

## Integrated Weed Management in Cabbage (*Brassica oleracea* var. *capitata* L.)

T. R. Nandal, Narinder Kumar Dhiman and Rajender Sharma  
CSK HPKV Hill Agricultural Research & Extension Centre  
Dhaulakuan, Sirmour-173 001 (H. P.), India

### ABSTRACT

The major weeds were *Coronopus didymus* (41%), *Poa annua* (21.8%), *Cyperus rotundus* (11.2%), *Medicago denticulata* (4.7%) and *Ageratum conyzoides* (4.6%). Oxadiazon at 1.0 kg ha<sup>-1</sup> and oxadiazon at 0.75+pendimethalin 0.75 kg ha<sup>-1</sup> were found to be the most effective in terms of weed control and yield.

### INTRODUCTION

Cabbage is one of the most important cole crops grown commercially in almost all parts of India and covers about 4% of the total area under vegetable cultivation. The heavy manurial and frequent irrigation requirements of this widely spaced crop create conducive conditions for germination and growth of weeds, which reduce cabbage yield by 45-80% (Chadha and Fornasier, 2001). Hand weeding, no doubt, is an effective method of weed control but is laborious, time consuming, tedious, cost intensive and uneconomical under many situations. Herbicides have been very promising in controlling the weeds. No single herbicide is effective in controlling the wide range of weed flora and even continuous use of same herbicide may create resistance in weeds. Therefore, the present experiment was conducted to find out the efficacy of different herbicides and their combinations.

### MATERIALS AND METHODS

The experiment was conducted at the Research Farm of Hill Agricultural Research & Extension Centre, Dhaulakuan during rabi 2002 and 2003. The soil of the experimental field was sandy loam with pH 5.6. The experiment was laid out in randomized block design with three replications having a plot size of 3.0 x 2.7 m with the cabbage var. Golden Acre. Alachlor, pendimethalin and oxadiazon were

applied alone at two doses and the lower doses were supplemented with one manual weeding (HW) at 40 days after transplanting. Lower doses of herbicides were also mixed with each other and compared with farmers' practice (2 HW at 30 and 60 DAT), weed-free and weedy check (Table 1). The transplanting was done on October 31 and 29 during first and second year, respectively, at a spacing of 60 x 45 cm. All the herbicides were applied 24 h before transplanting.

### RESULTS AND DISCUSSION

#### Effect on Weeds

The prominent weed species present in the field were *C. didymus* (41%), *P. annua* (21.8%), *C. rotundus* (11.2%), *M. denticulata* (4.7%) and *A. conyzoides* (4.6%). Minimum intensity of *C. didymus* at 30 DAT was recorded due to alachlor at 1.5 kg ha<sup>-1</sup>, which was closely followed by alachlor at 1.0+oxadiazon at 0.75 kg ha<sup>-1</sup> and oxadiazon at 0.75+pendimethalin at 0.75 kg ha<sup>-1</sup> and differed significantly from rest of the treatments. Oxadiazon at 1.0 kg ha<sup>-1</sup> reduced the intensity of *P. annua*, *C. rotundus*, *M. denticulata* and *A. conyzoides* significantly compared to all other herbicidal treatments 30 DAT (Table 1). Contrary to this, at 60 DAT, oxadiazon at 0.75 kg ha<sup>-1</sup> followed by hand weeding at 40 DAT reduced the intensity of *C. didymus* and *P. annua* significantly; alachlor at 1.0 kg ha<sup>-1</sup> followed by hand weeding at 40 DAT that

Table 1. Weed density at different stages of crop growth (Data pooled over two seasons)

Treatment	Dose (kg ha <sup>-1</sup> )	Weed intensity m <sup>-2</sup>												Total weeds (No. m <sup>-2</sup> )					
		C. <i>didymus</i>			P. <i>annua</i>			C. <i>rotundus</i>			M. <i>denticulata</i>			A. <i>conyzoides</i>			30	60	DAT
		DAT	30	60	DAT	30	60	DAT	30	60	DAT	30	60	DAT	DAT	DAT			
Alachlor	1.00	11.80 (139)	13.68 (187)	8.92 (80)	7.42 (56)	6.42 (51)	8.71 (85)	4.14 (19)	5.91 (37)	4.39 (19)	4.93 (24)	20.60 (424)	23.84 (568)						
Alachlor	1.50	9.43 (88)	10.86 (117)	8.16 (67)	6.66 (45)	5.72 (40)	7.49 (67)	2.56 (8)	4.14 (19)	3.60 (13)	4.39 (19)	17.59 (309)	20.61 (424)						
Alachlor fb HW	1.00	11.67 (136)	10.49 (109)	6.72 (45)	7.15 (53)	7.25 (59)	5.21 (32)	4.93 (24)	3.35 (13)	4.12 (16)	3.60 (13)	20.74 (429)	17.54 (307)						
Oxadiazon	0.75	13.23 (181)	15.53 (245)	7.83 (61)	6.10 (37)	6.96 (69)	8.79 (91)	2.56 (8)	3.87 (16)	5.41 (39)	5.89 (35)	20.95 (445)	24.38 (597)						
Oxadiazon	1.00	10.32 (107)	11.08 (123)	5.79 (35)	4.12 (16)	5.21 (32)	6.51 (45)	1.52 (3)	2.56 (8)	4.66 (21)	5.14 (27)	16.36 (261)	18.40 (339)						
Oxadiazon fb HW	0.75	13.94 (197)	9.52 (91)	5.62 (32)	6.60 (43)	7.61 (69)	5.63 (43)	2.83 (11)	1.00 (0)	4.93 (24)	3.00 (8)	21.35 (459)	15.58 (243)						
Pendimethalin	0.75	13.51 (184)	15.03 (227)	7.99 (67)	6.97 (53)	5.72 (40)	7.92 (67)	4.41 (21)	5.00 (29)	5.68 (32)	6.10 (37)	21.54 (464)	24.05 (579)						
Pendimethalin	1.00	10.32 (107)	11.55 (133)	7.64 (61)	6.66 (45)	4.83 (27)	6.63 (45)	2.56 (8)	3.35 (13)	3.87 (16)	4.41 (21)	17.13 (299)	19.44 (379)						
Pendimethalin fb HW	0.75	13.11 (176)	10.36 (107)	5.91 (37)	6.93 (51)	5.72 (40)	5.21 (32)	4.35 (21)	4.39 (19)	5.10 (29)	3.79 (13)	20.80 (435)	16.75 (280)						
Alachlor+Oxadiazon	1.00+	9.83 (96)	10.74 (115)	6.94 (53)	6.63 (43)	6.46 (53)	7.88 (72)	2.56 (8)	3.08 (11)	3.62 (16)	4.14 (19)	17.05 (293)	19.19 (268)						
Oxadiazon+Pendimethalin	0.75+	9.98 (99)	10.32 (107)	6.40 (48)	6.40 (48)	5.57 (37)	7.10 (53)	2.04 (5)	3.08 (11)	4.14 (19)	4.41 (21)	17.05 (291)	18.75 (352)						
Pendimethalin+Alachlor	0.75+	11.65 (136)	12.65 (160)	7.11 (56)	6.63 (43)	6.29 (48)	7.63 (67)	2.83 (11)	3.89 (19)	4.58 (27)	5.16 (29)	19.61 (384)	21.55 (464)						
HW at 30 & 60 DAT	-	20.47 (421)	11.22 (333)	7.14 (51)	13.08 (171)	8.61 (85)	4.69 (29)	5.68 (32)	3.65 (13)	6.78 (48)	2.56 (8)	30.82 (952)	18.13 (328)						
Weed-free	-	1.00 (0)	1.00 (0)	1.00 (0)	1.00 (0)	1.00 (0)	1.00 (0)	1.00 (0)	1.00 (0)	1.00 (0)	1.00 (0)	1.00 (0)	1.00 (0)						
Weedy check	-	21.11 (448)	23.62 (560)	17.04 (293)	13.18 (173)	8.94 (93)	11.22 (141)	6.34 (40)	7.60 (58)	6.75 (48)	7.74 (61)	31.50 (995)	36.47 (1335)						
LSD (P=0.05)		0.84	0.84	1.00	0.97	1.47	1.03	1.67	1.54	1.62	1.50	0.82	0.75						

Transformation= $\sqrt{(n+1)}$ .

Table 2. Effect of treatments on weed dry weight, crop and net returns (Data pooled over two seasons)

Treatment	Dose (kg ha <sup>-1</sup> )	Weed dry weight m <sup>-2</sup>		No. of heads ha <sup>-1</sup>	Head weight plant <sup>-1</sup> (g)	Total yield (t ha <sup>-1</sup> )	Net return (Rs. ha <sup>-1</sup> )
		30 DAT	60 DAT				
Alachlor	1.00	12.11 (146)	15.95 (254)	28000	433	12.20	7272
Alachlor	1.50	8.80 (77)	12.18 (148)	30000	535	15.45	16880
Alachlor fb HW	1.00	12.09 (145)	11.36 (128)	25000	521	14.97	13972
Oxadiazon	0.75	11.51 (134)	15.53 (242)	31000	455	14.24	12610
Oxadiazon	1.00	8.07 (64)	10.7 (115)	33000	632	19.07	26517
Oxadiazon fb HW	0.75	11.75 (138)	9.82 (94)	32000	543	17.78	21352
Pendimethalin	0.75	12.21 (148)	15.59 (243)	30000	458	13.39	10615
Pendimethalin	1.00	8.59 (73)	11.53 (133)	31000	505	15.41	16257
Pendimethalin fb HW	0.75	11.61 (135)	10.62 (112)	31000	499	15.25	14333
Alachlor+Oxadiazon	1.00+0.75	8.29 (68)	10.83 (117)	31000	458	14.75	13365
Oxadiazon+	0.75+0.75	8.08 (64)	10.48 (109)	32000	615	18.68	24701
Pendimethalin							
Pendimethalin+	0.75 +1.00	9.50 (89)	12.41 (153)	32000	520	13.68	10710
Alachlor							
HW at 30 & 60 DAT	-	18.19 (331)	11.20 (128)	33000	596	17.62	21126
Weed-free	-	1.0 (0)	1.0 (0)	35000	649	22.24	23714
Weedy	-	18.61 (347)	23.08 (534)	22000	310	5.96	-10091
LSD (P=0.05)	-	0.42	0.46	2383	7	1.05	

Transformation= $\sqrt{(n+1)}$ .

of *C. rotundus*, while *M. denticulata* and *A. conyzoides* were controlled effectively by oxadiazon at 1.0 kg ha<sup>-1</sup> followed by hand weeding at 40 DAT.

Weed intensity in the weedy check was significantly higher than in all other treatments. Among the herbicidal treatments, oxadiazon at 1.0 kg ha<sup>-1</sup> recorded the lowest weed intensity closely followed by oxadiazon at 0.75+pendimethalin at 0.75 kg ha<sup>-1</sup>. This can be attributed to the fact that oxadiazon at 1.0 kg ha<sup>-1</sup> had persistency over longer period of time. The minimum dry weight of weeds was also recorded in oxadiazon at 1.0 kg ha<sup>-1</sup> followed by oxadiazon at 0.75+pendimethalin at 0.75 kg ha<sup>-1</sup>, whereas the maximum was observed in the weedy check (Table 2). The lower weed intensity resulted in low fresh weight and ultimately in lower dry weight. These results are in consonance with the findings of the earlier workers (Noonia *et al.*, 1992). Oxadiazon at 1.0 kg ha<sup>-1</sup> followed by oxadiazon at 0.75+pendimethalin at 0.75 kg ha<sup>-1</sup> recorded the highest weed control

efficiency among the herbicidal treatments.

### Effect on Crop

Though number of heads, head weight and total yield were recorded maximum under weed-free treatment, however, amongst the set of herbicidal treatments, the maximum yield was recorded with oxadiazon at 1.0 kg ha<sup>-1</sup> followed by oxadiazon at 0.75+pendimethalin at 0.75 kg ha<sup>-1</sup> (Table 2). Further oxadiazon at 0.75 kg ha<sup>-1</sup> gave total yield at par with manual weeding at 30 and 60 DAT. The increase in yield over the weedy check was 219% when oxadiazon at 1.0 kg ha<sup>-1</sup> was applied. These results are in consonance with the findings of earlier workers (Scott *et al.*, 1968).

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