EFFECT OF SOME WEED CONTROL TREATMENTS ON GROWTH, PRODUCTIVITY AND QUALITY OF CABBAGE (*BRASSICA OLERACEA* VAR *CAPITATA*)

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Abstract

The present study was carried out in the experimental farm, Sakha Agricultureal Research Station, Kafer El-sheikh governorate during 2003/04 and 2004/05 winter seasons, to investigate the effect of some weed control treatments on growth, productivity and quality of cabbage (*Brassica oleracea* var *capitata*). Each experiment included nine treatments i.e butralin, pendimethalin, oxyfluorfen, metribuzin + fluazifop-p-butyl, metosulam + fluazifop-p-butyl, oxadiargyl 120, oxadiargyl 200, hand hoeing twice and weedy check.

The obtained results indicated that all weed control treatments exerted significant efficacy in controlling annual weeds present in both seasons. The superior treatments were oxyfluorfen, metribuzin + fluazifop-p-butyl, hand hoeing twice and oxadiargyl on controlling Amaranthus cruentus, Malva parviflora, Corchorus olitorius and Portulaca oleracea as annual broad leaf weeds, and metribuzin + fluazifop-p-butyl, metosulam +fluazifop-p-butyl, oxadiargyl 200 and hand hoeing twice on controlling Dinebra retroflexa as annual grassy weed. The results were reflected yield increases and its components. The best treatments on increasing the number and weight of edible leaves were metribuzin + fluazifop-p-butyl and hand hoeing twice, the highest head quality was obtained by oxadiargyl 200 and pendimethalin, while the highest head characteristics and plant yield (ton/fed) was observed in the hand hoeing twice and pendimethalin treatments. In addition, the highest net return was obtained by pendimethalin, hand hoeing twice and oxyfluorfen. Thus, these herbicidal treatments can replace hand hoeing for controlling annual weeds in cabbage crop.

INTRODUCTION

Most of the vegetables crops are considered to be extremely poor competitor against weeds under field condition. Dixit *et al.* (2005) and Sonnenberg and Silva (2005) cited that plants of plots weeded once (one month after transplanting) and twice (one and 2 months after transplanting) were significantly earlier than those weeded only once (2 months after transplanting) or not weeded. Ibrahim *et al.* (1989) reported that cabbage yield reduction in unweeded check compared with hand hoeing at four times was estimated by 59.7 and 65.8% in both seasons, respectively. Smart

et al. (2001) reported that cabbage has few selective post-emergence herbicides registered sulfentrazone ,however, at 46 and 93 g a.i. ha^{-1}, effectively controlled weeds and had no adverse effect on cabbage size or quality. Arora and Gopal (2004) and Dixit *et al.* (2005) indicated that the herbicide pendimethalin at 0.50 kg a. i./ha was highly effective for weed control in cabbage and with one manual weeding/ hoeing recorded the highest head weight of 30.18 t/ha and gave the highest benefit /cost ratio (2.24 LE). Semidey *et al.*(1999), Bracy and Parish (2003) and Dillard *et al.* (2004) stated that the oxyfluorfen at 0.16 kg a.i./ha, pendimethalin at 0.75 kg a.i./ $ha^{-1}$and metribuzin at 0.70 kg a.i./ha significantly reduced the population and dry weight accumulation of weeds at 45 days after cabbage transplanting and increased the cabbage yield above that of the untreated control. Dhiman *et al.*(2005) found that pendimethalin at 1.0 kg ha^{-1} resulted in the highest number of total heads per plot (26.67), marketable heads per plot (18.83), average head weight (0.632 kg), marketable yield (141.97 q/ ha^{-1}) and thus, the maximum returns (Rs.26 517)/ ha^{-1}. Tariq *et al.* (2003) reported that the formation of cabbage heads in weedy control was significantly lower compared to the weed free treatment. Oxadiazon alone at 0.8 L/ha was significantly higher fresh weed biomass (4.01 kg/plot) compared to oxadiazon with one or two hoeings and weed free (three hoeings). Qasem and Hill (2003 a and b) cited that weed /crop competition in cabbage resulted shoot dry weight compared to the control (no competition). However, cabbage plants showed higher competition index and relative competitive ability index. Caruso *et al.* (2000) found that the highest yield (62 t/ha^{-1}) was obtained by herbicide treatment and with an increase of 27.3% compared to the control. Crop biomass and leaf area index attained the highest values at harvest (662 g m^{-2} and 3.9 m^2, respectively). As there is no local official recommendation for weed management by herbicides until the recent years, the present work was designed to find out suitable herbicides and their mixtures for weed control in cabbage crop.

MATERIALS AND METHODS

The present study was conducted in carried out in the experimental farm, Sakha Agricultural Research Station, ARC, Kafer El- sheikh Governorate during 2003/04 and 2004/05 winter seasons. The aim of this study is to evaluate the effect of some soil and folige herbicides and their mixtures on controlling weeds and on cabbage (Brassica oleracea var capitata)productivity.The cabbage cultivar Bron zwik was used. **The experiment carried out in both seasons included the following nine treatments**

1. Butralin 960 g a. i./fed. as pre- transplanting.

2. Pendimethalin 1000 g a. i. /fed. as pre- transplanting.
3. Oxyfluorfen 180 g a. i. /fed. . as pre- transplanting.
4. Metribuzin 49 g a. i. /fed. as pre- transplanting + fluazifop-p-butyl 62.5 g a. i. /fed. post- transplanting after 30 days from transplanting.
5. Metosulam 3 g a.i./fed as pre- transplanting + fluazifop-p-butyl 62.5 g a. i. /fed. post- transplanting after 30 days from transplanting
6. Oxadiargyl 120 g a i. /fed. as pre- transplanting.
7. Oxadiargyl 200 g a. i./fed. as pre- transplanting.
8. Hand hoeing twice at 30 and 45 days from transplanting.
9- Weedy check.

Table a. Common, trade and chemical names of the used herbicides.

Common name	Trade name	Chemical name
Butralin	Amex 48 %EC	4-(1,1-dimethylethyl)-*N*-(1-methylpropyl)-2,6-dinitrobenzenamine
Pendimethalin	Stomp 50 %EC	*N*-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine
Oxyfluorfen	Goal 24 %EC	2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene
Metribuzin	Sencor 70 %WP	4-amino-6-(1,1-dimethylethyl)-3-(methylthio)-1,2,4-triazin-5(4*H*)-one
Metosulam	Sinal 10% SC	*N*-(2,6-dichloro-3-methylphenyl)-5,7- dimethoxy[1,2,4] triazolo[1,5-*a*]pyrimidine-2-sulfonamide
Oxadiargyl	Topostar 80% WP	3-[2,4-dichloro-5-(2-propynyloxy)phenyl]-5-(1,1-dimethylethyl)-1,3,4-oxadiazol-2(3*H*)-one
Fluazifop-P-butyl	Fusilade Super 12.5 %EC	butyl (*R*)-2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoate

In both seasons, calcium super phosphate (15.5% P_2O_5) at a rate of 100 kg/fed. was added before planting and ammonium nitrate (33.5% N) at the rate of 50 kg N add in two portions (25 +25 kg N) before the 1st and 2nd irrigation. All herbicidal treatments were sprayed with knapsack sprayer CP3 with 200 - liter water/ fed. , the rest of the agriculture practices i e. irrigation, pests and diseases control were managed in accordance to the local recommendations.

The treatments were arranged in a Complete Randomized Block Design with 4 replicates. The plot area was 21 m^2 which contained five rows, each with 6m length and 0.7 m width. The cabbage cultivar, Bron zwik seeds ware sown on 1st September

in the two seasons, and after 45 days, the seedlings were transplanted in the field. Cabbage was sown on one side of the row. The mature cabbages were harvest at three days intervals from 21st January to 22nd February i.e. eleven batches from each plots. The following data were recorded:

A-Weed survey

1- Fresh weight of weeds (g/m2)

Weeds were hand pulled at random from one square meter of each plot after 45 days from transplanting, then identified into species and their fresh weight (g/m^2) were estimated. These weeds were classified into three categories : annual broad leaf, annual grassy and total weeds.

2-Susceptibility

the susceptibility was measured by estimating the reduction percentage of the fresh weight of each species compared to the unweeded check according to Frans and Talbert (1977) as follows:

a- Susceptible (S) = >90%. b- Moderately susceptible (MS) = >80-90%.

c- Moderately tolerant (MT) = > 60-79%. d- Tolerant (T) = < 60%.

B. On cabbage yield and its components

Five plants were selected randomly from each plot at harvesting time to determine the following data

1-Vegetative growth

a. Number of inedible and edible leaves.

b. Averge fresh weight of inedible and edible leaves.

Plant leaf area was calculatedaccording to the method described by Koller (1972).

Using following growth

$$\text{c- Leaf area / plant (m2)} = \frac{\text{- Fresh weight of inedible and edible leaves}}{\text{Fresh weight of the 20 disks}} \times \text{No. of disks x disk area}$$

2 - Head quality

a. GROSS HEAD WEIGHT (KG.)

b. PERIMETER OF NET EDIBLE HEAD(CM)

c. DIAMETER OF NET EDIBLE HEAD (CM)

$$\text{d- Head compression:} = \frac{\text{Head wt.}}{\text{Head diameter}} \times 100$$

e- Stem length (cm)

f- Dry weight of leaves /plant (g)

3- Heads yield

The fresh weight of the whole head (outer, inner leaves and the stem) were estimated and expressed as ton/fed from all plants of each plot (the total of eleven batches).

4- Economic Evaluation

Net return was calculated by expressing the cost and yield of the unit area in monetary. The retail price used in computing cash returns was 150 Egyptian Pounds for cabbage /ton for both seasons. The costs were negated from the overall cash returns as the resulted cash was considered to be the net return.

5- Statistical analysis

All data were subjected to the proper statistical analysis as described by Snedecor and Cochran (1980) and the least significant differences LSD at 5 % level of significancy were calculated.

RESULTS AND DISCUSSION

1- Weed species sensitivity to herbicidal treatments

Results in Table (1) indicated that *Amaranthus cruentus, Malva parviflora, Corchorus olitorius* and *Portulaca oleracea* as annual broad leaf weeds were moderately by susceptible (80 to 82 controlling %) to metosulam + fluazifop-p-butyl , oxadiargyl 200g, oxyfluorfen, metribuzin + fluazifop-p-butyl, pendimethalin and butralin. However, these weeds were moderately tolerant to oxadiargyl 120 g a. i./fed (48 -73 controlling %) in the first season.

Similar results were observed in the second season with some differences. *Amaranthus cruentus, Malva parviflora, Corchorus olitorius* and *Portulaca oleracea* were moderately by susceptible (80 to 88 percentage %) to metribuzin + fluazifop-p-butyl, oxyfluorfen, oxadiargyl 200g, oxyfluorfen , pendimethalin, butralin and metosulam + fluazifop-p-butyl. meanwhile, *Portulaca oleracea* was more tolerant to butralin and pendimethalin which gave (78 -79 controlling %). Again, *Portulaca oleracea* were tolerant and /or moderately tolerant to oxadiargyl 120 g (71 -79 controlling %). As for the *Dinebra retroflexa* (the only grassy weed present) it was affected in a similar way in both seasons. It was moderately by tolerant (67 -79 controlling %) to butralin, pendimethalin, oxyfluorfen, oxadiargyl 120 and metribuzen +fluazifop –p- butyl and moderately susceptible (80- 83 controlling %) to metosulam + fluazifop –p- butyl and oxadiargyl 200g.

Table 1. The susceptibility of annual weed species to the weed control treatments in 2003/04 and 2004/05 seasons

Weed control treatments (rate g a.i./fed)	Annual broad leaf weeds Seasons 2003/04				Annual gassy weeds
	Amaranthes cruentus	*Malva parviflora*	*Corchorus olitorius*	*Portulaca Oleracea*	*Dinebra retroflexa*
Butralin 960	80 MS	82 MS	80 MS	80 MS	77 MT
Pendimethalin 1000	80 MS	80 MS	81 MS	81 MS	79 MT
Oxyfluorfen 180	82 MS	80 MS	81 MS	84 MS	79MT
Metribuzin+fluazifop-p-butyl (70+ 62.5)	80 MS	82 Ms	81 MS	82 MS	85 MS
Metosulam+fluazifop-p-butyl (3+ 62.5)	81 MS	82 MS	92 S	80 MS	83 MS
Oxadiargyl 120 /fed	61 MT	73 MT	48 T	70 MT	69 MT
Oxadiargyl 200 /fed	82 MS	81 MS	80 MS	82 MS	80 MS
	Seasons 2004/05				
Butralin 960	86 MS	83 MS	80 MS	79 MT	78 MT
Pendimethalin 1000	87 MS	82 MS	82 MS	78 T	79 MT
Oxyfluorfen 180	88 MS	85 MS	82 MS	81 MS	78 MT
Metribuzin+fluazifop-p-butyl (70+ 62.5)	88 MS	85 MS	82 MS	80 MS	84 MS
Metosulam+fluazifop-p-butyl (3+ 62.5)	85 MS	82 MS	80 MS	79 MT	82 MS
Oxadiargyl 120	79 MT	77 MT	71 MT	74 T	67 MT
Oxadiargyl 200	88 MS	81 MS	80 MS	80 MS	81 MS

S = >90 MS = >80-89 MT = 60-79 T= <60

2- Effect of weed control on weeds

Data in Table 2. showed that the infestation rate of *Dinebra retroflexa* was 202 and 197 fresh weight g/ m ^{2}as an annual grassy weed in the two seasons ,respectively, *Portulaca oleracea* was 474 and 536 fresh weight g/ m^2, *Amaranthes cruentus* was 180 and 294 fresh weight g/ m^2, *Malva parviflora* was 121 and 189 fresh weight g/ m^2 and *Corchorus olitorius* was 22 and 67 fresh weight g/ m^2 as annual broadleaf weeds (total of 998 and 1282 fresh weight g/ m^2) in the two seasons respectively.

Results in Table (2) indicated that a ll single and herbicides mixtures of beside hand hoeing were significantly, effective on controlling the studies weed species. The efficacy of controlling annual weeds was increased by using the herbicides mixtures in the two seasons.

Similar results were obtained by Semidy *et al* .(1999) , Dillard *et al.* (2004) and Sonnenberg and Silva (2005) , thus they reported that oxyfluorfen at 0.16 kg a.i./ha, pendimethalin at 0.75 kg a.i./ha and metribuzin at 0.70 kg a.i./ha significantly reduced the weed population.

The efficiency weed control treatments on *Dinebra retroflexa*, can be arranged in descending order as follows metribuzin/ fluazifop-p-butyl, metosulam /fluazifop-p-butyl, oxadiargyl, hand hoeing, pendimethalin, oxyfluorfen, butralin and oxadiargyl 120 (84, 83, 80, 80,79, 78, 76 and 68 %), and (84, 82, 81, 80, 79, 78, 77 and 67 %) in the first and second seasons respectively. It was also noticed that all weed control treatments gave approximately equal efficacy in reducing the fresh weight of broadleaf weed species in the two seasons (80 and 82 control %) respectively.

Table 2. Effect of weed control treatments on reducing the fresh weight (g/m^2) of annual weed species in 2003/04 and 2004/05 seasons

Weed control treatments (rate g a.i./fed)	Fresh weight of annual weeds (g/m^2) Season 2003/04						
	Amaranthes cruentus	*Malva parviflora*	*Corchorus olitorius*	*Portulaca oleracea*	Total br.leaf	*Dinebra retroflexa*	Total annuals
Butralin 960	36.4	22.3	4.2	93.4	156.3	47.7	204.0
Pendimethalin 1000	36.1	24.2	4.3	89.3	153.9	42.4	196.3
Oxyfluorfen 180	33.2	24.3	4.4	78.6	140.5	43.5	184.0
Metribuzin+fluazifop-p-butyl (70+ 62.5)	33.3	22.4	4.3	86.3	146.3	31.4	177.7
Metosulam+fluazifop-p-butyl (3+ 62.5)	34.5	22.3	4.4	94.4	155.6	34.3	189.9
Oxadiargyl 120	70.8	32.7	11.9	143.7	259.1	63.6	322.7
Oxadiargyl 200	33.3	23.4	4.5	86.3	147.5	40.3	187.8
Hand hoeing twice	36.5	22.4	4.6	83.4	146.9	40.4	187.3
Weedy check	180.4	120.6	21.7	473.6	796.3	201.5	997.8
LSD : at 5% level	25.64	10.80	3.1	34.3	46.6	20.8	56.64
	Season 2004/05						
Butralin 960	41.4	32.5	13.5	113.3	200.7	44.7	245.4
Pendimethalin 1000	37.2	33.4	12.5	120.5	203.6	41.6	245.2
Oxyfluorfen 180	34.3	29.2	12.4	102.6	178.5	43.4	221.9
Metribuzin+fluazifop-p-butyl (70+ 62.5)	34.4	29.2	12.5	108.4	184.5	31.7	216.2
Metosulam+fluazifop-p-butyl (3+ 62.5)	43.3	34.5	13.3	113.2	204.4	35.4	239.8
Oxadiargyl 120	61.4	44.6	19.5	141.3	266.8	65.6	332.4
Oxadiargyl 200	36.3	35.4	13.1	105.4	190.2	37.4	227.6
Hand hoeing twice	36.2	32.4	13.5	108.4	190.5	38.5	229.0
Weedy check	294.4	188.5	66.5	535.6	1085.0	196.7	1281.7
LSD : at 5% level	8.07	7.81	6.2	25.9	29.3	6.5	30.13

3- Effect of weed control treatments on cabbage

1-Vegetative growth

Data in Tasble (3) showed that the number of both inedible and edible leaves were not affected significantly with all weed control treatments used compared to weedy check. On the contrary, the weight of both inedible and edible were affected significantly by most weed control treatments. The previous results hold fairly true in both seasons.

In both seasons, it was hand hoeing twice was the only treatment which decreased the inedible leaves compared to weedy check but with no significant difference. Meanwhile, the increase in the fresh weight of edible leaves was (33.3, 20.5, 18.7, 18.4 ,11.4,10.1 and 7.0%) for metosulam /fluazifop-p-butyl, oxyfluorfen ,oxadiargyl 120 g ,metribuzin/ fluazifop-p-butyl, pendimethalin, oxadiargyl and butralin respectively. In the second season, the significant increase values for fresh weight of edible leaves was (36.6, 32.6, 31.9, 30.3, 29.2, 19.3, 13.2, and 1.1 %) for metosulam /fluazifop-p-butyl, hand hoeing, metosulam /fluazifop-p-butyl, oxadiargyl 120 g, oxadiargyl 200 g, oxyfluorfen, pendimethalin and butralin respectively.

Table 3. Effect of weed control treatments on vegetative growth of cabbage during 2003/04 and 2004/05 seasons

Seasons	2003/04					2004/05				
Weed control treatments (rate g a.i./fed)	Inedible leaves		Edible leaves		Leaf area index	Inedible leaves		Edible leaves		Leaf area index
	No.	Wt.	No.	No.		No.	Wt.	No.	Wt.	
Butralin 960	8	1413	43	1667	5.11	8	1225	41	1550	5.1
Pendimethalin 1000	11	1367	44	1750	7.29	10	900	46	1767	7.2
Oxyfluorfen 180	11	1350	45	1950	5.76	9	875	47	1900	5.7
Metribuzin+fluazifop-butyl (70+ 62.5)	10	983	49	1900	5.67	10	650	48	2250	5.4
Metosulam+fluazifop-butyl (3+ 62.5)	9	1000	44	2325	5.81	8	733	43	2417	6.2
Oxadiargyl 120	11	1100	55	1907	5.37	9	750	50	2200	5.5
Oxadiargyl 200	12	1333	51	1725	5.90	10	1183	50	2167	6.1
Hand hoeing twice	10	733	50	2050	6.76	10	567	49	2275	7.1
Weedy check	10	767	49	1550	5.21	9	617	49	1533	5.1
LSD : at 5% level	N.S	240.79	10.3	389.4	0.4	N.S	294.65	12.91	422.62	0.5

Regarding leaf area index , the results were similar in both seasons. In first season, pendimethalin, hand hoeing twice, oxadiargyl 120, metosulam +fluazifop-p-butyl and oxyfluorfen increased the leaf area index by 2.1, 1.6, 0.7, 0.6 and 0.6 m^2 over weedy check (5.21) , meanwhile butralin, ,oxadiargyl 120 treatments did not affect this character , significantly.

In second season, pendimethalin, hand hoeing twice, oxadiargyl 120, metosulam/ fluazifop-p-butyl and oxyfluorfen increased the leaf area index by 2.1 ,2.0,1.0,1.1 and 0.6m^2 over weedy check (5.1) , meanwhile butralin, metribuzin/ fluazifop-p-butyl and oxadiargyl 120 treatments did not affect this character, significantly.

2 - Head quality

It is clear from Table (4) that all herbicidal treatments beside hand hoeing increased significantly the gross head weight of cabbage , perimeter and diameter of the head / plant in both seasons. In the first season , hand hoeing , pendimethalin, oxyfluorfen, ,metribuzin+ fluazifop-p-butyl, oxadiargyl 200 g, metosulam +fluazifop-p-butyl , butralin and oxadiargyl 120 g increased significantly the fresh weight of the gross head by (2.1, 2.1, 1.4, 1.4, 1.2, 1.1 and 1.1 kg) over the weedy check respectively.

Table 4. Effect of weed control treatments on the head quality of cabbage plant during 2003/04 and 2004/05 seasons

Weed control treatments (rate g a.i. /fed)	Head quality					
	Gross wt.(kg)	Perimeter (cm)	Diameter (cm)	Gross wt.(kg)	Perimeter (cm)	Diameter (cm)
	2003/04 season			2004/05 season		
Butralin 960	4.1	92.3	21.3	3.2	95.3	22.3
Pendimethalin 1000	5.1	103.0	23.7	4.4	101.0	24.7
Oxyfluorfen 180	4.4	101.7	22.3	3.5	95.0	23.0
Metribuzin+fluazifop-p-butyl (70+ 62.5)	4.4	100.3	22.3	3.5	95.7	23.7
Metosulam+fluazifop-p-butyl (3+ 62.5)	4.1	99.3	21.2	4.2	95.7	21.7
Oxadiargyl 120	3.1	84.0	23.0	3.1	89.3	24.0
Oxadiargyl 200	4.2	100.3	24.7	4.0	98.7	25.3
Hand hoeing twice	5.1	88.0	24.3	4.2	92.0	25.0
Weedy check	3.0	86.7	19.7	3.2	93.7	22.3
LSD : at 5% level	0.97	11.25	1.62	0.76	8.25	2.78

Hand hoeing, pendimethalin, oxyfluorfen, ,metribuzin/ fluazifop-p-butyl, oxadiargyl and metosulam /fluazifop-p-butyl increased significantly by the perimeter of the head by (16.3, 15.0, 13.6, 13.6, and 12.6 cm) over the weedy check and oxadiargyl 200 g, hand hoeing, pendimethalin oxadiargyl 120 g , oxyfluorfen, and metribuzin/ fluazifop-p-butyl increased significantly by the diameter of the head by (5.0, 4.7, 4.0, 3.3, 2.7 and 1.7 cm) over the weedy check.

In the second season , pendimethalin, hand hoeing, metosulam +fluazifop-p-butyl , oxadiargyl 200 g, oxyfluorfen, and metribuzin+fluazifop-p-butyl increased significantly the fresh weight of the gross head by (1.2, 1.0, 1.0, 0.8, 0.3 and 0.3 kg) over the weedy check.

pendimethalin, oxadiargyl 200g , metribuzin+ fluazifop-p-butyl, metosulam +fluazifop-p-butyl butralin and oxyfluorfen increased significantly the perimeter of the head by (7.3, 5.0, 2.0, 2.0, 1.6 and 1.3 cm) over the weedy check and oxadiargyl 200 g, hand hoeing, pendimethalin oxadiargyl 120 g, and metosulam + fluazifop-p-butyl significant the diameter of the head by (3.0, 2.7, 2.4, 1.7 and 1.4 kg) over the weedy check.

Results presented in Table (5) demonstrat that butralin ,oxadiargyl 200g and pendimethalin treatments increased the stem length significantly by 5, 2 and 2 cm over weedy check (11.0 cm) in first season , meanwhile butralin, metosulam /fluazifop-p-butyl and oxadiargyl 200g increased this character significantly by 3.5 ,2.8 and 1.5 cm respectively over weedy check (11.5 cm) in second season, the rest weed control did not affect the stem length significantly in both seasons.

The increase in the dry weight of leaves/plant (g) due to weed control treatment gave the similar trend in both seasons. In first season, hand hoeing twice, metribuzin/ fluazifop-p-butyl oxyfluorfen and pendimethalin gave increasing values by 5.7, 3.5, 2.5 and 1.8 g/plant respectively over weedy check, meanwhile ,oxadiargyl 200g treatment did not affect this character significantly . In second season, hand hoeing twice, metribuzin /fluazifop-p-butyl and metosulam /fluazifop-p-butyl increased the dry weight of leaves/ plant (g) significantly by 6.9, 5.1 and 2.8 g /plant respectively over weedy check.

As for head compression the results obtained in both seasons were similar but with some differences. In thefirst season, pendimethalin, hand hoeing twice, metribuzin/ fluazifop-p-butyl , butralin and metosulam/ fluazifop-p-butyl increased the head compression ratio significantly by 0.07, 0.06, 0.05, 0.04 and 0.04% respectively, over weedy check. However, the increase in the head compression ratio, by the rest of the treatments was not significant. In the second season, pendimethalin, hand hoeing twice and metosulam/ fluazifop-p-butyl increased the head compression ratio

significantly by 0.04, 0.03, and 0.03% respectively over weedy check. The rest of the treatments also increased the head compression ratio but without significant differences. The present results confirm the findings of Dhiman *et al.* (2005) who reported that they found that pendimethalin treatment beside hand hoeing were increment to the vegetative growth and head quality compared with the control.

This results may be due to the efficacy in controlling weeds and hence avoiding cabbage weed competition.

Table 5. Head compression ratio, stem length cm and dry weight of leaves % as affected by weed control treatments during 2003/04and 2004/05 seasons.

Weed control treatments (rate g a.i. /fed)	2003/04 season			2004/05 season		
	Head. compression.	Stem. length (cm)	Leaves D.W. /plant (g)	Head. compression.	Stem. length (cm)	Leaves D.W. /plant (g)
Butralin 960	0.19	16.0	6.41	0.14	15.0	6.1
Pendimethalin 1000	0.22	13.0	6.91	0.18	11.0	7.0
Oxyfluorfen 180	0.18	11.5	7.59	0.15	10.7	7.3
Metribuzin+fluazifop-p-butyl (70+ 62.5)	0.20	11.8	8.56	0.15	12.3	10.1
Metosulam+fluazifop-p-butyl (3+ 62.5)	0.19	11.7	6.70	0.17	14.3	7.8
Oxadiargyl 120	0.14	11.0	7.97	0.13	12.0	9.4
Oxadiargyl 200	0.17	13.0	5.57	0.16	13.0	6.8
Hand hoeing twice (the price +labour)	0.21	10.9	10.80	0.17	10.7	11.9
Weedy check	0.15	11.0	5.11	0.14	11.5	5.0
LSD : at 5% level	0.04	1.25	0.65	0.03	1.56	0.3

3- Head yield t/feddan and its economic evaluation

Data presented in Table (6) for the total head yield (t/fed) show the same trend in both seasons. In the first season hand hoeing twice, pendimethalin, oxyfluorfen , metribuzin/ fluazifop-p-butyl, oxadiargyl 200 g, butralin and metosulam/ fluazifop-p-butyl increased the total yield significantly by 41, 40, 32, 31.5, 29, 26 and 26.5% respectively compared to weedy check. On the other hand, the increase percentage by oxadiargyl 120 treatment was little and not significant.

In the second season, pendimethalin, hand hoeing twice, butralin, metosulam/ fluazifop-p-buty oxadiargyl 200 g, oxyfluorfen , metribuzin/ fluazifop-p-butyl and oxadiargyl 120 increased the total yield significantly by 38, 36.4, 36.2, 34.4, 32.7, 23.1, 22.3 and 13.3 % respectively compared to weedy check.

Table 6. Cost of weed control treatments , total head yield t/fed. and net return of cabbage yield (L E/fed.) as affected by weed control treatments during 2003/04and 2004/05 seasons

Seasons	2003/04			2004/05		
Weed control treatments (rate g a. i. /fed)	Weed control cost (L.E /f.)	Head yield t/fed.	Net return (LE /fed)	Weed control cost (L.E /f.)	Head yield t/fed.	Net return (LE /fed)
Butralin 960	135	38.80	5685	145	40.08	4362
Pendimethalin 1000	175	48.30	7070	185	41.34	6016
Oxyfluorfen 180	125	41.95	6168	135	33.25	4853
Metribuzin+fluazifop-p-butyl (70+ 62.5)	100	41.65	6148	110	32.93	4830
Metosulam+fluazifop-p-butyl (3+ 62.5)	110	38.80	5710	120	39.90	5865
Oxadiargyl 120	80	29.70	4375	90	29.45	4327
Oxadiargyl 200	125	40.15	5898	135	38.00	5565
Hand hoeing twice(the price +labour)	280	48.45	6988	300	40.22	5733
Weedy check	0	28.50	4275	0	25.57	3836
LSD : at 5% level		2.27			1.77	

The labor costs was assumed as 15 L.E/person per day.

Economic Evaluation Data in Table indicated that the weed control treatments could be arranged in a descending order according to their effect on the net return of cabbage yield (L. E. /fed.) in the following order:- pendimethalin, hand hoeing twice, oxyfluorfen , metribuzin+ fluazifop-p-butyl, oxadiargyl 200g, metosulam/ fluazifop-p-butyl and butralin, in first season compared to weedy check. In the second seasons, pendimethalin, metosulam/ fluazifop-p-butyl, hand hoeing twice, oxadiargyl 200g, oxyfluorfen, metribuzin+ fluazifop-p-butyl and butralin, compared to weedy check. Thus the net return (L E/fed) in the case of pendimethalin was 7070 and 6016 in the two seasons respectively. The obtained results are in agreement with those reported by Semidey *et al* .(1999), Arora and Gopal (2004), Dillared *et al* . (2004) and Dixit *et al* . (2005) who report that the use of pendimethalin and hand hoeing gave the highest yield and net return , these results my be due to the effect of these treatments on increasing leaf area /plant , dry weight of leaves /plant (g) and gross head weight.

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تأثير بعض معاملات مكافحة الحشائش على جودة و انتاجية محصول الكرنب

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أجري هذا البحث في المزرعة البحثية محطة البحوث الزراعية سخا كفر الشيخ مركز البحوث الزراعية خلال موسمي٢٠٠٣/٢٠٠٤و٢٠٠٤/٢٠٠٥ وكان الهدف من البحث هو دراسة تأثير بعض مبيدات الحشائش على مكافحة الحشائش الحولية ونمو وأنتاجية وجودة محصول الكرنب. وكانت معاملات مكافحة الحشائش على النحو التالي:-

١- بوترالين بمعدل ٩٦٠ جم / ف بعد الزراعة وقبل الري .

٢- بندميثالين بمعدل ١٠٠٠جم / ف بعد الزراعة وقبل الري .

٣- أوكسى فلورفن بمعدل ١٨٠جم / ف بعد الزراعة وقبل الري.

٤- متربيوزين بمعدل ٧٠جم / ف بعد الزراعة وقبل الري + فلوزيفوب ب بيوتايل بمعدل ٦٢,٥جم / ف بعد شهر من الإنبات.

٥- ميتوسولام بمعدل ٣جم / ف بعد الزراعة وقبل الري+ فلوزيفوب ب بيوتايل بمعدل ٦٢,٥جم / ف بعد شهر من الإنبات.

٦- أوكسادرجل بمعدل ١٢٠جم / ف بعد الزراعة وقبل الري.

٧- أوكسادرجل بمعدل ٢٠٠جم / ف بعد الزراعة وقبل الري.

٨- عزيق مرتين . ٩- معاملة (المقارنة).

وكانت معاملات أوكسى فلورفن و متربيوزين بمعدل + فلوزيفوب ب بيوتايل و العزيق مرتين و أوكسادرجل٢٠٠ جرام أكثر فاعلية على الحشائش العريضة مثل عرف الديك والخبيزة والملوخية والرجلة ، و متربيوزين + فلوزيفوب ب بيوتايل و ميتوسولام + فلوزيفوب ب بيوتايل و أوكسادرجل ٢٠٠ جرام والعزيق مرتين أكثر فاعلية على الحشائش النجيلية مثل نجيل النمر.

كما أوضحت النتائج زيادة الحاصل و مكوناته فى كلا الموسمين، و كانت أفضل المعاملات لزيادة الأوراق الخارجية هى معاملتى متربيوزين + فلوزيفوب ب بيوتايل والعزيق مرتين، كما أظهرت النتائج أن أحسن جودة لصفات الرأس من معاملتى أوكسادرجل ٢٠٠ جرام و بندميثالين، كما زادت صفات الرأس و حاصل النبات طن / ف من معاملتى والعزيق مرتين و بندميثالين . بالأضافة للحصول على أعلى صافى ربح من معاملات بندميثالين والعزيق مرتين و أوكسى فلورفن.

من ذلك يمكن التوصية باستخدام مبيدات الحشائش مثل الأوكسى فلورفن، متربيوزين و أوكسادرجل مع بعض مبيدات الحشائش النجيلية مثل فلوزيفوب لتحل محل العزيق مرتين فى مكافحة الحشائش وزيادة إنتاجية حاصل الكرنب .