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Effect of growing conditions and sowing time on growth, yield and quality of fenugreek (*Trigonella foenum-graecum*)

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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). 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 farmer's 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.

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An experiment was conducted during September 2019 to January 2020 at College of Horticulture, Sardarkrushinagar Dantiwada Agricultural University, Jagudan, Gujarat to study the effect of various growing conditions and sowing time on growth, yield and quality of fenugreek. In this study two factors were taken, one was growing condition with four levels, viz. Open field, 50% green shade net, 50% white shade net and Naturally ventilated polyhouse. Second factor was sowing time with 4 levels, viz. 3rd week of Sept, 1st week of October, 3rd week of October and 1st week of November 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 cuttings, yield per cutting, yield per ha in all cuttings, total yield per plot, total yield per ha) and quality (chlorophyll a, b and total chlorophyll content and carotenoid content) in a plot size of 1.5 m × 2 m. During the crop growth period of winter (*rabi*) 2019–20 season temperature varied from 15 to 40°C in open field, 17 to 35°C in 50% green shade net and also in 50% white shade net and 20 to 37°C in NVP. The atmospheric humidity ranged from 55 to 85% in open field, 70 to 89% in 50% green shade net and also in 50% 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 with soil *p*H 7.7.

Effect of growing conditions and sowing time on growth parameter: Data (Table 1) showed significant difference for growth parameters in all growing condition. Significantly minimum days taken to germination, maximum plant height, minimum days taken for cutting for 1st cutting and 2nd cutting was recorded with 50% white shadenet and 3rd week of October. Different growing condition affects the different growing parameters of crop and different sowing

Table 1 Effect of growing conditions and sowing time on growth parameter

Growing condition	Days taken to germination	Plant height (cm)				Days taken to cutting	
		1st cutting	2nd cutting	3rd cutting	4th cutting	1st cutting	2nd cutting
Open field	3.83	17.03	16.05	11.20	2.77	53.83	20.67
50% green shade net	3.00	19.12	17.36	16.30	9.56	43.50	20.08
50% white shade net	2.92	20.63	17.56	17.03	11.12	41.67	18.92
NVP	3.33	19.03	17.25	12.45	3.48	43.92	20.67
SEm±	0.07	0.34	0.17	0.27	0.53	0.60	0.17
CD at 5%	0.24	1.16	0.59	0.94	1.82	2.08	0.58
CV%	7.21	6.15	3.44	6.58	27.07	4.55	2.87
3rd week of Sept	3.50	18.47	16.70	15.38	7.35	53.75	20.92
1st week of Oct	3.25	18.71	17.21	16.60	8.87	44.83	19.75
3rd week of Oct	3.00	19.92	17.58	16.99	10.66	41.08	19.42
1st week of Nov	3.33	18.71	16.72	8.02	0.05	43.25	20.25
SEm±	0.12	0.28	0.12	0.23	0.65	0.61	0.23
CD at 5%	NS	0.80	0.35	0.68	1.89	1.78	0.67
CV%	12.74	5.04	2.42	5.67	33.30	4.63	3.98

time provide different climatic conditions and plant is going to perform better under favourable climatic condition.

Effect of growing conditions and sowing time on yield parameter: Data (Table 2) showed significant difference for yield parameters in all growing condition. Significantly maximum number of cuttings, yield/cuttings, yield/ha in all cuttings, total yield/plot and total yield/ha was recorded with 50% white shadenet and 3rd week of October. Reason for variation in yield characters was due to climate difference of different growing conditions and sowing dates.

Effect of growing conditions and sowing time on quality parameter: Data (Table 3) showed significant difference for quality parameters in all growing condition. Significantly maximum chlorophyll a, chlorophyll b, total chlorophyll content and carotenoid content was recorded with 50 percent white shadenet and 3rd week of October. Singh *et al.* (2005) proved the role of micro-climate in improving quality parameters of growing of crops under protection. Like other parameters, quality characters also influenced, hence, variation in different growing conditions and sowing times are obvious. Kotadia *et al.* (2012) also mentioned that producing vegetables under net house has several benefits including improved quality.

These all findings corroborate with the results of

Table 2 Effect of growing conditions and sowing time on yield parameter

Growing condition	Number of cutting	Yield per cuttings (kg)				Yield per ha in all cuttings (t)				Total yield per plot (kg)	Total yield per ha (t)
		1st	2nd	3rd	4th	1st	2nd	3rd	4th		
Open field	3.00	0.70	0.45	0.35	0.13	2.34	1.50	1.18	0.44	1.64	5.46
50% green shade net	3.67	0.81	0.57	0.36	0.16	2.70	1.89	1.21	0.54	1.90	6.34
50% white shade net	3.75	1.17	0.80	0.90	0.33	3.90	2.68	3.00	1.08	3.20	10.67
NVP	3.00	0.68	0.49	0.20	0.11	2.28	1.64	0.66	0.36	1.49	4.95
SEm±	0.04	0.07	0.04	0.07	0.02	0.24	0.14	0.23	0.06	0.14	0.47
CD at 5%	0.14	0.25	0.15	0.24	0.07	0.83	0.49	0.80	0.22	0.49	1.62
CV%	4.30	29.7	25.28	53.22	36.9	29.7	25.28	53.22	36.90	23.63	23.63
3rd week of Sept	3.50	0.49	0.33	0.34	0.19	1.62	1.12	1.15	0.62	1.35	4.51
1st week of Oct	3.67	0.56	0.44	0.48	0.22	1.87	1.45	1.60	0.73	1.69	5.65
3rd week of Oct	3.75	1.45	0.94	0.55	0.28	4.85	3.13	1.83	0.92	3.22	10.74
1st week of Nov	2.50	0.87	0.60	0.44	0.05	2.88	2.01	1.47	0.17	1.96	6.53
SEm±	0.04	0.06	0.04	0.05	0.02	0.20	0.14	0.16	0.06	0.10	0.34
CD at 5%	0.12	0.18	0.12	0.14	0.05	0.60	0.41	0.46	0.17	0.29	0.98
CV%	4.30	25.3	25.42	36.14	32.46	25.3	25.42	36.14	32.46	16.96	16.96

Table 3 Effect of growing conditions and sowing time on quality parameter

Growing condition	Chlorophyll a content (mg/g)	Chlorophyll b content (mg/g)	Total chlorophyll content (mg/g)	Carotenoid content (mg/g)
Open field	0.21	0.11	0.32	7.42
50% green shade net	0.33	0.15	0.48	10.39
50% white shade net	0.36	0.17	0.52	10.96
NVP	0.34	0.15	0.48	10.18
SEm±	0.01	0.01	0.01	0.10
CD at 5%	0.03	0.02	0.02	0.34
CV%	9.37	14.13	4.18	3.45
3rd week of Sept	0.31	0.15	0.46	9.00
1st week of Oct	0.30	0.15	0.45	9.19
3rd week of Oct	0.33	0.16	0.49	10.49
1st week of Nov	0.29	0.11	0.41	10.27
SEm±	0.01	0.01	0.01	0.17
CD at 5%	0.02	0.02	0.01	0.50
CV%	7.63	12.64	3.91	6.09

Waseem *et al*. (2000) in palak, Dixit (2007) in fenugreek; Kotadia *et al.* (2012) in fenugreek, coriander, amaranth and spinach; Rajasekar *et al*. (2013) in tomato, eggplant, chilli, radish, cucumber, coriander, amaranthus; Dabhi (2015) in fenugreek; Anitha *et al.* (2016) and Kauser *et al.* (2018) in fenugreek; Neelesh *et al.* (2017) in fenugreek; Govindaraj *et al.* (2019) in fenugreek and Nahar *et al*. (2022) in fenugreek.

SUMMARY

An experiment was conducted during September 2019 to January 2020 at College of Horticulture, Sardarkrushinagar Dantiwada Agricultural University, Jagudan, Gujarat to study the effect of various growing conditions and sowing time on growth, yield and quality of fenugreek (*Trigonella foenum-graecum* L.). In this investigation comprising of two factors, first one was different growing conditions which have 4 sub factors, viz. Open field, 50% green shadenet, 50% white shadenet and Naturally ventilated polyhouse and second one was different sowing time which also have 4 sub factors, viz. 3rd week of September, 1st week of October, 3rd week of October and 1st week of November which were tested in the SPD with 3 replications. Treatments were evaluated on the basis of growth, yield and quality characteristics of fenugreek. The 50% white shadenet and 3rd week of Oct reported minimum days for germination and harvesting, maximum plant height in all four cutting, yield attributes, viz. number of cutting, yield per cuttings, yield per ha in all cuttings, total yield per plot, total yield per ha and also the quality parameters, viz. chlorophyll a, b and total chlorophyll content and carotenoid content.

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