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Studies on the influence of nitrogen levels and herb harvests on the yield and economics of fenugreek (*Trigonella foenum-graecum* L.) Cv. Ajmer Fenugreek-1

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Abstract
The present experiment was conducted to determine "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" under Southern Telangana agro-climatic conditions in the Department of Plantation, spices, medicinal and aromatic crops, was conducted during *kharif* season (August 2017 to December 2017) at the Department of Plantation, Spices, Medicinal and Aromatic crops section, College of Horticulture, Hyderabad.. The laboratory experiment was conducted in Factorial Randomized Block Design with three replications and Nitrogen was applied at three levels (30, 45 and 60 kg/ha). Application of nitrogen at different levels had a significant impact on growth and yield parameters of fenugreek recorded during the course of investigation different treatments. The result reveals that application of nitrogen at 60 kg per hectare improved and recorded maximum values for all the growth and yield parameters such as plant height, number of branches per plant, fresh and dry weight per plant, fresh and dry herb yield, number of pods per plant, pod length, number of seeds per pod, test weight of seeds, seed yield, biological yield, harvest index, NPK content and uptake. However, there was significant delay in flowering and maturity with 60 kg nitrogen per hectare. Among the harvesting practices (single, double and no herb harvest), the uncut plants showed maximum plant height, early flowering and maturity.

Keywords: fenugreek, nitrogen levels, factorial randomized block design, NPK content

Introduction
Indian spices are adding flavour, taste, aroma, colour and pungency to the world food. Indian spices have earned high reputation in the international market and India is the largest seed spice producing and exporting country in the world. Among the 63 spices grown in the country, 17 are seed spices.Fenugreek (*Trigonella foenum-graecum* L.) commonly known as *Greekaye*s and also *Methi* is an annual legume seed spice. It is a multi-purpose crop, where, leaves are used as vegetable, seeds as spice and flavouring agent, besides having number of medicinal uses. Its fresh and tender leaves are rich in iron, calcium, protein, vitamins and essential amino acids.

In fenugreek, both herb and seeds are the economic parts. In North India, the crop is grown for seed, while in South India, it is a green leafy vegetable. Among different nutrient elements required by the plants for their growth and development, nitrogen is most important and has direct role in the nutrient metabolism and photosynthesis process. It plays a key role in the growth and seed yield of the crop. An adequate supply of nitrogen to fenugreek will also improve source to sink relationship leading to higher productivity.

Keeping in view the vital role of nitrogen in improving the herbage and seed yield of crops, the present study was taken up to explore the possibility of raising fenugreek as a dual purpose crop in Hyderabad with one or two herb harvests and ultimately leaving it for seed with varied levels of nitrogen. Though research data is available on nutrient management of fenugreek especially in the traditional fenugreek growing areas such as Rajasthan and Gujarat, the systemic research on the nitrogen requirements and raising it as a dual purpose crop under the Hyderabad condition is not taken up so far.

Material and Methods
The present study entitled "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 was conducted during *kharif* season (August 2017 to December 2017) at the Department of Plantation, Spices, Medicinal and Aromatic crops section, College of Horticulture, Hyderabad. Details of methods followed and material used in the experiment are detailed below.

Location
The experiment will be conducted at the Department of Plantation, Spices, Medicinal and Aromatic crops section, College of Horticulture, Hyderabad

Experimental Site
The site of experiment plot is located at an elevation of 543.2 meters or 1782.2 feet above MSL at 17^0 33^1 latitude and 78^0 41^1 longitude.

Details of Treatment
Factor-1
Nitrogen Levels-3
N_1: 30 kg nitrogen per hectare
N_2: 45 kg nitrogen per hectare
N_3: 60 kg nitrogen per hectare

Factor-2
Herb harvests-3
C_0: No cut
C_1: Single cutting at 30 Days after sowing (DAS)
C_2: Double cuts at 30 and 60 DAS

Treatment combinations

T_1 : $N_1 C_0$- 30: 40: 20 Kg/ha NPK+ without herb harvest
T_2 : N_1C_1- 30: 40: 20 Kg/ha NPK+ herb harvest at 30 DAS
T_3 : N_1C_2- 30: 40: 20 Kg/ha NPK +herb harvests at 30 and 60DAS
T_4 : N_2C_0- 45: 40: 20 Kg/ha NPK+ without herb harvest
T_5 : N_2C_1- 45: 40: 20 Kg/ha NPK+ herb harvest at 30 DAS
T_6 : N_2C_2- 45: 40: 20 Kg/ha NPK+ herb harvests at 30 and 60DAS
T_7 : N_3C_0- 60: 40: 20 Kg/ha NPK+ without herb harvest
T_8 : N_3C_1- 60: 40: 20 Kg/ha NPK+ herb harvest at 30 DAS
T_9 : N_3C_2- 60: 40: 20 Kg/ha NPK+ herb harvests at 30 DAS and 60DAS

Results and Discussion

Seed yield (kg/ha)

Seed yield of fenugreek as influenced by varied levels of nitrogen and herb harvests have been presented in table 1, which clearly indicates the significant impact of nitrogen levels in all the various treatments. Similarly, the harvesting practices and their interactions also had a significant influence on seed yield.

Maximum seed yield of 1003.44 kg/ha was recorded with highest level of nitrogen at 60 kg per hectare (N_3) followed by nitrogen at 45 kg per hectare recording 991.56 kg per hectare seed yield. Whereas, the minimum seed yield (958.33 kg/ha) was recorded with plants applied with nitrogen at 30 kg per hectare (N_1). Similarly single cut plants resulted in maximum seed yield (1173.0 kg/ha) which was *at par* with uncut recording a seed yield of 972.22 kg per hectare. The lowest seed yield (808.11 kg/ha) was recorded in the plants subjected to double leaf harvest.

With regard to treatments combination, nitrogen levels and harvest practices had a significant influence on seed yield. The interaction of nitrogen at 60 kg per hectare with single cut plants (N_3C_1) caused for the maximum seed yield of 1186.67 kg per hectare, while it was *at par* in the plants applied with 60 kg per hectare and uncut plants (N_3C_0) weighting 1007.0 kg per hectare of seeds.The minimum seed yield (791.33 kg/ha) was noticed in the treatment which received nitrogen at 30 kg per hectare and harvested twice (N_1C_2) for leaf. These results are in accordance with the findings of Parakhia *et al.* (2000) [6], Jat *et al.* (2003), Surendra Kumar *et al.* (2002) [9] in coriander and Yadav *et al.* (2006) [11] in fenugreek.

Straw yield

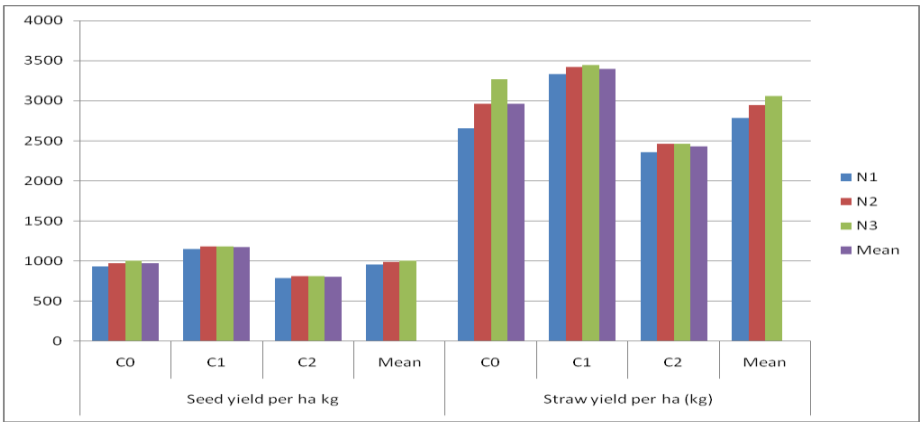
Various levels of nitrogen and harvesting practices had a significant impact on straw yield of fenugreek (Table 1).

Application of nitrogen at 60 kg per hectare (N_3) produced maximum straw yield of 3058.56 kg per hectare. While plants supplied with nitrogen at 45 kg per hectare resulted in 2946.56 kg per hectare of straw yield. The lowest straw yield (2781.56 kg/ha) was recorded with nitrogen application at 30 kg per hectare (N_1). Similarly, single cut at 30 DAS resulted in maximum straw yield (3397.67 kg/ha) which was followed by the uncut plants producing a straw yield of 2960.44 kg per hectare. The minimum straw yield (2428.56 kg/ha) was recorded in (C_2).

Varied levels of nitrogen levels and herb harvests combination had a significant impact on straw yield of fenugreek. The combination of nitrogen at 60 kg per hectare with single cut (N_3C_1) recorded maximum straw yield (3442.67 kg/ha), while, the minimum straw yield (2359.67 kg/ha) was recorded in the treatment which received nitrogen at 30 kg per hectare and harvested twice (N_1C_2) for leaf.

Table 1: Seed and straw yield (kg/ha) of fenugreek (*Trigonella foenum–graecum*L.) as influenced by various nitrogen levels and leaf harvests:

Treatment	Seed yield per ha kg				Straw yield per ha (kg)			
	C_0	C_1	C_2	Mean	C_0	C_1	C_2	Mean
N_1	936.33	1147.33	791.33	958.33	2653.33	3331.67	2359.67	2781.56
N_2	973.33	1185.00	816.33	991.56	2959.67	3418.67	2461.33	2946.56
N_3	1007.00	1186.67	816.67	1003.44	3268.33	3442.67	2464.67	3058.56
Mean	972.22	1173	808.11		2960.44	3397.67	2428.56	
	S.Em±		C.D (5%)		S.Em±		C.D (5%)	
N	1.03		3.11		6.12		18.38	
C	1.03		3.11		6.13		18.38	
NXC	1.79		5.38		10.61		31.83	



Legend:

Nitrogen Levels
N_1 : 30 kg nitrogen per hectare
N_2 : 45 kg nitrogen per hectare
N_3 : 60 kg nitrogen per hectare

Herb harvests
C_0: No cut
C_1: Single cutting at 30 Days after sowing (DAS)
C_2: Two cuttings at 30 and 60 DAS

Fig 1

Economics of fenugreek cultivation as influenced by nitrogen levels and herb harvests

Economics is an important and ultimate factor which decides the optimum levels of inputs to be used in the production of any crop. The perusal of data presented in table 2 detailing the economics of fenugreek cultivation as influenced by N levels and harvesting practices clearly demonstrated the feasibility of fenugreek crop cultivation under Hyderabad conditions.

In the present study, the maximum gross returns (Rs 1,15,684/ha) and net returns (Rs 78,534/ha) and B:C ratio (3.01) was recorded in plants applied with nitrogen at 60 kg per hectare and harvested once for fresh herb (N_3C_1). The application of nitrogen at 60 kg enhanced the herb as well as the seed yield of fenugreek making the cultivation more remunerative. However, harvesting the crop more than once for the fresh herb will not yield higher dividends due to higher cost of production, lower seed yield, despite higher herb yield. The results are in accordance with the findings of Choudhary *et al*. (2011) [2] and Patel *et al*. (2010) [7] in fenugreek, Raj Singh and Rao (2006) [8] in cumin and Mehta *et al*. (2012) [5] in fenugreek.

Hence, it is highly profitable to cultivate fenugreek as a dual purpose crop with the application of 60 kg nitrogen per hectare and taking one leaf crop at 30 DAS for the fresh herb and reaping the seed, as this practice gave maximum net profit with a B: C ratio of 3.01.

Table 2: Economics of fenugreek (*Trigonella foenum–graecum* L.) cultivation under Hyderabad condition as influenced by Nitrogen levels and herb harvests

Treatments	Cost of cultivation (Rs.ha^{-1})	Gross returns (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	B:-C ratio
N_1 C_0	35459	66904	32145	1.88
N_1C_1	37959	80754	43995	2.12
N_1C_2	40459	84604	45845	2.09
N_2C_0	35655	80328	45373	2.25
N_2C_1	38155	97886	60931	2.56
N_2C_2	40655	101314	62359	2.49
N_3C_0	35850	94136	58986	2.62
N_3C_1	38350	115684	78534	3.01
N_3C_2	40850	108974	69824	2.66

Legend: **Nitrogen Levels** — N_1 : 30 kg nitrogen per hectare; N_2 : 45 kg nitrogen per hectare; N_3 : 60 kg nitrogen per hectare

Herb harvests — C_0: No cut; C_1: Single cutting at 30 DAS; C_2: Two cuttings at 30 and 60 DAS

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