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Weed dynamics and growth parameters of fenugreek seed crop as influenced by various irrigation levels and weed control measures

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ABSTRACT

An experiment was conducted during the winter season of the year 2006-07 and 2007-08 to study the effect of irrigation levels and weed control measures on the growth and yield of fenugreek. There was a significant effect of irrigation levels and weed control measures on weed density, weed dry weight and growth parameters. Significantly the maximum plant height and plant spread was observed when crop was irrigated five times, *i.e.* seedling, branching, flowering, pod formation and pod development stages. Various irrigation levels could not exert a significant influence on attaining 50% flowering stage. Weed density of monocot, dicot and sedges as well as total weeds 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}.

Key words : Fenugreek, Monocot, Dicot, Sedges weed, Weed flora, Pendimethalin, Fluchloralin, Metribuzui

INTRODUCTION

Fenugreek commonly known as methi is one of the important seed spices in India cultivated on 50,000 hectares producing 60,000 tonnes of seeds annually. 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 levels and weed control measures on growth and yield of fenugreek is scanty; therefore, present study was under taken.

MATERIALS AND METHODS

A field experiment was conducted during winter 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 levels and six weed control measures including control. The experiment was laid out in split plot design with three replications. Irrigation levels were allotted to main plot and weed weed control measures to sub-plots. Three pre-emergence herbicides *viz.*, pendimethalin, fluchloralin and metribuzin were included in weed control measures 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 density of monoct, dicot and sedges weeds were recorded as number in a square meter area of each plot. These weeds were air dried separately for each plot till they reached to constant weight and considered as dry weeds weight per meter square.

RESULTS AND DISCUSSION

The results obtained from the present investigation are presented in Table 1, 2 and 3:

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Weed flora :

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.*

Effect of Irrigation :

The plant height was significantly influenced by irrigation. With each successive increase in the number of irrigations the plant height was observed to be increased. Significantly the tallest plants (46.33 cm) was observed with irrigation schedule I_3 (five irrigations) while the shortest (33.61 cm) with I_1 (three irrigations) (Table 3). Increased plant height with I_3 irrigations may be due to adequate soil moisture availability to the plants (Patel *et al*., 2005).

The results pertaining to days to 50% flowering revealed that the various irrigation levels could not exert a significant influence on attaining 50% flowering stage. The possible explanation is that the crop was irrigated evenly in all the irrigation treatments before flowering, *i.e*. two irrigations, one at seedling and another at branching stage applied up to the flowering stage, therefore, no treatment effect was observed for hastening flowering initiation.

The plant spread recorded at harvest showed significant effect of various irrigation treatments. Maximum plant spread (24.74 cm) was registered with irrigation level I_3 and minimum with I_1 (17.93 cm). The plant spread of treatment I_3 was 18.15 % and 40.77 % higher than I_2 and I_1 treatment, respectively. Plant spread is regarded as the indicator of plant growth. But in simplest term, the growth and development of plant depends on progressive limitation of tissue and organ primordial and on the differentiation and expansion of the cell component until the characteristics of the plant is realized. In general, all plant processes take place in effective aqueous medium since; water is involved either as a transporting agent or a reagent or both. It is not surprising that optimum water supply had promoting effects on most of these physiological processes. Hence, plant growth in term of plant height which ultimately resulted in higher plant spread under plots treated with irrigation treatment I3 which ensured adequate moisture supply to fenugreek crop thus augmenting vegetative growth. Increase in vegetative growth with increase in irrigation level was also reported earlier by Kumar *et al.* (2000).

Significantly the lowest monocot, dicot, sedges and total weeds at harvest were observed under treatment I_1 (Irrigations at seedling stage, branching and pod formation stage). Treatment I_3 (Irrigation at seedling, branching, flowering, pod formation and pod development stage), being statistically at par with I_2 (Irrigation at seedling, branching, flowering and pod formation stage), recorded significantly the highest monocot, dicot, sedges and total weeds at harvest (Table 2). Less weed population in moisture stress condition have also been reported by Patel *et al*. (2005).

The treatment I_1 (Irrigation at seedling stage, branching stage and pod formation stage) recorded significantly the lowest dry weight of 9.414 at harvest, while treatment I_3 (Irrigation at seedling, branching, flowering, pod formation and pod development stage), recorded significantly the highest dry weight of 11.683 kg ha^{-1}, though it was at par with treatment I2 (Irrigation at seedling, branching, flowering and pod formation stage)(Table 1). This was apparently because of the higher monocot dicot and sedges weed population and availability of adequate soil moisture which resulted in aggressive growth of weeds and there by more dry matter accumulation. Higher dry weight with increase in the number of irrigations was also reported by Patel *et al.* (2005).

Effect of weed management practices :

Significantly the lowest monocot, dicot, sedges and total weeds recorded at harvest were observed under treatment W_2 (2 HW at 20 and 45 DAS)(Table 2). Treatment W_4 (Pendimethalin @ 0.750 kg ha^{-1} as pre-emergence) was found equally effective for lowering monocot, dicot, sedges and total weeds at harvest. The least number of monocot, dicot, sedges and total weeds at harvest might be due to two hand weeding carried out at 20 and 45 DAS under this treatment. The dense crop canopy in terms of plant spread and number of branches per plant might have smoothering effects on weeds and consequently lower weed counts in this treatment. (Zalawadia, 1999).

Significantly the lowest dry weight of 5.783 kg ha^{-1} at harvest was recorded under treatment W_2 (2 HW at 20 and 45 DAS). It was closely followed by treatment W_4 (Pendimethalin @ 0.750 kg ha^{-1} as pre-emergence) (Table 1). The longer persistency of herbicide and favorable effect of cultural practices responsible for keeping down the monocot, dicot and sedges population and thereby resulted into less dry weight of weeds under these treatments. These findings are similar to the findings of Mali and Suwalka (1987).

Plant height, plant spread and days to 50% flowering were significantly influenced by weed control treatments (Table 3). The maximum plant height (44.00 cm) and plant

Table 1 Effect of different treatments on Total weed density and dry weight of weeds at harvest

Treatment	Total weed density(m^2)			Weed dry weight (kg ha^{-1})		
	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled
Irrigation Schedules						
I_1 (At seedling, branching and pod formation stages)	6.770 (50.33)	7.101 (54.00)	6.936 (52.17)	9.166 (170.6)	9.663 (171.6)	9.414 (171.1)
I_2 (At seedling, branching, flowering and pod formation stages)	7.503 (61.06)	7.874 (65.56)	7.688 (63.31)	10.942 (203.0)	11.000 (198.1)	10.971 (200.5)
I_3 (At seedling, branching, flowering pod formation and pod development stages)	7.967 (68.33)	8.132 (69.78)	8.050 (69.06)	11.590 (210.8)	11.777 (214.2)	11.683 (212.5)
C.D. (P=0.05)	0.652	0.411	0.320	0.776	0.926	0.502
Weed control measures						
W_1 (Weedy)	11.259 (127.3)	11.103 (123.6)	11.181 (125.5)	30.721 (944.8)	30.311 (920.6)	30.516 (932.7)
W_2 (Hand weeding at 20 & 45 DAS)	4.145 (17.67)	4.958 (24.89)	4.552 (21.28)	5.483 (32.00)	6.083 (37.47)	5.783 (34.73)
W_3 (Hand weeding at 20 DAS & interculturing at 45 DAS)	7.121 (51.11)	7.338 (54.22)	7.230 (52.67)	6.858 (48.53)	7.130 (52.00)	6.994 (50.27)
W_4 (Pendimethalin ,0.75 kg a.i. ha^{-1})	6.482 (42.22)	6.827 (47.00)	6.655 (44.61)	5.952 (36.80)	6.229 (40.00)	6.091 (38.40)
W_5 (Fluchloralin , 0.90 kg a.i. ha^{-1})	7.338 (54.33)	7.529 (56.78)	7.434 (55.56)	6.741 (46.67)	6.986 (49.87)	6.863 (48.27)
W_6 (Metribuzin , 0.35 kg a.i. ha^{-1})	8.136 (66.78)	8.458 (72.11)	8.297 (69.44)	7.642 (60.27)	8.139 (68.00)	7.891 (64.13)
C.D. (P=0.05)	0.476	0.406	0.306	0.713	0.777	0.517

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

Table 2 : Effect of irrigations and weed management practices on weed dynamics at harvest

Treatment	Weed density (m^2)								
	Monocot			Dicot			Sedges		
	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled
Irrigation schedules									
I_1 (At seedling, branching and pod formation stages)	3.988 (18.50)	4.402 (21.33)	4.195 (19.92)	4.338 (21.22)	4.514 (22.28)	4.426 (21.75)	3.166 (10.61)	3.157 (10.39)	3.162 (10.50)
I_2 (At seedling, branching, flowering and pod formation stages)	4.556 (23.50)	4.868 (25.61)	4.712 (24.56)	4.787 (25.22)	5.112 (28.00)	4.950 (26.61)	3.429 (12.33)	3.393 (11.94)	3.411 (12.14)
I_3 (At seedling, branching, flowering pod formation and pod development stages)	4.874 (26.61)	5.048 (27.50)	4.961 (27.06)	5.123 (28.50)	5.262 (29.56)	5.192 (29.03)	3.568 (13.22)	3.510 (12.72)	3.539 (12.97)
C.D.(P=0.05)	0.464	0.387	0.251	0.493	0.454	0.279	0.249	0.246	0.145
Weed Management Practices									
W_1 (Weedy)	7.570 (57.56)	7.365 (54.44)	7.468 (56.00)	7.293 (53.56)	7.343 (54.11)	7.318 (53.83)	4.013 (16.22)	3.876 (15.11)	3.945 (15.67)
W_2 (Hand weeding at 20 & 45 DAS)	2.254 (5.22)	3.029 (9.44)	2.642 (7.33)	2.504 (6.89)	3.074 (9.67)	2.789 (8.28)	2.350 (5.56)	2.398 (5.78)	2.374 (5.67)
W_3 (Hand weeding at 20 DAS & interculturing at 45 DAS)	4.497 (20.44)	4.755 (22.78)	4.626 (21.61)	4.935 (24.56)	4.958 (24.78)	4.946 (24.67)	2.428 (6.11)	2.559 (6.67)	2.494 (6.39)
W_4 (Pendimethalin ,0.75 kg a.i. ha^{-1})	3.528 (12.56)	3.788 (14.44)	3.658 (13.50)	3.883 (15.33)	4.180 (18.00)	4.031 (16.67)	3.784 (14.33)	3.814 (14.56)	3.799 (14.44)
W_5 (Fluchloralin , 0.90 kg a.i. ha^{-1})	4.110 (17.11)	4.508 (20.44)	4.309 (18.78)	4.702 (22.44)	4.735 (22.56)	4.718 (22.50)	3.839 (14.78)	3.706 (13.78)	3.772 (14.28)
W_6 (Metribuzin , 0.35 kg a.i. ha^{-1})	4.878 (24.33)	5.191 (27.33)	5.035 (25.83)	5.180 (27.11)	5.487 (30.56)	5.334 (28.83)	3.912 (15.33)	3.768 (14.22)	3.840 (14.78)
C.D.(P=0.05)	0.335	0.369	0.571	0.515	0.454	0.337	0.236	0.184	0.147

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

Table 3 : Effect of irrigation and weed management practices on growth parameters of fenugreek

Treatment	Plant height (cm)			Days to 50% flowering			Plant spread (cm)		
	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled
Irrigation schedules									
I_1 (At seedling, branching and pod formation stages)	32.22	35.00	33.61	38.72	40.67	39.69	17.11	18.74	17.93
I_2 (At seedling, branching, flowering and pod formation stages)	38.11	40.28	39.19	38.89	40.94	39.92	20.29	21.60	20.94
I_3 (At seedling, branching, flowering pod formation and pod development stages)	45.61	47.06	46.33	39.72	41.94	40.83	24.23	25.24	24.74
C.D. (P=0.05)	3.82	3.61	2.18	NS	NS	NS	2.06	1.95	1.18
Weed control measures									
W_1 (Weedy)	34.44	37.00	35.72	42.00	42.33	42.17	18.31	19.82	19.07
W_2 (Hand weeding at 20 & 45 (DAS)	43.22	44.78	44.00	36.11	39.22	37.67	23.31	24.16	23.73
W_3 (Hand weeding at 20 DAS & interculturing at 45 DAS)	38.89	40.89	39.89	39.67	41.78	40.72	20.69	21.91	21.30
W_4 (Pendimethalin ,0.75 kg a.i. ha^{-1})	41.44	43.44	42.44	36.33	40.11	38.22	21.67	23.18	22.42
W_5 (Fluchloralin , 0.90 kg a.i. ha^{-1})	39.00	41.22	40.11	39.44	41.33	40.39	20.73	22.09	21.41
W_6 (Metribuzin , 0.35 kg a.i. ha^{-1})	34.89	37.33	36.11	41.11	42.33	41.72	18.56	20.02	19.29
C.D. (P=0.05)	3.53	3.21	2.34	2.08	2.03	1.42	1.88	1.74	1.25

spread (23.73 cm) and least number of days to 50% flowering (37.67) was recorded under treatment W2 (2 HW at 20 and 45 DAS), however, it was statistically at par with the treatment W4 (Pendimethalin @ 0.750kg ha $^{-1}$ as pre-emergence). Increase in plant height and plant spread in these treatments may be due to less weed-crop competition through out the crop growth. Good weed control in these treatments might have developed favourable environment for absorption of more water and nutrient. Thus, enabled availability of nutrients, water, light and space to the crop plant resulted into increased plant height and plant spread. The lowest plant height (35.72 cm), plant spread (19.07 cm) and maximum number of days to 50 % flowering (42.17) were recorded under treatment W1 (unweeded check), this might be due to severe competition by weed for resources which made the crop plants inefficient to take up moisture and nutrients, consequently growth was affected. Similar results were reported by Kamboj *et al*. (2005) for plant height and by Mali and Suwalka (1987) for plant spread in fenugreek.

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