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Effect of pinching and plant growth regulators on yield and quality of fenugreek (*Trigonella foenum-graecum*)

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Abstract

A field experiment was conducted to find out the effect of pinching and plant growth regulators on yield and quality of fenugreek (*Trigonella foenum-graecum* L.) cv. Pant Ragini during 2020-21 at Department of Horticulture, H N B Garhwal University, Srinagar (Garhwal), Uttarakhand. Minimum days taken to first and 50 % first pod formation (89.88 and 93.97 days), significantly maximum length of pod (11.23 cm), pod diameter (2.13 mm), pods/plant (51.85), number of seeds/pod (18.92), seed yield/plant (8.02g), seed yield/plot (657.78 g) and seed yield/ha (39.70 q), and quality parameters, *viz.* TSS (13.08 ^{0}Brix) and ascorbic acid (60.73 mg/100g) were recorded with seed soaking of S_1 (GA_3 50 ppm). Among plant growth regulators, foliar spray of G_1 (GA_3 50 ppm) twice (30 and 60 DAS) took minimum days to first and 50 % first pod formation (89.88 and 93.97 days), maximum length of pod (11.23 cm) and pod diameter (2.13 mm), number of pods/plant (51.87), number of seeds/pod (18.85), seed yield/plant (7.86g), seed yield/plot (609.62 g) and seed yield/ha (37.13 q) and quality parameters, *viz.* TSS (13.75 ^{0}Brix) and ascorbic acid (62.29 mg/100g) of different pinching applications, P_1 (no pinching) took minimum days to first and 50 % first pod formation (90.55 and 94.31 days) and different yield application of P_2 (double pinching at 60 DAS) were maximum length of pod (10.91 cm), pod diameter (2.50 mm), number of pods/plant (54.87), number of seed/pod (18.61), seed yield/ plant (7.11 g), seed yield/plot (596.40 g) and seed yield/ha (35.51 q), highest TSS (11.73 ^{0}Brix) and ascorbic acid (60.16 mg/100g).

Key words: Growth regulators, Pinching, Yield, Pod length, Quality parameters

Fenugreek (*Trigonella foenum-graecum* L.) chromosome number 2n = 16, is commercially cultivated for its leaves and seeds. The plant growth regulators (PGRs), GA_3 and NAA, improves its growth, yield and quality attributes. They enhance nucleic acid activities, flowering, fruit setting, fruit retention and fruit quality in various horticultural crops (Alagukannan and Vijay Kumar, 1999; Dodiya *et al.*, 2021). Pinching is done to affect canopy structure. It redirects movement of auxin from apical part of a plant to lower areas, stimulating the development of lateral branches which increases the potential podding points on a plant thereby increasing the number of fruits. Cutting management or pinching practice greatly influences growth and yield attributes in fenugreek (Baboo, 1997).

MATERIALS AND METHODS

This field experiment was conducted at Department of Horticulture, H.N.B. Garhwal University, Srinagar (Garhwal), Uttarakhand, during *rabi* season of 2020-21, with three replications in a Factorial Randomized Block Design. Fenugreek cv. Pant Ragini was used. 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, seeds 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 seeds were dried at room temperature. The plant growth regulators, *i.e.* GA_3 50 ppm and NAA 50 ppm were sprayed 30 and 60 days after sowing with the help of hand sprayer. The pinching was done by removing apical buds manually without causing damage to plant parts.

The data were recorded on yield and quality parameters, viz. days taken to first pod formation, days taken to 50 % pod formation, pod length (cm), pod diameter (mm), number of pods/plant, number of seeds/pod, seed yield/plant (g), seed yield/plot (g), seed yield/ha (q), total soluble solids (^{0}Brix) and ascorbic acid (mg/100g). The data were analysed according to the procedure of analysis of FRBD with three replications (Snedecor and Cochran, 1961). The significance of treatments was tested through F test at 5 per cent level of significance. The critical difference was calculated to assess the significance of difference among different treatments.

RESULTS AND DISCUSSION

Effect of seed soaking

The data on showed that treatment S_1 (GA_3 50 ppm) had minimum days taken to first pod formation (89.88

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days) and days taken to 50 % pod formation (93.97), whereas treatment S_0 (control) had maximum days taken to first pod formation (98.39 days) and days taken to 50 % pod formation (101.40). The maximum length of pod (11.23 cm) and pod diameter (2.13 mm) were observed in treatment S_1 (GA_3 50 ppm), whereas minimum length of pod (10.30 cm) and pod diameter (2.03 mm) in treatment S_0 (control). There were maximum number of pods/plant (51.85), number of seeds/pod (18.92), seed yield/plant (8.02g), seed yield/plot (657.78 g) and seed yield/ha (39.70 q) in treatment S_1 (GA_3 50 ppm), whereas minimum number of pods/plant (46.44), number of seeds/pod (17.87), seed yield/plant (4.29 g), seed yield/plot (351.98 g) and seed yield/ha (21.25 q) were observed in treatment S_0 (control) (Table 1). The maximum TSS (13.08 ^{0}Brix) and ascorbic acid (60.73 mg/100g) were observed in treatment S_1 (GA_3 50 ppm), whereas minimum TSS (9.72 ^{0}Brix) and ascorbic acid (55.47 mg/100 g) in treatment S_0 (control) (Table 2).

The increasing yield parameters following soaking of seed with GA_3 might be due to higher rate of cell division in root and shoot tips incited by the application of GA_3. These studies are in conformity with those of Sharma (2012), Tania *et al.* (2015), Tavelu *et al.* (2018), Karn *et al.* (2022) and Pangtu *et al.* (2024).

Effect of plant growth regulators

The spraying of plant growth regulators, G_1 (GA_3 50 ppm) had minimum (89.88) days taken to first pod formation and days taken to 50 % pod formation (93.97 days), whereas treatment G_0 (control) had maximum days taken to first pod formation (99.88 days) and days taken to 50 % pod formation (101.61). Maximum length of pod (11.23 cm) and pod diameter (2.13 mm) were observed in treatment G_1 (GA_3 50 ppm), whereas minimum length of pod (10.19 cm) and pod diameter (1.96 mm) in treatment G_0 (control). Maximum number of pods/plant (51.87), number of seeds/pod (18.85), seed yield/plant (7.86g), seed yield/plot (609.62 g) and seed yield/ha (37.13 q) were observed in G_1 (GA_3 50 ppm), whereas minimum number of pods/plant (44.51), number of seeds/pod (17.58), seed yield/plant (4.16 g), seed yield/plot (334.69 g) and seed yield/ha (20.64 q) in G_0 (control). The data revealed treatments significantly affected to all characters. Maximum TSS (13.75 ^{0}Brix) and ascorbic acid (62.29 mg/100g) were observed in G_1 (GA_3 50 ppm), whereas minimum TSS (9.96 ^{0}Brix) and ascorbic acid (51.87 mg/100g) were observed in treatment S_0 (control) (Table 2).

The yield parameters were comparatively better with treatment G_1 (GA_3 50 ppm) compared to other treatments. The positive influence of GA_3 can be attributed to increased photosynthetic activity and more efficient nutrient translocation from roots to apical parts of plants. This made the treated plants physiologically more active, resulting in improved growth, yield, and quality. This enhancement is likely due to rapid cell division and elongation, which stimulated growth and increased nutrient uptake. Similar effects of GA_3 on plant yield have been reported by Gour *et al.* (2009), Vasudevan *et al.* (2008), Meena *et al.* (2014), Yugandhar *et al.* (2015), and Poonia *et al.* (2024).

Effect of pinching

The treatment P_1 (control) had minimum days taken to first pod formation (90.55 days) and days taken to 50 % pod formation (94.31 days), whereas treatment P_2 (double pinching at 60 DAS) had maximum days taken to first pod formation (98.86 days) and days taken to 50 % pod formation (101.12 days). Maximum length of pod (10.91 cm) and pod diameter (2.50 mm) were observed in treatment P_2 (double pinching at 60 DAS), whereas minimum length of pods (10.57 cm) and pod diameter (1.81 mm) were observed in P_0 (control). Maximum number of pods/plant (54.87), number of seeds/pod (18.61), seed yield/plant (7.11 g), seed yield/plot (596.40 g) and seed yield/ha (35.51 q) were observed in P_2 (double pinching at 60 DAS), whereas minimum number of pods/plant (42.52), number of seeds/pod (18.11), seed yield/plant (4.41 g), seed yield/plot (334.16 g) and seed yield/ha (21.14 q) were observed in P_0 (control). Maximum TSS (11.73 ^{0}Brix) and ascorbic acid (60.16 mg/100g) in P_2 (double pinching at 60 DAS), whereas minimum TSS (10.93 ^{0}Brix) and ascorbic acid (55.23 mg/100g) in P_0 (control).

The effect of pinching on early pod formation, pod length, pod diameter, number of pods/plant, number of seeds/pod, seed yield/plant (g), seed yield/plot (g), seed yield/ha (q), TSS (^{0}Brix) and ascorbic acid (mg/100g) observed the maximum increase was observed with treatment P_2 (double pinching at 60 DAS). This might be due to that second pinching provided sufficient time for regeneration of vegetative parts and enhanced the development of lateral productive branches. These changes influenced the plant parts by maintaining the source-sink relationship of nutrients. This could be attributed to pinched plants producing a greater number of branches/plant, which led to early pod formation, increased pod length, and pod diameter, as well as a higher number of pods per plant. As a result, there was an increase in seed yield and quality parameters. Similar results were reported by Vasudevan *et al.* (2008), Krishnaveni *et al.* (2016), Sowmya *et al.* (2017), and Kauser *et al.* (2018) in fenugreek.

Table 1: Effect of pinching and plant growth regulators on days taken to first, 50 % pod formation, pod length, pod diameter, number of pods/plant and number of seeds/pod

Treatment	Days taken to first pod formation	Days taken to 50 % pod formation	Length of pod (cm)	Pod diameter (mm)	Number of pods/plant	Number of seeds/pod
Seed Soaking						
S_0 (Control)	98.39	101.40	10.30	2.03	46.44	17.87
S_1 (GA_3 50 ppm)	89.88	93.97	11.23	2.13	51.85	18.92
SEm±	0.72	0.74	0.08	0.02	0.37	0.14
CD (0.05%)	2.05	2.12	0.23	0.05	1.05	0.40
Spraying of PGRs						
G_0 (Control)	99.88	101.61	10.19	1.96	44.51	17.58
G_1 (GA_3 50 ppm)	89.88	93.97	11.23	2.13	51.87	18.85
G_2 (NAA 50 ppm)	92.71	97.49	10.90	2.16	51.07	18.77
SEm±	0.88	0.91	0.10	0.02	0.45	0.17
CD (0.05%)	2.51	2.60	0.28	0.06	1.28	0.49
Pinching						
P_0 (Control)	90.55	94.31	10.57	1.81	42.52	18.11
P_1 (Single pinching at 45 DAS)	93.00	97.62	10.82	1.93	50.07	18.47
P_2 (Double pinching at 60 DAS)	98.86	101.12	10.91	2.50	54.87	18.61
SEm±	0.88	0.91	0.10	0.02	0.45	0.17
CD (0.05%)	2.51	2.60	0.28	0.06	1.28	0.49
CV (%)	6.96	6.95	6.90	6.98	6.87	6.92

Table 2: Effect of pinching and plant growth regulators on seed yield TSS and ascorbic acid

Treatment	Seed yield g/plant	Seed yield g/plot	Seed yield q/ha	TSS (^{0}Brix)	Ascorbic acid (mg/100g)
Seed Soaking					
S_0 (Control)	4.29	351.98	21.25	9.72	55.47
S_1 (GA_3 50 ppm)	8.02	657.78	39.70	13.08	60.73
SEm±	0.04	3.36	0.20	0.08	0.44
CD (0.05%)	0.12	9.60	0.58	0.24	1.24
Spraying of PGRs					
G_0 (Control)	4.16	334.69	20.64	9.96	51.87
G_1 (GA_3 50 ppm)	7.86	609.62	37.13	13.75	62.29
G_2 (NAA 50 ppm)	6.45	570.33	33.68	10.48	60.13
SEm±	0.05	4.12	0.25	0.10	0.53
CD (0.05%)	0.14	11.76	0.71	0.29	1.52
Pinching					
P_0 (Control)	4.41	334.16	21.14	10.93	55.23
P_1 (Single pinching at 45 DAS)	6.95	584.08	34.77	11.54	58.91
P_2 (Double pinching at 60 DAS)	7.11	596.40	35.51	11.73	60.16
SEm±	0.05	4.12	0.25	0.10	0.53
CD (0.05%)	0.14	11.76	0.71	0.29	1.52
CV (%)	6.47	6.46	6.46	6.81	6.90

CONCLUSION

Thus, it was concluded that application of seed soaking and foliar application of GA_3 at 50 ppm (30 and 60 DAS), along with pinching treatment P_2 (double pinching at 60 DAS), had a beneficial effect on yield and quality of fenugreek cv. Pant Ragini. The double pinching and GA_3 at 50 ppm treatment showed superior effectiveness in improving the yield and quality of fenugreek.

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