and Shahin, M. D. (2018)^[1].

Number of seed per plant was maximum (867.88) recorded in the treatment T_4 i. e. GA_3 75ppm, followed by treatment T_5 i.e. GA_3 100 ppm (800.68) with mean of 704.60 whereas, minimum (451.67) in treatment T_1 i. e. control.

The maximum pod length (11.27 cm) was recorded in the treatment T_5 i.e. GA_3 100 ppm, followed by treatment T_4 i.e. GA_3 75ppm (10.83 cm) with mean of 9.86cm. whereas, minimum (8.10) in treatment T_1 i. e. control.

The maximum 1000 seed weight (15.07 g) was recorded in the treatment T_5 i.e. GA_3 100 ppm, followed by treatment T_4 i.e. GA_3 75 ppm (14.87 g) with mean of 13.55g whereas, minimum (11.30) in treatment T_1 i. e. control.

The maximum seed yield per plant (12.11 g) was recorded in the treatment T_4 i. e. GA_3 75ppm, followed by treatment T_5 i. e. GA_3 100 ppm (11.65 g) with mean of 10.80g whereas, minimum (6.45 g) in treatment T_1 i. e. control. Improved vegetative growth due to plant growth regulators application coupled with increased photosynthates on one hand and greater mobilization of photosynthesis towards reproductive sites on the other hand might have been found to increase in the growth and yield attributes Similar result reported by Alam and Shahin, M. D. (2018)^[1] investigated the effect of gibberellic acid on morphology, vegetative growth and seed yield of fenugreek.

Seed yield per hectare was maximum (1062.43 kg) recorded in the treatment T_4 i.e. GA_3 75 ppm, followed by treatment T_5 i.e. GA_3 100ppm (835.70 kg) with mean of 815.07kg whereas, minimum (654.37 kg) in treatment T_1 i. e. control.

Table 1: Effect of GA₃ on growth and yield parameters in fenugreek cv. Co-2

Treatment	GA ₃ Concentration	Plant Height (cm)				Days to 50% flowering	Number of primary branches per plant	Number of pods per plant	Pod length (cm)	Number of seeds per pod	Weight of 1000 seeds (g)	Number of seeds per plant	Seed yield per plant (g)	Seed yield per ha (kg)
		45 DAS	60 DAS	75 DAS	At harvest									
T1	0 ppm	20.70	42.20	51.33	56.17	42.67	4.52	29.80	8.10	15.13	11.30	451.67	6.45	654.37
T2	25 ppm	21.30	43.27	54.00	59.50	40.67	4.78	37.13	8.77	16.00	12.37	594.45	8.94	740.10
T3	50 ppm	24.53	45.07	58.03	62.87	37.67	4.74	45.07	10.07	17.13	13.67	736.23	10.83	841.60
T4	75 ppm	27.67	45.57	58.33	66.57	37.00	6.00	55.60	10.83	18.60	14.87	867.88	12.11	1062.43
T5	100 ppm	27.10	46.60	61.50	67.90	38.67	6.70	49.47	11.27	18.20	15.07	800.68	11.65	835.70
T6	125 ppm	25.53	48.20	56.70	63.37	41.67	4.59	48.53	10.13	18.13	14.03	776.67	11.10	756.20
Mean		24.47	45.15	56.65	62.73	39.78	5.22	44.27	9.86	17.20	13.55	704.60	10.18	815.07
S.Em		1.01	0.64	0.92	1.45	0.81	0.21	1.27	0.28	0.42	0.59	21.93	0.44	40.34
Sed		1.43	0.90	1.30	2.05	1.15	0.29	1.79	0.40	0.60	0.83	31.01	0.63	57.05
CD (5%)		3.18	2.01	2.90	4.58	2.56	0.65	3.99	0.89	1.33	1.85	69.09	1.39	127.13
CV		5.83	2.00	2.30	3.28	2.89	5.56	4.04	4.06	3.48	6.12	4.40	6.14	7.00

Conclusion

From the above findings, it can be concluded that the T4 (75 ppm GA₃) showed best performance regarding maximum growth and yield contributing parameters of fenugreek. So, this treatment, T4 (75 ppm GA₃) can be considered as the best among the entire treatments.

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