Legume Res., **35** (1) : 28 - 31, 2012

AGRICULTURAL RESEARCH COMMUNICATION CENTRE
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YIELD AND PROFITABILITY OF FENUGREEK (*TRIGONELLA FOENUM-GRAECUM*) AS INFLUENCED BY IRRIGATION AND NUTRIENT LEVELS WITH VARYING CROP GEOMETRY

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Received : 27-08-2011 Accepted : 22-02-2012

ABSTRACT

An experiment was conducted during rabi season of 2003-06 to study growth, profitability and productivity of fenugreek as influenced by irrigation and nutrients levels with varying crop geometry.Three irrigation levels (8,12 and 15 days interval) in main plot, nutrient levels (N and P_2O_5 each of 20+10,30 +20 and 40+25 kg /ha, respectively) in sub plot and crop geometry (20 cm x 10 cm , 25 cm x 10 cm and 30 cm x 10 cm) in sub-sub plot were studied in split- split plot design with three replications. The maximum plant height and dry matter accumulation per plant at all the growth stages as well as number of branches per plant at harvest (3.84) and yield attributes, seed yield (1120 kg /ha), net return (35086) and BCR(1.68) in fenugreek was obtained highest with application of irrigation at 12 days interval. Application of 30 +20 kg N and P_2O_5 per ha gave higher yield attributes, seed yield(1121 kg /ha) net return (Rs 34465/ha) and BCR (1.62) being at par with 40 + 25 kg N and P_2O_5.The Crop geometry of 25 x 10 cm resulted 10 per cent higher seed yield over 20 x10 cm crop geometry.Thus, application of irrigation at 12 days interval with combined application of 30 kg N and 20 kg P_2O_5 /ha at 25 cm x 10 cm crop geometry is better for realizing higher yield, productivity and net return in fenugreek.

Key words: Fenugreek, Irrigation, Crop geometry, Fertility.

INTRODUCTION

Fenugreek (*Trigonella foenum-graecum* L) commonly known as methi is a major seed spices grown during *rabi* season which is cultivated in an area of 35737 ha producing 35737 tonnes of seed with a productivity of 1000.1 kg/ ha. It belongs to apeaceae family. In India it is mainly cultivated in Rajasthan, Gujarat, MP and Karnataka. Rajasthan ranks first in area and production of fenugreek in our country. The limited quantity of water available for irrigation calls urgent need for application of water at appropriate intervals for ensuring better water use efficiency. Nitrogen and phosphorus are important essential plant nutrients for growth, development and various physiological and biochemical process. The prices of fertilizers are escalating. Therefore standardization of optimum dose of fertilizers is the need of present time.Further, maintenance of optimum plant population is essential for interception of solar radiation without exerting competition for nutrient and water in plants. Very meager information on integrated management of nutrient and water along with crop geometry is available in fenugreek. Thus, the present investigation was carried out with an object to find optimum irrigation interval, suitable fertilizer doses and efficient crop geometry in fenugreek.

MATERIALS AND METHODS

The field experiment on growth and yield of fenugreek as influenced by irrigation and nutrient levels with varying crop geometry was conducted at National Research Centre on Seed Spices, Ajmer (Raj) during three consecutive *rabi* season of 2003-04, 2004-05 and 2005-06. The soil of the experimental site was sandy loam with a pH 8.92 having 0.21 per cent organic carbon and 76.0, 33.4, and 234.1 kg/ha available N, P_2O_5 and K_2O respectively. The experiment was laid out in split-

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split plot design comprising three levels of irrigation (I_1-8 days interval, I_2-12 days interval and I_3-15 days interval) as main plot, three doses of nitrogen and phosphorus (N and P_2O_5 each of 20+10, 30+20 and 40+25 kg /ha, respectively) as sub plot treatment and three crop geometry (20cm x 10cm, 25cm x 10 cm and 30cm x 10cm) as sub-sub plot treatment replicated thrice. Sowing of fenugreek (Ajmer fenugreek-1) using 20 kg seed /ha was done at 20cm, 25cm and 30cm line to line spacing and plant to plant distance of 10 cm was maintained at first hoeing and weeding at 30 DAS. Immediately after sowing light irrigation was applied for ensuring proper germination and establishment of the crop. Seed treatment with *Rhyzobium meliloti* was done before sowing. Afterward each irrigation of 50 mm depth measured with Pashall flume of 7.5 mm throat placed at the head irrigation channel was provided as per irrigation intervals under study. Total 7, 5 and 4 irrigations were provided at 8,12 and 15 days of irrigation interval, respectively. Full dose of both nitrogen and phosphorus was provided at the time of sowing. The nitrogen and phosphorus were supplied through urea and DAP respectively. Five plants were selected randomly from each plot and their dry weight was taken after drying in oven at 70°C for 72 hours or till constant weight was obtained. Observations on plant height, branches per plant, yield attributing characters *viz.* pods per plant, pod length, and seeds per pod and yield were recorded. The statistical analysis was done as per procedure suggested by Panse and Sukmate (1955).

RESULTS AND DISCUSSION

Growth : The plant height, dry matter accumulation /plant at all the growth stages and branches /plant at harvest were significantly influenced with application of varying levels of irrigation. Application of irrigation at 8 days interval resulted in significantly higher plant height at all the growth stages over longer irrigation interval but dry matter accumulation per plant at 60, 90 DAS and at harvest as well as branches per plants at harvest were produced significantly higher with application of irrigation at 12 days interval. The significant increase in plant height at 8 days irrigation interval was due to increase of cell length at higher moisture level but branches /plant and dry matter accumulation at 12 days irrigation levels was obtained due to optimum moisture status available in soil which in turn maintained favourable physicochemical process for better dry matter accumulation in plant. These results are in conformity with the findings of Mehta *et al* (2010a). Application of 40+20 kg /ha N and P_2O_5

TABLE 1. Effect of irrigation and fertility levels with varying crop geometry on growth and yield attributes of fenugreek (Pooled of three year).

Treatments	Plant height (cm)				Branches /plant at harvest	Dry matter accumulation /plant (g)			
	30 DAS	60 DAS	90 DAS	Harvest		30 DAS	60 DAS	90 DAS	Harvest
Irrigation intervals									
8 days	9.95	26.43	41.93	52.93	4.55	0.71	4.51	8.76	10.59
12 days	8.62	23.04	38.54	49.54	4.80	0.61	5.49	9.74	11.55
15 days	6.93	19.88	35.38	46.38	3.84	0.57	4.81	9.06	10.90
SEm±	0.17	0.46	0.72	0.90	0.08	0.01	0.08	0.15	0.18
CD(P=0.05)	0.66	1.81	2.82	3.55	0.30	0.05	0.30	0.58	0.70
N and P_2O_5 levels									
20 10 kg/ha	7.32	20.73	36.23	47.23	4.23	0.50	4.53	8.78	10.58
30 20 kg/ha	8.89	23.41	38.91	49.91	4.51	0.64	5.49	9.74	11.56
40 25 kg/ha	9.29	25.21	40.71	51.71	4.44	0.75	4.79	9.04	10.90
SEm±	0.13	0.36	0.60	0.76	0.07	0.01	0.07	0.14	0.16
CD(P=0.05)	0.41	1.12	1.84	2.35	0.21	0.03	0.23	0.42	0.51
Crop geometry									
20x10cm	8.95	24.66	40.16	51.16	4.26	0.59	4.65	8.90	10.70
25x10cm	8.61	23.17	38.67	49.67	4.56	0.64	5.37	9.62	11.50
30x 10cm	7.94	21.52	37.02	48.02	4.37	0.67	4.79	9.04	10.84
SEm±	0.31	0.63	0.77	0.89	0.08	0.03	0.17	0.21	0.22
CD(P=0.05)	0.87	1.81	2.21	2.35	0.24	NS	0.49	0.59	0.63

kg /ha gave significantly the highest plant height at all the growth stages. The increase in plant height with increase in N and P levels is in conformity with the finding of Halesh *et al* (2000) and Mehta *et al* (2010 b). However branches /plant and dry matter accumulation per plant at all the growth stages except at 30 DAS, were obtained higher with application of 30 + 20 kg N and P_2O_5 /ha. Close spacing in fenugreek promoted plant height but higher dry matter accumulation/plant at all the growth stages as well as branches /plant were recorded with crop geometry of 25 x 10 cm row to row and plant to plant spacing (Table 1). Similar results were reported by Yadav *et al* (2000).

Yield attributes : The maximum number of pod / plant, seeds/pod, pod length, test weight and seed yield /plant was produced with application of irrigation at 12 days interval. The increase in pods / plant, pod length and seed yield /plant with irrigation at 12 days interval was in order of 10.40,17.7 and 36 per cent ,respectively over 8 days interval. This might be due to favorable moisture regime with irrigation at 12 days interval which resulted higher growth and yield arributes. The results corroborate with finding of Dutta and Chatarjee (2006) who reported higher seed yield of fenugreek with 1.0 IW/ CPE ratio. Application of 30 + 20 kg /ha N and P_2O_5 produces 7.84, 13.94 and 25.61 per cent more pods /plant, seed / pod and seed yield /plant respectively over 20+10kg N and P_2O_5 kg/ha. Rathore and Manohar (1989) reported improvement in quality of fenugreek with combined application of N and P_2O_5. Halesh *et al* (2000) and Mehta *et al* (2010 b) also reported higher yield and yield attributes of fenugreek with combined application of N & P. Sowing at 25 cm X 10 cm in fenugreek resulted significantly higher yield attributes over 20 X 10 cm and 30 X 10 cm row to row and plant to plant spacing. Sowing of fenugreek with crop geometry of 25 cm x 10 cm gave 8.85, 7.84, 13.78 and 15.80 per cent higher pod length, Pods /plant, seeds/pod and yield per plant, respectively over 20cm x 10cm crop geometry (Table2) Yadav *et al.* (2000) also reported higher yield attributes with crop geometry of 30 cm in fenugreek.

Yield : The highest seed yield of fenugreek was obtained with irrigation at 12 days interval (Table 2). Irrigation at 12 days interval produced 15.0 per cent higher seed yield over irrigation at 8 days interval. The harvest index was not influenced with irrigation levels. Favourable moisture status in the root zone of the crop through irrigation at 12 days

TABLE 2. Effect of irrigation and fertility levels with varying crop geometry on yield, return and BCR of fenugreek (Pooled of three year.

Treatments	Pod length (cm)	Pods/ plant	Seeds/ pod	Test weight (g)	Seed yield/ plant (g)	Seed Yield (q/ha)	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	BCR
Irrigation intervals										
8 days	8.74	28.82	14.73	10.96	4.22	9.77	22100	48865	26765	1.21
12 days	10.29	31.82	16.80	11.23	5.77	11.20	21100	55978	34878	1.65
15 days	9.10	29.08	15.68	11.07	4.57	10.77	20100	53835	33735	1.68
SEm±	0.15	0.48	0.24	0.18	0.07	0.09	373	827	460	0.02
CD(P=0.05)	0.57	1.88	0.95	0.72	0.28	0.34	1463	3247	1807	0.08
N and P2O5 levels										
20 10 kg/ha	8.99	28.46	14.56	10.42	4.45	9.41	20595	47054	26459	1.29
30 20 kg/ha	10.11	31.17	16.59	11.51	5.59	11.21	21100	56051	34951	1.67
40 25 kg/ha	9.04	30.08	16.05	11.33	4.51	11.11	21605	55574	33969	1.58
SEm±	0.14	0.44	0.23	0.17	0.07	0.10	325	782	463	0.02
CD(P=0.05)	0.43	1.35	0.71	0.51	0.22	0.30	1001	2409	1425	0.07
Crop geometry										
20 x 10cm	9.04	28.83	14.80	10.93	4.54	10.08	21100	50387	29287	1.39
25 x10cm	9.84	31.09	16.75	11.29	5.26	11.13	21100	55670	34570	1.64
30 x 10cm	9.26	29.81	15.66	11.04	4.76	10.52	21100	52622	31522	1.50
SEm±	0.23	0.54	0.34	0.21	0.20	0.27	326	1437	1214	0.05
CD(P=0.05)	0.65	1.55	0.97	0.51	0.57	0.79	934	4121	3480	0.07

interval favoured growth and development of plant and thus increased growth and yield attributes which increased seed yield of fenugreek over 8 and 15 days interval. Increase in seed in straw and biological yield with irrigation at 1.0 IW/CPE ratio was also reported by Bhati (1993) and Mehta *et al* (2010 a). Application of 30+ 20 kg/ha N and P_2O_5 exhibited seed 19.12 per cent higher seed yield over 20 +10 kg/ha N and P_2O_5 /ha respectively. Application of increasing levels of N and P enhanced vegetative growth and thus yield attributes which results increase in seed yield of fenugreek. These results were in conformity with those of Mehta *et al* (2010b). Significantly higher seed yield was recorded with crop geometry of 25 x 10 cm row which was on account of higher dry matter accumulation and yield attributes. Sowing of fenugreek at 25 cm x 10 cm to row and plant to plant spacing resulted 10.42 per cent higher seed over 20 cm x 10 cm crop geometry. The higher seed yield with higher 30 cm row to row spacing was reported by Yadav *et al* (2000).

Economic analysis : Nitrogen and phosphorus levels significantly influenced the net return and BCR in fenugreek (Table 2). Application of irrigation at 12 days interval resulted 30 per cent higher net return over 8 days interval. Higher net return (32.09%) was recorded with the application of 30 + 20 kg/ha N and P_2O_5 over lower levels. These results were in conformity with the findings of Chaudhary (1999). Crop geometry of 25 cm x 10 cm crop geometry resulted 18 per cent higher net return and BCR over closer spacing.

Thus, application of irrigation at 12 days interval with combined application of 30 kg N + 20 kg P_2O_5 /ha at 25 cm x 10 cm crop geometry is better for realizing higher yield and net return in fenugreek production.

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