RESEARCH PAPER International Journal of Agricultural Sciences, June to December, 2009, Vol. 5 Issue 2 : 568-571

Effects of irrigation schedules and weed management practices on growth and yield of fenugreek (Trigonella *foenum-graecum* L.)

P.K. CHOVATIA*, K.V. JADAV AND S.P. KACHHADIYA
Department of Agronomy, College of Agriculture, Junagadh Agriculture University, JUNAGADH (M.S.) INDIA

ABSTRACT

An experiment was conducted during the *rabi* season of the year 2006-07 and 2007-08 to study the effect of irrigation schedules and weed management practices on the growth and yield of fenugreek. There was a significant effects of irrigation schedules and weed management treatments on weed density, weed dry weight, seed yield and 1000-seed weight. Significantly the highest seed yield, straw yield and 1000- seed weight was observed when crop was irrigated five times, *i.e.* seedling, branching, flowering, pod formation and pod development stages. Weed density and weed dry weight was significantly lowest under two hand weeding *i.e.* at 20 and 45 DAS, but was at par with the pre-emergence application of pendimethalin 0.75 kg a.i. ha^{-1}. These two treatments also gave higher seed yield. Based on benefit cost ratio, five irrigation at critical stages (1: 3.07) and application of pendimethalin 0.75 kg a.i. ha^{-1} (1: 3.12) were found to be better management practices in fenugreek.

Key words : Irrigations, Weed control, Seed yield, Fenugreek

INTRODUCTION

Fenugreek is one of the important minor spice crops. India is one of the major producer and exporter of fenugreek with an annual export of nearly 1500 tones. Fenugreek is raised in *rabi* season and fairly tolerant to frost and low temperature. It can be grown in all types of soil under irrigated conditions, but does best on loamy soils. Judicious use of water along with suitable agronomic techniques at appropriate crop growth stages would substantially increase both plant growth and yield. Increasing use of fertilizer and irrigation water would also increase manifolds weed problem. Therefore, application of irrigation water in proper amount and proper time will go a long way in arresting the problem created by weeds.

Fenugreek is slow growing crop during its initial stage and getting severe competition from the weeds during this stage. If unchecked, it may reduce the seed yield to the tune of 14.2 to 69.0 % depending upon their density and duration of competition (Tripathi and Singh, 1993). Sometimes, scarcity of labour does not permit mechanical weeding to keep the field weed free. In such situations, the use of herbicides is the way to eliminate the weed-crop competition. However, it is well known that the efficacy of pre-emergence herbicides depends upon soil moisture. Information on effect of irrigation schedules and weed management practices on growth and yield of fenugreek is scanty; therefore, present study was under taken.

MATERIALS AND METHODS

A field experiment was conducted during *rabi* seasons of 2006-07 and 2007-08 at the Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh. Soil of the experimental area was medium black in texture, low in available nitrogen and medium in available phosphorus and potassium with the pH of 8.05. The treatments consisted of three irrigation schedules and six weed management practices including control. The experiment was laid out in split plot design with three replications. Irrigation schedules were allotted to main plot and weed management practices to sub-plots. Three pre-emergence herbicides *viz.*, pendimethalin, fluchloralin and metribuzin were included in weed management practices and applied at 0.75, 0.90 and 0.35 kg a.i. ha^{-1}, respectively. The quantity of herbicide was diluted in water at the rate of 500 litter per hectare and applied in the treatmental plots using knapsack sprayer fitted with deflector type nozzle at optimum soil moisture condition. Fenugreek variety GF-1 was sown by drilling on November 9, in 2006 and November 11, in 2007 at row spacing of 30 cm with seed rate of 25 kg ha^{-1}. Crop was fertilized with 20- 40-0 NPK kg ha^{-1} as basal before sowing.

The data were recorded for seed and straw yield on net plot basis and then converted on hectare basis. Thousand seed weight was recorded by counting 1000 seeds from bulk produce of each plot. Weed density was recorded as number of weed plants occured in a square meter area of each plot. These weeds were air dried

*** Author for correspondence.** Present Address : Agricultural Research Station, Junagadh Agricultural University, Keriya Road, AMRELI (GUJARAT) INDIA

separately for each plot till they reached to constant weight and considered as dry weeds weight per meter square.

RESULTS AND DISCUSSION

Results obtained are summarized in Table 1 and 2. Analysis of variance revealed that irrigation schedule and wee management practices had significant effect on growth and yield parameters.

Effect on weeds:

The experimental field was infested with *Cynodon dactylon, Echinochloa crusgalli, Brachiaria ramosa, Eluropus villosus, Chenopodium album, Amaranthus viridis, Digera arvensis, Euphorbia hirta, Boerhavia diffusa, Portulaca oleracea* and *Cyperus rotundus.* A perusal of data presented in Table 1 revealed that irrigation at seedling, branching and pod formation stages contributed significantly lesser weed count at 40 DAS and harvest during both the years. Similar effects also were observed for weed dry weight. Thus, results showed that weed density and weed dry weight increased steadily with increasing in number of irrigation.

The density and dry matter of weeds decreased significantly due to different weed management practices (Table 1). Among the weed management practices, two hand weeding, one at 20 and another at 45 DAS recorded the least weed counts and weed dry matter in both the years, but it was at par with pre-emergence herbicide application of pendimethalin 0.75 kg a.i. ha^{-1}. These findings are akin to the results obtained by Zalawadia (1999). Besides the effectiveness of cultural practices, chemical weed control is becoming essential now a days where scarcity of human labour arising frequently during peak season. As observed in the present study, comparative better performance of pendimethalin than other herbicides for controlling weeds in fenugreek was also reported by Mali and Suwalka (1987). Eshel *et al.* (1979) stated that higher efficacy and long lasting effect of pendimethalin in reducing weed dry matter may primarily be due to its greater resistance towards degradation in soil mass and secondarily due to its retarding effect on cell division of the meristem. Severe weed infestation under metribuzin 0.35 kg a.i. ha^{-1} compared to other herbicides may be due to its selective

Table 1 : Effect of irrigations and weed management practices on weed density and weed dry weight at two growth stages in fenugreek

Treatments	Weed density (m^2)				Weed dry weight (kg ha^{-1})			
	40 DAS		Harvest		40 DAS		Harvest	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
Irrigation schedules								
At seedling, branching and pod formation stages	5.89 (36.81)	6.13 (39.23)	6.77 (50.33)	7.10 (54.00)	6.12 (52.78)	5.94 (50.83)	9.17 (170.6)	9.66 (171.6)
At seedling, branching, flowering and pod formation stages	6.90 (49.98)	7.13 (52.71)	7.50 (61.06)	7.87 (65.56)	6.84 (61.48)	6.97 (63.41)	10.94 (203.0)	11.00 (198.1)
At seedling, branching, flowering, pod formation and pod development stages	7.09 (52.76)	7.25 (54.56)	7.97 (68.33)	8.13 (69.78)	6.95 (63.40)	6.98 (64.32)	11.59 (210.8)	11.78 (214.2)
C.D.(P=0.05)	0.76	0.71	0.65	0.41	0.32	0.54	0.77	0.93
Weed management practices								
Weedy	9.23 (85.96)	9.17 (84.72)	11.26 (127.3)	11.10 (123.6)	15.23 (232.3)	15.35 (235.9)	30.72 (944.8)	30.31 (920.6)
Hand weeding at 20 and 45 DAS	4.74 (22.70)	5.14 (26.66)	4.15 (17.67)	4.96 (24.89)	4.33 (19.07)	4.54 (20.90)	5.48 (32.00)	6.08 (37.47)
Hand weeding at 20 DAS and interculturing at 45 DAS	6.30 (40.36)	6.25 (39.62)	7.12 (51.11)	7.34 (54.22)	5.10 (26.15)	4.88 (24.08)	6.86 (48.53)	7.13 (52.00)
Pendimethalin	5.64 (32.12)	6.17 (38.22)	6.48 (42.22)	6.83 (47.00)	4.44 (19.83)	4.76 (22.90)	5.95 (36.80)	6.23 (40.00)
Fluchloralin	6.46 (42.42)	6.71 (45.59)	7.34 (54.33)	7.53 (56.78)	5.00 (25.15)	5.00 (25.28)	6.74 (46.67)	6.99 (49.87)
Metribuzin	7.40 (55.53)	7.59 (58.18)	8.14 (66.78)	8.46 (72.11)	5.72 (32.81)	5.26 (27.97)	7.64 (60.27)	8.14 (68.00)
C.D.(P=0.05)	0.62	0.49	0.48	0.41	0.29	0.27	0.71	0.78

Data on weed density and weed dry weight subjected to square root transformation. Figures in parentheses are original values.

action in controlling only broad leaved weeds.

Effect on yield:

Seed and straw yields of fenugreek were significantly affected by irrigation schedules and weed management practice (Table 2). In case of irrigation schedules, significantly higher seed and straw yields were recorded when the crop was irrigated five times, *i.e.* at seedling, branching, flowering, pod formation and pod development stage in both the years. No doubt, weed density and weed dry weight increased steadily with increasing in number of irrigation but at the same time seed yield was also increased. This suggests that increasing irrigation numbers might have caused faster growth of fenugreek plants and inhibited weed seed germination and the growth of early emerged weeds, which in turn, reduced the weed-crop competition resulting into higher seed yield. On the other hand, weeding twice (one at 20 DAS and another at 45 DAS) produced significantly the highest seed and straw yields than rest of the weed management practices. However, it was at par with the herbicide treatment of pendimethalin 0.75 kg a.i. ha^{-1}. Zalawadia (1999) obtained the highest seed and straw yield with two hand weedings, while Dungarwal *et al*. (2002) reported higher seed yield due to herbicides application for weed control in fenugreek. As compared to other herbicide treatments, higher seed yield of fenugreek with pendimethalin in the present study may be due to its less toxic effects on crop growth and effective inhibition of weed seed germination and limited growth of early emerged weeds as well as inhibition of regeneration of vegetatively propagated weeds thereby reducing the weed- crop competition which contributed for better yield. Uncontrolled weeds caused poor crop growth and the lowest yield.

Effect of irrigations and weed management practices was also observed on seed size (weight). Thousand seed weight was significantly higher when irrigation was applied at all five critical growth stages of crop during both the years. This might be due to better utilization of nutrients, moisture and sunlight by the fenugreek plants because of lower weed crop competition. Similarly, all the weed management practices had significantly increased the test weight over weedy check during both the years, except pre-emergence application of metribuzin 0.35 kg ha^{-1}. Significantly the highest 1000-seed weight was recorded under two hand weeding at 20 and 45 DAS followed by pre-emergence application of pendimethalin 0.75 kg a.i. ha^{-1} and the lowest in weedy check. Increase in seed size due to weed management practices could be attributed to the reduction in weed crop competition providing favourable condition for better crop growth and development.

The interaction effects between irrigation schedules and weed management practices were non-significant for all the characters.

Economics:

In terms of monetary return, irrigation at seedling,

Table 2 : Effect of irrigations and weed management practices on yield parameters and economics in fenugreek

Treatments	1000-seed weight (g)		Seed yield (kg ha^{-1})		Straw yield (kg ha^{-1})		Net returns (Rs ha^{-1})	Benifit: cost ratio
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08		
Irrigation schedules								
At seedling, branching and pod formation stages	12.74	13.07	1322	1406	2003	2124	13282	2.65
At seedling, branching, flowering and pod formation stages	14.16	14.52	1512	1567	2295	2418	15735	2.88
At seedling, branching, flowering pod formation and pod development stages	16.17	16.58	1687	1720	2603	2647	18009	3.07
C.D. (P=0.05)	1.55	1.61	171	152	234	217	1478	0.18
Weed management practices								
Weedy	12.50	12.82	1271	1341	1947	1943	12962	2.74
Hand weeding at 20 and 45 DAS	16.43	16.86	1704	1756	2639	2737	18121	3.02
Hand weeding at 20 DAS and interculturing at 45 DAS	14.26	14.62	1476	1533	2186	2361	15071	2.78
Pendimethalin (0.75 kg a.i. ha^{-1})	15.21	15.60	1646	1699	2552	2612	17806	3.12
Fluchloralin (0.90 kg a.i. ha^{-1})	14.56	14.93	1510	1565	2309	2456	15697	2.88
Metribuzin (0.35 kg a.i. ha^{-1})	13.18	13.52	1437	1492	2168	2267	14396	2.69
C.D. (P=0.05)	1.42	1.39	142	145	142	217	1539	0.18

branching, flowering, pod formation and pod development stages recorded significantly the highest net return (Rs. 18009) and B:C ratio of Rs. 1: 3.07. In case of weed management practices significantly the highest net return was realized with two hand weeding, *i.e*. one at 20 and another at 45 DAS (Rs. 18121) followed by the herbicide treatment of pendimethalin 0.75 kg a.i. ha^{-1} (Rs. 17806), but both were at par with each other. Though the net return was higher in hand weeding twice, the B: C ratio was calculated the highest (1: 3.12) under the treatment pendimethalin 0.75 kg a.i. ha^{-1} due to relatively lower cost of cultivation for this treatment.

Hence, the results of the present study revealed that irrigations at five critical stages, *i.e*. seedling, branching, flowering, pod formation and pod development, gave significantly higher seed yield. Hand weeding twice (one at 20 DAS and another at 45 DAS) effectively reduced the weed growth and increased the 1000-seed weight as well as seed yield substantially. However, the performance of pendimethalin 0.75 kg a.i. ha^{-1} was also found better and was at par with hand weeding twice. Considering the economic indices, hand weeding twice gave the highest net return, but the B: C ratio was obtained higher under the pre-emergence application of pendimethalin. Thus, five irrigations and application of pendimethalin 0.75 kg ha^{-1} found to be better for getting higher seed yield in fenugreek.

Acknowledgement :

The authors thank Dr. B.A. Monpara, Associate Research Scientist, Agricultural Research Station, Amreli, for his critical suggestions on the manuscript.

REFERENCES

Dungarwal, H.S., Chaplot, P.C. and Nagda, B.L. (2002). Herbicidal weed management in fenugreek. *Indian J. Agron.*, **34** : 247-250.

Eshel, Y., Oholi, Y., Gargi, G., Yager, D.and Azad, I. (1979). Pendimethalin- A new selective herbicide for cotton and other crops. *Phytoparasitica*, **7**: 143.

Mali, A.L. and Suwalka, S.N. (1987). Studies on weed control in fenugreek. *Indian J. Agron.*, **30** : 188-189.

Tripathi, S.S. and Singh, G. (1993). Crop-weed competition studies in fenugreek (*Trigonella foenum-graecum* L.). Integrated weed management for sustainable agriculture. *Proc. Indian Soc. Weed Sci., International Symposium, Hisar, India,* **11**: 41-43.

Zalawadia, K.S. (1999). Integrated weed management in fenugreek. *GAU Res. J.*, **29**: 91-93.

Received : April, 2009; Accepted : May, 2009