The Pharma Innovation Journal 2023; 12(4): 2056-2059

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(4): 2056-2059

www.thepharmajournal.com
Received: 15-01-2023
Accepted: 18-02-2023

Bhanuja Dwivedi
Department of Horticulture, College of Agriculture, RVSKVV, Gwalior, Madhya Pradesh, India

PKS Gurjar
Department of Horticulture, College of Agriculture, RVSKVV, Gwalior, Madhya Pradesh, India

Ashwini Uikey
Department of Horticulture, College of Agriculture, RVSKVV, Gwalior, Madhya Pradesh, India

Priyanka Gurjar
Department of Horticulture, College of Agriculture, RVSKVV, Gwalior, Madhya Pradesh, India

Corresponding Author:
Bhanuja Dwivedi
Department of Horticulture, College of Agriculture, RVSKVV, Gwalior, Madhya Pradesh, India

Impact of plant growth regulators and biofertilizers on quality of fenugreek under Gwalior region

Bhanuja Dwivedi, PKS Gurjar, Ashwini Uikey and Priyanka Gurjar

Abstract
An experiment was conducted for two consecutive *Rabi* seasons during 2019-20 and 2020-21 on sandy loam soil at Department of Horticulture, College of Agriculture, RVSKVV, Gwalior (Madhya Pradesh) to study the Impact of plant growth regulators and biofertilizers on quality of fenugreek under Gwalior region. Results revealed that the maximum fresh weight of plant and dry weight of plant at 30, 60 and 90 DAS in first, second year and in pooled was recorded in treatment T3 (Seed inoculation with 50% Rhizobium + 50% PSB), whereas the minimum fresh weight of plant and dry weight of plant at 30, 60 and 90 DAS in first, second year and in pooled was observed in treatment T0 (Distilled water spray). Maximum number of pods per plant at 30, 60 and 90 DAS in first, second year and in pooled was recorded in treatment T3 (Seed inoculation with 50% Rhizobium + 50% PSB), whereas the minimum number of pods per plant at 30, 60 and 90 DAS in first, second year and in pooled was observed in treatment T0 (Distilled water spray). The maximum seed protein content (%) in first, second year and in pooled was recorded in treatment T3 (Seed inoculation with 50% Rhizobium + 50% PSB), whereas the minimum seed protein content (%) in first, second year and in pooled was observed in treatment T0 (Distilled water spray).

Keywords: Fenugreek, biofertilizer, protein, growth and Rhizobium

Introduction
Fenugreek belongs to *Fabaceae* family and an annual herbaceous legume, the plant is erect or branched and, generally, grows to a height of about 30-60 cm, depending on the variety. It is a diploid species and considered as the oldest known medicinal plant and abundant use of fenugreek such as pickle, as flavoring agent, as herb and spice, as breast milk enhancer etc (Govind *et al.* 2016) [1]. Beside its medicinal value, it is also used as a part of various food product developments as food stabilizer, adhesive, and emulsifying agent. Fenugreek seeds can go beyond rendering a spellbinding aroma and a distinct flavour to your meals, if used earnestly, the ingredient can promise good health and a revved up immune system. Fenugreek possesses pharmacological properties such as antimicrobial, carminative, emollient, febrifuge, laxative, restorative, uterine tonic, expectoral, galactogogue, anticarcinogenic, anti-inflammatory, antiviral, antioxidant, demulcent and hypotensive (Meena *et al.* 2014) [4]. Fenugreek is spread across the world because of its ability to survive in vast range of temperatures and soil types. The seed is produced as a spice, as forage for cattle, and for medicinal purpose. Fenugreek seeds contain many substances like protein (6.3%), fat (9.5%), carbohydrates (42.3%), vitamin-A (1040 IU) and calories (370/100g). Besides, methi contains alkaloid trigonelline (0.13-0.35%), diosgenin (0.78-1.9%) and a trace trigogenin.
Giberrellic acid is one of the most important growth vitalizing substances which used in agriculture and occurs naturally in many plants. It regulates various important functions such as elongation of stems, creation of proteins and germination of seed plants. The role of NAA in enhancing the fruit set, growth and yield attributes in fenugreek (Kumawat *et al.*, 2017) [3]. Many researchers find an vital effect of NAA on fenugreek plant height, number of leaves, branches, pods, and seed yield (Badar *et al.* 2016) [10]. The PGPR promote and enhance some growth parameters such as seed germination, seedling vigor, emergence, plant stand, root and shoot growth, total biomass of the plants and seed weight. *Rhizobium* as PGPR is a key factor for establishment of symbiosis with legumes (Anandhi *et al.* 2019) [11]. Inoculation of legumes with these bacteria increases biological nitrogen fixation in agriculture, especially in N depleted soils (Talab *et al.* 2014) [9]. The increasing use of chemical fertilizer, pesticides and weed control chemicals has damaged soil quality, ecology, environment and most importantly human health. Use of inorganic nitrogen fertilizer always bears a risk of contamination of

underground and surface water resources through leaching or run off. In recent years, continued and imbalance application of chemical fertilizers with little or no use of organic manure is leading to poor nutrient use efficiency and low yield of crops. At the same time its increasing cost of production, changing trend towards increase environmental sensitivity and consumer's preference towards organic products are commonly realized now a days. Thus to sustain the productivity and being a legume to enhance soil fertility of hungry soil, judicious use of fertilizer with integration of bio-fertilizers is important and to regulate physiological processes for balancing source and sink to enhance flowering and pod setting exogenous application of plant bioregulator. (Mounika *et al.* 2017) [5]. Use of bacterial fertilizers as a source of N and P can also minimize dependence on chemical fertilizers. Rhizobium has potential to fix atmospheric nitrogen, while PSB has the capacity to solublize and mobilize P and micronutrients present in non-available form in the soil (Naher *et al.* 2016) [6].

Materials and Methods

An experimental was conducted at Department of horticulture, college of agriculture, Rajmata Vijayaraje Scindia Vishwa Vidhyalaya, Gwalior is situated on 26°13' north latitude and 78°18' east longitude at an altitude in central part of Madhya Pradesh and enjoy semi-arid tropical climate during 2019-20 and 2020-21. The average rainfall varies from 751.0 mm concentrated mostly from the month of second week of June and remains active up to end of October less rainfall occurs during the winter season also. The minimum and maximum temperature during crop growth period varied 5.900C to 21.200C and from 19.700C to 40.400C, with season's average values of 10.670C and 27.720C, respectively. The morning and evening relative humidity ranged between 56.50 to 98.30% and 24.40 to 57.70% with season's average of 84.05% and 39.86%, respectively. The evaporation varied from 1.0 to 9.20 mm with an overall average of 3.39 mm. The soil was sandy clay in texture and slightly alkaline in reaction (pH 7.7 & 7.7) with electric conductivity 0.14 & 0.15 dS/m, low in available N (211.5 & 219.0 kg/ha), and medium in available P (16.56 & 16.12 kg/ ha), available K (187 & 194 kg/ha). A combination of 14 treatments, *viz*., Distillled Water Spray, Seed inoculation with 100% Rhizobium, Seed inoculation with 100% Phosphorous solubilizing bacteria, Seed inoculation with 50% Rhizobium + 50% PSB, GA3 (Foliar spray) - 25 ppm, GA3 (Foliar spray) - 50 ppm, GA3 (Foliar spray) - 75 ppm, GA3 (Foliar spray) - 100 ppm, NAA (Foliar spray) - 5 ppm NAA (Foliar spray) - 10 ppm, NAA (Foliar spray) - 15 ppm, NAA (Foliar spray) - 20 ppm, BR (Foliar spray) - 0.30 ppm and BR (Foliar spray) - 0.60 ppm were tested in a randomized block design and three replication. Fenugreek 'RMT-1' was sown at 30 cm × 10 cm with spacing 388 m2 during consecutive year of 2019-20 and 2020-21. Nitrogen and P2O5 were applied through urea and single superphosphate, respectively are recommended dose of fertilizers is as per treatments.

Results and Discussion

Growth parameters

The maximum fresh weight per plant (Table 4.1) and dry weight per plant (Table 4.2) at 30, 60 and 90 DAS in first, second year and in pooled was recorded in treatment T3 (Seed inoculation with 50% Rhizobium + 50% PSB), whereas the minimum fresh weight per plant and dry weight per plant at 30, 60 and 90 DAS in first, second year and in pooled was observed in treatment T0 (Distilled water spray). Similar results for most of the growth characters were also reported by Talab *et al.* (2014) [9], Singh *et al.* (2018) [8] and Nair *et al.* (2021) [7] and Naher *et al.* (2016) [6].

Yield parameters

The maximum number of pods per plant (Table 4.3) at 30, 60 and 90 DAS in first, second year and in pooled was recorded in treatment T3 (Seed inoculation with 50% Rhizobium + 50% PSB), whereas the minimum number of pods per plant at 30, 60 and 90 DAS in first, second year and in pooled was observed in treatment T0 (Distilled water spray).

Similar results for most of the yield characters were also reported by Singh *et al.* (2012) [8], Talab *et al.* (2014) [9] and Nair *et al.* (2021) [7].

Quality parameters

Higher seed protein content (%) (Table 4.3) in first, second year and in pooled was recorded in treatment T3 (Seed inoculation with 50% Rhizobium + 50% PSB), whereas the minimum seed protein content (%) in first, second year and in pooled was observed in treatment T0 (Distilled water spray). Similar results for most of the quality characters were also reported by Govind *et al.* (2018) [1], Krishraveni *et al.* (2016) [2], Nair *et al.* (2021) [7], Kumawat *et al.* (2017) [3], and Mounika *et al.* (2017) [5].

Table 4.1: Effect of plant growth regulators and biofertilizers on fresh weight (g) of plant at 30, 60 and 90 DAS of fenugreek

Fresh weight of plant (g)									
Treatments detail	Ist Year			IInd Year			Pooled		
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
T0: Distilled Water Spray	2.00	15.00	36.06	2.06	15.11	36.16	2.03	15.05	36.11
T1: Seed inoculation with 100% Rhizobium	2.79	19.74	41.23	2.70	19.80	41.37	2.75	19.77	41.30
T2: Seed inoculation with 100% Phosphorous solubilizing bacteria	2.73	19.30	40.51	2.67	19.20	40.34	2.70	19.25	40.42
T3: Seed inoculation with 50% Rhizobium + 50% PSB	3.02	21.05	45.07	3.06	21.12	45.18	3.04	21.09	45.13
T4: GA3 (Foliar spray) - 25 ppm	2.29	15.76	37.12	2.31	15.82	37.22	2.30	15.79	37.17
T5: GA3 (Foliar spray) - 50 ppm	2.46	16.64	38.01	2.44	16.67	38.18	2.45	16.66	38.10
T6: GA3 (Foliar spray) - 75 ppm	2.63	18.69	39.76	2.62	18.61	39.73	2.63	18.65	39.75
T7: GA3 (Foliar spray) - 100 ppm	2.96	20.84	44.61	3.00	20.93	44.54	2.98	20.89	44.57
T8: NAA (Foliar spray) - 5 ppm	2.18	15.34	36.77	2.20	15.43	36.84	2.19	15.39	36.80
T9: NAA (Foliar spray) - 10 ppm	2.36	16.02	37.78	2.39	16.14	37.84	2.38	16.08	37.81
T10: NAA (Foliar spray) - 15 ppm	2.55	17.99	39.08	2.60	18.05	39.15	2.58	18.02	39.12
T11: NAA (Foliar spray) - 20 ppm	2.90	20.30	43.75	2.99	20.34	43.63	2.94	20.32	43.69

T12: BR (Foliar spray) - 0.30 ppm	2.50	17.36	38.44	2.58	17.43	38.57	2.54	17.40	38.51
T13: BR (Foliar spray) - 0.60 ppm	2.85	20.00	42.55	2.81	20.14	42.69	2.83	20.07	42.62
S.Em ±	0.045	0.087	0.142	0.034	0.068	0.060	0.028	0.055	0.077
CD 5%	0.131	0.254	0.413	0.098	0.196	0.176	0.080	0.157	0.219

Table 4.2: Effect of plant growth regulators and biofertilizers on dry weight (g) of plant at 30, 60 and 90 DAS of fenugreek

Dry weight of plant (g)									
Treatments detail	**Ist Year**			**IInd Year**			**Pooled**		
	30 DAS	**60 DAS**	**90 DAS**	**30 DAS**	**60 DAS**	**90 DAS**	**30 DAS**	**60 DAS**	**90 DAS**
T0: Distilled Water Spray	0.20	1.42	3.13	0.19	1.36	3.13	0.19	1.39	3.13
T1: Seed inoculation with 100% Rhizobium	0.26	1.80	4.04	0.25	1.81	4.05	0.25	1.81	4.05
T2: Seed inoculation with 100% Phosphorous solubilizing bacteria	0.25	1.78	3.83	0.24	1.78	3.84	0.25	1.78	3.84
T3: Seed inoculation with 50% Rhizobium + 50% PSB	0.36	2.53	5.41	0.37	2.52	5.42	0.36	2.52	5.42
T4: GA3 (Foliar spray) - 25 ppm	0.21	1.44	3.40	0.21	1.44	3.35	0.21	1.44	3.38
T5: GA3 (Foliar spray) - 50 ppm	0.22	1.50	3.46	0.23	1.57	3.47	0.23	1.53	3.47
T6: GA3 (Foliar spray) - 75 ppm	0.24	1.69	3.71	0.24	1.70	3.82	0.24	1.69	3.76
T7: GA3 (Foliar spray) - 100 ppm	0.33	2.32	4.91	0.33	2.30	4.90	0.33	2.31	4.90
T8: NAA (Foliar spray) - 5 ppm	0.21	1.44	3.34	0.21	1.42	3.25	0.21	1.43	3.30
T9: NAA (Foliar spray) - 10 ppm	0.22	1.50	3.42	0.22	1.45	3.41	0.22	1.48	3.41
T10: NAA (Foliar spray) - 15 ppm	0.23	1.62	3.61	0.24	1.67	3.72	0.24	1.65	3.66
T11: NAA (Foliar spray) - 20 ppm	0.33	2.29	4.86	0.32	2.30	4.84	0.32	2.30	4.85
T12: BR (Foliar spray) - 0.30 ppm	0.23	1.56	3.50	0.24	1.63	3.49	0.23	1.60	3.50
T13: BR (Foliar spray) - 0.60 ppm	0.29	2.06	4.37	0.29	2.05	4.37	0.29	2.05	4.37
S.Em ±	0.005	0.009	0.013	0.003	0.007	0.006	0.003	0.006	0.007
CD 5%	0.015	0.026	0.037	0.010	0.021	0.016	0.009	0.016	0.020

Table 4.3: Effect of plant growth regulators and biofertilizers on number of pods per plant and seed protein content of fenugreek

Treatments detail	**Number of pods per plant**			**Seed protein content (%)**		
	Ist year	**IInd year**	**Pooled**	**Ist year**	**IInd year**	**Pooled**
T0: Distilled Water Spray	43.67	43.00	43.33	0.57	0.55	0.56
T1: Seed inoculation with 100% Rhizobium	52.67	51.67	52.17	0.73	0.72	0.72
T2: Seed inoculation with 100% Phosphorous solubilizing bacteria	51.67	51.33	51.50	0.72	0.71	0.71
T3: Seed inoculation with 50% Rhizobium + 50% PSB	58.00	57.33	57.67	0.84	0.83	0.83
T4: GA3 (Foliar spray) - 25 ppm	45.67	43.67	44.67	0.63	0.63	0.63
T5: GA3 (Foliar spray) - 50 ppm	47.33	46.00	46.67	0.65	0.66	0.65
T6: GA3 (Foliar spray) - 75 ppm	48.67	49.67	49.17	0.68	0.69	0.69
T7: GA3 (Foliar spray) - 100 ppm	56.67	55.33	56.00	0.83	0.82	0.83
T8: NAA (Foliar spray) - 5 ppm	43.67	43.00	43.33	0.62	0.58	0.60
T9: NAA (Foliar spray) - 10 ppm	45.67	45.00	45.33	0.64	0.64	0.64
T10: NAA (Foliar spray) - 15 ppm	48.67	47.67	48.17	0.68	0.69	0.68
T11: NAA (Foliar spray) - 20 ppm	53.67	53.00	53.33	0.75	0.73	0.74
T12: BR (Foliar spray) - 0.30 ppm	48.33	47.00	47.67	0.67	0.66	0.67
T13: BR (Foliar spray) - 0.60 ppm	53.00	52.67	52.83	0.75	0.73	0.74
S.Em ±	1.491	1.313	0.993	0.011	0.014	0.009
CD 5%	4.334	3.816	2.819	0.031	0.042	0.025

Conclusion

Based on the results of the experimental findings, it was concluded that growth and yield parameters at 30, 60 and 90 days after sowing was found to be higher when the seeds of fenugreek were inoculated with 50% Rhizobium+ 50% PSB (T3) during the first year and second year. Among the quality parameters, it was noted that higher seed protein content (%) of fenugreek was inoculated with 50% Rhizobium+ 50% PSB (T3) during the consecutive two years under Gwalior region.

References

1. Govind S, Lal N, Barcchiya J. Effect of different levels of phosphorus and biofertilizers on yield and quality of fenugreek (*Trigonella foenum-graecum* L.). Advances in Life Sciences. 2016;5(21):1-4.
2. Krishraveni V, Padmalaths TS, Padme SV, Prasad ALN. Influence of pinching and plant growth regulators on flowering, yield and economies of fenugreek (*Trigonella foenum-graecum* L.). Journal of Species and Aromatic Crops. 2016;25(1):41-48.
3. Kumawat K, Patel PP, Dambiwal D, Reddy TV, HaklaChouthu R. Effect of liquid and solid bio-fertilizers (Rhizobium and PSB) on growth attributes, yield and economics of fenugreek (*Trigonella foenum-graecum* L.). International Journal of Chemical Studies. 2017;5(4):239-242.
4. Meena SS, Mehta RS, Bairwa M, Meena RD. Productivity and profitability of fenugreek (*Trigonella foenum graecum* L.) as influenced by bio-fertilizers and plant growth regulators. Legume Research. 2014;37(6):646-650.
5. Mounika Y, Thanuja Sivaram G, Reddy PSS, Ramaiah M. Influence of Biofertilizers and Micronutrients on Growth, Seed Yield and Quality of Coriander (*Coriandrum sativum* L.) cv. Sadhana. International Journal of Current Microbiology Application Science.

2017;7(1):2099-2107.
6. Naher MS, Fahim AHF, Wadud MA. Crop productivity and nutrient uptake of fenugreek (*Trigonella foenum-graecum* L.) As influenced by integrated nutrient management. SAARC Journal of Agriculture. 2016;14(1):71-79.
7. Nair R, Pandey SK, Jyothsna J. Growth and yield of fenugreek (*Trigonella foenum graecum* L.) in response to different levels of phosphorus and biofertilizer (*Rhizobium* and PSB) under Kymore Plateau and Satpura hill agro-climatic zone of Madhya Pradesh. The Pharma Innovation Journal. 2021;10(1):419-422.
8. Singh S, Choudhary MR, Garhwal OP, Jakhar ML, Yadav BL. Effect of biofertilizers and inorganic sources of Nitrogen andPhosphorus on quality production of kasuri methi (*Trigonella corniculata*). International Journal of Seed Spices. 2012;2(2):38-40.
9. Talab SD, Mehrafarin A, Labbafi M, Qavami N, Qaderi A, Badi HN. Responces of fenugreek (*Trigonella Foenum-Graecum* L.) to exogenous application of plant growth regulatores (PGRs). Trakia Journal of Sciences. 2014;2:142-148.
10. Aba EK, Badar MA, Hayden MA. Impact of ISO 9001 certification on firms financial operating performance. International Journal of Quality & Reliability Management. 2016 Jan 4;33(1):78-89.
11. Li S, Harris S, Anandhi A, Chen G. Predicting biochar properties and functions based on feedstock and pyrolysis temperature: A review and data syntheses. Journal of Cleaner Production. 2019 Apr 1;215:890-902.