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Nitrogen Rate and Cutting Management for Fenugreek Green Leaf and Seed Production

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Abstract

Fenugreek (*Trigonella foenum-graecum* L.) is an annual seed spice crop also used as a leafy vegetable, and reported to have medicinal properties. Farmers usually practice leaf cutting in fenugreek only when crop grown for vegetable purpose. There is need to standardize the nitrogen requirement when leaf cutting is practiced at different stages of growth since it may influence leaf and seed yields. Hence, present field Experiment was conducted to study the effect of Nitrogen rate and Cutting Management on Fenugreek leaf and seed production during 15th November, 2015 to 25th March, 2016. Treatments were comprised of three nitrogen levels of 20, 40 or 60 kg ha^{-1} and three levels of cutting i.e. no cutting, or cutting at 45 or 60 days after sowing (DAS). All treatment combinations were replicated 3 times in a factorial randomized complete block design. The observations were recorded on plant height, number of pods $plant^{-1}$, number of seed pod^{-1}, green leaf yield, seed yield and biological yield (sum of seed and straw yield). Harvest index was calculated by dividing economic yield to biological yield. The results revealed that increased green leaf and seed yields occurred when nitrogen level increased and cutting was delayed. The maximum harvest index (0.44) was when nitrogen was applied @ 60 kg ha^{-1} and plants were cut at 60 DAS. Thus, delaying cutting increases nitrogen requirement in fenugreek if supplied in proper amount, it results to increased yield.

Keywords: Fenugreek, nitrogen rate, cutting management, leaf, seed production

1. Introduction

Fenugreek (*Trigonella foenum-graecum* L.), commonly known as *methi* is an annual herbaceous plant belonging to family Fabaceae. Its seeds are used as spice in the preparation of pickles, vegetable dishes, dal, and spice mixes such as *panch phoron* and *sambar* powder. Fresh fenugreek leaves are an ingredient in some curries, such as "*aloo methi*" curry. It has also been reported to have medicinal properties (Syeda et al., 2008; Vidyashankar, 2016). India is a major producer, with fenugreek production in India derived from numerous states. Rajasthan accounts for over 80% of India's output (Parthasarathy et al., 2008). Being a leguminous vegetable, it fixes atmospheric nitrogen in the soil which helps in improving soil fertility. Nitrogen is essential for vegetative growth of the plant resulting in higher green and seed yield (Tehelan and Thakral, 2008; Tunctruk et al., 2011). Increased addition of nitrogen usually results in increased yield of crop plant (Korus and Lisiewska, 2009). Productivity of the crop is low but may be increased with supply of optimum amounts of fertilizer and improved agronomic practices. Apical bud pinching helps in altering the source sink relationship by curbing the vegetative growth and hastening reproductive phase of the plant. It also helps in production of side shoots or branches thus resulting in increased photosynthetic activity and accumulation of more photo-synthates ultimately resulting in increased seed size and yield (Lakshmi et al., 2015). Cutting of stems significantly effects branching and enhances flowering in most of the crops (Ahmed and Oladiaran, 2012). Since in most of the leafy vegetables several cuttings are possible, they require a good amount of fertilizer for quick growth. One or 2 leaf cutting may be done if adequate nitrogen is supplied since it is associated with vigorous vegetative growth, leading to higher seed production. The experiment was undertaken to determine the best nitrogen level and appropriate stage of leaf cutting to enhance yield.

2. Materials and Methods

The present field Experiment was conducted during 15th November, 2015 to 25th March, 2016 to study the effect of Nitrogen rate and Cutting Management on Fenugreek leaf and seed production. The experiment took place at the

Agriculture Farm of Aroma College, Roorkee (Uttarakhand), India. The experimental site lies between 29.52°N Latitude and 78.53°E Longitude at 270 m above the mean sea level. The soil was a sandy loam with homogenous fertility and good drainage. The experiment included the nitrogen levels of 20, 40 or 60 kg ha^{-1} and cutting treatments of no cutting, and cutting at 45 or 60 days after sowing. Phosphorus and potassium were applied at the rate of 40 and 20 kg ha^{-1}, respectively. All treatment combinations were replicated 3 times in a factorial randomized complete block design. Seeds of cv. Pusa Early Bunching were sown on 15th November of 2015 at a rate of 25 kg ha^{-1} in row to row spacing of 30 cm. The crop was thinned out 25 days after sowing to provide a plant to plant distance of 10 cm. In respect of treatments, first time leaf cutting was done on 30th December of 2015 and the second time on 15th January of 2016. The crop was harvested for seed yield on 25th March of 2016. The crop was irrigated in flood at 10 days interval by the end of January month and further at 7 days interval 15 March 2016. Pesticides i.e. carbendazim 50% WP @ 2 ml l^{-1} and imidacloprid 17.8% SL @ 1.5 ml l^{-1} were applied twice after each cutting to keep the crop free of fungal disease and insects, respectively.

Measurements of plant height, number of branches plant^{-1}, number of pods plant^{-1}, number of seed pod^{-1}, test weight (1000 seed weight), seed yield, biological yield and green leaf yield were obtained. Harvest index was calculated by the formula of Donald (1962). Data were analyzed statistically following Gomez and Gomez (1983). If the interaction was significant it was used to explain the results and the difference between treatments was compared with LSD.

3. Results and Discussion

Analysis of variance showed that all growth and yield parameters were affected by nitrogen dose except for number of branches plant^{-1} and harvest index (Table 1). Plant height, number of pods plant^{-1}, number of seed pod^{-1}, test weight, seed yield, green leaf yield and biological yield increased with increasing nitrogen level (Table 2). Plant height has positive correlation with green leaf yield as well as seed yield (Singh et al., 2013) which recorded highest for the nitrogen @ 60 kg ha^{-1} and this nitrogen also gave rise to maximum seed yield. Biological yield was found at par for the nitrogen @ 60 kg ha^{-1} and 40 kg ha^{-1}. These findings indicate that higher doses of nitrogen are required for seed production than for biomass production. The results are in confirmatory to findings of Datta et al. (2005) that green leaf yield and seed yield increases with increase in nitrogen level.

Table 1: Analysis of variance for fenugreek characters due to effect of nitrogen levels and cutting stages

Source	d.f.	Plant height (cm)	No. of branches plant^{-1}	No. of pod-splant^{-1}	No. of seeds pod^{-1}	Test weight (g)	Seed yield (mt ha^{-1})	Green leaf yield (mt ha^{-1})	Biological yield (mt ha^{-1})	Harvest index
Nitrogen (N)	2	1275.80**	1.27	92.96**	6.05*	2.03*	0.136**	0.006*	1.378**	0.005
Cutting (C)	2	1873.61**	8.71**	689.39**	7.43**	2.67*	0.266**	0.863**	0.137	0.017**
N×C	4	144.53	0.22	29.59**	2.25	0.72	0.058*	0.003	0.302	0.008*
Error	16	10.147	0.92	2.74	1.11	0.44	0.015	0.001	0.105	0.002

d.f.: Means degree of freedom; * ,**: Significant at (p=0.05), (p=0.01) level of probability, respectively

Table 2: Effect of nitrogen rate on growth and yield attributing characters of fenugreek

Nitrogen rate (kg ha^{-1})	Plant height (cm)	No. of pods plant^{-1}	No. of seeds pod^{-1}	Test weight (g)	Seed yield (mt ha^{-1})	Green leaf yield (mt ha^{-1})	Biological yield (mt ha^{-1})
20	87.10	44.89	10.44	9.19	1.15	0.33	3.58
40	91.89	48.08	11.12	9.20	1.20	0.36	4.24
60	109.69	51.31	12.08	10.02	1.38	0.38	4.28
SEm±	1.06	0.55	0.35	0.22	0.04	0.01	0.12
LSD (p=0.05)	3.21	1.67	1.06	0.67	0.13	0.04	0.33

LSD: Least statistical difference

Analysis of variance showed that all growth and yield parameters were affected by cutting stage except for biological yield (Table 1). The tallest plants and most branches plant^{-1} were for plants that were not cut (Table 3). Decrease in plant height with higher branches was observed with the effects of cutting which curbs the vertical growth of plant resulting in translocation of photosynthates to leaf axils thus, encouraging auxillary branches. The results are in agreement with Krishnaveni et al. (2014). Increases in number of pods plant^{-1}, number of seeds pod^{-1} and test weight was when plants were cut at 45 DAS or 60 DAS (Table 3). Increased green leaf and seed yield were obtained when cutting was at 60 DAS

(Table 3) which resulted in the maximum harvest index. The findings are supported by Rana et al. (2015). Sowmya et al. (2017) also reported that delaying in pinching of leaves found to be superior in respect of green leaf and seed yield including harvest index.

Table 3: Effect of cutting management practices on growth and yield attributing characters of fenugreek

Cutting	Plant height (cm)	No. of branches plant^{-1}	No. of pods plant^{-1}	No. of seeds pod^{-1}	Test weight (g)	Seed yield (mt ha^{-1})	Green leaf yield (mt ha^{-1})	Harvest index
None	110.85	8.38	38.11	11.07	8.91	1. 09	0.00	0.27
45 DAS	95.83	7.08	51.71	10.39	9.49	1. 21	0.49	0.31
60 DAS	82.00	6.46	54.45	12.19	10.00	1. 43	0.57	0.36
SEm±	1.06	0.32	0.55	0.35	0.22	0.04	0.01	0.01
LSD (*p*=0.05)	3.21	0.97	1.67	1.06	0.67	0.13	0.04	0.04

DAS: means days after sowing; LSD: Least statistical difference

Analysis of variance showed that interaction between nitrogen rate and cutting management had significant effect on no. of pods plant^{-1}, seed yield and harvest index (Table 1). The interaction results showed that the most pods plant^{-1} (60.36) and seed yield (1.75 mt ha^{-1}) was for the nitrogen @ 60 kg ha^{-1}+cutting at 60 DAS (Table 4). The maximum harvest index (0.44) was for this treatment might be due to a higher proportion of seed yield than biological yield. This treatment also produced additional return from green leaves yield which might be due to less accumulation of dry matter in the herbs of plant. Our findings are closely related with the results of Gill et al. (2001) and Dahiya et al. (2009).

Table 4: Interaction effect between nitrogen and cutting for number of pods, seed yield and harvest index of fenugreek

Nitrogen×cutting	No. of pods plant^{-1}	Seed yield (mt ha^{-1})	Harvest index
20 kg ha^{-1}×none cutting	37.98	1.06	0.30
20 kg ha^{-1}×cutting at 45 DAS	46.18	1.12	0.32
20 kg ha^{-1}×cutting at 60 DAS	50.49	1.26	0.34
40 kg ha^{-1}×none cutting	38.01	1.07	0.26
40 kg ha^{-1}×cutting at 45 DAS	53.71	1.24	0.31
40 kg ha^{-1}×cutting at 60 DAS	52.51	1.28	0.29
60 kg ha^{-1}×none cutting	38.34	1.14	0.24
60 kg ha^{-1}×cutting at 45 DAS	55.24	1.25	0.30
60 kg ha^{-1}×cutting at 60 DAS	60.36	1.75	0.44
SEm±	0.96	0.07	0.02
LSD (*p*=0.05)	2.90	0.22	0.07

DAS: means days after sowing; LSD: Least statistical difference

4. Conclusion

Farmers usually practice cutting only if the crop is grown for vegetable purpose. However, the results of this work indicate that there may be an additional benefit of leaf yield with increased seed yield if fenugreek fertilized with nitrogen at a level of 60 kg ha^{-1} in addition to cutting be practiced at 60 days after sowing.

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