

Influence of Irrigation Scheduling and Weed Management Practices on Growth, Yield and Protein Content of Fenugreek (*Trigonella foenum-graecum* L)

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Abstract: A field trial on growth, yield and quality of fenugreek (*Trigonella foenum-graecum* L) as influenced by irrigation scheduling and weed management practices was conducted during rabi season of 2006-07 and 2007-08 at S.D. Agricultural University, Sardarkrushinagar. The experiment consisting of three levels of irrigation (0.6, 0.8 and 1.0 IW/CPE ratios) in main plot and six weed control methods (Weedy check, weed free, hand weeding at 20 and 40 DAS, HW at 20 + Inter-culturing at 40 DAS, application of Pendimethalin @ 0.75 kg ha⁻¹ (PE) and application of Pendimethalin @ 0.75 kg ha⁻¹ (PE) + IC at 40 DAS) in sub plots was laid out in split plot design with four replications. Application of irrigation at 1.0 IW/CPE ratio resulted significantly higher plant height at all the growth stages as well as seed and straw yield during both the years as well as in pooled analysis. Protein content in seed and straw were not significantly affected in both the years but in pooled analysis significantly higher protein content was recorded in seed and straw with irrigation at 1.0 IW/CPE ratio. Besides weed free treatment, the highest plant height as well as seed yield and straw yields were recorded with pre emergence application of Pendimethalin @ 0.75 kg per ha + IC at 40 DAS followed by hand weeding (HW) at 20 and 40 DAS during both the years which were statistically at par with each other as well as with weed free treatments and significantly superior over rest of the treatments but protein content in seed and straw was not significantly influenced with weed management practices

Keywords: Fenugreek, IW/CPE ratio, Dry matter accumulation, Weed management.

INTRODUCTION

Historically, India has always been recognized as a land of spices. Rajasthan and Gujarat has been emerged as “seed spice bowl” and together contributes more than 80 per cent of total seed spices produced in the country. Fenugreek is an important major seed spice crop mainly grown in Rajasthan, Gujarat, Madhya Pradesh Maharashtra, Haryana, Punjab, Bihar and Andhra Pradesh. The seeds of fenugreek are used as a condiment and seasoning agent for garnishing and flavourings dishes. Water is an indispensable factor for every metabolic activity of plant. In the world, specifically in arid and semi arid regions water is an important limiting factor for crop production. Agriculture’s share of fresh water supply is likely to decline by 8 to 10 per cent because of increasing competition from the urban and industrial sector (Seckler *et al.* 1998). Weed is an important factor responsible for causing tremendous loss in fenugreek. Due to slow initial growth of fenugreek, it is more susceptible to weed problem hence simultaneous emergence and rapid growth of

weed leads to severe weed crop competition for light, moisture, space and nutrients. In agriculture, weed causes more damage as compared to insect pest and diseases due to hidden losses caused by weed in crop production. Precise information on water and weed management in fenugreek is essential and inevitable. Hence, the study was carried out to evaluate effect of irrigation scheduling and weed management practices on growth, yield and quality of fenugreek.

MATERIALS AND METHODS

The field study was conducted at S.D. Agricultural University, Sardarkrushinagar during rabi season of 2006-07 and 2007-08. The experiment was laid out at different sites during the both the years. The soil of the experimental field was loamy sand in texture having pH 7.75 and 7.73 and electrical conductivity 0.12 and 0.11 dSm⁻¹, respectively during 2006-07 and 2007-08. The soil of the experimental field of both the sites were low in organic carbon (0.17 & 0.22) available nitrogen (152.75 & 165.25 kg /ha), medium in available P₂O₅ (40.75 and 47.6 kg /ha) and good in respect to

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available K_2O (260.25 & 264.7 kg /ha). The experiment was laid out in split plot design with four replications, keeping three levels of irrigation (0.6, 0.8 and 1.0 IW/CPE ratios) in main plot and six weed control treatments (Weedy check, weed free, hand weeding at 20 and 40 DAS, HW at 20 + Inter-culturing at 40 DAS, application of Pendimethalin @ 0.75 kg ha (PE) and application of Pendimethalin @ 0.75 kg /ha (PE) + IC at 40 DAS) in sub plots. The fenugreek variety GF-2 was sown in second week of November during both the years at 30 cm row to row spacing keeping seed rate of 20 kg per ha. Full dose of nitrogen and phosphorus was drilled manually through DAP and urea at the time of sowing. Cumulative pan evaporation was taken as the sum of the daily pan evaporation from USWB class-A. Application of Pendimethalin @ 0.75 kg per ha (PE) was done on second day after irrigation with the help of a knapsack sprayer with a spray volume of 600 litres per ha. In manual weed control treatments, weeds were uprooted and removed at 20 and 40 DAS and inter-culturing was done as per treatments at 40 DAS. In weed free plots, the weeds were removed manually after every seven days for ensuring complete weed free condition. Needed periodic observation on plant height were taken and nitrogen in seed and was determined by Snell and Snell (1949) and protein content was found by multiplying nitrogen with 6.25.

RESULTS AND DISCUSSION

Effect of Irrigation Levels

Significantly higher plant height at different growth stages was recorded with irrigation at 1.0 IW/CPE ratio over 0.8 and 0.6 IW/CPE ratio during both the years as well as in pooled analysis. (Table 1). The higher plant growth with 1.0 IW/CPE ratio might be attributed to maintenance of favourable and congenial moisture regime due to application of frequent irrigation which facilitated better water and nutrient absorption resulting in higher plant height. Application of irrigation at 1.0 IW/CPE ratio resulted significantly higher seed and straw yields during both the years as well as in pooled analysis. Protein content in seed and straw was not significantly influenced individually in both the years but in pooled analysis significantly higher protein content in both seed and straw was obtained with irrigation at 1.0 IW/CPE ratio followed by with 0.8 IW/CPE ratio. (Table 2). The increase in seed, and straw l yields with application of irrigation at 1.0 IW/CPE ratio could be attributed to frequent application of irrigation which facilitated

maintenance of optimum moisture level in soil as well as in plant during entire growth period resulting higher seed and straw biological yield. Though protein content in seed and straw was not influenced with irrigation levels but protein yield in seed and straw was recorded higher with 1.0 IW/CPE ration due to higher yield of fenugreek. These findings are in close agreement with those of Dutta *et al.* (2006)

Effect of Weed Management Practices

Besides, weed free treatment, the highest plant height at all the growth stages were recorded with pre emergence application of Pendimethalin @ 0.75 kg ha⁻¹ + IC at 40 DAS followed by HW at 20 and 40 DAS which were higher over rest of the weed management treatments. (Table 1). The maximum values of all these growth parameters under these treatments might be due to better control of weeds through out the crop growth period which might have resulted better availability of moisture and nutrients to the crop resulting more favourable condition for crop consequently crop attained luxuriant growth having smothering effect on weed. Application of Pendimethalin @ 0.75 kg ha⁻¹ + IC at 40 DAS and HW at 20 and 40 DAS gave at par values of these parameters with weed free treatment which revealed that both of these treatments are as effective as maintaining weed free environment and reduce crop weed competition at critical growth stages of crop. These results are in conformity to that reported by (Kamboj, 2005) and Patel *et al.* (2007). Similarly, besides weed free treatment, significantly the highest seed and straw yields as well as protein yield in seed and straw of fenugreek were recorded with pre emergence application of Pendimethalin @ 0.75 kg per ha + IC at 40 DAS followed by with HW at 20 and 40 DAS which were statistically at par with each other as well as with weed free. Higher seed yield of fenugreek seems to be due to cumulative effect of growth and yield attributes which were recorded significantly higher in weedy check, application of Pendimethalin @ 0.75 kg ha⁻¹(PE) + IC at 40 DAS and HW at 20 and 40 DAS. The least weed population these treatments were also responsible for better seed yield, straw and biological yields. Tiwari *et al.*, (2006) and Patel *et al.* (2007) also reported similar results in fenugreek.

Interaction Effect of Irrigation and Weed Management Practices

Significantly the highest seed and straw yields were recorded by application of irrigation at 1.0 IW/CPE ratio in weed free treatment (I_3W_2) being at par with

irrigation at 1.0 IW/CPE ratio in combination with weed control by pre emergence application of Pendimethalin @ 0.75 kg/ha (I₃W₆) and hand weeding at 20 and 40 DAS(I₃W₃) during both the years as well as in pooled analysis which were significantly higher over rest of the treatment combinations (Table 3&4). This might be due to effective control of weeds with application of

Pendimethalin @ 0.75 kg ha⁻¹(PE)+ IC at 40 DAS and HW at 20 and 40 DAS coupled with sufficient availability of moisture at 1.0 IW/CPE ratio increased growth of crop and enhanced photosynthetic efficiency resulting higher seed, straw and biological yields under these treatment combinations. The results are in close conformity with those reported by Bhimani (1988) in mustard.

Table 1
Plant Height of Fenugreek as Influenced by Irrigation Levels and Weed Management Practices

Treatments	0-30 DAS			30-60 DAS			60-90 DAS			90 DAS - Maturity		
	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled
<i>Irrigation levels</i>												
I ₁ : 0.6 IW:CPE	7.3	7.4	7.3	33.5	34.3	33.9	42.4	42.5	42.4	45.3	46.3	45.8
I ₂ : 0.8 IW:CPE	7.6	7.8	7.7	38.2	38.6	38.4	50.3	52.8	51.5	57.5	58.3	57.9
I ₃ : 1.0 IW:CPE	8.3	8.4	8.3	41.5	42.3	41.9	55.2	56.8	56.0	62.8	63.5	63.1
C.D. (P=0.05)	0.6	0.6	0.4	2.6	2.6	1.6	3.4	2.6	2.2	4.1	3.9	2.5
<i>Weed management practices</i>												
W ₁ : Weedy check	5.7	5.8	5.7	27.8	28.3	28.0	36.3	37.3	36.8	40.6	41.3	41.0
W ₂ : Weed free	8.7	8.9	8.8	42.7	43.4	43.0	55.8	57.3	56.6	62.4	63.4	62.9
W ₃ : HW at 20 and 40 DAS	8.5	8.6	8.5	41.4	42.1	41.8	54.1	55.6	54.9	60.6	61.5	61.0

Table 2
Seed, Straw and Biological Yields as well as Harvest Index of Fenugreek as Influenced by Irrigation Levels and Weed Management Practices (Pooled of Year 2006-07 and 2007-08)

Treatments	Seed yield (kg /ha)			Straw yield (kg /ha)			Protein content in seed (%)			Protein content in straw (%)		
	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled
<i>Irrigation levels</i>												
I ₁ : 0.6 IW:CPE	1015	1128	1072	2085	2315	2200	20.03	20.06	20.04	7.28	7.39	7.34
I ₂ : 0.8 IW:CPE	1325	1367	1346	2642	2725	2684	20.61	20.96	20.78	7.59	7.60	7.60
I ₃ : 1.0 IW:CPE	1450	1498	1474	2785	2885	2835	21.13	21.19	21.16	7.66	7.73	7.69
CD (P=0.05)	98.1	102.0	63.0	190.4	200.4	123.1	NS	NS	0.68	NS	NS	0.23
<i>Weed management practices</i>												
W ₁ : Weedy check	910	961	936	1873	1981	1927	20.46	20.41	20.44	7.41	7.47	7.44
W ₂ : Weed free	1441	1518	1479	2827	2980	2904	20.79	21.14	20.97	7.64	7.71	7.67
W ₃ : HW at 20 and 40 DAS	1397	1471	1434	2760	2910	2835	20.63	20.78	20.70	7.53	7.59	7.56

Table 3
Seed Yields (kg ha⁻¹) as Influenced by Interaction Effect between Irrigation Levels and Weed Management Practices

Weed management practices / Irrigation levels	2006-07			2007-08			Pooled		
	0.6 IW/CPE	0.8 IW/CPE	1.0 IW/CPE	0.6 IW/CPE	0.8 IW/CPE	1.0 IW/CPE	0.6 IW/CPE	0.8 IW/CPE	1.0 IW/CPE
W ₁ : Weedy check	816	914	1001	907	943	1034	861	929	1017
W ₂ : Weed free	1127	1526	1670	1252	1575	1726	1189	1551	1698
W ₃ : HW at 20 and 40 DAS	1102	1471	1618	1225	1517	1672	1164	1494	1645

Table 4
Straw Yields (kg ha⁻¹) as Influenced by Interaction Effect between Irrigation Levels and Weed Management Practices

Weed management practices / Irrigation levels	2006-07			2007-08			Pooled		
	0.6 IW/CPE	0.8 IW/CPE	1.0 IW/CPE	0.6 IW/CPE	0.8 IW/CPE	1.0 IW/CPE	0.6 IW/CPE	0.8 IW/CPE	1.0 IW/CPE
W ₁ : Weedy check	1776	1871	1972	1972	1929	2043	1874	1900	2007
W ₂ : Weed free	2277	3012	3192	2528	3107	3306	2402	3059	3249
W ₃ : HW at 20 and 40 DAS	2239	2933	3108	2486	3025	3220	2363	2979	3164

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