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Influence of sowing time and fertilizer levels on quality parameters in Kasuri Methi (*Trigonella corniculata* L.), under Akola (M.S.) Conditions

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Abstract

The present investigation entitled “Effect of sowing time and fertilizer levels on seed yield of kasuri methi (*Trigonella corniculata* L.)” was carried out in the year of 2016–2017 and 2017-18, at Chilli and Vegetables Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. An experiment was laid out in Factorial Randomized Block Design (FRBD) with twenty four treatment combinations. There were two factors of an experiment, first being sowing time with six levels and second was fertilizer dose with four levels and replicated as three time to study the sowing times and fertilizer levels effect on seed yield and quality parameters in kasuri methi.

Results of the present investigation revealed that, the yield and quality parameters viz. Test weight (g), germination (%), total chlorophyll content (mg/100gm), trigonellin content (%), oleoresin content (%), protein content (%) were found maximum with early sowing D₁ (10th October) and test weight (g), germination (%), total chlorophyll content (mg/100 gm), protein content (%) were found the maximum with fertilizer dose F₄ (50:50:25 kg ha⁻¹ NPK) while, maximum *Trigonella* content were found in F₁ (40:40:20 kg/ha. NPK) and the maximum oleoresin content found in F₂ (40:50:25 kg/ha. NPK). As regards the interaction effect of sowing times and fertilizer levels, the treatment combination D₁F₄ viz. kasuri methi sown on 10th October and fertilized @ 50:50:25 kg ha⁻¹ NPK produced significantly the maximum seed yield.

Keywords: Fertilizer levels, sowing times, quality parameters, kasuri methi

Introduction

Trigonella corniculata L. is annual, herbaceous, bushy, slow growing spice crop growing to the height of 60 cm. Leaves are pinnate, leaflets, obovate-cuneate, flowers are hermaphrodite, yellow in colour having close racemes type inflorescence. Pods are long, sickle shaped, 4 to 8 seeded. The kasuri methi has a diploid number of chromosomes 2n=16 (Anon., 2004) [2]. It is used as food, fodder, medicine and cosmetics. The dried leaves and seeds are the economical part of the plant. Seeds and tender pods are used as spice for pickle preparation. These are also used in indigenous medicines like diuretic, tonic, carminative, astringent, aphrodisiac (Sharma, 2006) [11]. The seeds are aphrodisiac and customarily used for the treatment of colic flatulence, diarrhea, dyspepsia with loss of appetite, chronic cough, dropsy, enlargement of liver and spleen, rickets, gout and diabetes and are good for the elimination of bad breath and bad odor. Also, the importance of fenugreek as seed spice is increasing day by day as its seed are exported in the world market (Rana *et al.*, 2015) [10].

Material and methods

The present investigation was carried out during *Rabi* seasons of 2016-2017 and 2017-18, at Chilli Vegetable Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. An experiment was laid out in Factorial Randomized Block Design (FRBD) with twenty four treatment combinations. There were two factors of an experiment, first being sowing times with six levels viz. D₁ (10th October), D₂ (30th October), D₃ (20th November), D₄ (10th December), D₅ (30th December), D₆ (20th January) and another was fertilizer doses with four levels i.e. F₁ (40:40:20 kg ha⁻¹ NPK), F₂ (40:50:25 kg ha⁻¹ NPK), F₃ (50:40:20 kg ha⁻¹ NPK) and F₄ (50:50:25 kg ha⁻¹ NPK) and replicated thrice to study the sowing times and fertilizer levels effect on vegetative growth for seed yield of kasuri methi. Irrigations were given at an interval of 4-5 days, during the whole cropping period depending on the soil moisture conditions. Plot size 2.10 m x 2.00 m, spacing 30 cm x 20 cm and seed was sown on flat bed. Variety Rajendra Abha was used for conducting the experiment.

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In order to evaluate the effect of different treatments on growth and yield of crop, necessary periodical observations were recorded and the recorded data was statistically analyzed by ANOVA method given by Panse and Sukhatme (1967) [9].

Result and discussion

a) Test weight of kasuri methi seeds (g)

i) Effect of sowing dates on test weight of kasuri methi seeds (g)

The data furnished in Table 1 said that, the sowing date 10th October (D₁) was recorded significantly the maximum (1.176 g) test weight. Whereas, the crop sown on 20th January (D₁) was recorded minimum (1.166 g) test weight.

This might be due to that, an early sown crop would have produced the maximum branches per plant, leaves per plant. Similarly, due to the favourable climatic conditions prevailing during period and more photosynthetic activity has resulted in better seed filling which resulted in the quality seeds in terms of higher test weight. The results of present investigation are in close agreement with the findings of Nandre (2006) [6] and Singh *et al.* (2017^a) [12] in fenugreek.

ii) Effect of fertilizer level on test weight of kasuri methi seeds (g)

The data presented in Table 1 revealed that, the fertilizer dose 50:50:25 kg/ha (F₄) and 40:50:25 kg/ha NPK (F₂) were recorded the maximum (1.172 g) test weight. However, significantly the minimum (1.170 g) test weight was observed in fertilizer dose 40:40:20 kg/ha NPK (F₁). This might be due to the fact that, more supply of nutrients, combined with their availability freely and easily throughout of the crop growth phase might have produced the heavier seeds of kasuri methi. Similar results have been recorded an earlier workers like Nandre (2006) [6] in fenugreek.

Interaction effect

The interaction effect of sowing dates and fertilizer doses to the test weight, were found to be non-significant in kasuri methi crop.

b) Germination per cent (%)

i) Effect of sowing dates on germination (%) of kasuri methi seeds

The sowing date 10th October (D₁) was recorded significantly the maximum germination per cent (69.08%) and it was found to the significantly superior over rest of the treatments. Whereas, minimum germination per cent (54.54%) was measured in sowing date 20th January (D₆).

The better performance of early sown crop (10th October) was because of availability of congenial climatic conditions for the vegetative growth to kasuri methi crop. Due to which increase in the photosynthetic rate, accumulation of more photosynthesites resulting into better seed development and ultimately caused better seed germination and seedling vigour in the seeds produced in kasuri methi crop. Similar results have been obtained by earlier workers like Singh *et al.* (2017) [12] in fenugreek

ii) Effect of fertilizer levels on germination (%) of kasuri methi seeds

The maximum (63.81%) germination per cent was noted in the fertilizer dose 50:50:25 kg/ha NPK (F₄) and it was found to be at par with the treatment F₂ (62.94%). Whereas, the fertilizer dose 40:40:20 kg/ha NPK (F₁) was recorded the

minimum (60.53%) germination per cent in kasuri methi crop. As nitrogen is the integral part of the process of germination viz. protein synthesis, which might have enhanced the process of protein synthesis and which would have help to increase the germination percentage of kasuri methi seed. The results of the present investigation are in harmony with the findings of Nandre (2006) [6] in fenugreek.

Interaction effect

The germination per cent (%) was significantly influenced due to the interaction effect of dates of sowing and fertilizer doses. However, the treatment combination D₁F₄ was produced maximum (70.33%) germination per cent. Whereas, the minimum (51.00%) germination per cent was recorded in the treatment combination D₅F₁. The results of the present investigations are supported by the findings of Nandre (2006) [6] in fenugreek.

c) Total chlorophyll content (mg/100 mg of leaves)

i) Effect of sowing dates total chlorophyll content (mg/100 mg of leaves)

The significantly the maximum (3.07 mg/100 mg) total chlorophyll content was recorded in sowing date 10th October (D₁). While, the minimum (2.70 mg/100 mg) total chlorophyll content was observed in sowing date 20th January (D₆).

As the time of sowing become late (20th January), the subsequent reductions were observed in the content of total chlorophyll. This might be due reduction in transpiration pull in late cooler months as compared to early sown (10th October) kasuri methi crop. Similar results have been obtained an earlier workers like Anitha *et al.* (2016) [1] in fenugreek.

ii) Effect of fertilizer doses total chlorophyll content (mg/100 mg of leaves)

Effect of fertilizer doses during both the years of experimentations were found to be non-significant. the fertilizer dose 50:50:25 kg/ha NPK (F₄) was measured the maximum (2.89 mg/100 mg) total chlorophyll content. However, minimum (2.78 mg/100 mg) total chlorophyll content was observed in kasuri methi crop fertilized with 40:40:20 kg/ha NPK (F₁).

Interaction effect

An interaction effect between sowing dates and fertilizer doses on chlorophyll content in kasuri methi were found to be statistically non-significant in kasuri methi crop.

d) Trigonelline content (%)

i) Effect of sowing dates on trigonelline (%)

The data furnished in Table 1 said that, sowing date 10th October (D₁) was recorded the maximum (0.25%) trigonelline content in the seeds of kasuri methi while, sowing date 30th December (D₅) was recorded minimum trigonelline content (0.23%) in the present study.

Effect of fertilizer doses on trigonelline (%)

The data analysis said that, fertilizer dose 40:40:20 kg/ha NPK (F₁) was recorded the maximum (0.25%) trigonelline content in the seeds of kasuri methi while, fertilizer dose F₃, F₂ and F₄ were recorded minimum trigonelline content (0.24%) in the present study.

ii) Interaction effect

Interaction effect of sowing dates and fertilizer doses on the

trigonelline content of seeds, were found to be statistically non-significant.

e) Oleoresin content (%)

The data in respect of oleoresin content (%) in seed of kasuri methi crop influenced by sowing dates and fertilizer doses were found to be non-significant and it is presented in Table 1.

i) Effect of sowing dates on oleoresin content (%)

The data analysis, noticed that, the sowing date 10th October (D₁) was recorded the maximum (20.54%) oleoresin content in seed. However, the sowing date 30th October (D₂) was recorded the minimum (20.02%) oleoresin content in seed.

ii) Effect of fertilizer doses on oleoresin content (%)

Oleoresin content in seed as influenced due to the fertilizer doses was found non-significant. But, numerically the maximum (20.61%) oleoresin content in seed was observed in F₂. Whereas, minimum (20.04%) observed in F₄ in the kasuri methi crop.

Interaction effect

Interaction effect of sowing dates and fertilizer doses on the oleoresin content in seed, were found to be statistically non-significant.

f) Protein content (%)

The data in respect of protein content (%) in seeds of kasuri methi influenced by sowing dates and fertilizer doses were found to be statistically non-significant and it is presented in Table 1.

i) Effect of sowing dates on protein content (%)

The data analysis said that, the sowing date 10th October (D₁) was recorded numerically the maximum (21.02%) protein content in seed. Whereas, the minimum (18.31%) protein content was observed in sowing date 20th January (D₆).

ii) Effect of fertilizer doses on protein content (%)

As regards to protein content, it is revealed that, numerically the maximum (20.14%) protein content in seeds of kasuri methi was reported with F₄ (50:50:25 kg/ha NPK). However, numerically the minimum (19.67%) protein content in seed of kasuri methi was observed with application of F₁ (40:40:20 kg/ha NPK)

Interaction effect

Interaction effect of sowing dates and fertilizer doses on the protein content of seed were found to be statistically non-significant in kasuri methi crop.

g) Seed yield per plot (g)

i) Effect of sowing dates on seed yield per plot (g)

The data presented in Table 1 revealed that the sowing date 10th October (D₁) was recorded significantly the maximum (370.77 g) seed yield per plot found to be at par with D₂ (361.85 g). Whereas, sowing date 20th January (D₆) was recorded minimum (189.39 g) seed yield per plot in kasuri methi crop.

This might be due to the improvement in overall growth i.e. better vegetative growth with an early sowing date (10th October) coupled with increased net photosynthesis towards reproduction structure, on the other hand, such crop might

have increase the yield attributes like florets per plant, pods per floret and seeds per pod, which might be turned into more seed yield per plot. Similar results have been recorded by the earlier workers like Nandre *et al.* (2011)^[7, 8] and Singh *et al.* (2017)^[12] in fenugreek.

ii) Effect of fertilizer doses on seed yield per plot (g)

The data furnished in Table 1 revealed that, the fertilizer dose 50:50:25 kg/ha NPK (F₄) was recorded significantly the maximum (297.71 g) seed yield per plot. However, significantly the minimum (273.58 g) seed yield was observed in the fertilizer dose 40:40:20 kg/ha NPK (F₁) in kasuri methi crop.

The application of higher level of primary nutrients might have positive effects on growth parameters like plant height and number of branching which might have passed through long span and this might be resulted to delay in maturity and ultimately resulted in yields and yield attributes in kasuri methi seeds. Which is positively correlated with number of branches per plant, florets per plant, pods per floret and seeds per pod in kasuri methi crop. Similar results have been recorded by the earlier workers like Datta *et al.* (2017)^[3] in fenugreek.

Interaction effect

The result in respect of seed yield per plot was significantly influenced due to an interaction effect of dates of sowing and fertilizer doses. The treatment combination D₁F₄ was produced maximum (378.14 g) seed yield per plot and minimum (172.66 g) seed yield per plot was recorded in the treatment combination D₆F₃. This could be attributed due to the fact that, in early sown kasuri methi crop might had benefited by favourable conditions like temperature and humidity could achieved better seedling vigour, maximum photosynthetic surface which might leads to accumulation to the maximum fresh and dry weight as compare to late sown kasuri methi crop. At the same time higher application of phosphorus might responsible for early root growth and proliferation, which might resulted into desired nitrogen uptake. Similar results have been recorded by the earlier workers like Anitha *et al.* (2016)^[11] and Meena *et al.* (2018)^[15] in fenugreek.

h) Seed yield per hectare (q)

The data of kasuri methi crop in respect of seed yield per hectare as influenced by sowing dates and fertilizer doses are presented in Table 1.

i) Effect of sowing dates on seed yield per hectare (q)

The data furnished in Table 2 found that, significantly the maximum (8.83 q) seed yield per hectare was obtained in sowing date 10th October (D₁). However, sowing date 20th January (D₆) was recorded significantly the minimum (4.51 q) seed yield per hectare. It is well known fact that, more the seed yield per plot of kasuri methi seed, when calculating simply with the help of hectare factor one could get the maximum seed yield per hectare in the present investigation. Similar results have been recorded by the earlier workers, Anitha *et al.* (2016)^[11] in fenugreek.

ii) Effect of fertilizer doses on seed yield per hectare (q)

The data indicated that, the fertilizer dose 50:50:25 kg/ha NPK (F₄) was recorded significantly the maximum (7.09 q) seed yield per hectare. Whereas, the fertilizer dose 40:40:20

kg/ha NPK (F₁) was noticed significantly the minimum (6.51 q) seed yield per hectare. When the seed yield of kasuri methi per plot was recorded maximum with an application of 50:50:25 kg/ha NPK. It would be natural thing that, similar treatment showed maximum seed yield of kasuri methi per hectare by multiplying it with hectare factor. The results of the investigation are in close agreement with the findings of Sharma (2006) [11] and Sunanda *et al.* (2014) [13].

Interaction effect

The results in respect of seed yield per hectare was significantly influenced due to the interaction effect of sowing dates and fertilizer doses. However, the treatment

combination D₁F₄ was produced

the maximum (9.00 q) seed yield per hectare and minimum (4.11 q) seed yield per hectare was recorded in the treatment combination D₆F₃.

The combination of early sowing date and fertilizer doses at higher levels gave the maximum seed yield per plot which ultimately reflected in its arithmetical calculation in per hectare basis. Which might be observed in the treatment combination D₁F₄ in the present study. These results are in harmony with the findings of Sharma (2006) [11] in kasuri methi, Nandre *et al.* (2011) [7, 8] and Meena *et al.* (2018) [5] in fenugreek.

Table 1: Effect of dates of sowing and fertilizer levels on seed yield and yield contributing parameters in kasuri methi

Treatments	Test weight of seed (g)	Germination per cent (%)	Total chlorophyll content (mg/100mg of leaves at 60 DAS)	Trigonelline content (%)	Oleoresin content (%)	Protein content (%)	Seed yield per plot (g)	Seed yield per ha (q)
Dates of sowing (D)								
D ₁ - 10 th October	1.176	69.08 (56.22)	3.07	0.25 (2.85)	20.54 (26.95)	21.02 (27.29)	370.77	8.83
D ₂ - 30 th October	1.175	67.96 (55.53)	2.94	0.24 (2.82)	20.02 (26.58)	20.74 (27.09)	361.85	8.42
D ₃ - 20 th November	1.130	64.42 (53.38)	2.72	0.23 (2.76)	20.48 (26.90)	20.31 (26.79)	305.15	7.27
D ₄ - 10 th December	1.170	60.88 (51.28)	2.83	0.24 (2.83)	20.19 (26.69)	19.93 (26.51)	259.42	6.18
D ₅ - 30 th December	1.167	56.71 (47.87)	2.73	0.23 (2.77)	20.33 (26.80)	19.21 (26.00)	220.88	5.27
D ₆ - 20 th January	1.166	54.54 (47.61)	2.70	0.24 (2.81)	20.40 (26.84)	18.31 (25.34)	189.39	4.51
'F' test	Sig	Sig	Sig	NS	NS	NS	Sig	Sig
SE(m) ±	0.0004	0.20	0.03	0.02	0.14	0.03	3.54	0.08
CD at 5%	0.0011	0.58	0.10	-	-	0.08	10.08	0.24
Fertilizer dose (F)								
F ₁ - 40:40:20 kg ha ⁻¹ NPK	1.170	60.53 (51.12)	2.78	0.25 (2.83)	20.29 (26.77)	19.67 (26.32)	273.58	6.51
F ₂ - 40:50:25 kg ha ⁻¹ NPK	1.172	62.94 (52.55)	2.82	0.24 (2.82)	20.61 (27.00)	20.00 (26.56)	288.33	6.87
F ₃ - 50:40:20 kg ha ⁻¹ NPK	1.171	61.78 (51.86)	2.84	0.24 (2.78)	20.36 (26.82)	19.87 (26.46)	278.69	6.64
F ₄ - 50:50:25 kg ha ⁻¹ NPK	1.172	63.81 (53.07)	2.89	0.24 (2.79)	20.04 (26.59)	20.14 (26.66)	297.71	7.09
'F' test	Sig	Sig	NS	NS	NS	NS	Sig	Sig
SE(m) ±	0.0003	0.17	0.03	0.02	0.11	0.02	2.89	0.07
CD at 5%	0.0009	0.48	-	-	0.32	0.07	8.23	0.20
Interaction (D X F)								
'F' test	NS	Sig	NS	NS	NS	NS	Sig	Sig
SE(m) ±	0.0008	0.41	0.12	0.05	0.27	0.06	7.08	0.17
CD at 5%	-	1.17	-	-	-	-	20.16	0.48

Table 2: Effect of dates of sowing and fertilizer levels on seed yield of kasuri methi

Treatments	Seed yield per plant (g)					Seed yield per Hectare (q)				
	Fertilizer dose (F)					Fertilizer dose (F)				
	Dates of sowing (D)	F ₁	F ₂	F ₃	F ₄	Mean	F ₁	F ₂	F ₃	F ₄
D ₁	5.17	5.39	5.28	5.42	5.32	8.61	8.93	8.77	9.00	8.83
D ₂	5.09	5.23	5.14	5.26	5.18	8.47	8.69	8.56	8.74	8.62
D ₃	4.12	4.41	4.28	4.55	4.34	6.88	7.40	7.15	7.64	7.27
D ₄	3.68	3.55	3.23	3.97	3.61	6.32	6.12	5.62	6.65	6.18
D ₅	2.82	3.31	3.51	3.39	3.26	4.35	5.45	5.61	5.63	5.26
D ₆	2.52	2.83	2.48	2.95	2.70	4.46	4.60	4.11	4.87	4.51
Mean	3.90	4.12	3.99	4.26		6.52	6.87	6.64	7.09	
		D	F		D X F	D	F		D X F	
'F' test		Sig.	Sig.		Sig.	Sig.	Sig.		Sig.	Sig.
SE (m) ±		0.05	0.04		0.11	0.08	0.07		0.17	
CD at 5%		0.15	0.12		0.3	0.24	0.2		0.48	

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