

Economic feasibility of weed management practices in cumin (*Cuminum cyminum* L.)

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Abstract

Field experiments conducted at Ajmer (Rajasthan), to find out the economic feasibility of weed management practices in terms of weed control efficiency and performance of cumin (*Cuminum cyminum*) indicated that weed-free treatments resulted in maximum vegetative growth and seed yield (6.03 q ha⁻¹) followed by pre-emergence application of oxadiargyl @ 75 g ha⁻¹ + hand weeding at 45 days after sowing (DAS). Maximum net returns (Rs. 46,365 ha⁻¹) and highest cost : benefit ratio (1:3.48) was also obtained in pre-emergence application of oxadiargyl @ 75 g ha⁻¹ + hand weeding at 45 DAS.

Keywords: cumin, *Cuminum cyminum*, herbicides, weed management, yield.

Introduction

Weeds are an important factor responsible for the low productivity (380 kg ha⁻¹) of cumin (*Cuminum cyminum* L.) in India. The crop is more susceptible to weed competition during the earlier growth period, and if the weed problem is not managed properly, there is strong chance of crop failure. Herbicides are the most effective and economic weed control measures. Generally, cumin farmers control weed manually, which is labour consuming. Moreover, there is shortage of manpower during early growth stage and therefore, complete weeding is not possible. Rathore *et al.* (1990) found that pre-emergence application of pendimethalin @ 1 kg ha⁻¹ gave better performance in comparison to other treatments in cumin. However, the chemical is costly and not cost effective to farmers. Meena & Chaudhary (2007) studied the phytotoxic effect of

oxadiargyl @ 75, 150 and 300 g ai ha⁻¹ and found that higher doses ie, 150 and 300 g ai ha⁻¹ causes slight injury on leaf tips and wilting of plants. Hence, the present study was carried out for identifying an effective and economically viable weed management practice for obtaining higher yield of cumin.

Materials and methods

The experiment was carried out at National Research Centre on Seed Spices, Ajmer (Rajasthan) during the winter season of 2005-06 and 2006-07. The experiment comprised of nine treatments namely, weedy check-control (T1), hand weeding (45 days after sowing) (DAS) (T2), pendimethalin @ 1 kg ha⁻¹ (pre-emergence) (T3), oxadiargyl @ 75 g ha⁻¹ (pre-emergence) (T4), fluchloralin 1 kg ha⁻¹ (pre-emergence) (T5), pendimethalin @ 1 kg ha⁻¹ (pre-emergence) + hand weeding (45 DAS) (T6), oxadiargyl @ 75 g ha⁻¹ (pre-emergence) + hand weeding (45 DAS) (T7),

fluchloralin @ 1 kg ha⁻¹ (pre-emergence) + hand weeding (45 DAS) (T8) and weed-free (T9). The experiment was laid out in a randomized block design with three replications. The soil of the experimental site was sandy loam with a pH of 8.92 and having 0.21% organic carbon and 76.0, 33.4 and 234.1 kg ha⁻¹ available N, P₂O₅ and K₂O, respectively. Irrigation and other cultural practices were adopted as per recommendation. Observations on growth, yield attributing characters, yield and economics were taken. Net returns and benefit : cost (B : C) ratio were also worked out. Weed control efficiency (WCE) was calculated as per the formula suggested by Patil & Patil (1983). Observations on weed dry matter were recorded for whole plot of 3 x 3 m, which was used to calculate the WCE.

$$\text{WCE (\%)} = [(\text{DMC}-\text{DMT})/\text{DMC}] \times 100$$

where, DMC is the dry matter weight of weeds in control plot and DMT is the dry matter weight of weeds in treated plot. Weed index (WI) was calculated as per the formula suggested by Gill & Kumar (1969).

$$\text{WI (\%)} = [(X-Y)/X] \times 100$$

where, X is the yield from weed-free plot and Y is the yield from treated plot.

Results and discussion

Weed parameters

The important weed species in the experimental field during the growing period were, *Plantago pumila* L. (Plantaginaceae), *Chenopodium murale* L. (Chenopodiaceae), *Chenopodium album* L. (Chenopodiaceae), *Amaranthus viridis* L. (Amaranthaceae), *Cyperus rotundus* L. (Cyperaceae), *Phalaris minor* Retz. (Poaceae), *Cynodon dactylon* (L.) Pers. (Poaceae) and *Anagallis arvensis* L. (Primulaceae).

The highest dry weight of weeds (92.58 q ha⁻¹) was obtained in the un-weeded treatment (control plot), which was significantly higher than that of other treatments (Table 1). Weed-free treatment recorded the lowest weed density and dry weight of weeds at harvest. Pre-emergence application of oxadiargyl @ 75 g ha⁻¹ + hand weeding at 45 DAS resulted in significantly

Table 1. Crop growth parameters, dry weight of weeds, weed index and weed control efficiency as affected by weed management practices in cumin (pooled data of 2 years)

Treatment	No. of branches plant ⁻¹	Dry weight of weeds at harvest (q ha ⁻¹)	Weed control efficiency (%)	Weed index (%)
Weedy check (control)	3.30	92.58	0.00 (4.05)	77.94
Hand weeding (45 DAS)	3.88	12.21	86.38 (68.51)	65.33
Pendimethalin (1 kg ha ⁻¹ PE)	4.95	7.39	91.57 (73.61)	17.08
Oxadiargyl (75 g ha ⁻¹ PE)	5.52	5.14	94.28 (76.33)	12.93
Fluchloralin (1 kg ha ⁻¹ PE)	4.51	10.09	88.57 (70.70)	33.66
Pendimethalin (1 kg ha ⁻¹ PE) +				
Hand weeding (45 DAS)	5.57	6.03	93.08 (75.33)	3.98
Oxadiargyl (75 g ha ⁻¹ PE) +				
Hand weeding (45 DAS)	5.74	3.97	95.48 (78.31)	1.99
Fluchloralin (1 kg ha ⁻¹ PE) +				
Hand weeding (45 DAS)	4.98	8.99	89.87 (71.87)	21.55
Weed-free	5.76	0.00	100.0 (85.94)	0.00
SEM±	0.20	1.28	1.36	-
CD (P = 0.05)	0.60	3.83	4.06	-

Values in parenthesis are arc sin transformed values; PE= Pre-emergence; DAS= Days after sowing

lower weed density and dry weight of weeds (3.97 q ha^{-1}) than that in other treatments except weed-free condition. Fluchloralin @ 1 kg ha^{-1} (pre-emergence) was less effective in reducing dry weight of weeds (10.09 q ha^{-1}).

Highest weed control efficiency was observed in weed-free treatment (85.94%) due to continuous removal of weeds up to 90 days after sowing. Among all the weed management practices, maximum weed control efficiency was recorded in pre-emergence application of oxadiargyl @ 75 g ha^{-1} + one hand weeding at 45 DAS (78.31%) followed by pre-emergence application of pendimethalin 1 kg ha^{-1} + hand weeding at 45 DAS (75.33%). The lowest weed control efficiency was recorded in pre-emergence fluchloralin @ 1 kg ha^{-1} (70.70%).

Crop growth parameters

In general, better growth of cumin was found in plots having weed control treatments than un-weeded treatment (Table 1). Pre-emergence application of oxadiargyl @ 75 g ha^{-1} + hand weeding at 45 DAS significantly increased plant growth parameters over weedy check (control) (Table 1). Significantly higher plant height and other growth attributes were

obtained with pre emergence application of oxadiargyl @ 75 g ha^{-1} . + hand weeding at 45 DAS followed by pre emergence application of pendimethalin 1 kg ha^{-1} + hand weeding at 45 DAS. The lowest plant growth attributing characters were obtained in weedy check. This result supports the study by Meena & Chaudhary (2007).

Yield components and yield

All the weed management practices significantly influenced the yield attributes and yield of cumin over un-weeded treatment (Table 2). Significantly higher yield components and seed yield were obtained with weed-free treatment over all the other treatments (Table 2). Among all other weed management practices, significantly higher umbels plant^{-1} , umbellets umbel^{-1} and seeds umbellets^{-1} were obtained with pre-emergence application of oxadiargyl @ 75 g ha^{-1} + hand weeding at 45 DAS followed by pre-emergence application of pendimethalin 1 kg ha^{-1} + hand weeding at 45 DAS. The lowest yield attributing characters and seed yield were obtained in weedy check.

Pre-emergence application of oxadiargyl @ 75 g ha^{-1} + hand weeding at 45 DAS produced

Table 2. Yield components and yield as affected by weed management practices in cumin (pooled data of 2 years)

Treatment	No. of umbels plant^{-1}	Test weight (g)	Essential oil (%)	Seed yield (q ha^{-1})
Weed check (control)	6.75	3.50	3.47	1.33
Hand weeding (45 DAS)	9.36	3.95	3.57	2.09
Pendimethalin (1 kg ha^{-1} PE)	13.22	4.41	4.05	5.00
Oxadiargyl (75 g ha^{-1} PE)	14.47	4.50	4.03	5.25
Fluchloralin (1 kg ha^{-1} PE)	12.09	4.16	3.88	4.00
Pendimethalin (1 kg ha^{-1} PE) + Hand weeding (45 DAS)	15.79	4.53	4.02	5.79
Oxadiargyl (75 g ha^{-1} PE) + Hand weeding (45 DAS)	16.04	4.60	4.09	5.91
Fluchloralin (1 kg ha^{-1} PE) + Hand weeding (45 DAS)	14.32	4.45	3.85	4.73
Weed-free	15.84	4.57	4.07	6.03
SEM±	0.11	0.002	0.01	0.01
CD (P = 0.05)	0.33	0.01	0.03	0.02

PE= Pre-emergence; DAS= Days after sowing

significantly higher test weight (4.60 g), essential oil content in seed (4.09%) and seed yield (5.91 q ha⁻¹) followed by pre-emergence application of pendimethalin @ 1 kg ha⁻¹ + hand weeding at 45 DAS, over rest of the treatments under study (Table 2). The lowest seed yield (1.33 q ha⁻¹) was recorded in weedy check during both the years, which indicated the extent of loss caused by the presence of the weeds in cumin, if unchecked. Similar results were obtained by Meena & Chaudhary (2007) who reported that application of oxadiargyl gave higher seed yield of cumin which may be attributed to better weed control efficiency. Similarly, Rathore *et al.* (1990) found that pre-emergence application of pendimethalin @ 1 kg ha⁻¹ resulted in highest seed yield of cumin.

Economics

Maximum net returns (Rs. 46,365 ha⁻¹) and highest cost : benefit ratio of 1:3.48 were obtained in pre-emergence application of oxadiargyl @ 75 g ha⁻¹ + hand weeding at 45 DAS followed by pre-emergence application of pendimethalin @ 1 kg ha⁻¹ + hand weeding at 45 DAS over rest of the treatments (Table 3). Thus it can be concluded that pre-emergence application of oxadiargyl @ 75 g

ha⁻¹ + hand weeding at 45 DAS is safe and economical to control weeds effectively and obtain highest benefit : cost ratio in cumin.

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Table 3. Economics of various weed management practices in cumin (pooled data of 2 years)

Treatment	Seed yield (q ha ⁻¹)	Gross returns (Rs. ha ⁻¹)	Cost of cultivation (Rs. ha ⁻¹)	Net returns (Rs. ha ⁻¹)	Cost : Benefit ratio
Weed check (control)	1.33	14630	15775	-1145	0.92
Hand weeding (45 DAS)	2.09	22990	17775	5215	1.29
Pendimethalin (1 kg ha ⁻¹ PE)	5.00	55000	18187	36813	3.02
Oxadiargyl (75 g ha ⁻¹ PE)	5.25	57750	16645	41105	3.46
Fluchloralin (1 kg ha ⁻¹ PE)	4.00	44000	17166	26834	2.56
Pendimethalin (1 kg ha ⁻¹ PE) + Hand weeding (45 DAS)	5.79	63690	20186	43503	3.15
Oxadiargyl (75 g ha ⁻¹ PE) + Hand weeding (45 DAS)	5.91	65010	18645	46365	3.48
Fluchloralin (1 kg ha ⁻¹ PE) + Hand weeding (45 DAS)	4.73	52030	19166	32864	2.71
Weed free	6.03	66330	23774	42555	2.78
SEM±	0.01	--	--	--	--
CD (P = 0.05)	0.02	--	--	--	--

PE=Pre-emergence; DAS=Days after sowing; Cost of: Seed Rs. 11,000 q⁻¹; Labour Rs. 114 day⁻¹