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Economic analysis of fenugreek as affected by different growing conditions and sowing time

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Abstract
Effect of various growing conditions and sowing time on growth, yield and quality of fenugreek (*Trigonella foenum-graecum* L.) experiment was carried out during September 2019 to January 2020 at College of Horticulture, SDAU, Jagudan (Gujarat). In this investigation comprising of two factor, first one is different growing conditions which have 4 sub factors *viz*. Open field, 50 percent green shadenet, 50 percent white shadenet and Naturally Ventilated Polyhouse and second one is different sowing time which also have 4 sub factors *viz*. 3rd week of Sept, 1st week of Oct, 3rd week of Oct and 1st week of Nov which were tested in the SPD with three replications. On the basis of economics, sowing of fenugreek under 50% white shade net on 3rd week of October treatment was found beneficial for higher yield and net return.

Keywords: Fenugreek, growing condition, sowing time, economics, benefit cost ratio

Introduction
An important leafy vegetable, fenugreek (*Trigonella foenum-graecum* L.), commonly called as 'Greek hay' and also called as 'methi' in Hindi, occupies a prime position among the leafy vegetable and seed spices grown in India. One of the important factor responsible for yield enhancement of methi is proper time of sowing, which exerts a distinct effect on growth promote. Summer or hot days are one of the limiting factor in fenugreek production. The aim of protected cultivation is to achieve independence of climate and weather and to allow crop production in climate where the natural environment limits or prohibits plant growth. Further low cost structures may be most economical for farmers to produce a remunerative crop production. In the present scenario of perpetual demand of vegetable and shrinking land holding drastically, protected cultivation is the best alternative and drudgery-less approach for using land and other resources more efficiently. In protected environment (Green house, net house), the natural environment is modified to suitable condition for optimum plant growth, which ultimately provides quality vegetables (Sirohi and Behera, 2000) [12]. From protected structures crop yield is several time more, than the yield obtain from outdoor cultivation. Because of environmental control, any crop can be grown at any time of the year, and even one type of crop can be raised round the year, if needed. Sowing in the plains is generally taken up in late October to November while in the hills, it is grown from March which limits it's availability for a shorter period of year. Another benefit of harvesting green leaves lies in its very short crop span of 25 to 30 days. With the introduction of liberalized and farmers friendly government policy *i.e.* subsidy on protected structures, the area under protected structures is increasing rapidly. In the North-Gujarat also farmers are equipping with different types of protected structures.

Materials and Methods
In this experiment we have taken two factors, one is growing condition with four levels *viz*. Open field, 50 percent green shade net, 50 percent white shade net and Naturally Ventilated Polyhouse and second factor is sowing time with four levels *viz*. 3rd week of Sept, 1st week of Oct, 3rd week of Oct and 1st week of Nov were experimented for fenugreek cv. Pusa Early Bunching. All the growing conditions and sowing time were evaluated on the basis of growth (days taken to germination, plant height and days taken to cutting), yield attributes (number of

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cutting, yield per cuttings, yield per hectare in all cuttings, total yield per plot, total yield per hectare) and quality (chlorophyll a, b and total chlorophyll content and carotenoid content). During the crop growth period of winter-2019-20 temperature varied from 15 °C to 40 °C in open field, 17 °C to 35 °C in 50 percent green shade net and also in 50 percent white shade net and 20 °C to 37 °C in NVP. The atmospheric humidity ranged from 55 to 85% in open field, 70 to 89% in 50 percent green shade net and also in 50 percent white shade net and 72 to 92% in NVP. This data of weather was collected by the researcher herself. Collected data were subjected to statistical analysis. The soil of experimental site is sandy loam in texture with slightly alkaline in reaction, low in organic carbon and available nitrogen, medium in available phosphorus and potassium. pH of soil was 7.7. Plot size in the experiment was: 1.5 m × 2 m.

Result and Discussion

Table 1: Effect of different growing conditions & sowing time on income per day

Treatments	Income per day (Rs.)			
	1st cutting	2nd cutting	3rd cutting	4th cutting
Growing conditions (G)				
Open field (g_1)	0.34	0.55	0.51	0.14
Green shade net 50% (g_2)	0.48	0.71	0.55	0.23
White shade net 50% (g_3)	0.74	1.07	1.50	0.48
NVP (Naturally Ventilated Polyhouse) (g_4)	0.41	0.61	0.27	0.13
S. Em. ±	0.05	0.05	0.11	0.03
C. D. (5%)	0.17	0.19	0.39	0.10
C. V. %	33.80	25.32	55.42	41.91
Sowing time (D)				
3rd week of September (d_1)	0.23	0.41	0.60	0.25
1st week of October (d_2)	0.32	0.56	0.78	0.28
3rd week of October (d_3)	0.91	1.22	0.86	0.39
1st week of November (d_4)	0.52	0.75	0.59	0.05
S. Em. ±	0.04	0.05	0.09	0.03
C. D. (5%)	0.11	0.16	NS	0.08
Interaction				
S. Em. ±	0.07	0.11	0.17	0.05
C. D. (5%)	0.22	NS	0.51	0.16
C. V. %	26.30	25.49	42.83	37.74

Among the different growing conditions, treatment g_3 (50 % white shade net) recorded significantly maximum income per day ₹ 0.74, 1.07, 1.50 and 0.48 in first, second, third and fourth cutting respectively. Whereas, minimum income per day in first (₹ 0.34) and second (₹ 0.55) cutting was observed in treatment g_1 (open field) and in third (₹ 0.27) and fourth (₹ 0.13) cutting was observed in treatment g_4 (NVP).

Significantly maximum income per day in first (₹ 0.91), second (₹ 1.22) and fourth (₹ 0.39) cutting was recorded in treatment d_3 (3rd week of October). Whereas, minimum income per day in first (₹ 0.23) and second (₹ 0.41) cutting was observed in treatment d_1 (3rd week of Sept) and fourth (₹ 0.05) cutting was observed in treatment d_4 (1st week of November). However income per day was statistically non-significant in second cutting.

Table 2: Effect of different growing conditions & sowing time on economics and benefit cost ratio

Treatments	Yield per hectare (t/ha)	Gross realization (₹/ha)	Total cost of cultivation (₹/ha)	Net returns (₹/ha)	Benefit Cost Ratio
g_1d_1	3.62	90500	97883	-7383	0.92
g_1d_2	5.60	140000	99183	40817	1.41
g_1d_3	8.72	218000	97883	120117	2.22
g_1d_4	3.90	97500	96583	917	1.01
g_2d_1	4.19	104750	160043	-55293	0.65
g_2d_2	4.36	109000	159613	-50613	0.68
g_2d_3	10.02	250500	160043	90457	1.56
g_2d_4	6.79	169750	158743	11007	1.06
g_3d_1	7.31	146200	161383	-15183	0.90
g_3d_2	9.04	226000	161383	64617	1.40
g_3d_3	14.41	360250	161383	198867	2.23
g_3d_4	11.92	298000	160083	137917	1.86
g_4d_1	2.90	72500	497883	-425383	0.14
g_4d_2	3.58	89500	497883	-408383	0.17
g_4d_3	9.81	245250	499183	-253933	0.49
g_4d_4	3.51	87750	496583	-408833	0.17

Fenugreek selling price 25 ₹/kg

Data indicated that, treatment combination g_3d_3 *i.e.* under white shade net 50% on 3rd week of October sowing recorded maximum gross return, net return and cost: benefit ratio than rest of treatments.

On the basis of economics of the treatments, it could be concluded that for getting higher yield and net return of green leafy fenugreek, it is advisable that sowing of fenugreek under 50 % white shade net on 3rd week of October is beneficial.

This result is in accordance with Dixit (2007) [3] in fenugreek, Kotadia et al. (2012) [6] in fenugreek, coriander, amaranth and spinach, Anitha et al. (2016) [1] and Kauser et al. (2018) [5] in fenugreek, Waseem et al. (2000) [13] in palak, Rajasekar et al. (2013) [11] in tomato, eggplant, chilli, radish, cucumber, coriander, amaranthus, Dabhi (2015) [2] in fenugreek, Govindaraj et al. (2019) [4] in fenugreek, Nandal et al. (2007) [8] in fenugreek, Pan et al. (1992) [10] in amaranth, Neelesh et al. (2017) [9] in fenugreek and Nahar et al. (2022) [7] in fenugreek.

Cost of cultivation of fenugreek and other details of operational cost (Per ha.) (Fix cost)

Table 3: Cost of cultivation of fenugreek and other details of cost incurred

Sr. No.		Particular	Labour	Frequency	Fixed Cost (₹.)	
					Cost of material	Labour cost
[A]		**Pre sowing operation**				
	1	Field preparation (8 hr. × 700 = Rs. 5600)	2	1	5600	520
		[B] sowing				
	1	Sowing of seed (Mechanical sowing) (3 hr. × 700 = Rs. 1800)	2	1	2100	520
	2	Cost of seed (30 kg)	0	-	3000	-
	3	Manures and Fertilizer application				
		(i) N @ 20 kg/ha	2	2	295	1040
		(ii) P @ 60 kg/ha	2	1	3200	520
		(iii) K @ 30 kg/ha	2	1	590	520
		(iv) FYM 20 t/ha	6	1	20000	1560
		[C] Post sowing operations				
	1	Weeding	8	4	-	8320
	2	Plant protection (Pesticide + Manpower)	2	1	3500	648
[D]		Irrigation charges	-	-	42000	-
[E]		Land revenue	-	-	50	-
[F]		Total fixed cost			80335	13648
					93983	

Note: Rate of various items

Tractor charges @ ₹ 700 per hours
Labour charges @ ₹ 260 per day & for spraying @ ₹ 324 per day
Cost of seed @ ₹ 100 per kg

Irrigation charges @ ₹ 300 per irrigation
FYM cost @ ₹ 1 per kg
Urea cost @ ₹ 295 per 50 kg
SSP cost @ ₹ 400 per 50 kg
MOP cost @ ₹ 590 per 50 kg

(B) Calculation of economic value of growing conditions

Sr. no.	Particulars	Cost ₹/ha
	50% agro green shade net	
1.	**Cost of framed structure for 4 months –** Price of framed structure: 726000 with 10 year lifespan So 1 year price: 72600 And 1 month price: 6050 4 month price = 24200	24200
2.	**Cost of 50 % shade net (green) for 4 months –** Price of green shade net: 55 /m^2 So per hectare: 550000 with 5 year life span So 1 year price: 110000 And 1 month price: 9166.66 4 month price = 36660	36660
	Total cost	**60860**
	50% agro white shade net	
1.	**Cost of framed structure for 4 month –** Price of framed structure: 726000 with 10 year lifespan So 1 year price: 72600 And 1 month price: 6050 4 month price = 24200	24200
2.	**Cost of 50 % shade net (white) for 4 months –** Price of green shade net: 57 /m^2 So per hectare: 570000 with 5 year life span So 1 year price: 114000 And 1 month price: 9500 4 month price = 38000	38000
	Total cost	**62200**
	Naturally ventilated polyhouse	
1.	**Cost of NVP for 4 month (10 year life span) -**	400000

	Price of NVP: 1200 /m^2 So per hectare: 12000000 And 1 year price: 1200000 So 1 month price: 100000 So 4 month price: 400000	
	Total cost	400000

(C) Details of treatment wise cost per ha of fenugreek crop

Treatment No.	Common cost/ Fixed cost (₹/ha)	Cost of growing condition (₹/ha)	Harvesting cost (₹)	Total cost (₹/ha)
T$_1$	93983	0	3900	97883
T$_2$	93983	0	5200	99183
T$_3$	93983	0	3900	97883
T$_4$	93983	0	2600	96583
T$_5$	93983	60860	5200	160043
T$_6$	93983	60860	4770	159613
T$_7$	93983	60860	5200	160043
T$_8$	93983	60860	3900	158743
T$_9$	93983	62200	5200	161383
T$_{10}$	93983	62200	5200	161383
T$_{11}$	93983	62200	5200	161383
T$_{12}$	93983	62200	3900	160083
T$_{13}$	93983	400000	3900	497883
T$_{14}$	93983	400000	3900	497883
T$_{15}$	93983	400000	5200	499183
T$_{16}$	93983	400000	2600	496583

Note:- Harvesting cost is calculated by multiplying number of cuttings and cost of cutting.
Cost for 1 harvesting is 1300 ₹ /ha.

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