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Effect of different growing condition and sowing time on fenugreek: A review

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Abstract
Fenugreek needed to grow at correct time for higher growth and in protected structure for increase yield. The aim of protected cultivation is to attain independence of climate and weather. During this study we tend to examine the literature of various protected structure like shade net of various colour like white, black, red, blue, green and polyhouse of low cost, medium cost and high cost conjointly examine sowing time on September, October, November, December. Result show that planted throughout November sowing in shade net compared to open field and germination, plant height, leaf yield were found to be best and also polyhouse is best compared to shade net. 15th October sowing time were best in case of higher leaf yield and 1st November were best in case of plant growth, seed yield and quality.

Keywords: Cucumber, boron, yield, quality, konkan

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. Methi is a dual purpose crop which is used as leafs for green vegetable and seed as spice. India is the largest producer of fenugreek with an area of 1,49,000 hectare and production of 2,02,000 MT. Fenugreek widely grown in Mediterranean countries, Argentina, France, India, Pakistan, China, Egypt, Turkey, Spain, North Africa and the U.S.A. India is one of the major producer and exporter of fenugreek. It is one of the important winter season leguminous crops cultivated mainly in Northern India, where Rajasthan is the major producer (90%) of fenugreek followed by Gujarat (2016-17) and also grown in Madhya Pradesh, Haryana, Maharashtra, Chhattisgarh, Utter Pradesh and Punjab (Anonymous 2018) [3].

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. At the same time, in summer, price of green fenugreek remains high, as compared to other seasons. Therefore, the optimum sowing time for fenugreek has to be worked out for getting remunerative 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) [16]. 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. Like other crops, fenugreek may also be grown during out of the normal season provided to grow under some kind of protected structure.

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.

The productivity of crop in a particular area depends on the overall climate. Protected cultivation is proving a successful tool to reduce the dependency on environment which creates several constrains in vegetable production and is regarded as an environmentally sustainable system. Protected cultivation or controlled environment agriculture (CEA) is a

total concept of modifying the natural environment for optimum plant growth. 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. Therefore, vegetable production under low cost net house technology is the best alternative to use the land and other resources more efficiently. Net house provide one of the feasible solutions for raising vegetables and horticultural crops for improving crop productivity. Khan *et al.* (1996) [10] has also suggested that the cultivation under net house should be adopted for making the cultivation profitable venture.

Review of literature

1) Effect of different growing condition

Highest yield, height of plant, number of leaves, number of branches, length of leaves, width of leaves and weight of leaves per plot of leafy vegetable under protected environment of fenugreek were also found superior in greenhouse compared to open field condition is noticed by Dixit (2007) [6]. Kotadia *et al.* (2012) [11] observed that all leafy vegetables grown in shade net situation favoured plant growth attributes and gave higher production as compared to open field situation during summer season. Amaranthus and spinach grown in 30 per cent shade net produced vigorous growth in terms of plant height, root length, number of leaves and leaf area. In case of fenugreek and coriander under 75 percent shade net recorded maximum growth attributes. The leafy vegetables grown in shade net situation during summer season gave maximum yield than other situations. In the experiment, Solanki (2017) [17] revealed that 50 per cent agro shade net performed significantly superior over open field with respect to early germination, maximum plant height, leaf area, minimum days taken for first cutting, days taken for subsequent cutting, maximum yield of first cutting, yield of subsequent cutting, yield per plot, maximum yield per hectare, highest iron content and carotenoid content of leafy vegetable (coriander, fenugreek, amaranthus). Comparision different leafy vegetables like amaranthus, beet leaf, coriander and fenugreek under polyhouse and open field conditions. It was reported that highest germination percentage and the higher values of growth attributes viz., plant height, No. of branches per plant, No. of leaves per plant, leaf length, leaf width, leaf area, No. of stomata, length of whole plant, length of shoot, length of root, dry weight of whole plant, dry weight of shoot, dry weight of root and minimum days to potential germination (7.75) and days required for horticultural maturity (30.00) were under polyhouse condition as compared to open field condition (Angad 2018) [1]. High germination percentage and minimum days to germination under polyhouse condition as compared to open field conditions in all the leafy vegetables like amaranthus, beet leaf, coriander, fenugreek by Garde *et al.* (2019) [7].

2) Effect of different sowing time

While working on different planting time in fenugreek Obour *et al.* (2015) [15] reported that early planting increased CP (crude protein) levels and lower ADF (Acid detergent fiber) and NDF (Neutral detergent fiber) concentrations. 15th October sowing dates of fenugreek was found to be on par with 1st November in case of higher fresh weight of leaf, dry weight of plant, leaf area, seed yield, chlorophyll content, diosgenin content and protein content (Anitha *et al.* 2016) [2]. Sowmya (2016) [18] observed that growth of fenugreek plant, weight of plant was maximum when planted on 10th Oct. The maximum number of days taken (53.33 days) to 50% flowering was recorded with 25th September sowing and minimum number of days taken to 50% flowering were recorded under 9th November. Sowing date had significant effect on fenugreek significant effect on plant height, number of leaves, branches, seed yield, weight of seed and minimum days for germination was reported when sowing was done on 2nd November (Bhutia and sharangi, 2017) [4]. In an experiment on fenugreek, Kumawat *et al.* (2017) [12] observed that November 30th sown crop showed minimum per cent disease intensity, whereas 10th October sown crop showed maximum per cent disease intensity and minimum seed yield. The crop sown on 30th October registered maximum seed yield (16.48 q / ha) with 61.10 per cent disease intensity. Kauser *et al.* (2018) [9] recorded that Sowing on 15th October and Pinching at 35 DAS recorded maximum plant spread, number of branches per plant, dry matter production of leaves (DMPL), dry matter production of stem (DMPS), dry matter production of pods (DMPP), dry matter production of seeds (DMPS), total dry matter production (TDMP), number of pods per plant, length of pod, fresh weight of pod, number of seeds per pod, weight of seeds per pod, seed yield, harvest index and 1000 seed weight of fenugreek. While, lower values for these parameters were observed in sowing on 1st October and Pinching at 25 DAS. Mahor (2018) [13] revealed that sowing of fenugreek on 30th October was found to be the superior compared to the other dates of sowing with respect to plant growth, seed yield and quality. Result obtained by Meena *et al.* (2018) [14] illustrated that significantly higher plant height, per plant primary branches, secondary branches, nodules, seed yield and biological yield of fenugreek were recorded when sown on 30th October. 2nd Nov sowing date had a significant influence on phenology, growth and yield parameter of fenugreek (Sultana 2018) [19].

3) Effect of different growing condition and sowing time

Between two growing conditions, net house condition performed superior over open field condition with respect to vegetative growth and leaf yield characters except chlorophyll a, chlorophyll b and total chlorophyll content of fenugreek, while open field condition performed better over net house condition with respect to quality characters like chlorophyll a, chlorophyll b and total chlorophyll content Dabhi (2015) [5] noticed that the sowing date 25th October showed superiority under net house and open field conditions with respect to growth, leaf yield and quality characters. Govindaraj *et al.* (2019) [8] observed that days taken for germination were earlier when the seeds were sown during November under shade net condition compared to open field condition and plant height, number of leaves and leaf yield were found to be the highest with November sown crop followed by October sown crop in shade net house condition. While, in open condition, fenugreek seeds sown during the months of August and March failed to germinate causing crop failure. In this study, the yield was almost doubled under shade net house condition, when compared to open field condition.

Conclusion

In this study we examine the literature of different protected structure and sowing time. Result show that sown during November under shade net condition compared to open field condition and plant height, number of leaves and leaf yield were found to be the highest, highest germination percentage

and the higher values of growth attributes were under polyhouse as compared to shade net. October sowing time of fenugreek was found best in case of plant growth, fresh and seed yield and quality.

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