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Biological Response and Economic Feasibility of Weed Control Treatments on Weeds and Productivity of Cucumber (*Cucumis sativus* L.)

Ghalwash, A. M.[1] and A. S. El –Gendy[2]
[1]Weed Research Central Laboratory, Agric. Res. Center, Giza, Egypt
[2]Breeding vegetable department, Horticulture institute, Agric. Res. Center, Doki, Egypt

ABSTRACT

Two field experiments were carried out during the two summer seasons of 2012 and 2013 at the wire-house of Sakha Agricultural Research Station, Kafrelsheikh Governorate, Egypt, to study cucumber (*Cucumis sativus* L.) susceptibility to herbicides and its efficacy on annual weed control and cucumber productivity. Each experiment included ten weed control treatments which consists of six herbicides (four herbicides used alone as pre-emergence i. e. pendimethalin 500 g, butralin 480 g, oxyfluorfen 120 g and metribuzin 49 g a. i. /fed., followed by one hand hoeing at 30 days after sowing, while the two other herbicides i. e. fluazifop-p-butyl 62.5 g sethoxydim 62.5 g a .i./fed. were used as post-emergence application with metribuzin), moreover using both oxyfluorfen and metribuzin alone at the high rate (180 and 70 g, respectively), hand hoeing twice at 30 and 45 days after sowing and weedy chick. The studied treatments were arranged in a randomized complete block design with four replications. All weed control treatments increased significant efficiency in controlling annual weeds. Reduction in cucmber yield per feddan was 50.4 and 66.4 % due to weed competition which gave 8.64 and 7.14 tons of fresh weight of annual weeds /feddan in unweeded check during 2012 and 2013 seasons, respectively as compared to hand hoeing twice. The most effective treatment in controlling broad-leaved and total annual weeds in both seasons were hand hoeing twice treatment (93 and 94.3 %), oxyfluorfen alone at the rate of 180 g/ feddan. The high rates of 92,4 and 91.4 % and oxyfluorfen at the low rate of 120 g/fed plus hand hoeing once 89 and 87.1 % in 2012 and 2013 seasons, respectively as compared to weedy chick without significant differences between them. The best weed control treatments were metribuzin 49 g a. i./ fed followed by fluazifop-p-butyl 125 g a. i./ fed., hand hoeing (twice), metribuzin at the rate of 49g a. i. / fed and metribuzin at the rate of 49 g a. i./ fed. followed by hand hoeing time and they hand one susceptibility indices of gave 51.9, 50.40 and 48.84% in the first season, while metribuzin at the rate of 49 g a. i./ fed. followed by hand hoeing one, metribuzin at the rate of 49 g a. i./ fed. followed by sethoxydim 62.5 g a. i./ fed.and hand hoeing twice gave (71.86, 68.03 and 66.31 in the second season, respectively(Table 3). The above mentioned treatments increased yield of cucumber by 1.17, 1.14 and 1.10 ton/fed. in the first season and by 1.71, 1.62 and 1.58 ton/fed. in second season as compared to unweeded in the two seasons, Also metribuzin 49 g/fed. plus fluazifop-p-butyl 62.5 g/fed. and, oxyfluorfen 120 g/fed. followed by hand hoeing once gave 61.90 and 57.16 % in the second season, respectively(Table 5). It can recommend to integrate some herbicidal treatments with fluazifop or sethoxydim or hand hoeing to minimize weed competition and increase cucumber productivity.

INTRODUCTION

A good crop stand in which plants emerge and rapidly shade the ground is an often a good tool for reducing weed competition. The plant that emerges first and covers the ground most rapidly has the competitive advantage. Most vegetables as cucumber could not be grown economically without weed control because the rate of growth is so very slow in early growth stages and the crop is unable to compete effectively with weeds.

Good weed management practices and establishment of adequate plant populations all help reduce weed competition reducing. Thus, if weed control is not carried out on timely, weeds will emerge and compete with the crop in the first weeks, yield will be reduced or may be no production at all. Stilwell and Sweet (1974) found that weed free squash plots produced the highest yields. Bell *et al*. (1999) found that squash highest yield was obtained when 85-90% control of weeds.

Properly selected herbicides are effective tools for weed management in cucurbits such as cucumber. Cucurbits as a group have very limited tolerances to most herbicides. Most of the new tested (registered) herbicides for cucumber have a narrow range of tolerance. In abroad, Walters and Kindhart (2002) reviewed literatures allover the world about using herbicides in squash where few herbicides are available in this situation. There is a few studies about the use of herbicides either during stale seedbed preparation or after planting for weed control in squash, Lonsbary *et al.* (2003) Using herbicides at the proper rate and correct time is very necessary to avoid crop damage. During the last few years new chemical weed control treatments have been introduced to control annual weeds such as pendimethalin, fluazifop-P-butyl, sethoxydim and haloxyfop–ethoxy–ethyl in cucurbits. Adrian *et al*. (2006) cited that weed interference resulted in a reduction in cucumber fruit yield. Smooth pigweed, livid amaranth, and cucumber plant dry weight decreased as weed density increased, and studies indicated that cucumber reduced the dry weight of both species of amaranths. Mechanical control practices include field preparation, cultivation, hand hoeing, and hand pulling are among the oldest weed management techniques. Seedbed preparation by plowing or disking exposes many weed seeds to variations in light, temperature, and moisture. For some weeds, this process breaks weed-seed dormancy, leading to early season control with herbicides or additional cultivation. Bad cultivation (in wrong time or more deep) may cut or harm a large number of roots, reduce water and nutrient uptake, bring weed seeds to soil surface, and disturb soil that previously treated with an herbicide. Hand hoeing was still the main method for controlling weeds in squash in Egypt. Ghalwash *et al.* (2007) cited that It can concluded that metribuzin, butralin, oxyfluofen and hand hoeing twice when applied individuaily pre emergence or combination with some graminicides fluzifop-p-butyl or sethoxydim post emergence herbicides can be recommended for controlling annual weeds with high economic feasibility as alternative to hand hoeing in squash Egypt. Ghalwash *et al.*(2014) reveled that the previous pre-herbicides exceeded in a great extent the unweeded treatment in controlling annual broad-leaved weeds and annual grassy weeds. The maximum reduction values of dry weight of broad-leaved, grassy and total annual weeds were obtained by using pendimethalin, metribuzin , and hand weeding twice and the highest increases in yield and its components in two seasons, The present investigation was carried out to study the biological response and economic feasibility of weed control treatments on weeds and productivity of cucumber

(*Cucumis sativus* L.) by standing on the ability of different weed control programs (herbicides alone or followed by one hand hoeing or in combination with other herbicides and mechanical control) for minimizing weed competition in cucumber fields for maximizing its productivity and quality, subsequently to achieve the best return.

MATERIALS AND METHODS

Two field experiments were carried out in both 2012 and 2013 summer seasons at the wire-house of Sakha Agricultural Research Station, Kaferelsheikh Governorate, Egypt, in clayey soil with low available phosphorus and potassium content, to study the effect of ten weed control treatments on annual weed and cucumber (*Cucumis sativus* L.) productivity. Each experiment included ten weed control treatments which consists of eight herbicides treatments two pre-emergence application, herbicides were alone used alone as two post-emergence herbicides used as in combination with another pre-emergence and four herbicides were used pre-emergence followed by hoeing), hand hoeing twice and weedy chick.

These treatments were arranged in a randomized complete block design with four replications. The physical and chemical properties of the experimental soil as well as Common trade and chemical names of the six tested herbicides during both growing seasons are presented in Tables 1 and 2.

The tested weed control treatments were as follows:

1- Pendimethalin "Stomp" 50 % EC at the rate of 500 g a. i./ fed, applied pre-emergence + one supplementary hand hoeing at 30 (D A S) = (days after sowing).
2 - Butralin "Amix" 48 % EC at the rate of 480 g a. i. / fed, applied pre-emergence + one supplementary hand hoeing at 30 (DAS).
3- Oxyfluorfen, "Goel" 24% EC at the rate of 120 g a. i. / fed, applied pre-emergence + one supplementary hand hoeing at 30 (DAS).
4- Metribuzin "Sencor" 70 % WP at the rate of 120 g a. i. / fed, applied pre-emergence + one supplementary hand hoeing at 30 (DAS).
5- Oxyfluorfen, "Goel" 24% EC at the rate of 180 g a.i./fed, applied pre-emergence.
6- Metribuzin "Sencor" 70 % WP at the rate of 120 g a. i./ fed, applied pre-emergence.
7- Metribuzin "Sencor" 70 % WP at the rate of 180 g a. i./ fed, applied pre-emergence + fluazifop-p-butyl 125 g a. i./ fed, applied post-emergence.
8- Metribuzin "Sencor" 70 %WP at the rate of 180 g a. i. / fed, applied, pre-emergence + sethoxydim 62.5 g a. i./ fed, applied post-emergence.
9- Hand hoeing (twice) carried out at 30 and 45 DAS
10- Weedy check.

The experimental plot size was 5.5 m^2 (2.2 x 2.5 m) included two ridge rows 2.5m long and 1.1 m apart. Cucumber variety "Al-brens" was sown in 18th March in both 2012 and 2013 seasons. Three seeds were sown a $hill^{-1}$ (30 cm apart) on one ridge side to be thinned at late for two plants $hill^{-1}$. All used pesticides were diluted with water at the rate of 200 L feddan and sprayed uniformity with CP3 knapsack sprayer. Other culture practices were carried out as recommended in cucumber production.

Table 1. Physical and chemical properties of soil during 2012 and 2013 seasons.

Season	Soil Depth cm.	Particle size distribution				Texture Class	O.M. %	Caco3 %	PH (1:2.5)
		Coarse Sand %	Fine Sand %	Silt %	Clay %				Suspension
2012	0-30	1.73	13.35	21.72	63.2	clayey	1.21	2.35	7.9
2013	0-30	1.69	13.32	21.8	63.19	clayey	1.22	2.31	7.3

Table 2 .Common, trade and chemical names of the six tested herbicides.

Common name	Trade name	Chemical name
Pendimethalin	Stomp 50% EC	*N*-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine
Butralin	Amex 48% EC	4-(1,1-dimethylethyl)-*N*-(1-methylpropyl)-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
Fluazifop-P-butyl	Fusilade super 12.5% EC	butyl (*R*)-2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propionate
Sethoxydim	Select 12.5% EC	(±)-2-[1-(ethoxyimino)butyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one (i)

Data recorded

A- Weeds

Weeds were hand pulled from one square meter of each plot at 60 DAS. Weeds were counted, identified and classified into species, and the following traits were recorded:

1 - Fresh weight of annual broad-leaved weeds, g m^{-2}.
2 - Fresh weight of annual grassy weeds, gm^{-2}.
3 -Total fresh weight of annual weeds, gm^{-2}.

B- Cucumber susceptibility:

Susceptibility index was measured according to Frans and Talbert (1977) as follow:

1- Susceptible (S) = >90%.
2- Moderately susceptible (MS) = >80-90%.
3- Moderately tolerant (MT) = > 60-79%.
4- Tolerant (T) = < 60%.

C. Cucmber yield and yield components:

The yield of cucumber was gathered every three days intervals from all plot where, eleven gathers were obtained in the period from May 21st to June 20th and the following data were recorded:

1- Number of fruits $plant^{-1}$. 2- Average weight of fruit (g).
3- Yield of fruits $plant^{-1}$ (g). 4- Yield of each gather (ton fed^{-1}).
5- Total yield (ton $fed.^{-1}$).

D- Economic analysis:

Economic evaluation for cucumber yield (ton/feddan), total variable cost, gross income (GI), profitability and benefit/cost ratio (B/C) were estimated according to Heady and Dillon (1961) estimations, where as,

1-Total costs (costs of land preparation, planting, post sowing activities, fertilization, irrigation, insect control, harvesting and rental value per fed.
2-Gross income (GI) (ton fed^{-1})
3- Net income (NI) = gross income — total costs.
4- Profitability (P) = (net income/total costs) x 100.
5- Benefit/costs ratio (B/C) = gross income/total costs.

E -Statistically analysis:

All obtained data were statistically analyzed according to the technique of analysis of variance (ANOVA) for the design as published Gomez and Gomez (1984). Least significant difference (LSD) method was used to test the difference between treatment means at 5 % of probability as described by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

The obtained results concerning the effect of weed control treatments on weeds and Cucumber susceptibility, cucumber yield, yield components and economic analysis are presented in Tables (3 - 4 -5 and 6) in both 2012 and 2013 summer seasons and discussed as follows:

A-Effect of weed control treatments on weeds:

Data recorded in Table 3 show that the effect of weed control treatments on annual fresh weight gm^{-2} at 60 DAS, control and susceptibility % during 2012 and 2013 seasons.

The most predominant weeds accompanied with cucumber plants through the two growing seasons were Pigweeds (*Amaranthus s*pp.), Annual southishle (*Sonchus oleraceus* L),

Common lambsquater (*Chenopodium* spp.) And Common Purslanes (*Portulaca oleracea* L). as broad leaf weeds and *Dinebra retroflexa* L. as grassy weed.

The rating system described by Frans and Talbert (1977) was used in order to detect the efficiency of the herbicides that applied in this study on five weed species. Depending on the scale of weed susceptibility as shown in Table 3, results indicated that concerning to control and susceptibility %, data revealed that *Amaranthus* Spp. and *Portulaca oleracea* L. were more sensitive to both oxyfluorfen (at the rate 120 or 180 g and metribuzin at the rate of 70 or 49 g a. i. /fed. Whereas, *Sonchus oleraceus* L and *Chenopodium* Spp. were moderately susceptible and moderately tolerant to the same herbicides.

Sonchus oleraceus L was only sensitive with applying butralin in 2012 season, and with all tested herbicides in 2013 season, except both oxyfluorfen and metribuzin herbicides when tested alone. *Dinebra retroflexa* L. the only grassy weed was only sensitive to using fluazifop-p-buty at 125 g in its combination with metribuzin at 49 g/fed in 2012 season only, but was moderately susceptible to the other treatments in 2012 season and all treatments in 2013 season. *Chenopodium* Spp. was only sensitive to mechanical weed control hand hoeing twice in both 2012 and 2013 seasons, and moderately susceptible oxyfluorfen in both seasons, while was moderately tolerant to the other treatments.With regard to fresh weight of annual weeds gm^{-2} at 60 (DAS), results clearly indicated that average fresh weight of annual weeds in the untreated plots was about 2059 and 1718 gm^{-2}, approximately 88 and 84 % of these weeds were broadleaf species, while grass species were about 12 and 16 % only in 2012 and 2013 seasons, respectively.

Data also revealed that the differences between weed control treatments were significant in fresh weight of annual broad leaf, grassy and total annual weeds.

The most effective treatments in controlling broad-leaved and total annual weeds in both seasons were hand hoeing twice treatment 93 and 94.3 %, oxyfluorfen alone at 180 g/fed. the high rate 92,4 and 91.4 % and oxyfluorfen at the low rate 120 g fed. plus hand hoeing once 89 and 87.1 %, in 2012 and 2013 seasons, respectively as compared to weedy chick without significant differences between them.

Although the application of metribuzin at the low rate 49 g/fed either in its combinations with other herbicides fluazifop-p-butyl 125g and sethoxydim 62.5 g/ fed or followed by hand hoeing recorded the low efficacy in controlling broad leaf weeds and total annual weeds in both seasons. On the other hand, the latter mentioned treatments resulted in the best results in controlling grassy weeds and recorded the highest control percentage 90.8, 86.9 and 88.8 % in the first season and 89.6, 85.2 and 87.0 % in the second season, respectively as compared to weedy chick without.

Generally, data in Table 3 show that the best results in controlling grassy, broad leaf and total annual weeds in both seasons were achieved with using hand hoeing twice (at 30 and 45 DAS) and the pre-emergence application of oxyfluorfen alone at the high rate (180 g/fed.) or using oxyfluorfen at the low rate (at 120 g/fed.) followed by one hand hoeing at 30 DAS. These obtained results are in agreement with the results that reported by Wagih *et. al.* (1987), Johnson and Mullinix (1998), Toma *et al.* (1998), Wells and Talbert (1999) and Walters and Kindhart (2002). High temperature which prevailed and retarded plant development and decreased the total yield of cucumber. Adrian *et al*. cited that(2006) weed interference resulted in a reduction in cucumber fruit yield. Smooth pigweed, livid amaranth, and cucumber plant dry weight decreased as weed density increased, and studies indicated that cucumber reduced the dry weight of both species of amaranthsas a result of Ghalwash *et al.* (2007).

B- Effect of weed control treatments on cucmber:

It is striking that the obtained results of cucumber yield and yield components that shown in tables 4 & 5 in the second season 2013 were high, this may be due to the low competition with broad-leaved weeds that appearance 1448 g/m^{-2} and weather conditions during the growing season as compared to (1814 $gm^{-2)}$ in the first season 2012.

1- Number of fruits $plant^{-2}$.

Data in Table 4 indicated that all weeds control treatments significantly increased the number of fruits $plant^{1}$as compared to the untreated plot in both 2012 and 2013 seasons. The application of metribuzin at 49 g plus fluazifop-p- butye at 62.5 g a. i. $fed.^{-1}$, pendimethalin at 500 g. or oxyfluorfen at 120 g /fed. +H.H and metribuzin at 49 g + H.H were more effective than the other tested herbicides in 2012 season, these treatments increased the number of fruit $plant.^{-1}$ by 83.3, 66.7, 66.7 and 58.3 %, respectively comparing with weedy check. The application of pendimethalin at 500 g $fed.^{-1}$ or oxyfluorfen at 180 g fed^{-1} followed by on hand weeding increased the number of fruits $plant.^{-1}$ by 62.5 and 50.0 %, respectively in the second season.

Table 3. Fresh weight g/m² of broad leaf, grassy and total annual weeds control and susceptibility index % as affected by some weed control treatments during both 2012 and 2013 seasons.

Treatments	Control & susceptibility %					Fresh weight of annual weeds g/m²		
	Broad Leaved Weeds			Grassy				
	Amaranthus Spp	*Sonchus oleraceus*	*Chenopodium* Spp.	*Portulaca Oleracea*	*Dinebra retroflexa*	Broad leaf weeds	Grassy weeds	Total Annual *weeds*
Season 2012								
Pendimethalin 500g/fed.+ H.H	93 S	80 MS	82 MS	93 S	84.5MS	205.5	38.0	243.5
Butralin 480g fed. /+ H.H	87 MS	85 S	77 MT	98 S	86.1MS	245.0	34.0	279.0
Oxyfluorfen 120g/ fed.+ H.H	92 S	78 MT	81 MS	99 S	82.9MS	199.0	42.0	241.0
Oxyfluorfen 180g/ fed.	94 S	84 MS	89 MS	98 S	86.7MS	137.5	34.0	171.5
Metribuzin 49g/ fed.	97 S	84 MS	72 MT	94 S	79.0MT	221.5	51.5	273.0
Metribuzin49 g/ fed. + H.H	94 S	80 MS	69 MT	95 S	88.8MS	258.5	27.5	286.0
Metribuzin 49 g/ fed. + fluazifop-p-butyl 125g/ fed.	93 S	80 MS	75 MT	89 S	90.8S	256.5	22.5	279.0
Metribuzin 49 g/ fed. + sethoxydim 62.5 g/ fed.	91 S	75 MT	70 MT	76 MT	86.9MS	358.5	32.0	390.5
Hand hoeing (twice)	91 S	79 MT	90 S	98 S	82.4MS	126.5	43.0	169.5
Weedy check	0	0	0	0	0	1450.0	550.0	2000.0
LSD at 5%						96.4	60.4	142.7
Season 2013								
Pendimethalin 500g/f fed.+ H.H	97 S	85 S	73 MT	57 T	81.5MS	210.0	50.0	260.0
Butralin 480g fed. /+ H.H	94 S	96 S	79 MT	75 MT	82.2MS	172.0	48.0	220.0
Oxyfluorfen 120g/ fed. + H.H	98 S	87 S	74 MT	80 MS	84.1MS	187.0	43.0	230.0
Oxyfluorfen 180g/f fed.	99 S	80 MS	85 MS	89 MS	83.7MS	124.3	44.0	168.3
Metribuzin 49g/ f fed.	99 S	85 MS	70 MT	64 MT	78.1MT	206.8	59.0	265.8
Metribuzin49 g/ fed. + H.H	98 S	89 S	57 T	59 T	87.0MS	280.0	35.0	315.0
Metribuzin 49 g/ fed. + fluazifop-p-butyl 125g/ fed.	97 S	85 S	65 MT	73 MT	89.6MS	246.5	28.0	274.5
Metribuzin 49 g/ fed.+ sethoxydim 62.5 g/ fed.	94 S	83 S	63 MT	61 MT	85.2MS	284.0	40.0	324.0
Hand hoeing (twice)	98 S	86 S	93 S	77 MT	81.5MS	83.0	50.0	133.0
Weedy check	0	0	0	0	0	1270.0	430.0	1700.0
LSD at 5%						67.3	56.2	172.5

H.H = Hand hoeing (once), 30 days after treatment
S = > 90 % control MS = > 80-90 % control MT = >60-79 % control
T = <60 % control
Susceptible Moderately *S*usceptible Moderately Tolerant Tolerant.

Table 4. The effect of some weed control treatments on number of fruits/plant, average fruit weight and yield of fruit/plant (g) during 2012 and 2013 seasons

No.	Treatments	Season 2012			Season 2013		
		Number of fruit / plant	Av. weight cucumber fruit (g)	Yield / plant (g)	Number of fruit / plant	Av. weight cucumber fruit (g)	Yield / plant (g)
1	Pendimethalin 500 g/fed. + H.H	5.00	54.18	270.9	6.50	45.56	296.1
2	Butralin 480 g/fed. + H.H	4.50	43.18	194.3	5.50	30.53	167.9
3	Oxyfluorfen 120 g/fed. + H.H	5.00	41.85	209.3	5.75	40.08	230.5
4	Oxyfluorfen 180 g/fed.	4.50	50.13	225.6	6.00	42.70	256.2
5	Metribuzin 49 g/fed.	4.50	40.48	182.2	5.50	29.43	236.5
6	Metribuzin 49 g/fed. + H.H	4.75	35.13	166.9	5.50	26.23	144.3
7	Metribuzin 49 g/fed.+fluazifop-p-butyl 125 g/fed.	5.50	38.28	210.5	5.50	27.95	153.7
8	Metribuzin 49 g/fed. +sethoxydim 62.5 g/fed.	4.25	34.53	146.8	5.50	24.25	133.4
9	Hand hoeing (twice)	4.50	43.63	196.3	5.50	29.86	164.2
10	Weedy check	3.00	24.58	73.8	4.00	18.00	74.0
LSD : between treatments at 5%		0.95	10.04	54.1	1.10	10.95	71.6

2- Average weight of fruit (g).

Data in Table 4 also revealed that the main highest increases percentage in cucumber fruit weight than that of weedy check treatment were obtained by the application of pendimethalin 500 g/fed. followed by one hand hoeing (120.4 and 153.1 %) or the single application of oxyfluorfen at 180 g/fed. (103.9 and 137.2 %) in 2012 and 2013 seasons, respectively. The application of oxyfluorfen at the low rate (120 g fed.$^{-1}$ followed by one hand hoeing resulted in an increase reached to 122.7 % as compared to weedy check in the second season.

3- Yield of fruits plant^{-1} (g).

It is obvious from Table 4 that all weed control treatments had a significant increase in yield of cucumber in grams / plant. The application of pendimethalin at 500 g fed. $^{-1}$ followed by one hand hoeing or using the single application of oxyfluorfen at 180 g/fed. gave the highest yield plant^{-1} in grams, these treatments recorded an

increase in yield/plant reached to 267.1 and 205.7 % in 2012 season and 300.1 and 246.2 % in 2013 season, respectively as compared to weedy check.

Table 5. Effect of some weed control treatments on yield of each gather and total yield of cucumber t/fed. during 2012 and 2013 seasons.

Number of gathers Treatments	Season 2012 yield of gathers											Total yield t/fed
	1	2	3	4	5	6	7	8	9	10	11	
Pendimethalin 500g/fed+ H.H	0.286	0.275	0.266	0.315	0.322	0.385	0.442	0.333	0.211	0.105	0.041	2.981
Butralin 480g fed /+ H.H	0.277	0.267	0.288	0.298	0.276	0.255	0.244	0.225	0.211	0.065	0.041	2.447
Oxyfluorfen 120g/ fed + H.H	0.244	0.286	0.285	0.277	0.255	0.276	0.222	0.243	0.144	0.075	0.061	2.368
Oxyfluorfen 180g/fed	0.267	0.266	0.321	0.330	0.312	0.351	0.366	0.344	0.355	0.244	0.109	3.265
Metribuzin 49g/ fed	0.327	.0341	0.312	0.322	0.305	0.333	0.322	0.322	0207	0.256	0.112	3.159
Metribuzin49 g/ fed + H.H	0.366	0.377	0.345	0.321	0.344	0.335	0.367	0.344	0.267	0.155	0.134	3.355
Metribuzin 49 g/ fed + fluazifop-p-butyl 125g/fed.	0.322	0.312	0.355	0.365	0.366	0.315	0.344	0.365	0.281	0.233	0.166	3.424
Metribuzin 49 g/ fed + sethoxydim 62.5 g/ fed.	0.355	0.319	0.324	0.388	0.346	0.381	0.275	0.182	0.151	0.131	0.111	2.963
Hand hoeing (twice)	0.341	0.377	0.344	0.314	0.388	0.351	0.355	0.333	0.312	0.165	0.111	3.391
Weedy check	0.211	0.210	0.286	0.275	0.255	0.265	0.233	0.212	0.104	0.102	0.101	2.254
Mean	0.300	0.303	0.313	0.321	0.317	0.325	0.317	0.290	0.224	0.153	0.089	2.961
LSD at 5%	0.018	0.016	0.018	0.019	0.019	0.020	0.019	0.017	0.013	0.010	0.005	1.082
	Season 2013											
Pendimethalin 500g/fed+ H.H	0.322	0.342	0.354	0.342	0.334	0.355	0.359	0.245	0.247	0.200	0.122	3.222
Butralin 480g fed /+ H.H	0.333	0.324	0.322	0.324	0.324	0.358	0.357	0.251	0.257	0.197	0.155	3.202
Oxyfluorfen 120g/ fed+ H.H	0.318	0.488	0.417	0.444	0.476	0.457	0.367	0.255	0.221	0.122	0.177	3.742
Oxyfluorfen 180g/fed	0.321	0.436	0.351	0.421	0.315	0.420	0.310	0.210	0.211	0.120	0.123	3.238
Metribuzin 49g/ fed	0.354	0.347	0.367	0.381	0.313	0.371	0.342	0.224	0.221	0.111	0.112	3.143
Metribuzin49 g/ fed + H.H	0.422	0.452	0.471	0.452	0.421	0.431	0.425	0.327	0.255	0.222	0.214	4.092
Metribuzin 49 g/ fed + fluazifop-p-butyl 125g/fed.	0.321	0.451	0.421	0.422	0.411	0.400	0.410	0.411	0.211	0.214	0.183	3.855
Metribuzin 49 g/ fed + sethoxydim 62.5 g/ fed.	0.312	0.416	0.422	0.426	0.432	0.412	0.422	0.412	0.312	0.241	0.194	4.001
Hand hoeing (twice)	0.366	0.377	0.399	0.387	0.444	0.418	0.478	0.412	0.311	0.211	0.157	3.960
Weedy check	0.222	0.244	0.214	0.254	0.256	0.247	0.211	0.222	0.200	0.210	0.101	2.381
Mean	0.329	0.388	0.374	0.385	0.373	0.387	0.368	0.297	0.245	0.185	0.154	3.484
LSD at 5%	0.020	0.023	0.024	0.046	0.022	0.021	0.056	0.021	0.014	0.015	0.015	1.340

H.H = Hand hoeing (twice) at 30 and 45 days after sowing.

4- Yield of each gathers ton fed $^{-1}$.

It is striking that the obtained results of cucumber yield of each gathers listed in Tables 5 in both seasons gradually increased from gather to another until the seventh gather, then decreased as number of gather increased until the final gather of season.

Data also indicated that the top five treatments of weed controlling affected cucumber production on each gather were: metribuzin 49 g/fed + fluazifop-p-butyl 62.5 g/fed, hand hoeing twice, metribuzin 49 g/fed + one hand hoeing, oxyfluorfen 180 g/fed and metribuzin 70 g/fed. in the first season. These treatments significantly increased yield of each gather as compared to weedy check. In the second season, the best five treatments were: metribuzin 49 g/fed + H.H, metribuzin 49 g/fed + sethoxydim 62.5 g/fed, hand hoeing twice, metribuzin 49 g/fed + fluazifop-p-butyl 62.5 g/fed and oxyfluorfen 120 g/fed + H.H. These treatment achieved the top significant increases in yield of each gather as compared to weedy check. The reduction in yield of weedy check comparing with other weed control treatments may be attributed to the inter-specific competition between weeds that left free and cucumber plant for growth resources under weedy check plot conditions. These results are attributed to the successful weed control treatments in minimizing weed competition to cucumber plants which increased the capacity of cucumber plants on utilizing of light, nutrients and water etc. which in turn increased cucumber yield and yield components.

5- Total Yield (ton/fed).

Data in Table 5 indicated that the top five treatments affected total yield of cucumber (ton/fed) were: metribuzin 49 g/fed + fluazifop-p-butyl 62.5 g/fed, hand hoeing twice, metribuzin 49 g/fed + one hand hoeing, oxyfluorfen 180 g/fed. and metribuzin 70 g/fed. in the first season. These treatment increased total yield by 51.9, 50.4, 48.8 44.9 and 35.7 %, respectively as compared to weedy check.

In the second season, the best five significant treatments influenced in cucumber production were: metribuzin 49 g/fed + one hand hoeing, metribuzin 49 g/fed + sethoxydim 62.5 g/fed, hand hoeing twice, metribuzin 49 g/fed+ fluazifop-p-butyl 62.5 g/fed and oxyfluorfen 120 g/fed + hand hoeing once. These treatment increased total yield by 71.9, 68.0, 66.3, 61.9 and 57.2%, respectively as compared to weedy check. Peachey *et al.* (1998) cited that results of measurements of crop biomass made 6 weeks after planting indicated that some herbicidal treatments were phytotoxic, but the herbicides did not reduce yield of squash.Wells and Talbert (1999) cited that no observable injury to squashes or the highest yield of summer squashes. Walters and Kindhart (2002) indicated that few herbicides are currently labeled for use in summer squash. Ghalwash, *et al.*(2007) concluded that metribuzin, butralin and hand hoeing twice when applied individuaily as pre emergence or combination with some graminicides fluzifop-p-butyl or sethoxydim post emergence herbicides can be recommended for controlling annual weeds with high economic feasibility as alternative to hand hoeing squash in Egypt.

The obtained results are in harmony with those reported by Wagih *et al.* (1987) and Gowda *et al.* (2003) they revealed that hoeing twice and post-emergence herbicides as Nabu-S and Fusilade significantly decreased

the dry weight of annual and perennial grasses. Similar increase in yield t/fed. due to application of weed control treatment was reported by Miller and Libbey (1999) they indicated that weed control by pendimethalin significantly reduced cucumber emergence to 4.0 plants/hill, compared with 5.6 plants/hill in the untreated control. On the other hand, total number and weight of cucumber fruits resulting from treatment did not differ from the hand-weeded control. The successful treatments for weed control mentioned in table 3 could be arranged in a descending order according to respective value treatments for their increases of cucumber yield t/fed. as follow; hand hoeing, twice (68.1%); oxyfluorfen 180 g a.i. /fed. (90.8%); and oxyfluorfen 120 g/fed. + hand hoeing once (61.8%) in 2004 season. Meanwhile it was hand hoeing twice (28.3%); oxyfluorfen 180 g a.i. /fed. (68.6 %); and butralin 480 g/fed + hand hoeing once (51.0%) in 2013 season.

C- Economic analysis

Data presented in table 6 and fig 1,2 & 3 showed that all herbicidal treatments and hand weeding at once kich calculated as 4550 L.E in 20l2 season and 5000 L.E in 2013. It is reported that, the total cost, wst (lanpreparation, planting, post sowing activities, fertilization, irrigation, insect control, harvesting and rental per fed and random cost of weed control about 350,240,220,350,400, 350 and 500 L. E./fed for with treatments, metribuzin at 49g/fed, oxyfluofen at 120g/fed, metribuzin at49g/fed +sethoxydim at 62.5g/fed, metribuzin at 49g/fed + fluzifop-p- butyl at 125g/fed and hand hoeing twice respectively. The total Cost increased with using sethoxydim at 62.5 g/fed or fluzifop-p-butyl at125g/fed to control grass weeds. Gross incom increased significantly by the deferent of herbicides treatments as a result of increasing yield/ fed by decreasing weed interference with cucmber crop. The highest total cost (5950and 5450 L.E.) were obtained by the treatment number 9 followed by number 8 in first and seconed seasons, reaspectively.

The highest value of gross income (11565 L.E) was resulted from metribuzin + fluzifop-p-butyl at49+125g/fed treatment in 2013 season. On the other hand, hand hoeing at twice had 10173 and 10888 L.E in gross incomes in 2012 and 3013 seasons. The highest means of not income (4540 & 6430 L E) in were produced by the treatment of hand hoeing in 2012 and 2013 seasons, respectively.

Metribuzin + sethoxydim at 49+62.5g/faddan recorded (5159 L.E.) in 2012 and (6001 L.E.) in 2013 season, treatment metribuzin +hand hoeing at (49) g/fed were recorded 4315 and 5991 L.E. through 2012 and 2013 seasons . On the other hand, untreated check for whole season had lowest values of it total cost and give lowest gross income(6762and7831)L.E. in two seasons) due to decreased yield and yield, due to weed infestation on cucmber plants.

An increasing of gross income and net income was due to increase cucumber yield due to integrated control to weed cucmber. In the 1st season the highest values of obtained by treatments metribuzin + sethoxydim at 49+62.5g/fed, metribuzin + fluzifop-p-butyl at 49+ 125g / fed, metribuzin +hand hoeing at 49 g/fed, hand hoeing twice and metribuzin with 1.84, 1.80, 1.75, 1.71 and1.72, meanwhile treatments metribuzin + fluzifop-p-butyl at 49+125g/fed, metribuzin + sethoxydim at 49+62.5g/fed, metribuzin + hand hoeing at(49)g/fed, hand hoeing twice and oxyfluofen +H.H with 2.17, 2.15, 2.13, 1.99 and1.99 in second season.

Table 6.The effect of economic feasibility of herbicides treatments of weeds on cucmber quality on economic analysis in 20l2 and 2013 seasons.

No.	Treatments	Rate / faddan	Time of application	Total costs (L.E.)	Gross income (L.E.)	Net income (L.E.)	Probability	Benefit /cost ratio
			2012 season					
1	Pendimethalin +H.H	500	P.E.	5950	8943	3993	50.30	1.50
2	Butralin + H.H	480	P.E.	5820	7341	1521	26.13	1.26
3	Oxyfluorfen + H.H	120	P.T.	5870	7104	1234	421.01	1.21
4	Oxyfluorfen	180	P.E.	5930	9795	3865	65.01	1.65
5	Metribuzin	49	P.E.	5670	9751	4081	72.07	1.72
6	Metribuzin + H.H	49	P.E.	5750	10065	4315	75.04	1.75
7	Metribuzin + fluazifop-p-butyl	49+125	P.E & 30 d P.E.	5875	10572	4697	80.01	1.80
8	Metribuzin + sethoxydim	49+62.5	P.E. & 30 d P.E.	5930	10889	5159	87.01	1.84
9	Hand hoeing (twice)	-	-	5950	10173	4540	71.02	1.71
10	Weedy check	-	-	4550	6762	2212	48.61	1.49
L.S.D.		-	-	271.0	809.0	982.0	124.0	1.41
			2013 season					
1	Pendimethalin + H.H	500	P.E.	5400	9666	4266	79.00	1.79
2	Butralin + H.H	480	P.E.	5370	9606	4236	78.88	1.79
3	Oxyfluorfen + H.H	120	P.E.	5345	10626	5281	98.80	1.99
4	Oxyfluorfen	180	P.E.	5180	9428	4248	82.01	1.82
5	Metribuzin	49	P.E.	5120	9429	4309	84.16	1.84
6	Metribuzin + H.H	49	P.E.	5285	11276	5991	113.35	2.13
7	Metribuzin + fluazifop-p-butyl	49+125	P.T. & 30 d P.E.	5325	11565	6240	117.18	2.17
8	Metribuzin + sethoxydim	49+62.5	P.T. & 30 d P.E.	5205	11206	6001	115.30	2.15
9	Hand hoeing (twice)	-	-	5450	10880	6430	99.63	1.99
10	Weedy check	-	-	5000	7831	2831	52.82	1.56
L.S.D.		-	-	165.0	796.0	120.6	118.0	2.0

P.E.= pre emergence 30 d P.E. 30 days pre emergence & = followed by P.E. & 30 d P.E. treatment.

It was noticed that treatments metribuzin and oxyfluofen as a single herbicide were superior treatments on benefit cost ratio in both seasons addition to oxyfluofen +hand hoeing in the two season These results agreed with Heady and Dillon (1961). The most effective treatments in controlling broad-leaved and total annual weeds in both seasons were hand hoeing twice treatment (93 and 94.3 %), oxyfluorfen alone at (180 g/fed.) the high rate (92,4 and 91.4 %) and oxyfluorfen at the low rate (120 g/fed.) plus hand hoeing once (89 and 87.1 %), in 2012 and 2013 season, respectively as compared to weedy chick without significant differences between them.

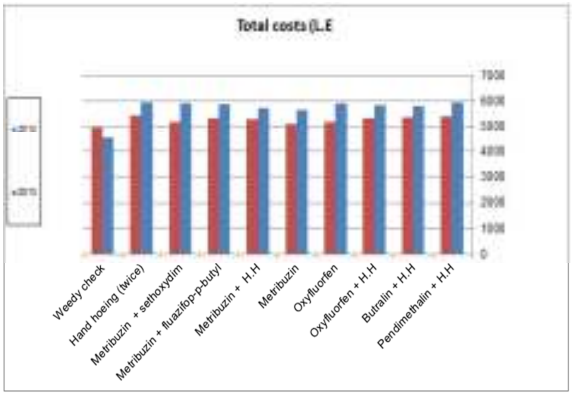

Fig. 1. Effect of some weed control treatments on total costs during two seasons.

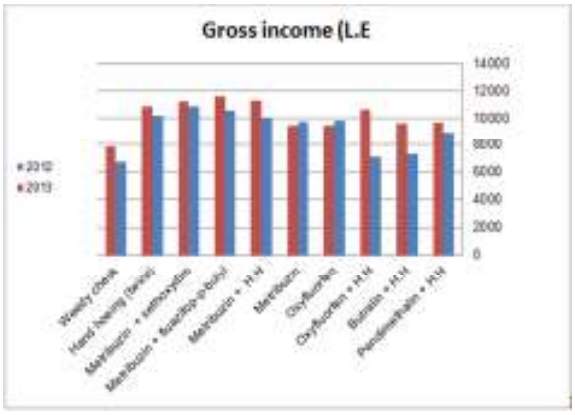

Fig. 2. Effect of some weed control treatments on gross income during two seasons.

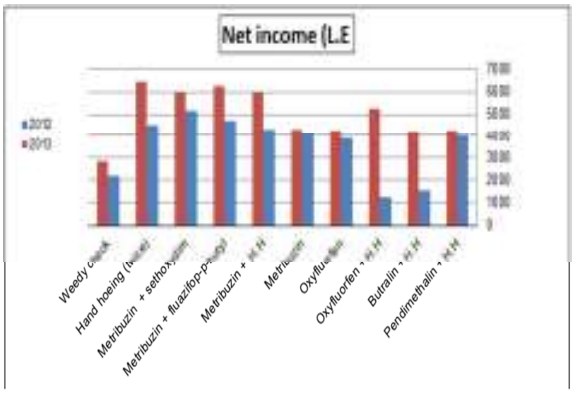

Fig. 3. Effect of some weed control treatments on net income during two seasons.

CONCLUSION

It can be concluded that metribuzin, oxyfluofen and hand hoeing twice when applied individuaily pre emergence or combination with some graminicides fluzifop-p-butyl or sethoxydim post emergence herbicides can be recommended for controlling annual weeds with high economic feasibility as alternative to hand hoeing in cucumber in Egypt.

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الأستجابة البيولوجية والجدوى الأقتصادية لمعاملات مكافحة الحشائش على الحشائش وإنتاجية محصول الخيار

عادل مصطفى غلوش[1] و عبد المنعم سيدأحمد الجندى[2]

[1]المعمل المركزي - لبحوث الحشائش – مركز البحوث الزراعية - الجيزة

[2]قسم الخضر- معهد بحوث البساتين- مركز البحوث الزراعية – الجيزة

أجريت تجربتان حقليتان في الصوبة السلكية بمحطة سخا للبحوث الزراعية بمحافظة كفر الشيخ خلال موسمي صيف 2012 و2013م، وكان الهدف من البحث هو دراسة الأستجابة البيولوجية والجدوى الأقتصادية لمعاملات مكافحة الحشائش على الحشائش وإنتاجية محصول الخيار. وقد احتوت التجربة على 10 معاملات لمكافحة الحشائش، كانت على النحو التالي :- أربعة معاملات لمبيدات منفردة متبوعة بعزقة وهي 1 - بندميثالين بمعدل 500جم 2- بوترالين بمعدل 480 جم3- أوكسى فلورفن بمعدل 120جم+ عزيق مرة واحدة 4- أوكسى فلورفن بمعدل 120جم و متريبوزين بمعدل 49جم / ف بعد الزراعة وقبل الري، ومعاملتين لمبيدين منفردين منهم ولكن بتركيز أعلى وهما1- أوكسى فلورفن بمعدل180جم، 2- متريبوزين بمعدل 70 جم / ف بعد الزراعة وقبل الري، ومعاملتين 1- متريبوزين بمعدل 49جم / ف + فلوزيفوب ب بيوتايل بمعدل 62.5جم / ف بعد شهر من الزراعة2- -متريبوزين بمعدل 49جم / ف + سيزوكسيديم بمعدل 62.5جم / ف بعد شهر من الإنبات 3- عزيق مرتين4- معاملة (المقارنة).أوضحت النتائج أن كل معاملات مكافحة الحشائش أعطت كفاءة فى مكافحة الحشائش الحولية وكان النقص فى محصول الخيار فى معاملة المقارنة 50.4 , 66.4 % بالنسبة لمعاملة العزيق مرتين نتيجة لمنافسة الحشائش حيث كان الوزن الغض للحشائش الحولية فى معاملة المقارنة 8.64 , 7.14 طن للفدان فى موسمى 2012 و 2013 على الترتيب مقارنة بمعاملة الكنترول. و كانت اعلى المعاملات فى مكافحة الحشائش الحولية عريضة الأوراق و الكلية فى الموسمين من معاملتى العزيق (مرتين) وأوكسى فلورفن بمعدل 180 جم/ف بمفرده حيث اعطو (93و94.3%) و(92.4و91.1 %) على الترتيب ثم أوكسى فلورفن بمعدل 120 جم/ف + عزيق مرة واحدة حيث أعطت هى ألأخرى (89.0و87.1 %) فى الموسمين مقارنة بمعاملة الكنترول ، بينما أعطت معاملات متريبوزين بمعدل 49جم / ف + فلوزيفوب بيوتايل بمعدل 62.5جم / ف و العزيق مرتين و متريبوزين بمعدل 49جم / ف متبوعا بعزيق مرة واحدة (51.9،50.4و48.84 %) فى الموسم الأول، بينما أعطى مبيد المتريبوزين + فلوزيفوب بيوتايل ، مبيد المتريبوزين + السيزوكسيديم (94.2 و 67.6 %) و (73.4 و 54.8 %) فى الموسمين على الترتيب بالنسبة لمعاملة المقارنة . بينما أعطى مبيد متريبوزين بمعدل49جم / ف متبوعا بعزيق مرة واحدة و متريبوزين بمعدل49جم / ف + السيزوكسيديم ، و العزيق مرتين (71.86،68.03،66.31%) على الترتيب فى الموسم الثانى. وكانت الزيادة فى محصول الخيار لهذه المعاملات (1.17، 1.14، 1.10) و (1.71 ،1.62، 1.58) طن /فدان فى الموسمين على الترتيب بالنسبة لمعاملة المقارنة . أيضا المتريبوزين + فلوزيفوب بيوتايل و أوكسى فلورفن بمعدل180جم + عزيق مرة واحدة حيث أعطو زيادة فى المحصول(61.90 ،57.19%) الموسم الأول. من ذلك يمكن التوصية بتكامل استخدام بعض مبيدات الحشائش مثل المتروبيوزين اوأوكسى فلورفن مع الفلوزيفوب بيوتايل او السيزوكسيديم أ و العزيق فى تقليل منافسة الحشائش وزيادة إنتاجية محصول الخيار.