The Pharma Innovation Journal 2022; 11(4): 302-306

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(4): 302-306

www.thepharmajournal.com
Received: 02-02-2022
Accepted: 09-03-2022

Talaviya PL
Department of Agronomy, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Banaskantha, Gujarat, India

Patel KM
Assistant Research Scientist, Center for Research on IFS, Sardarkrushinagar Dantiwada Agricultural University, Banaskantha, Gujarat, India

Vora JR
Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat, India

Nisarata NV
Department of Agronomy, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Banaskantha, Gujarat, India

Faldu MR
Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat, India

Corresponding Author:
Talaviya PL
Department of Agronomy, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Banaskantha, Gujarat, India

Fenugreek: Green leaf, seed yield and FEY affected by phosphorus and cutting management

Talaviya PL, Patel KM, Vora JR, Nisarata NV and Faldu MR

Abstract
A field experiment on "Fenugreek: Green leaf, seed yield and FEY affected by phosphorus and cutting management" was conducted at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during *rabi* 2020-21 on loamy sand. Nine treatment combinations comprising three levels each of phosphorus (50,100 and 150% RDP) and sources of cutting management (no cutting, cutting at 60 DAS and 85 DAS as leafy vegetable + seed production) laid out in randomized block design (factorial) with four replications. Growth and yield attributes *viz;* plant height (30, 60, 85 DAS and at harvest) & branches/plant, pods/plant, length of pod, seeds/pod, test weight, seed and halum yields were significantly higher with 150% RDP and at par with 100% RDP whereas, in cutting management, growth and yield attributes were significantly higher with no cutting (only seed production). Maximum green leaf yield was recorded at 150% RDP and cutting at 85 DAS as leafy vegetable + seed production. In fenugreek the highest equivalent yield (2322 kg/ha) was found under 150% RDP and cutting at 60 DAS as leafy vegetable + seed production.

Keywords: Fenugreek, FEY, phosphorus, cutting, management

Introduction
Fenugreek is the third largest spice in India after coriander and cumin. Fenugreek belongs to Fabaceae family. It was named, Trigonella, from Latin language that means ''little triangle" due to its yellowish-white triangular flowers. It is named as Methi (Hindi, Urdu, Punjabi and Marathi), Hulba (Arabic), Moshoseitaro (Greek), Uluva (Malayalam), Shoot (Hebrew), Dari (Persian), and heyseed in English. It is cultivated worldwide as a semi-arid crop. Sowing in plains is generally taken up in September to November while in the hills, it is grown from march but optimum sowing time in general is from second fortnight of October to first fortnight of November. Its roots are endowed with mini factory to synthesize nitrogen for plant. (Altuntas *et al*., 2005) [1].

In India, fenugreek is grown in about 1,20,000 ha with an annual production of about 1,88,000 tonne of seeds and total productivity is 1,567 kg/ha. In Gujarat, fenugreek occupied an area of 7,326 ha producing 14,173 tonne of seeds and productivity is 1,935 kg/ha. The major fenugreek growing region are North Gujarat which area 1,814 ha and producing 3,652 tonne of seed (Productivity – 2,013 kg/ha) and middle Gujarat in which area 3,612 ha and producing 6,780 tonne of seed (Productivity – 1,877 kg/ha). The major districts of North Gujarat are Banaskantha, Patan, Surendranagar, Kutch and Mehsana produces 80 per cent of total production of the state (Anon., 2019-20) [2].

Fenugreek requires 5 - 10 days for germination while the first trifoliate leaf appears 5 - 8 days after germination. The pod matures within 80 - 110 days after sowing. Well drained loamy soil with 6.0 to 7.0 pH is ideal for better growth and development. It is a rabi crop it require low temperature during early stage for better vegetative growth stage, while a dry and relatively high temperature favours better ripening and high seed production. It is tolerant to frost. It has been grown all over India and the world in buckets mainly for condiments. Seeds are bitter in taste due to presence of two alkaloids "Trigonellin" and "Choline". Fenugreek is used in medicines as well as in food and food additive. In curried vegetables eaten as fresh tender pods, leaves and shoots.

Fenugreek being a legume crop is heavy feeder of phosphorus. Phosphorus is one of the major primary nutrient meanings that it is frequently deficient for crop production and required by crops. Phosphorus role on plant metabolism is enhance to symbiotic nitrogen fixation. In arid and semi-arid climatic condition, it gave cost effective nutrient management in fenugreek.

Total phosphorus concentration in agricultural crops generally varies from 0.1 to 0.5%. It is a key structural component of nucleic acids (DNA and RNA), coenzymes, phosphoproteins and phospholipids. Most essential functions are energy storage and transfer of energy (ADP and ATP), act as "energy currency". Due to deficiency of single element, the life cycle can't be completed hence, phosphorus is called "key of life". Therefore, phosphorus is essential nutrients for growth, development and various physiological and biochemical processes resulting in enhanced yield and quality.

Fenugreek is dual purpose spice crop plant, which is grown for its green leaves and dried seed. Therefore, appropriate cutting management practice plays an important role for production of quality green leaves for vegetable and dried seeds for spice purpose.

Apart from seed, tender stem and leaves of fenugreek are a rich source of protein, vitamins and minerals especially iron. In fenugreek, pinching is beneficial for higher production of seed as well as green leaf production to farmers. Cutting of stems significantly effects branching and enhances flowering in most of the crops. Since in most of the leafy vegetables several cuttings are possible, they require a good amount of fertilizer for quick growth. One or two leaf cutting may be done leading to higher seed production. It is a general practice with the farmers to leave the crop for seed taking a few leaf cuttings. The leaf plucking of fenugreek seed crop at early stage can provide an extra income to the farmers.

Keeping in view the importance of green and seed yield of fenugreek, the present experiment was undertaken to study the "Effect of phosphorus levels and cutting management on growth and yield of fenugreek under North Gujarat conditions" at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar.

Material and Methods

The present investigation entitled "Effect of phosphorus levels and cutting management on growth and yield of fenugreek under North Gujarat conditions" was conducted at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat during rabi season of year 2020-21.

Experimental site comes under North Gujarat Agro-climatic region (Zone IV). The climate of this region is sub - tropical monsoon type and falls under semi-arid region. The maximum temperature ranged between 22.9 °C to 38.9 °C, while mean minimum temperature ranged between 6.7 °C to 18.7 °C during the period of experimentation. The soil of experimental plot was loamy sand in texture, pH (7.45), EC (0.128 dS/m), low in organic carbon (0.29%), available nitrogen (171.2 kg/ha) and medium in available phosphorus (39 kg/ha), available potassium (262.3 kg/ha) were estimated in soil of experimental plot.

Nine treatment combinations comprising three levels each of phosphorus (50,100 and 150% RDP) and sources of cutting management (no cutting, cutting at 60 DAS as leafy vegetable + seed production and 85 DAS as leafy vegetable + seed production) laid out in randomized block design (factorial) with four replications. The cultivar of fenugreek used in experiment was Pusa Early Bunching. It is a quick growing, an erect type of shoot and born white coloured flowers from the leaf axils.

Before sowing the seed of fenugreek in field, it was treated with biofertilizer of Rhizobium @ 5 ml/kg seed and recommended seed rate of 18 kg/ha by maintaining in each plot at distance of 30 cm between rows at depth of 4 - 5 cm in each furrow. The experimental plots were fertilized as per treatments with urea and SSP. Thereafter, all the cultural practices, irrigation schedule, and plant protection measures were adopted as per need of crop during course of investigation.

Results and Discussion

Effect of phosphorus (P)

The result indicated that growth attribute character of plant height showed (Table 1) significantly variation due to phosphorus at all most stages of crop growth. Application of 150% RDP (P_3) recorded significantly higher plant height at 30 DAS (7.27 cm), 60 DAS (20.22 cm), 85 DAS (31.60 cm) and at harvest (48.69 cm) which was at par with 100% RDP (P2). Whereas, significantly lower plant height at 30 DAS (6.60 cm), 60 DAS (18.23 cm), 85 DAS (28.34 cm) and at harvest (44.42 cm) recorded with application of 50% RDP (P_1).

The increase in plant height under P_3 might be due to increased phosphorus concentration in the meristematic region like length of internode and slow releasing of phosphorus in root zone area during entire crop growth period also phosphorus is an essential constituent of nucleic acid and protein, which are very important in promoting quick growth which has shown positive response on plant height. These results corroborate the findings of Nehra *et al*. (2002) [12], Mehta (2009) [9], Meena (2013) [8], Chaudhary (2016) [3] and Singh *et al*. (2019) [14].

Observation of yield attributes (Table 1) and yield *viz*, number of branches per plant, number of pods per plant, length of pod, number of seeds per pod and test weight were recorded significantly higher with application of 150% RDP (P_3) which was at par with 100% RDP (P2). Number of branches per plant (8.89), number of pods per plant (20.26), length of pod (8.40 cm), number of seeds per pod (11.13) and test weight (6.82 g) were recorded significantly.

Being a vital component of ADP and ATP, phosphorus plays an important role in conservation and transfer of energy in metabolic reactions of living cells including biological energy transformations and thus acts as 'energy currency' within plants. More number of branches might be due to the more availability of phosphorus, which plays a vital role in cell division. Almost 2/3 portion of phosphorus from total applied P are used in early stages of plant life and maximum availability of nutrient are used in photosynthetic activity. Due to this reason increased levels phosphorus increasing number of pods per plant. Plant growth leading to a rapid photosynthetic process in which the greater growth was achieved in pod length at harvest. Artificial application of phosphorus through inorganic fertilizers might have resulted in increased carbohydrate accumulation and their remobilization to reproductive parts of the plant, being the closest sink and hence, resulted in increased flowering, fruiting and seed formation, so that it increased number of seed per plant and also increased test weight. The above findings are in complete agreement with earlier work of Nehra *et al*. (2002) [12], Mehta and Patel (2011) [10], Meena (2013) [8], Chaudhary (2016) [3], Somdutt *et al*. (2019) [16].

The data study considering of green leaf yield (Table 2) was

produced maximum green biomass (5722 kg/ha) with application of 150% RDP (P_3). Whereas seed yield (448 kg/ha) and haulm yield (1089 kg/ha) were recorded significantly higher in 150% RDP (P_3) but remained at par with application of phosphorus @ 100% RDP (P_2). Fenugreek equivalent yield (1683 kg/ha) was significantly highest @ 150% RDP.

Phosphorus being part of the essential nutrients required for the promotion of the meristematic and physiological activities such as plant height, number of leaves, root development, number of pods/plants, number of seeds/pod and test weight under this treatment. This might be the fact that efficient absorption and translocation of water and nutrients and assimilation of carbon dioxide. These activities promote higher photosynthetic activities leading to the production of enough assimilates for subsequent translocation towards sink and hence the production of higher green leaf yield, seed yield, haulm yield and fenugreek equivalent yield. These results are in conformity with those obtained by Singh *et al*. (2019) [14] and Deshmukh *et al*. (2020) [4].

A perusal of data furnished in Table 2 revealed that application of 150% RDP (P_3) gave highest gross realization (₹67,320/ha), net realization (₹37,455/ha) and benefit: cost ratio (2.25).

Effect of cutting management

The results noted that growth attribute plant hight (Table 1) showed significantly variation due to cutting at all stages of crop growth. At harvest C_1 treatment with no cutting (only seed production) noted the highest plant height (55.68 cm) followed by C_2 (48.46 cm). Significantly lower plant height was found in C_3 treatment with cutting at 85 DAS as leafy vegetable + seed production (35.65 cm).

Reason clearly indicated that plant height decreases with increasing cutting treatment because it suppressed shoot growth due to cutting. After cutting about three to four weeks were necessary for renewed and vigorous plant growth. The results are in line with those reported by Sudarshan (2004) [18], Nandal *et al*. (2007) [11], Krishnaveni *et al*. (2014) [6], Lakshmi *et al*. (2015) [7], Rana *et al*. (2015) [13], Sowmya *et al*. (2017) [17] and Singh *et al*. (2018) [15].

In yield parameter number of branches per plant, number of pods per plant, length of pod (cm), number of seeds per pod and test weight (g) were recorded significantly higher with no cutting- only seed production (C_1) which was at par with cutting at 60 DAS as leafy vegetable + seed production (C_2). Number of branches per plant (9.52), number of pods per plant (22.33), length of pod (9.24 cm), number of seeds per pod (11.16) and test weight (7.30 g) were recorded significantly.

The result proved that early days in single cutting encouraged growth of plant which is comparable to without cutting practices. Varietal characteristics of fenugreek gave more vegetative growth and vertical growth resulting in translocation of photosynthates to leaf axils, which produced a greater number of branches per plant. Number of pods per plant, pod length, seeds per pod drastically decreased with cutting practices at 60 DAS and at 85 DAS because more energy required for photosynthesis to regenerate new leaves, flowers but less photosynthesis produced lesser flowers and fruits as compare to no cutting. Also, reduction in test weight with cutting might be reduced plant height and leaf area, which is the main source of photosynthesis and supply energy to the seeds for development. In no cutting treatment produced bolder and heavier seeds as compare to cutting plants. These are supported by Singh *et al*. (2018) [15], Kauser *et al*. (2018) [5].

The maximum green leaf yield (Table 2) was observed in C_3 (cutting at 85 DAS as leafy vegetable + seed production) followed by C_2 (cutting at 60 DAS as leafy vegetable + seed production). The mean green yield obtains from C_2 and C_3 were 8379 kg/ha and 7574 kg/ha, respectively. Green leaf yield was increased with levels of leaf cutting. It is fact that increased yield by increase days of cutting because day to day plant green biomass and growth are increased with effect of photosynthesis. These results conform the findings of Rana *et al*. (2015) [13], Yousuf and Nayak (2018) [19] and Singh *et al*. (2018) [15].

Seed (529 kg/ha) and haulm (1336 kg/ha) yield was significantly higher (Table 2) with no cutting – only seed production (C_1). Suddenly reduction in seed yield is due to cutting practices because loss of photosynthetic energy by way of cutting after regrowth is not take completely like no cut plant. So that, less development of leaves, flower and seeds that decrease seed and haulm yield with increasing cutting management practices. These results collaborate with the finding with Greeshma (2017).

Fenugreek equivalent yield was significant with cutting management practices C_2 (cutting at 60 DAS as leafy vegetable + seed production) gave significantly the highest fenugreek equivalent yield (2322 kg/ha) followed by C_3 (1724 kg/ha) and C_1(562 kg/ha) respectively. In cutting practices no cutting has only seed and haulm yields are considered. While cutting at 60 and 85 DAS have green leaf yield, seed yield and haulm yield are included based on their prices, fenugreek equivalent yield was higher in cutting practices as compare to no cutting.

Data presented in Table 2 that the highest gross realization (₹92,880/ha), net realization (₹63,298/ha) and benefit: cost ration (3.13) was incurred with the treatment C_2 (cutting at 60 DAS as leafy vegetable + seed production) followed by treatment C_3 (cutting at 85 DAS as leafy vegetable + seed production).

Table 1: Effect of phosphorus levels and cutting management on growth and yield attributes of fenugreek

Treatment	Plant height (cm)				Number of branches per plant	Number of pods per plant	Length of pod (cm)	Number of seeds per pod	Test weight (g)
	30 DAS	60 DAS	85 DAS	At harvest					
Phosphorus (P)									
P_1 : 50% RDP	6.60	18.23	28.34	44.42	7.58	17.94	7.63	9.77	6.28
P_2 : 100% RDP	7.08	19.68	30.29	46.67	8.59	19.16	8.06	10.66	6.78
P_3 : 150% RDP	7.27	20.22	31.60	48.69	8.89	20.26	8.40	11.13	6.82
S.Em.±	0.15	0.42	0.88	1.16	0.20	0.49	0.21	0.17	0.13
C.D. (P = 0.05)	0.43	1.22	2.58	3.38	0.57	1.42	0.60	0.51	0.38

Cutting management (C)										
C_1	:	No cutting (only seed production)	7.06	19.44	35.07	55.68	9.58	22.33	9.24	11.16	7.30
C_2	:	Cutting at 60 DAS as leafy vegetable + seed production	7.00	19.39	20.97	48.46	9.14	18.98	8.84	10.59	6.95
C_3	:	Cutting at 85 DAS as leafy vegetable + seed production	6.90	19.30	34.20	35.65	6.33	16.06	6.02	9.81	5.63
S.Em.±			0.15	0.42	0.88	1.16	0.20	0.49	0.21	0.17	0.13
C.D. (P = 0.05)			NS	NS	2.58	3.38	0.57	1.42	0.60	0.51	0.38
Interaction effect (P × C)											
S.Em.±			0.25	0.72	1.53	2.00	0.34	0.84	0.36	0.30	0.23
C.D. (P = 0.05)			NS	NS	NS	NS	1.00	2.45	NS	NS	NS
C.V. %			7.26	7.48	10.17	8.60	8.19	8.79	8.96	5.76	6.91

RDP = Recommended Dose of Phosphorus, DAS = Days after Sowing, RDF: 20:40:00 NPK kg /ha 50% RDP = 20 kg P2O5/ha, 100% RDP = 40 kg P2O5/ha, 150% RDP = 60 kg P2O5/ha

Table 2: Effect of phosphorus levels and cutting management on yield and economics of fenugreek

Treatment			Green leaf yield (kg/ha)	Seed yield (kg/ ha)	Haulm yield (kg/ha)	FEY (kg/ha)	Gross realization (₹/ha)	Cost of cultivation (₹/ha)	Net realization (₹/ha)	BCR
Phosphorus (P)										
P_1	:	50% RDP	4746	315	880	1334	53360	27915	25445	1.91
P_2	:	100% RDP	5485	411	1005	1591	63640	28886	34754	2.20
P_3	:	150% RDP	5722	448	1089	1683	67320	29865	37455	2.25
S.Em.±				13	29	30				
C.D. (P = 0.05)				37	86	89				
Cutting management (C)										
C_1	:	No cutting (only seed production)	-	529	1336	562	22480	26315	-3835	0.85
C_2	:	Cutting at 60 DAS as leafy vegetable + seed production	7574	402	1089	2322	92880	29582	63298	3.13
C_3	:	Cutting at 85 DAS as leafy vegetable + seed production	8379	244	549	1724	68960	30769	38191	2.24
S.Em.±				13	29	30				
C.D. (P = 0.05)				37	86	89				
Interaction effect (P × C)										
S.Em.±				22	51	53				
C.D. (P = 0.05)				65	149	154				
C.V. %				11.31	10.29	8.85				

Interaction Effect

The interaction effects between phosphorus and cutting management (P × C) with respect to number of branches per plant, number of pods per plant, seed yield, haulm yield and fenugreek equivalent yield were found to be significant.

Conclusion

In light of the results obtained from this investigation, it is concluded that 60 kg P_2O_5/ha and cutting management at 60 DAS as leafy vegetable and its seed production gave higher fenugreek equivalent yield and net return in fenugreek (Pusa Early Bunching) under North Gujarat Agro climatic conditions.

References

1. Altuntas E, Ozgoz E, Taser OF. Some physical properties of fenugreek (*Trigonella foenum-graceum* L.) seeds. Journal Food Engineering. 2005;71(1):37–43.
2. Anonymous. District wise area, production and yield of important food and non-food crops in Gujarat State, Directorate of Agriculture, Gujarat State, Gandhinagar, 2019-20.
3. Chaudhary CG. Effect of phosphorus and PSB on growth and yield of fenugreek. M.Sc. (Agri.) Thesis (Unpublished). Sardarkrushinagar Dantiwada Agricultural University, Gujarat, 2016.
4. Deshmukh AA, Nagre PK, Wagh AP. Influence of nitrogen and phosphorus levels on yield, soil status and economics of fenugreek (*Trigonella-foenum-graecum*). Journal of Pharmacognosy and Phytochemistry. 2020;9(4):3229-3232.
5. Kauser H, Bhoomika HR, Ibaad MH. Interaction effects of different sowing dates and stage of pinching on growth, yield and economics of fenugreek (*Trigonella foenum – graecum* L.). International Journal Pure Application Bioscience. 2018;6(2):167-171.
6. Krishnaveni V, Padmalatha T, Padma SSV, Prasad ALN. Effect of pinching and plant growth regulators on growth and flowering of fenugreek. Plant Archives, 2014, pp. 901-907.
7. Lakshmi J, Gowda R, Parashivamurthy, Narayanaswamy S, Shivanandam VN. Influence of pre-flowering pinching and maleic hydrazide spray on plant growth, seed yield and quality attributes in fenugreek. Legume Research. 2015;38(3):353-357.
8. Meena P. Effect of varying levels of nitrogen, phosphorus and sulphur on fenugreek (*Trigonella foenum-graecum* L.) under North Gujarat conditions. M. Sc. (Agri.) Thesis (Unpublished). Sardarkrushinagar Dantiwada Agricultural University, Gujarat, 2013.
9. Mehta RS. Effect of various agrotechnique for enhancing growth and yield of fenugreek. M.Sc. (Agri.) Thesis (Unpublished). Sardarkrushinagar Dantiwada Agricultural University, Gujarat, 2009.
10. Mehta RS, Patel BS. Effect of nitrogen, phosphorus and bio-fertilizers on yield and profitability of fenugreek (*Trigonella foenum-graecum* L.). Madras Agricultural Journal. 2011;98(4-6):154-157.
11. Nandal JK, Dahiya MS, Gupta V, Singh D. Response of sowing time, spacing and cutting of leaves on growth and seed yield of fenugreek. Haryana Journal of Horticultural Science. 2007;36(3&4):374-376.

12. Nehra KC, Sharma HS, Agarwal HR. Response of fenugreek (*Trigonella foenum-graecum* L.) phosphorus and potassium. *Annals of Biology* (India), 2002.
13. Rana SC, Pandita VK, Sirohi S. Influence of spacing and number of leaf cuttings on seed yield in fenugreek. Legume Research. 2015;38(6):858-860.
14. Singh R, Dhillon BS, Sidhu BS. Effect of nitrogen and phosphorus on the productivity of fenugreek (*Trigonella foenum-graecum* L.) in South-West Punjab. Journal of Pharmacognosy and Phytochemistry. 2019;8(5):584-587.
15. Singh S, Dhangrah VK, Singh V, Thenua OVS, Pal K, Shukla RD. Nitrogen rate and cutting management for fenugreek green leaf and seed production. International Journal of Bio-resource and Stress Management. 2018;9(4):523-526.
16. Somdutt, Dashora LN, Mundra SL, Choudhary J, Choudhary P. Effect of inorganic and organic sources of fertilization on productivity of fenugreek (*Trigonella foenum-graecum* L.) under agro-climatic conditions of Southern Rajasthan. Journal of Pharmacognosy and Phytochemistry. 2019;8(4):1886-1888.
17. Sowmya PT, Naruka IS, Shaktawat RPS, Kushwah SS. Effect of sowing dates and stage of pinching on growth, yield and quality of fenugreek (*Trigonella foenum-graecum* L.). International Journal of Bio-resource and Stress Management. 2017;8(1):091-095.
18. Sudarshan JS. Influence of apical pinching, chemical spray and physiological maturity on seed yield and quality of fenugreek (*Trigonella foenum-graecum* L.). M.Sc. (Agri.) Thesis (Unpublished). University of Agricultural Science, Dharwad, Karnataka (India), 2004.
19. Yousuf M, Nayak H. Studies on the influence of nitrogen levels and herb harvests on the growth and yield of fenugreek (*Trigonella foenum-graecum* L.) cv. Ajmer fenugreek-1. Journal of Pharmacognosy and Phytochemistry. 2018;7(5):506-509.