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SHORT COMMUNICATION

Yield, quality and nutrient uptake of fenugreek (*Trigonella foenum-graecum*) as influenced by irrigation levels and weed management practices

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Fenugreek is an important seed spice crop mainly grown during *rabi* 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 India, water is increasingly becoming scarce and costly due to continuous lowering of water table on account of burgeoning population. . In India 80 per cent of available water is used for agriculture. There is a water crisis today but crisis is not about having too little water to satisfy our needs, it is a the crisis of managing water badly resulting in lower water use efficiency. Moreover; water is an indispensable for every metabolic activity of plant. Simultaneous emergence and rapid growth of weed leads to severe weed competition with fenugreek for light, moisture, space and nutrients. Weeds are responsible for causing significant losses in crop productivity and quality of product. Therefore, precise information on water and weed management in fenugreek is essential for realising higher yield of fenugreek.

A field experiment was conducted at S.D. Agricultural University, Sardarkrushinagar, a Gujarat during *rabi* 2006-07 and 2007-08. The soil of the experimental field was loamy sand in texture having water holding capacity of 7.09 and 7.14 %, pH 7.75 and 7.73 and electrical conductivity 0.12 and 0.11 dS/m, respectively during 2006-07 and 2007-08. The soil of the experimental field of both the sites were low in organic carbon (0.17 and 0.22) available nitrogen (152.8 and 165.3 kg /ha), medium in available P (18.0 and 21.0 kg /ha) and good in respect to available K (216.9 and 220.6 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 +IC at 40 DAS, pre emergence (PE) application of Pendimethalin @ 0.75 kg/ ha and application of Pendimethalin @ 0.75 kg/ ha + IC at 40 DAS) in sub plots. The fenugreek (GF-2) was sown in second week of November during both the years at 30 cm rows apart using a seed rate of 20 kg /ha.. Irrigation water was measured by parshall flume installed in the field channel and total 7, 8 and 10 irrigations of 50 mm depth with

Table 1. Yield, harvest index and protein content in seed and straw of fenugreek as influenced by irrigation levels and weed management practices (Pooled of 2006-07 and 2007-08)

Treatments	Seed yield (kg/ha)	Straw yield (kg/ha)	biological yield (kg/ha)	Harvest Index (%)	Protein content (%)	
					Seed	Straw
Irrigation levels (IW/CPE ratio)						
0.6	1072	2200	3272	32.7	20.04	7.34
0.8	1346	2684	4030	33.4	20.78	7.60
1.0	1474	2835	4309	34.1	21.16	7.69
CD (P=0.05)	63.0	123.1	185.2	NS	0.68	0.23
Weed management practices						
Weedy check	1479	2904	4383	32.69	20.44	7.44
Weed free	1434	2835	4269	33.65	20.97	7.67
HW at 20 and 40 DAS	1287	2552	3839	33.51	20.70	7.56
HW at 20 DAS and IC at 40 DAS	1199	2380	3580	33.42	20.58	7.51
Pendimethalin @ 0.75 kg ha^{-1} PE)	1447	2840	4287	33.42	20.45	7.47
Pend.@ 0.75 kg / ha + IC at 40 DAS (PE)	54.2	114.8	166.4	33.65	20.83	7.61
CD (P=0.05)	54.2	114.8	166.4	NS	NS	NS

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Table 2. Seed, straw and biological yields (kg ha^{-1}) 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_1: Weedy check	861	929	1017	1874	1900	2007	2736	2829	3024
W_2: Weed free	1189	1551	1698	2402	3059	3249	3592	4610	4947
W_3: HW at 20 and 40 DAS	1164	1494	1645	2363	2979	3164	3526	4473	4809
W_4: HW at 20 DAS and IC at AS	1041	1316	1503	2138	2624	2892	3180	3941	4395
W_5: ***Pend@ 0.75*** kg ha^{-1} (PE)	996	1284	1318	2046	2560	2534	3042	3844	3852
W_6: ***Pend.@ 0.75*** kg ha^{-1} + IC at 40 DAS (PE)	1177	1502	1663	2376	2979	3164	3553	4481	4827
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

Table 3. Nitrogen, phosphorus and potassium uptake in fenugreek as influenced by irrigation levels and weed management practices (Pooled of 2006-07 and 2007-08)

Treatments	Nitrogen uptake (kg/ha)			Phosphorus uptake (kg/ha)			Potassium uptake (kg/ha)		
	Seed	Straw	Total	Seed	Straw	Total	Seed	Straw	Total
Irrigation levels (IW/CPE ratio)									
0.6	34.41	25.88	60.29	4.54	3.03	7.57	12.34	25.87	38.21
0.8	44.89	32.72	77.61	5.82	3.74	9.57	15.78	30.99	46.77
1.0	49.94	34.94	84.88	6.49	4.03	10.51	17.57	32.17	49.75
CD (P=0.05)	2.51	1.91	4.33	0.34	0.21	0.54	0.90	1.79	2.63
Weed management practices									
Weedy check	30.73	22.97	53.69	3.99	2.65	6.64	10.86	22.04	32.89
Weed free	49.73	35.74	85.47	6.51	4.12	10.63	17.57	34.01	51.59
HW at 20 and 40 DAS	47.69	34.39	82.08	6.21	3.97	10.18	16.84	32.81	49.65
HW at 20 DAS and IC at 40 DAS	42.54	30.76	73.31	5.53	3.55	9.09	15.02	29.35	44.37
Pendimethalin @ 0.75 kg ha^{-1} PE)	39.37	28.51	67.88	5.13	3.30	8.43	13.91	27.22	41.14
Pend.@ 0.75 kg / ha + IC at 40 DAS (PE)	48.42	34.72	83.14	6.31	3.99	10.29	17.09	33.06	50.16
CD (P=0.05)	2.36	1.79	3.84	0.32	0.20	0.48	0.89	1.70	2.40

0.6.0.8 and 1.0 IW/CPE ratio, respectively were provided during both the seasons. Application of Pendimethalin @ 0.75 kg/ ha (PE) was done on second day after irrigation which was applied immediately after sowing with the help of a knapsack sprayer fitted with flat fan nozzle with a spray volume of 600 litres / 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. The concentration of N in seed and straw was determined by procedure suggested by Snell and Snell (1949) and of P and K content by methods suggested by Jackson (1973).The nutrient uptake was determined by multiplying the concentration with their respective dry matter accumulation.

Effect of irrigation levels

The highest, seed, straw and biological yields as well as nitrogen, phosphorus and potassium uptake and protein content in seed and straw was obtained with irrigation at 1.0 IW/CPE ratio followed by with 0.8 IW/CPE ratio but harvest index was not affected (Table1&2).Application of irrigation at 1.0 IW/CPE ratio resulted 10 and 38 % higher seed and 7 and 29 per cent straw yield over 0.8 and 0.6 IW/CPE ratio respectively. Significantly higher N,P and K uptake by seed , straw and total was recorded with 1.0 IW/CPE ratio followed by with 0.8 IW/CPE ratio. The lowest seed, straw and biological yields as well as N, P and K uptake was obtained with irrigation at 0.6 IW/CPE ratio. The increase in seed, straw and biological yield with 1.0 IW/CPE ratio could be explained by 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 which resulted better translocation of photosynthates from source to sink resulting in higher yield attributes and yield of fenugreek. Similarly, maximum uptake of N, P and K in seed, straw and crop might be due to cumulative effect of N content in seed and straw as well as higher yield and dry matter production under 1.0 IW/CPE ratio. These findings are in close agreement with those reported by, Dutta *et al.*(2006) .

Effect of weed management practices

Pendimethalin with IC at 40 DAS and HW at 20 and 40 DAS were found as effective as weed free treatments in respect to seed, straw and biological yields as well as NPK uptake by seed ,straw and crop but protein

content in seed and straw as well as harvest index was not affected with weed management practices. The higher yield and uptake of N,P and K by seed, straw and crop of fenugreek seems to be due to better weed control which resulted congenial competition free growing condition for higher yield which enhance higher uptake of nutrients with application of Pendimethalin + IC at 40 DAS and HW at 20 and 40 DAS. Tiwari *et al.*, (2006) and Patel *et al.* (2007) also reported similar results in fenugreek.

Interaction effect of irrigation and weed management practices

The higher seed, straw and biological yield was obtained with application of irrigation at 1.0 IW /CPE ratio with weed free treatment which was at par with irrigation at 1.0 IW/CPE ratio and Pendimethalin with IC at 40 DAS and significantly higher over rest of the treatment combinations (Table 2). Effective weed control with application of Pendimethalin + IC at 40 DAS and HW at 20 and 40 DAS along with adequate availability of moisture at 1.0 IW/CPE ratio gave higher growth and yield attributes which in turn resulted higher seed and straw yields. These results corroborate with those of Dungarwal *et al.*(2002).

Thus it can be inferred that application of irrigation at 1.0 IW/CPE ratio with weed control by pre emergence application of Pendimethalin @ 0.75 kg /ha is most effective for realising higher yield and better water use efficiency.

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