

## INFLUENCE OF IRRIGATION AND WEED MANAGEMENT PRACTICES ON NODULATION AND YIELD OF FENUGREEK (*TRIGONELLA FOENUM-GRÆCUM*L)

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### ABSTRACT

A field trial was conducted in *rabi* season of 2006-07 and 2007-08 at Sardarkrushinagar to study effect of irrigation and weed management practices on nodulation and yield of fenugreek. 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 treatments (Weedy check, weed free, hand weeding at 20 and 40 DAS, Hand Weeding (HW) at 20 + Inter-culturing (IC) at 40 DAS, Pre emergence (PE) application of Pendimethalin @ 0.75 kg/ha and PE application of Pendimethalin @ 0.75 kg/ha + IC at 40 DAS) in sub plots was laid in split plot design with four replications. Irrigation at 1.0 IW/CPE ratio gave significantly more number of nodules per plant and their dry weight at 40 and 60 DAS and leaf chlorophyll content in fresh leaf at 75 DAS as well as seed, straw and biological yields over 0.8 and 0.6 IW/CPE ratio but B:C ratio was recorded higher with 0.8 IW/CPE ratio. Significantly more number of nodules per plant and their dry weight at 40 and 60 DAS and leaf chlorophyll content, higher seed yield, straw yield, biological yield and B:C ratio were recorded with PE application of Pendimethalin @ 0.75 kg/ha + IC at 40 DAS followed by HW at 20 and 40 DAS which were statistically at par with each other and with weed free treatments and significantly superior over rest of the treatments but weed control efficiency at maturity was recorded higher with two hand weeding at 20 and 40 DAS.

**Key words:** Chlorophyll, Fenugreek, IW/CPE ratio, Nodulation

### INTRODUCTION

Fenugreek is an important winter season 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. In most part of the Asia, water is increasingly becoming scarce and costly. Per capita availability of water has declined in many Asian countries by 40 to 60 per cent during 1955 to 1990 (Gleik, 1993). 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). Moreover, 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. Initial slow growth of fenugreek responsible for weed problem leading

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 scanty. Therefore, the study was carried out find appropriate irrigation scheduling and weed management practices for realising higher yield of fenugreek.

### MATERIAL AND METHODS

The field experiment was conducted at Agronomy Instructional Farm of CP College of Agriculture, S.D.Agricultural University, Sardarkrushinagar during *rabi* season of 2006-07 and 2007-08. The experiment was laid on different sites in both the years. The soil of the experimental field of both the location was loamy sand in texture having pH (7.75 and 7.73), electrical conductivity (0.12 and 0.11 dS/m), low

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in organic carbon (0.17 and 0.22) available nitrogen (152.75 and 165.25 kg /ha), high in available  $P_2O_5$  (40.75 and 47.6 kg /ha) and in respect to available  $K_2O$  (260.25 and 264.7 kg /ha) respectively during 2006-07 and 2007-08. The experiment consisting 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<sup>-1</sup> (PE) and application of Pendimethalin @ 0.75 kg /ha (PE) + IC at 40 DAS) in sub plots was laid in split plot design with four replications. The fenugreek was sown 18<sup>th</sup> November during both the years at 30 cm row to row spacing using 20 kg seed / ha. FYM @ 10 tonnes /ha was applied before one month of sowing and mixed well in the soil and at the time of sowing 25 kg N and 40 kg phosphorus was applied through DAP and urea. Potassium was not applied in the soil. Cumulative pan evaporation was taken as the sum of the daily pan evaporation from USWB class-A open pan evaporimeter. Irrigation water was measured by Parshall flume installed in the field channel. Application of Pendimethalin @ 0.75 kg/ ha was done on second day after irrigation with the help of knapsack sprayer with a spray volume of 600 litres/ ha. In manual weed control treatments, weeds were uprooted and removed at 20 and 40 DAS and IC was done as per treatments at 40 DAS. Soil around five randomly selected plants, was moistened and dug out carefully from each plot, washed and used to count the total nodules from each plant roots. The weight of dried nodules per plant was recorded by electronic balance and expressed as mg/ plant. Fresh leaf samples were collected at 75 DAS from each net plot for estimation of chlorophyll "a", chlorophyll "b" and total chlorophyll spectrophotometrically by Arnon's method (1949). At maturity crop was harvested by removing two border rows from both the sides of plot and produce from net plot was recorded and expressed as kg per ha.

## RESULTS AND DISCUSSION

### **Effect of irrigation levels**

Number of nodules and their dry weight per plant at 40 and 60 DAS, chlorophyll content of fresh leaf at 75 DAS, as well as seed, straw

and biological yields were recorded significantly higher with application of irrigation at 1.0 IW/CPE ratio but B:C ratio and lowest values of these parameters were observed with irrigation at 0.6 IW/CPE ratio. (Table 1). The higher values of these parameters with irrigation at 1.0 IW/CPE ratio might be due to optimum moisture availability which exhibited better bacterial activity leading to higher root nodulation. Similarly higher chlorophyll (a, b and total) contents in fresh leaf at 75 DAS with irrigation at higher levels might be due to increased availability of water with frequent irrigations in fenugreek led to better absorption of nutrients along with maintaining optimum turgidity of cells resulted in more chlorophyll synthesis. The higher seed, straw and biological yields of fenugreek with increasing levels of irrigation seems to be due to the fact that frequent irrigations under this treatment facilitated maintenance of optimum moisture level in soil as well as in plant during entire growth period. These findings are in close agreement with those of Amin (1999) in drilled fennel, Dutta and Chatterjee (2006) and Nemichand *et al.* (2007) who reported significant improvement in yield attributes and yield of respective crops with increase in IW/CPE ratio or irrigation levels.

### **Effect of weed management practices**

The major weed flora of the experimental field were *Chenopodium album* L., *Asphodelus tenuifolius* L., *Euphorbia hirta* L., *Melilotus alba* Lamk, *Cynodon dactylon* (L.), *Digitaria sanguinalis* L. which were controlled by different weed management techniques. The study of different weed control techniques revealed that besides weed free treatment the highest, number of nodules per plant and their dry weight per plant and chlorophyll contents (a, b and total) in fresh leaf at 75 DAS were recorded with PE application of Pendimethalin @ 0.75 kg /ha + IC at 40 DAS followed by with HW at 20 and 40 DAS which were significantly superior over rest of the treatments. Besides weed free treatment the higher weed control efficiency was recorded with two manual hand weed at 20 and 40 DAS followed by pre emergence application of Pendimethalin @ 0.75 kg /ha + Inter-culturing at 40 DAS but the highest B:C ratio was obtained with Pendimethalin @ 0.75 kg /ha + IC at 40 DAS .

**Table 1:** Number of nodules and their dry weight per plant, and leaf chlorophyll content, seed yield, straw yield, biological yields, WCE and B:C ratio as influenced by irrigation levels and weed management practices (Pooled of 2006-07 and 2007-08)

Treatments	Number of nodules / plant		Dry weight of nodules per plant (mg)			Chlorophyll content (%)			Seed yield (kg/ha)	Straw yield (kg/ha)	Biolo. yield (kg/ha)	Weed control efficiency (%)	B:C ratio
	40 DAS	60 DAS	40 DAS	60 DAS	Total	A	b	Total					
Irrigation levels (IW/CPE)													
I <sub>1</sub> -0.6	5.04	9.24	9.86	19.55	0.700	0.330	1.030	1072	2200	3272	46.87	0.79	
I <sub>2</sub> -0.8	6.34	10.82	10.71	23.65	0.834	0.387	1.220	1346	2684	4030	46.91	1.11	
I <sub>3</sub> -1.0	6.99	12.20	12.40	25.91	0.852	0.410	1.261	1474	2835	4309	46.14	1.08	
SEm ±	0.08	0.13	0.14	0.28	0.010	0.004	0.014	20.5	39.9	60.1	1.05	0.02	
CD (P=0.05)	0.24	0.41	0.43	0.86	0.029	0.013	0.042	63.0	123.1	185.2	NS	0.05	
Weed management													
W <sub>1</sub> -Weedy check	4.51	7.92	8.10	16.97	0.686	0.324	1.010	936	1927	2863	0.00	0.57	
W <sub>2</sub> -Weed free	6.94	12.20	12.47	26.13	0.868	0.410	1.278	1479	2904	4383	100.00	1.14	
W <sub>3</sub> -HW at 20 and 40 DAS	6.73	11.82	12.08	25.32	0.852	0.402	1.255	1434	2835	4269	53.01	1.13	
W <sub>4</sub> -HW at 20 DAS	6.01	10.56	10.79	22.62	0.801	0.378	1.180	1287	2552	3839	51.12	0.98	
W <sub>5</sub> -Pend@ 0.75 kg/ ha(PE)	5.74	10.08	10.30	21.59	0.703	0.332	1.035	1199	2380	3580	35.01	0.90	
W <sub>6</sub> -Pend.@ 0.75 kg/ha + IC at 40 DAS (PE)	6.79	11.93	12.20	25.57	0.858	0.405	1.264	1447	2840	4287	40.71	1.25	
SEm ±	0.09	0.16	0.16	0.33	0.010	0.005	0.014	19.3	40.9	59.2	0.87	0.01	
CD (P=0.05)	0.25	0.45	0.46	0.93	0.027	0.013	0.040	54.2	114.8	166.4	2.46	0.04	
Interaction ( I x W)	NS	NS	NS	NS	NS	NS	NS	Sig.	Sig.	Sig.	0.00	0.57	

**Table 2:** Seed, straw and biological yields as influenced by interaction effect between irrigation levels and weed management practices (Pooled of year 2006-07 and 2007-08)

Weed management practices /Irrigation levels	Seed yield (kg/ ha)			Straw yield (kg/ha)			Biological yield (kg /ha)		
	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 <sub>1</sub> :Weedy check	861	929	1017	1874	1900	2007	2736	2829	3024
W <sub>2</sub> :Weed free	1189	1551	1698	2402	3059	3249	3592	4610	4947
W <sub>3</sub> :HW at 20 and 40 DAS	1164	1494	1645	2363	2979	3164	3526	4473	4809
W <sub>4</sub> :HW at 20 DAS and IC at 40 DAS	1041	1316	1503	2138	2624	2892	3180	3941	4395
W <sub>5</sub> :Pend@ 0.75 kg / ha(PE)	996	1284	1318	2046	2560	2534	3042	3844	3852
W <sub>6</sub> :Pend.@ 0.75 kg / ha +IC at 40 DAS (PE)	1177	1502	1663	2376	2979	3164	3553	4481	4827
SEm. ±	36.7	33.4		76.0	70.8		111.3	102.6	
CD (P =0.05)	106.3*	93.9**		219.1*	198.8**		321.5*	288.2**	

\* CD for irrigation levels means at same level of weed management practices

\*\* CD for weed management practices means at same level of irrigation mean

On account of less weed-crop completion due to effective control of the same resulted in creating congenial condition in *rhizosphere*, which facilitates higher absorption of nutrients and water by plants thereby maintaining favourable water status in leaf, which would have enhanced synthesis of chlorophyll. Similarly, bacterial activity was also increased under these treatments which might have enhanced nodulation and nodule weight in fenugreek. Significantly the highest seed, straw and biological yields of fenugreek were recorded with PE application of Pendimethalin @ 0.75 kg / ha + IC at 40 DAS followed by HW at 20 and 40 DAS which were statistically at par with each other and with weed free (Table1). 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, PE of Pendimethalin @ 0.75 kg ha<sup>-1</sup> + IC at 40 DAS and HW at 20 and 40 DAS. The least weed population under these treatments was 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**

Seed, straw and biological yields were significantly influenced with interaction effect

between irrigation levels and weed management practices. Application of irrigation at 1.0 IW /CPE ration along with weed free treatment resulted significantly highest seed, straw and biological yield which were at par with irrigation at 1.0 IW/CPE ratio + PE application of Pendimethalin @ 0.75 kg / ha and Irrigation at 1.0 IW/CPE + HW at 20 and 40 DAS. The lowest seed, straw and biological yields were obtained by irrigation at 0.6 IW/CPE ratio with weedy check followed by I<sub>1</sub>W<sub>5</sub> treatment combination (Table 2). Effective weed control with PE application of Pendimethalin @ 0.75 kg /ha + IC at 40 DAS and HW at 20 and 40 DAS along with adequate availability of moisture at 1.0 IW/CPE ratio resulted better nodulation and chlorophyll synthesis which in turn gave higher seed, straw and biological yields The results are in close conformity with those reported by Bhimani (1988) in mustard.

#### **CONCLUSION**

However, higher yield of fenugreek may be obtained with the application of irrigation at 1.0 IW/CPE ration along with weed control by pre emergence application of Pendimethalin @ 0.75 kg /ha +Inter-culturing at 40 DAS but B:C ratio was recorded higher with 0.8 IW/CPE ratio

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