

## Effect of Weed Management Practices on Weed Indices, Yield and Economics of Fennel (*Foeniculum vulgare* Mill.)

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### ABSTRACT

A field experiment was conducted during **rabi** seasons of 2007-08 and 2008-09 at the research farm of NRCSS, Ajmer (Rajasthan) to find out most suitable and economical method of weed control in fennel (*Foeniculum vulgare*). The experiment was laid in RBD. Based on two years' study, it was revealed that besides weed free treatment, significantly highest plant height at all the growth stages, number of branches/plant, yield attributes like number of umbels/plant, number of umbellates/umbel, number of seeds/umbellate, seed and straw yields of fennel were recorded with pre-emergence (PRE) application of oxadiargyl @ 75 g/ha+one hand weeding (HW) at 45 DAS which being at par with PRE application of pendimethalin @ 1.0 kg/ha+HW at 45 DAS. Similarly, besides weed free treatment, the lowest dry weight of weed at harvest and weed index as well as highest weed control efficiency was also obtained with PRE application of oxadiargyl @ 75 g/ha (PE)+HW at 45 DAS. This treatment also exhibited highest net returns (Rs.104310/ha) and B : C ratio.

**Key words** : Fennel, plant growth, weed control, weed index, yield, economics

### INTRODUCTION

Fennel (*Foeniculum vulgare* Mill.) commonly known as saunf, belongs to Apiaceae family. It is one of the most important major seed spice crops mainly grown in Gujarat, Rajasthan, Karnataka, UP, Punjab and Haryana. Fennel is used for flavouring soups, liquor, sauces, pastries and confectionery, bread-roll and meat dishes. Initially fennel being a slow growing seed spice is more prone to crop weed competition. Therefore, field should be kept weed free at initial stage of crop establishment by employing available weed control methods. Though manual weeding is commonly employed practice but availability of labour itself is a problem and it requires high drudgery and is a costly practice. Therefore, it is essential to find out an appropriate and economical method of weed control to keep fennel fields weed free at the critical stages of crop-weed competition. Initial slow growth of seed spices leads to severe weed crop competition and reduces growth as well as yield as high as 91.4% (Mali and Suwalka, 1987). Pre-emergence application of herbicides may lead to cost effective control of the weeds right from the start which otherwise may not be possible by manual weeding. Simultaneous emergence and rapid growth of weed lead to severe weed-crop competition for light, moisture, space and nutrients resulting in drastic reduction in yield. Though, use of herbicide has revolutionized weed control and

reduced the cost of production but unfortunately, until now majority of the farmers had been quite ignorant about the proper doses of herbicides, time of application and their economics, so that weed control has taken a back seat as far as their judicious use is concerned. Therefore, the study was carried out to find economically effective method of weed control for realising higher productivity and profitability of fennel.

### MATERIALS AND METHODS

The experiment was carried out at National Research Centre on Seed Spices, Ajmer (Rajasthan) during **rabi** seasons of 2007-08 and 2008-09. The experiment comprised nine treatments, namely, weedy check, hand weeding at 45 DAS, pre-emergence (PRE) application of pendimethalin @ 1.0 kg/ha, PRE application of oxadiargyl @ 75 g/ha, pre-plant incorporation (PPI) of fluchloralin 1/kg/ha, PRE application of pendimethalin @ 1.0 kg/ha+HW at 45 DAS, PRE application of oxadiargyl @ 75 g/ha+HW at 45 DAS, fluchloralin @ 1.0 kg/ha PPI+one hand weeding at 45 DAS and weed free. The experiment was laid out in randomized block design with three replications. The soil of the experimental field was sandy loam having low organic matter (0.23%), available nitrogen (178.0 kg/ha), phosphorus (12.0 kg/ha) and sufficient available potassium (165 kg/ha)

slightly alkaline with pH (8.04) and EC (0.076 dS/m). The average rainfall ranged from 250-500 mm during July to September in both the years. No irrigation was received during cropping season because fennel was grown during **rabi** season as an irrigated crop. The temperature ranged from 2-5°C during January and 42-45°C during May. The fennel (NRCSS-AF-1) was sown directly on 15 October during both the years with the seed rate of 8 kg/ha in the rows of 60 cm apart. After one month of sowing, thinning operation was performed to maintain the plant to plant spacing at 25 cm. All standard packages of practices were followed throughout the cropping season. PRE herbicides were applied immediately after sowing with the help of a Knapsack sprayer fitted with flat fan nozzle with a spray volume of 600 l/ha. In manual weed control treatments, weeds were uprooted and removed at 45 DAS as per treatments. In weed free plots, the weeds were removed manually after every seven days for ensuring complete weed free condition. After uprooting of weeds, the weeds were sun dried completely till reached to constant weight and finally the dry weight was recorded for each treatment and expressed as kg/ha. Weed control efficiency (WCE) and weed index (WI) were calculated by the formulae suggested by Kondap and Upadhaya (1985) and Gill and Kumar (1969), respectively. The crop was harvested on 20 April during both the years. Net return and B : C ratio were calculated for drawing conclusion.

## RESULTS AND DISCUSSION

The results obtained during 2007-08 and 2008-09 had similar trends in respect of weed as well as crop parameters. Therefore, data were presented on pooled basis.

### Weed Parameters

The major weed flora observed in the crop was *Chenopodium murale*, *C. album*, *Amaranthus viridis*, *Cyperus rotundus* and *Phalaris minor*. Application of different weed control methods significantly influenced dry weight of weed, weed control efficiency (WCE) and weed index (WI). Besides, weed free treatment, the lowest dry weight of weeds (3.97 q/ha) and weed index (3.54%) as well as highest WCE (95.48%) were recorded with oxadiargyl @ 75 g/ha+HW; however, it was at par with pendimethalin @ 1.0 kg/ha+HW at 45 DAS (Table

3). The lowest dry weight and WI were recorded with oxadiargyl @ 75 g/ha+HW at 45 DAS due to less weed density resulting in lower dry weight of weeds. Meena and Mehta (2009) in coriander observed that lowest weed biomass and the highest weed control efficiency at maturity were recorded with oxadiargyl @ 75 g/ha+HW. Mehriya *et al.* (2007) reported that oxyfluorfen and oxadiargyl at 50 g/ha applied at 20 DAS along with one hand weeding at 35 DAS caused maximum reduction in weed biomass production and resulted in higher weed control efficiency in cumin crop.

### Plant Growth

Application of different weed control treatments significantly influenced dry matter accumulation/plant at different stages, plant height at harvest, number of branches/plant at 90 DAS and harvest. Perusal of data (Table 1) revealed that besides weed free treatment, highest dry matter accumulation/plant at 60, 90 DAS and at harvest (17.65, 73.20 and 187.12 g/plant), plant height at harvest (191.30 cm), maximum number of branches/plant at 90 DAS and at harvest (12.67 and 16.87) were recorded with oxadiargyl @ 75 g/ha+HW at 45 DAS being at par with pendimethalin @ 1 kg/ha+HW at 45 DAS. Application of said treatment resulted in vigorous growth of fennel plants due to effective control of weeds during critical growth stages which helped in reducing crop weed interference, thus creating favourable condition in respect to availability of nutrients, moisture and sunlight resulting in better uptake of nutrients which consequently favoured the growth of fennel plants. These results conform the findings of Dungarwal *et al.* (2002). Similarly, Meena and Mehta (2009) reported that PE application of oxadiargyl 75 g/ha+HW at 45 DAS resulted in higher growth attributes in coriander.

### Yield Attributes and Yield

Yield attributes as well as seed and straw yield were significantly influenced with application of different weed control practices during both the years as well as in pooled. Results obtained revealed that besides weed free treatments significantly the highest yield attributes like number of umbels/plant (35.0), number of umbellates/umbel (38.8), number of seeds/umbellate (31.9), seed (2700 kg/ha) and straw yields (7860 kg/ha) were recorded with oxadiargyl @ 75 g+HW at 45 DAS being at par with

pendimethalin @ 1 kg/ha+HW at 45 DAS (Table 2). Increase in yield attributes with oxadiargyl @ 75 g/ha+HW at 45 DAS might be due to effective control of weeds like

*C. album* and *C. murale* resulting in lesser competition of weeds which might have ultimately resulted in the better utilization of nutrients and moisture available in the soil by

Table 1. Effect of weed management practices on growth attributes of fennel (Pooled data of two years)

Treatments	Dry matter accumulation/ plant (g)			Plant height (cm) at harvest	No. of branches/ plant	
	60 DAS	90 DAS	At harvest		90 DAS	At harvest
Weed check control	6.40	26.00	65.25	131.10	8.11	10.63
HW at 45 DAS	11.50	49.20	129.13	166.00	8.55	10.78
Pendimethalin 1 kg/ha PRE	14.20	62.80	159.71	175.00	9.78	13.45
Oxadiargyl 75 g/ha 16.80 PRE	68.20	173.25	178.30	9.90	15.67	
Fluchloralin 1 kg/ha PPI	13.60	54.60	138.14	167.70	9.00	10.89
Pendimethalin 1 kg/ha PRE+HW at 45 DAS	16.50	67.60	172.25	188.40	12.00	16.67
Oxadiargyl 75 g/ha PRE+HW at 45 DAS	17.65	73.20	187.12	191.30	12.67	16.87
Fluchloralin 1 kg /ha PPI+HW at 45 DAS	15.80	63.20	160.14	171.70	9.23	11.00
Weed free	18.82	76.20	198.24	196.30	13.33	23.00
LSD (P=0.05)	1.55	8.16	20.86	12.43	1.17	1.88

Table 2. Effect of weed management practices on yield attributes and yield of fennel (Pooled data of two years)

Treatments	No. of umbels/ plant	No. of umbellates/ umbel	No. of seeds/ umbellate	Seed yield (kg/ha)	Straw yield (kg/ha)
Weed check control	19.83	21.99	24.43	886	2588
HW at 45 DAS	23.23	30.43	25.33	1668	5376
Pendimethalin 1 kg/ha PRE	26.67	34.00	29.44	2200	6381
Oxadiargyl 75 g/ha PRE	27.00	34.89	30.77	2400	7020
Fluchloralin 1 kg/ha PPI	24.10	31.90	26.33	2000	5579
Pendimethalin 1 kg/ha PRE+HW at 45 DAS	29.20	37.01	30.78	2480	7051
Oxadiargyl 75 g/ha PRE+HW at 45 DAS	35.00	38.77	31.90	2700	7860
Fluchloralin 1 kg/ha PPI+HW at 45 DAS	25.90	32.74	27.33	2126	6860
Weed free	35.77	40.77	36.40	2800	7883
LSD (P=0.05)	2.50	2.76	2.11	2.23	8.55

Table 3. Effect of weed management practices on weed indices and economics of fennel (Pooled data of two years)

Treatments	Dry weight of weeds at harvest (kg/ha)	Weed control efficiency (%)	Weed index (%)	Cost of cultivation (Rs./ha)	Net returns (Rs./ha)	B : C ratio
Weed check control	9258	-	68.35	27820	16480	0.59
HW at 45 DAS	1221	86.38	40.36	29820	53580	1.80
Pendimethalin 1 kg/ha PRE	739	91.57	21.45	30232	79768	2.64
Oxadiargyl 75 g/ha PRE	514	94.28	14.31	28690	91310	3.18
Fluchloralin 1 kg/ha PPI	1009	88.57	28.49	29211	70789	2.42
Pendimethalin 1 kg/ha PRE+HW at 45 DAS	603	93.08	11.43	32232	91768	2.85
Oxadiargyl 75 g/ha PRE+HW at 45 DAS	397	95.48	3.54	30690	104310	3.40
Fluchloralin 1 kg/ha PPI+HW at 45 DAS	899	89.87	24.00	31211	75089	2.41
Weed free	-	100.0	0.00	40320	99680	2.47
LSD (P=0.05)	3.83	4.06	7.79	-	-	-

Selling price of fennel Rs. 50/kg.

the crop, which reflects in terms of increased yield attributes and yield of seed spices. The results are in accordance with those of Mehriya *et al.* (2007) and Meena and Mehta (2009).

### Economics

Application of weed control treatments significantly influenced gross return, net return and B : C ratio in fennel. Highest net return (Rs. 1,04,310/ha) and net B : C ratio (3.40) were recorded with the pre-emergence application of oxadiargyl @ 75 g/ha+HW at 45 DAS ( Table 3).

Thus, it is inferred that PE application of oxadiargyl @ 75 g/ha+HW at 45 DAS is the best weed control treatment resulting in efficient weed control which ultimately leads to higher yields and maximum economic returns.

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