Competition of weed community and its control in onion nursery fields

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ABSTRACT

Four field experiments were conducted at Sids Research Station, Agriculture Research Center, Beni Suef Governorate, Upper Egypt during 2010 and 2011 winter seasons. Two experiments were carried out to estimate the impact of fourteen treatments i. e. seven intervals of weed competition (weed infestation) and seven intervals of weeds removal (weed free), with two weeks interval between each treatment which began from sowing. Another two experiments were conducted to evaluate the efficacy of some herbicides i. e. Amex at 1.75 L./fad., Stomp extra at 1.7 L./fad., Starane at 150 cm^3/fad. + Fusilade super at 0.5 L./fad.; and Sencor at 100 g/fad. + Fusilade super at 0.5 L./fad. and Iquopart at 200 cm^3/fad. + Fusilade super at 0.5 L./fad. as well as hand weeding twice and unweeded check on controlling annual weeds associated with onion transplants and its effects reflection on onion transplanting yields.

The main findings of these studies showed that the weed infestation rate under onion nursery field was 2.4 and 2.5 kg fresh weight/m^2, which reduced yield of onion transplants per faddan by 80 and 75.9% competition treatment of onion transplant for whole season in both 2010 and 2011, respectively, compared with weed free for whole season treatment. Also, results show that the quadratic equations which had highest R^2 (0.986 and 0.984) for weed free period and (0.962 and 0.957) for weed competition durations in 2010 and 2011 seasons, respectively. They results were fit to represent the data of critical periods of weed competition to onion nursery and ten weeks period is required to be weed free to obtain the maximum yield of onion transplants and two weeks of weeds infestation can be allowed without onion transplants yield reduction.

On other hand, the use of Iquopart at the rate of 200 cm^3/fad. plus Fusilade super at the rate of 0.5 L./fad gave the highest controlling percentages of the annual broad leaf and grassy weeds with the highest values of onion transplant(yield and quality) without damage on chlorophyll pigments in the onion transplants can be advised for weed control in mentioned critical period of onion nursery.

INTRODUCTION

Onion (*Allium cepa* L.) is one of the most important field crops in Egypt for local consumption, processing and exportation. The cultivated area of sole onion crop reached to123487 faddan with an average of 14.3 ton/faddan in 2011 season*. Onion nursery is the key step for growing transplanted onion, where weeds can cause detrimental effects for onion nursery production, because the shallow canopy of onion seedling during its life span especially in earlier growing periods **Norsworthy *et al* (2007)**. There is a big lack of information about the nature of weed/onion nursery competition and control methods which can avoid weed competition . Estimation of

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the critical period of weed control is very important for planning weed control strategies because onion nursery strongly suffers from weed competition. Many researchers in abroad found that weed competition cause losses of onion yield even with a short time of competition (**Dunan *et al.*, 1995**), (**Zimdahl, 1988**) and **Babiker and Ahmed (1986)**. On the other hand, hand weeding is not feasible in onion nurseries, as reported by **Babiker and Ahmed (1986) , Ghosheh (2004) and Abdul Ghafoor *et al*., (2000)** whoes mentioned that, onion transplants plant height was greatest where the plots were kept weed free for 50 days after emergence. On the other hand, the critical period has been defined as the period which weeds must be controlled to prevent yield losses **Zimdahl (1988)**. There is evidence that the critical period for weed control in onion is extended beyond the first few weeks after seed emergence. **Bond and Burston (1996), Ghosheh (2004)**, **Mekky *et.al*.(2005) and Qasem (2005)** indicated that, weed competition throughout the season reduced onion yield by 94 % with lowered onion transplants quality and hinder crop harvest. **Qasem (2006)** found that, weed competition reduced onion fresh yield by 62 % as compared with the weed - free control.

Concerning weed management in onion nursery, many researchers mentioned that fluazifop-p-butyl gave excellent control of grassy weeds in onion **Sieczka *et al*., (1983). Hartley (1984)** found that, fluazifop-p-butyl gave moderate control of *Elymus repens*. *Cynodon dactylon, Lolium perenne, Echinochlaa*, *crus-galli* and *Digitaria sangunalis* in onion fields. **Kartofel (1991)** reported that, the best annual weed control in onion was obtained from post emergence application of fluazifop-p-butyl (2 kg/ha) at 4-5 leaf stage. **Khurana *et al*., (1987)** mentioned that, the use of metribuzin at 0.25 kg/ha gave over 90 % weed control in onion. **Sharma *et al*., (2009)** found that pendimethalin at 0.5 kg/ha can be used for better weed control and higher seedling production in onion nursery. **Pandey *et al*., (1991)** and **Kholosy *et al*., (1995)** found that, the use of pendimethalin at 2.5 liters + hand weeding resulted in the greatest weight of onion transplants per bed, the maximum number of seedlings per 250 g and the minimum fresh weight of associated weeds. Post emergence application of the herbicides gave similar yield of onion transplants to that of the weed free control and was phototoxic to seeded sown onion in two sites and reduced seedlings growth and the number stand below the weed infested control,**(Qasem 2006)**.

The extent of weed problem and available methods of control in onion nursery is our interest in this study. Thus, the objective of this research is firstly, to determine the magnitude of weed/onion nursery competition and when start and be stopped and modeling these relationships, secondly, to find out successful herbicidal treatments to control weeds in onion nursery through the critical competition.

MATERIALS AND METHODS

Four field studies were carried out at Sids Agricultural Research Station, Agriculture Research Center, Ministry of Agriculture, during 2010 and 2011 winter seasons and consist of two parts. Seeds of Giza 6 variety were broadcasted at rate 40 kg/faddan in 1st and 2nd of September in the 2010 and 2011 seasons, respectively, and onion transplant were hand pulled manually until the 1st of December in the same season.

Soil texture of the experimental plots was clay loam, in both seasons. Physical and chemical properties of the surface soil (0.0 – 90 cm) were determined according to **Wilde *et al*., (1985)** and data are shown in Table (1).

Table (1): Mechanical and chemical analysis of the experimental soil.

Mechanical analysis				Chemical analysis			Available nutrients					
Sand %	Silt %	Clay %	Texture	OM	ph	E.C mmhos/cm	N %	P ppm	K ppm	Fe ppm	Mn ppm	Zn ppm
22.16	30.22	48.62	Clay loam	1.56	7.70	1.02	0.08	29.01	371.2	33.0	18.9	6.0

Part I: Estimation the critical period of weed/onion nursery competition.

Two field experiments were conducted to estimate the critical period for weed competition in onion nursery. Every experiment included fourteen treatments of weed removal and weed competition period treatments in randomized complete block design as follows:-

1 - Weed free for 2 weeks from sowing.
2 - Weed free for 4 weeks from sowing.
3 - Weed free for 6 weeks from sowing.
4 - Weed free for 8 weeks from sowing.
5 - Weed free for 10 weeks from sowing.
6 - Weed free for 12 weeks from sowing.
7 - Weed free for the whole season.
8 - Weed competition for 2 weeks from sowing.
9 - Weed competition for 4 weeks from sowing.
10 - Weed competition for 6 weeks from sowing.
11 - Weed competition for 8 weeks from sowing.
12 - Weed competition for 10 weeks from sowing.
13 - Weed competition for 12 weeks from sowing.
14 - Weed competition for the whole season.

For weed free periods plots were kept free from weeds for 2, 4, 6, 8, 10, 12 weeks and whole season (treatments from 1 – 7) and after that weeds were allowed to compete with onion nursery for the remainder time of the season. In the weed competition periods, normal weed population were allowed to emergence and to compete for the periods at 2, 4, 6, 8, 10, 12 weeks and the whole season, (treatments from 8 - 14) and then weeds were removed manually until the end of the season.

The treatments were arranged in randomized complete block design with four replicates. The plot area was 4.5 m^2 (3.0 m length x 1.5 width). The agriculture practices i.e., fertilization; irrigations; pest and diseases control were managed in accordance with local recommendations.

Data were recorded as follows:

A- Weed characters:-

A random sample was taken from one square meter from each plot in the two first experiments. The sample was classified to grassy , broad-leaved and total annual weeds as fresh weight (g/m^2).

B- Onion transplants yield and quality:-

1- Length of onion transplant (cm.).
2- No. of leaves/onion transplant.
3- Transplanting thickness of onion transplant (cm.).
4- Weight of onion bulb transplant (g.).
5- Dry matter (DM%).
6- Onion yield of transplants (t/fad.) at time of hand pulling.

**** Statistical analysis**

All studied data were statistically analyzed according to the procedures outlined by **Gomez and Gomez, (1984)**; and the treatments mean were compared by least significant range LSR according to **Duncan,(1955)**. The relative and actual yield was subjected to analysis of variance using regression curve, estimation functions to analysis of statistical producers for social Sciences (SPSS 12.0 for windows), to evaluation the effect of the length of the weed –free periods and the duration of weed interference on relative onion yields according to (**Knezevic *et al.*, 2002 , Evans *et al.*, 2003; and Norsworthy and Oliveira, 2004).** Three response curve models namely, linear, quadratic and logistic were fitted to study the relationships between onion transplant yield/fad. and duration of weed-free and/or weed-competition periods. First and second models are linear and quadratic according to determine the onset of critical period of weed control **(Neter *et al.*, 1990).** The third model of logistic equation proposed by **(Hall *et al.*, 1992 and Cousen, 1991)** mentioned that, earlier work depend on **Duncan's** multiple test or LSD but they suggested that regression analysis appropriate and useful mean of determining the critical periods and modified by **(Knezevic *et al.*, 2003).**

** Estimation of the critical period for weed competition on onion transplanting yield:

The relationship between onion yield (Y) and durations of weed – free or weed competition period (x) by either linear and quadratic or logistic models where: -

*** Linear model is estimated using the formula:** $Y = a + b x$,

Where: Y = is the onion transplant yield kg/m^2. in ton, a : is the y intercept, b : is the linear coefficient of regression, x : is the duration of applied weed-free or weed competition period.

*** Quadratic polynomial model is computed using the formula:**

$Y = a + bx + cx^2$, Where: Y = is the onion transplant yield kg/m^2. in ton, a : is the y intercept, b : is the linear coefficient of regression, c : is the quadratic coefficient of regression, X: is the duration of applied weed-free or weed-competition period.

*** Logistic regression equation is computed using the formula:**

Y=ln (bo) + (ln (b1)*t), Where: b0 = is the constant (factor), b1 = is the regression coefficient, T = is the independent variable, x.

Part II: Weed control in onion nursery: -

Two field experiments were conducted to evaluate the effect of seven weed control treatments on controlling the mixed weed species mixture associated with onion nursery in randomized complete block design as follows:

1- Unweeded check.

2- Hand pulling at two times with 15 days intervals, begin at 18 days from sowing.

3- Butralin (4-(1,1-dimethylethyl)-N-(1-methylpropyl) -2,6-dinitrobenzenamine) known commercially as Amex 48 % EC, was applied at rate 1.75 liter/fad. as pre-sowing.

4- Pendimethalin (N-(1- ethylpropyl) – 3,4 dimethyl- 2,6 dinitrobenzenamin) known commercially as Stomp extra 45.5 % CS was applied at rate 1.7 liter /fad. as pre – sowing.

5- Fluroxypyr [4-amino-3,5-dichloro-6-fluoro-2-pyridyloxyacetic acid] known commercially as Starane 20 % EC applied at the rate of 150 cm^3/fad. as post-emergence at 25 days after sowing addition to Fluazifop-butyl (butyl (R)-2-[4-[5-(trifluoromethyl)-2-pyridinyl] oxy] phenoxy] propanoate) known commercially as Fusilade super 12.5 % EC was applied at rate of 0.5 liter/fad. after one month from sowing.

6- Metribuzin (4-amino-6-(1,1-dimethylethyl)-3-(methylthio)1,2,4-triazip-5 (4H) one) known commercially as Seconr 70 % WP was applied at the rate of 100 g/fad. as post-emergence at 25 days from sowing in addition to Fusilade super 12.5 % EC was applied at rate of 0.5 liter/fad. after one month from sowing.

7- Pyraflufen - ethyl (691) (2-chloro-5-[4-chloro-5-(difluoromethoxy)-1-methyl-1 H-pyrazol-3-yl] -4- fluorophenoxyacetate which known commercially as Iquopart 2 % SC was applied at rate 200 cm3/fad. after 25 days from sowing addition to fluazifop-butyl as Fusilade super 12.5 % EC at the rate of 0.5 liter/fad. after one month from sowing.

The treatments were arranged in randomized complete block design with four replicates. The plot area was 10.5 m^2 (3.5 m length x 3 m width). All herbicidal treatments were sprayed with knapsack sprayer CP3 with 200 liter water/fad. The agriculture practices i.e., fertilization; irrigations; pest and diseases control were managed in accordance with local recommendations.

Data were recorded as follows:

A- Weed characters:-

A random sample was taken from one square meter from each plot at 60 days after sowing. The sample was classified to grassy , broad-leaved and total annual weeds as fresh weight (g/m^2).

B- Growth characters and onion transplants yield:-

1- Length of onion transplant (cm.).
2- No. of leaves/onion transplant.
3- Transplanting thickness of onion transplant (cm.).
4- Weight of onion bulb transplant (g.).
5- Dry matter (DM%).
6- Onion yield of transplants (t/fad.) at time of hand pulling.

C – Photosynthetic apparatus pigments: -

Chlorophylls and carotenoids were determined in leaves after 15 days from applied herbicides using method described by **Robbelen (1957)**. 0.1 g of leaves was mixed with 10 ml. acetone 85 % and ground in mortar in the presence of pure sand and calcium carbonate till the exhaust of the green colour by washing several times and repeating the extraction when required. The total extraction was made up to 100 ml. in a volumetric flask. The absorbance of the previously obtained extraction was read in Shimadzu spectrophotometer UV 120-02 at 663nm, 644 nm and 452 nm for the estimation of chlorophyll a, b and carotenoids, respectively. The pigment concentration was calculated from the following formula:

Chlorophyll (a) mg / L = $10.3 (O.D)_{663} - 0.918(O.D)_{644}$
Chlorophyll (b) mg / L = $19.7 (O.D)_{644} - 3.87(O.D)_{663}$
Carotenoids mg / L = $4.75 (O.D)_{452}$ – Total chlorophyll x 0.226

The calculated concentrations as mg / L were converted to mg / gm fresh leaves according to **Wettstein (1957)** as follow:

Concentration of any pigment content as mg/gm = C x V /W x 1000

Where: C= Concentration of any pigment content as mg/L., V=The volume of extraction, W= The fresh weight of used leaf sample.

**** Statistical analysis**

All studied data were statistically analyzed according to the procedures outlined by **Gomez and Gomez, (1984)**; and the treatments mean were compared by least significant range LSR according to **Duncan, 1955**.

RESLTUS AND DISCUSSION

Part I: - Effect of weed competition treatments on weeds, yield and yield components of onion transplant.

Weed diagnosis and assessment show that annual predominated weed species in the experimental fields in both seasons were *Portulaca oleracaea* L.; *Beta vulgaris* L.; *Rumex dentatus* L. and *Sonchus oleraceus* L.; as annual broad-leaved weeds and *Phalaris minor* L. and *Echinochloa colonum* L. as annual grassy weeds.

a - <u>On weeds:</u>

Data in table (2) show that weed infestation rate in unweeded check was heavy s and reached to 9.9 and 10.4 ton fresh weight / fad. for mixture of weed species which represented by (84 and 16% broad leaf and grassy weeds ,respectively) ,which caused reduction in yield of onion transplant by 80 and 75.9% in 2010 and 2011 seasons, respectively table (3).

Table (2): Effect of weed competition methods on fresh weight of grassy weeds, broad weeds and total annual weeds (g./m^2) at harvest during 2010 and 2011 seasons.

Weed removal period	Broad leaved weeds (g/m^2)	Grassy weeds (g/m^2)	Total (g/m^2)
	2010 season		
Weed free for 2 WFS	1700.0b	230.0b	1930.0b
Weed free for 4 WFS	800.0c	98.0c	898.0c
Weed free for 6 WFS	250.0d	35.0bd	285.0d
Weed free for 8 WFS	150.0f	23.0e	173.0f
Weed free for 10 WFS	145.0fg	21.0e	166.0fg
Weed free for 12 WFS	130.0fg	19.0ef	149.0gh
Weed free for the whole season	100.0g	11.0f	111.0i
Weed competition for 2 WFS	110.0fg	22.0e	132.0h
Weed competition for 4 WFS	155.0f	25.0e	180.0f
Weed competition for 6 WFS	200.0e	35.0bd	235.0e
Weed competition for 8 WFS	261.0d	40.0bd	301.0d
Weed competition for 10 WFS	254.0d	41.0d	295.0d
Weed competition for 12 WFS	250.0d	42.0bd	292.0d
Weed competition for whole season	2010.0a	339.0a	2349.0a
	2011 season		
Weed free for 2 WFS	1850.0b	225.0b	2075b
Weed free for 4 WFS	910.0c	80.0c	990.0c
Weed free for 6 WFS	260.0d	42.5d	302.5d
Weed free for 8 WFS	155.1ef	26.0e	181.1ef
Weed free for 10 WFS	140.0fg	20.0ef	160.0f-h
Weed free for 12 WFS	125.0f-h	16.1ef	141.1g-i
Weed free for the whole season	99.0h	10.0f	109.0i
Weed competition for 2 WFS	109.0gh	15.0ef	124.0hi
Weed competition for 4 WFS	150.0ef	20.0ef	170.0fg
Weed competition for 6 WFS	185.0e	25.0e	210.0e
Weed competition for 8 WFS	235.0d	41.0d	276.0d
Weed competition for 10 w WFS	263.0d	40.0d	303.0d
Weed competition for 12 WFS	260.0d	50.0d	310.0d
Weed competition for the whole season	2035.0a	440.0a	2475.0a

Thus, the previous level of weed infestation can be considered very suitable for estimating the critical period of weed competition to onion nursery. Furthermore, increasing intervals of weed removal resulted in gradual decrease in the weight of the remaining weeds until the twelve weeks while the weed free for the whole season gave the highest reduction values.

b - <u>On onion transplant yield and its components</u>

Table (3) show that the effect of weed free or weed competition durations period on length, number of leaves, transplanting thickness, and dry matter accumulation %, weight of onion transplanting yield were statistically significant at 5% level. These results were true in 2010 and 2011 seasons. These characters tended to increase gradually with increasing weed – free durations. The length of transplant,

number of leaves/ plant, seedling sickness (cm), weight of transplant, dry matter accumulation %, and onion transplant yield (t/fad.) increased by 47.2,59.3, 128.6, 225.7, 201.4 and 400% than weed competition for whole season in 2010 season and 46.7, 60.1, 169.7, 217.2, 163.9 and 311.6% than weed competition for the whole season in 2011 season, respectively.

Table (3): Effect of weed competition durations on growth and onion transplant yield ton/fad. during 2010 and 2011 seasons.

Characteristics / Weed removal period	length of transplant (cm)	No. of leaves/plant	Transplanting thickness (cm)	Fresh weight of transplant (g/transpl)	% of dry matter	Fresh yield of onion trasplant (ton/fad)
2010 season						
Weed free for 2 weeks	37.6h	3.49f	0.41j	8.5j	10.4j	5.60i
Weed free for 4 weeks	41.0f	3.73e	0.51g	12.0f	14.2h	8.42g
Weed free for 6 weeks	45.0d	4.05d	0.62e	15.3d	18.0f	11.76f
Weed free for 8 weeks	47.3c	4.28c	0.71d	17.6c	19.5e	14.00d
Weed free for 10 weeks	48.8b	4.55b	0.76c	19.0b	20.3d	15.35c
Weed free for 12 weeks	49.0b	4.63ab	0.78b	19.6a	20.9b	16.24b
Weed free for the whole season	49.9a	4.78a	0.80a	19.9a	21.4a	16.80a
Weed competition for 2 weeks	46.6c	4.60b	0.79ab	19.0b	20.6c	16.24b
Weed competition for 4 weeks	43.8e	4.05d	0.60f	14.5e	17.2g	12.32e
Weed competition for 6 weeks	40.0g	3.50f	0.49h	11.6g	13.5i	7.84h
Weed competition for 8 weeks	38.3h	3.30g	0.43i	9.3h	10.4j	5.50i
Weed competition for 10 weeks	36.2i	3.10h	0.40j	7.9j	8.5k	4.23j
Weed competition for 12 weeks	34.0j	3.00h	0.36k	6.8k	7.4l	3.66k
Weed competition for the whole season	33.9j	3.00h	0.35k	6.1l	7.1m	3.36k
2011 season						
Weed free for 2 weeks	36.4i	3.50fg	0.40i	8.1k	10.6j	6.16f
Weed free for 4 weeks	42.0f	3.80e	0.53f	11.8h	13.9h	8.43e
Weed free for 6 weeks	46.0d	4.10d	0.64e	15.0f	16.7f	12.00d
Weed free for 8 weeks	48.0b	4.39c	0.73d	16.9e	19.8d	14.56c
Weed free for 10 weeks	48.6a	4.66ab	0.77c	18.2c	20.9c	15.68b
Weed free for 12 weeks	48.9a	4.75ab	0.79b	18.6b	21.4b	16.80a
Weed free for the whole season	49.0a	4.80a	0.81a	19.0a	21.9a	17.08a
Weed competition for 2 weeks	47.0c	4.59b	0.78bc	17.7d	20.8c	16.73a
Weed competition for 4 weeks	44.0e	4.10d	0.63e	14.5g	17.0e	12.43d
Weed competition for 6 weeks	41.0g	3.63ef	0.50g	11.3i	14.1g	8.74e
Weed competition for 8 weeks	38.9h	3.41gh	0.42h	8.4j	11.4i	5.60g
Weed competition for 10 weeks	35.1j	3.29h	0.38j	7.0l	9.5k	4.84h
Weed competition for 12 weeks	33.6k	3.05i	0.33k	6.3m	8.7l	4.21i
Weed competition for the whole season	33.4k	3.00i	0.30l	5.99n	8.3m	4.12i

Weed infestation for the whole season decreased onion transplant yield by 80.0 and 77.88% than weed free for whole season under level of weed infestation with corresponding values by 2349.0 and 2475.0 g/m^2 fresh weight of weeds, in 2010 and 2011 seasons, respectively. These results indicate clearly that onion transplant quality and yield/faddan improved with elimination of weeds in onion nursery and need to be clean from weeds allover the season. These results confirmed the results which obtained by **Bond and Burston (1996), Mekky *et al* (2005)** and **Qasem (2005)** that weeds cause severe yield reduction of onion.

c – Correlation studies between studded traits: -

Tables (4) show that the correlation coefficients between weed competition or weed removal period, fresh weight of total weeds (g/m^2), onion transplant yields and its components during 2010 and 2011 experiments.

Table (4): Correlation between period, fresh weight of total weeds, yield and yield components under weed free and weed competition duration in 2010 and 2011 seasons.

Characters	Period	Wt. of total weeds	L. of trans	No. of L./pl.	Transplanting thickness (cm),	Wt. of trans.	DM%
2010 season weed free							
Fresh W. of Total weeds (g/m^2)	- 0.883						
Length of transplant (cm).	0.964	- 0.953					
Number of leaves/transplant (No. L/Pl.)	0.953	- 0.903	0.965				
Transplanting thickness (cm),	0.981	- 0.925	0.984	0.954			
Fresh W. of trans. (g) (W. of trans.)	0.979	- 0.943	0.991	0.962	0.995		
% of dry matter (%DM)	0.958	- 0.973	0.992	0.957	0.983	0.992	
Yield of transplant, t/fad,	0.982	- 0.930	0.984	0.956	0.992	0.995	0.986
2010 season weed competition							
Fresh W. of Total weeds (g/m^2)	0.929						
Length of transplant (cm).	- 0.989	- 0.950					
Number of leaves/transplant (No. L/Pl.)	- 0.962	- 0.951	0.974				
Transplanting thickness (cm),	- 0.960	- 0.935	0.972	0.988			
Fresh W. of trans. (g) (W. of trans.)	- 0.979	- 0.939	0.982	0.984	0.994		
% of dry matter (%DM)	- 0.987	- 0.937	0.982	0.980	0.982	0.993	
Yield of transplant, t/fad,	- 0.970	- 0.939	0.977	0.988	0.991	0.994	0.993
2011 season weed free							
Fresh W. of Total weeds (g/m^2)	- 0.822						
Length of transplant (cm).	0.945	- 0.911					
Number of leaves/transplant (No. L/Pl.)	0.965	- 0.854	0.959				
Transplanting thickness (cm),	0.972	- 0.889	0.989	0.972			
Fresh W. of trans. (g) (W. of trans.)	0.973	- 0.881	0.992	0.974	0.996		
% of dry matter (%DM)	0.980	- 0.869	0.985	0.975	0.996	0.996	
Yield of transplant, t/fad,	0.981	- 0.845	0.975	0.969	0.987	0.987	0.992
2011 season weed competition							
Fresh W. of Total weeds (g/m^2)	0.917						
Length of transplant (cm).	- 0.994	- 0.914					
Number of leaves/transplant (No. L/Pl.)	- 0.951	- 0.878	0.954				
Transplanting thickness (cm),	- 0.978	- 0.895	0.977	0.956			
Fresh W. of trans. (g) (W. of trans.)	- 0.984	- 0.912	0.894	0.957	0.995		
% of dry matter (%DM)	- 0.987	- 0.908	0.987	0.957	0.995	0.999	
Yield of transplant, t/fad,	- 0.960	- 0.890	0.963	0.949	0.993	0.994	0.992

****Note : Correlation coefficient in all studied pairs of characters are statistically significant at 1% level.**

Correlation coefficient between these characters is highly significant at 1% level. There are negative correlation coefficients between weed competition period and all yield and yield components in 2010 and 2011seasons. These results are logic because of prolonged period of weed competition for onion transplant on light and depletion in macro nutrients uptake, meanwhile onion transplants length tended to increase plant shading by heavy weed infestation.

Concerning the correlation coefficients between weed free period of weeds and onion transplant as yields and its components was positive due to the improvement of onion growth and elimination of weed competition to onion plants.

On the other hand, the correlation coefficient between fresh weight of total weeds (g/m^2) and different characters of onion transplant yield and its components was negative explaining that onion transplant yield of nursery is very week competitor crop for weeds. Similar results were obtained by **Bond and Burston (1996), Qasem and Mekky *et al* (2005)**, and vice versa the correlation coefficients between onion yield of nursery and its components was positive, meaning that the onion yield depend mainly onion transplant characters.

d – Estimation the critical period (CP) for weed competition in onion nursery fields.

According Cousen (1991) there are two approaches to determine the critical period of weed competition to any crop: -

1 – Biological approach (classical). 2 – Regression approach

1 – Classical (Biological) approach: -

Figure [1] show clearly that the critical period of weed competition to onion nursery started after two weeks and ended at ten weeks from sowing. These results are true in both seasons. Obviously, the more of delay weed removal will be causing more decrease in onion transplanting yield due to weed/onion transplant competition seriously affect on yield of transplant onion .That may be due to the slow growth of onion transplant in the first stages and gave poor vegetative growth in one side, beside the weeds are growth faster than onion transplant in other side. Evidently, weed free maintenance for 2 to 10 weeks from sowing is required for good yield. **Norsworthy *et al* (2007)** mentioned that, green seeded onion need an extended period of effective weed management is necessary because the crop is direct seeded and is slow growing with an open canopy.

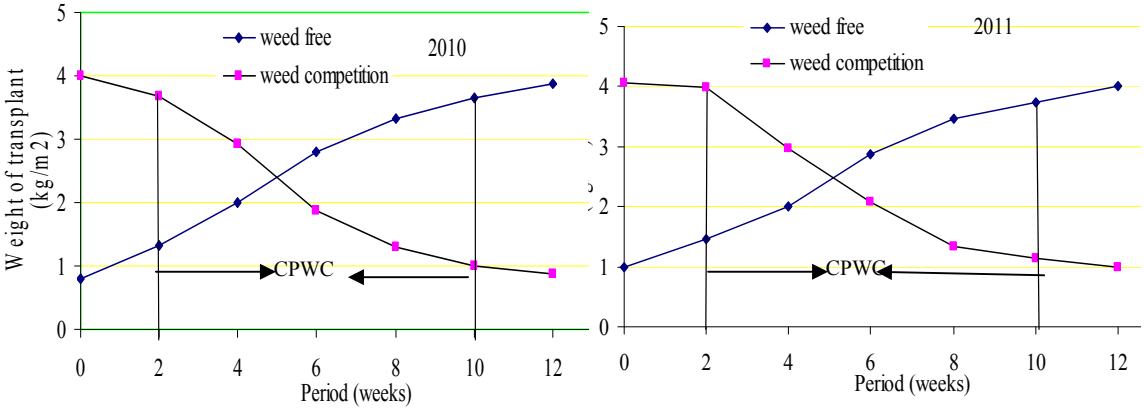

Fig (1). The critical period of weed competition for onion nursery yield 2010 and 2011 seasons.

2– Regression approach (mathematical models): -

In this approach, three mathematical models; being, linear, quadratic, and logistic models were tested as shown in Fig (2 and 3) and Table (5), show the relationship between onion transplant yield as kg/m^2 and the period of weed removal or weed competition. It was a clear that the suitable model which fitted for prediction yield losses or increases in onion nursery quadratic equation because the correlation coefficient (R^2) was greater than linear or logistic models and standard estimate error (SE) were more smaller than they those of the mentioned models in the two seasons. The respective values of R^2 and SE for quadratic model were 0.986 and 0.104 for weed free period and 0.962 and 0.188 for weed competition duration in 2010 and 0.984 and 0.108 for weed free periods and 0.957 and 0.199 for weed competition duration period in 2011, respectively.

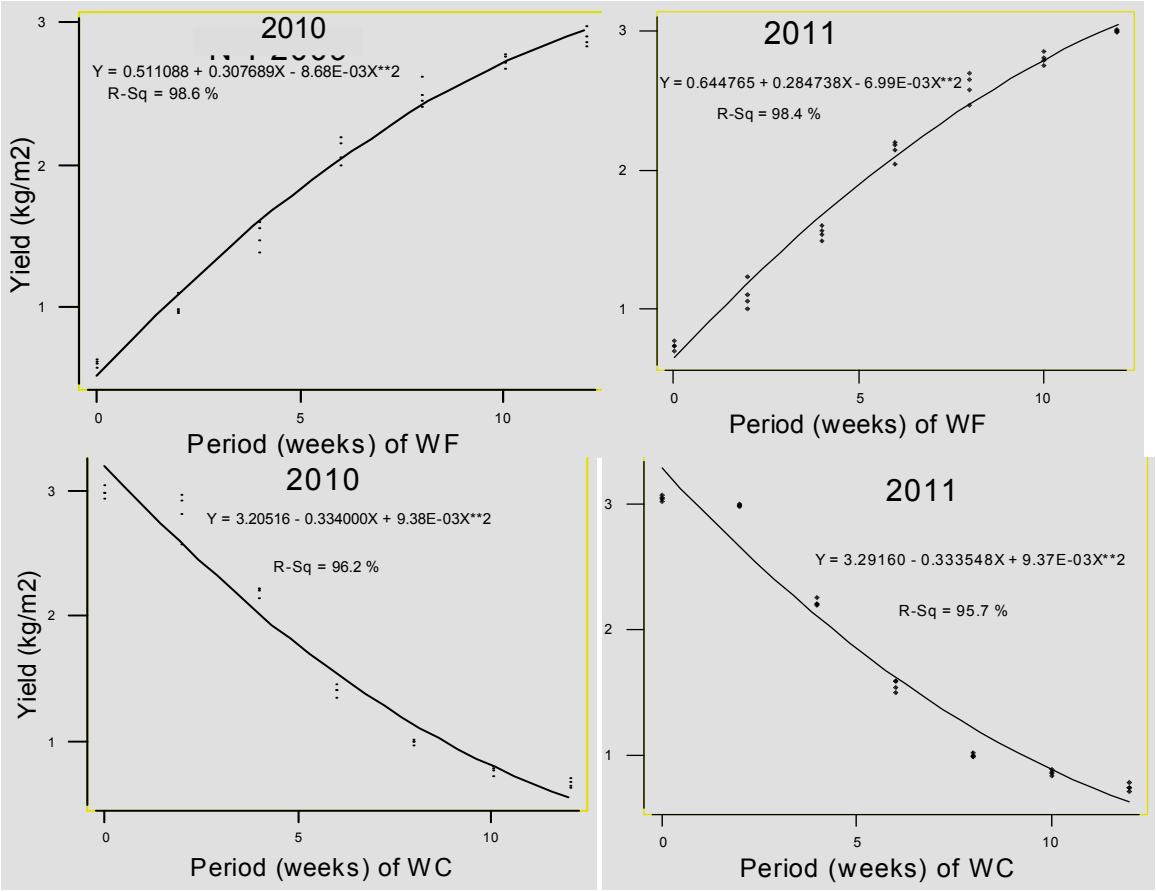

Fig (3). The relationship between duration of weed free and transplant yield (kg/m^2).

On the other hand, the critical period of weed control over all studied agricultural practices according to the recommended allowed losing yield value (10 %) being 9.4 and 9.2 weeks for weed-free and being 3.40 and 3.30 weeks for weed-competition in 2010 and 2011, respectively. Onion transplanting components namely the length, number of leaves, transplanting thickness (cm) and dry matter % were declined linearly with increasing duration the mixture of weed species competition which were sensitive to weed interference and closely resembled the pattern and extent, response to onion transplant yield. **Everman *et al* (2008)** green onion of directed seeded methods is poor do not grow in monocultures of single weed species weed control practitioners should use the critical period of weed mixture competition as guideline for weed control recommendation.

Table (5): Parameters of the three studied models of the effect of weed free or weed competition periods on yield of onion transplants nursery (kg/m^2) in 2010 and 2011 seasons.

Season	Weed competition Weed-free	Models	R^2	SE	Prediction equation	CPWC/ week allowed losing yield (10%)
2010 season	Weed-free	Linear	0.965	0.161	Y=0.685+ 0.203x	9.40
		Logistic	0.653	0.506	Y= ln (1.652) + ln (0.29)x	
		Quadratic	0.986	0.104	$Y= 0.511+ 0.308x - 0.009x^2$	
	Weed competition	Linear	0.942	0.228	Y= 3.017 - 0.221x	3.40
		Logistic	0.950	0.429	Y=ln(0.51) + ln (1.149)x	
		Quadratic	0.962	0.188	$Y=3.205 -0.334x+ 0.009x^2$	
2011 season	Weed-free	Linear	0.97	0.146	Y=0.784+ 0.201x	9.20
		Logistic	0.632	0.513	Y= ln (1.744) + ln (0.281)x	
		Quadratic	0.984	0.108	$Y= 0.644 + 0.285x - 0.007x^2$	
	Weed competition	Linear	0.938	0.237	Y= 3.102-0.221x	3.30
		Logistic	0.564	0.625	Y=ln (2.036) - ln (0.297)x	
		Quadratic	0.957	0.199	$Y=3.289 -0.333x + 0.009x^2$	

Part II: - Effect of weed control treatments on weeds, growth characters, and yield of onion transplanting.

a - On weeds

Results in table (6), show that the dominant weed species were the same as mentioned in the first part of study. All used herbicidal treatments and hand weeding gave significant effect on controlling weeds in 2010 and 2011. Iqupart + Fusilade super, Sencor + Fusilade super and hand weeding treatments gave the highest controlling % of the fresh weight of the annual broad-leaved weeds by 94.4, 91.8 and 91.9 % and (93.4, 91.6 and 91.1% compared to unweeded check in the 2010 and 2011 seasons, respectively. Similar results were obtained by **Hartley (1984) and Kholosy *et al* (1995).**

Whilst the Iqupart + Fusilade super, Starane + Fusilade super and Seconr + Fusilade super gave the highest reduction percentage for grassy weeds which estimated by 96.9, 95.5 and 95.3% and 96.8, 96.3 and 96.3 % compared to unweeded check in 2010 and 2011 seasons, respectively. On the other hand, the use of Stomp at 1.7 L./fad. gave significant results on reducing the fresh weight of broad leaved weeds by 91.0 % in the 2011 only. Many researchers indicated that the effectiveness of Fusilade super on grassy weed control in onion (*Phalaris minor* L. and *Echinochloa colonum* L.), Stomp extra against annual weeds (*Portulaca oleracaea* L.; *Beta vulgaris* L.; *Rumex dentatus* L. and *Sonchus oleraceus* L.), **Sieezka *et al* (1983), Hartley (1984), Pandey *et al* (1991) and Kholosye *et al* (1995)**.

Table (6): Effect of weed control methods on fresh weight of annual weeds (g./m^2) during 2010 and 2011 seasons.

Characteristics / Herbicides (Rate/fad.)	Broad leaved weeds (g/m^2)	Grassy weeds (g/m^2)	Total (g/m^2)
2010season			
Amex at 1.75 % L./fad.	522.0b	88.0b	610.0b
Stomp extra at 1.70 L./fad.	291.0c	46.0c	337.0d
Iqupart at 200 cm^3 /fad. + Fusilade super at 0.5L./fad.	127.0d	16.0d	143.0f
Starane at 150cm/^{3} /fad,.+ Fusilade super at 0.5 L./fad.	503.0b	21.0cd	524.0c
Sencor at 100 g. /fad .+ Fusilade super at 0.5 L./fad.	187.0d	22.0cd	209.0ef
Hand weeding twice	186.0d	55.0c	241.0e
Unweeded	2283.0a	466.0a	2749.0a
2011season			
Amex at 1.75 % L./fad.	449.0b	74.0b	523.0b
Stomp extra at 1.70 L./fad.	272.0c	39.0cd	311.0d
Iqupart at 200 cm^3 /fad. + Fusilade super at 0.5L./fad.	137.0d	14.0d	151.0f
Starane at 150cm/^{3} /fad,.+ Fusilade super at 0.5 L./fad.	439.0b	16.0d	455.0c
Sencor at 100 g. /fad .+ Fusilade super at 0.5 L./fad.	176.0d	16.0d	192.0ef
Hand weeding twice	188.0d	45.0c	233.0e
Unweeded	2105.0a	434.0a	2539.0a

b - <u>On chlorophyll pigment</u>: -

Data in table (7) indicated that chl. a, chl. b and chl. A+b tended to increase in leaf of onion plants than the untreated check in both seasons.

Table (7): Effect of weed control methods on chlorophyll (a and b), total chlorophyll, chlorophyll ratio and caroteinoids during 2010 and 2011 seasons.

Characteristics / Herbicides rate/fad.	Chl. a mg/g	Chl. b mg/g	Total chl. a+b mg/g	Chl. ratio	Caroteinoids
2010 season					
Amex at 1.75 % L./fad.	0.469d	0.117b	0.586e	4.06b	0.045a
Stomp extra at 1.70 L./fad.	0.555b	0.127ab	0.681c	4.39a	0.052a
Iqupart at 200 cm^3 /fad. + Fusilade super at 0.5L./fad.	0.589a	0.135a	0.723a	4.38a	0.058a
Starane at 150cm/^{3} /fad,.+ Fusilade super at 0.5 L./fad.	0.497c	0.121ab	0.618d	4.10b	0.049a
Sencor at 100 g. /fad .+ Fusilade super at 0.5 L./fad.	0.570b	0.132ab	0.701b	4.30a	0.057a
Hand weeding twice	0.507c	0.123ab	0.630d	4.12b	0.051a
Unweeded	0.464d	0.115b	0.579e	4.00b	0.042a
2011 season					
Amex at 1.75 % L./fad.	0.469d	0.117ab	0.586d	4.00d	0.044a
Stomp extra at 1.70 L./fad.	0.557b	0.123ab	0.680b	4.54b	0.050a
Iqupart at 200 cm^3 /fad. + Fusilade super at 0.5L./fad.	0.591a	0.130a	0.721a	4.55b	0.056a
Starane at 150cm/^{3} /fad,.+ Fusilade super at 0.5 L./fad.	0.495c	0.120ab	0.615c	4.11c	0.048a
Sencor at 100 g. /fad .+ Fusilade super at 0.5 L./fad.	0.571b	0.124ab	0.694b	4.62a	0.054a
Hand weeding twice	0.505c	0.122ab	0.628c	4.13c	0.050a
Unweeded	0.460d	0.110b	0.571e	4.18c	0.041a

Iquopart + Fusilade super exceeded significant at 5% level in both 2010 & 2011 seasons. They increased chl. a and chl. b and total chlorophyll 0.589, 0.135 and 0.723 in 2010 season and 0.591,0.130 and 0.721 in the second season. These increments are due to the decrease of weed competition and no phytoxicity in

chlorophyll pigment apparatus because there is no differences in chlorophyll ratio or carotenoid contents.

c – **On onion yield and transplant quality: -**

Results in table (8) showed that the controlling weed % in both seasons caused increases in yields and its transplant quality. The highest increasing percentage of onion transplanting yield was obtained by Iqupart + Fusilade super at (51 and 48 %) compared to un-weeded control in both seasons, respectively. On the other hand, Amex at1.75 l/fad. gave the lowest significant increasing yield of onion transplants ton/fad. by 32.4 and 31.1 % in 2010 and 2011, respectively. Actually, the same trend of the above findings was observed with significant effect on onion transplants characters i.e., length of onion transplants, no. of leaves, thickness (cm) and weight (g.) and dry matter %. These results were true in both seasons, **Elakkad (1983)** illustrated that increase weed infestation can reduce photosynthetically radiation available to leaves and deplete available soil nitrogen obtained by maize plants.

Table (8): Effect of weed control methods on yield ton/fad and its quality of onion transplanting during 2010 and 2011 seasons.

Characteristics / Herbicides rats/fad.	Length of onion transplant (cm.)	No. of leaves /transplant	transplanting thickness (cm)	Weight of bulb transplant (g.)	Dry matter %	Green yield of transplanting (ton/fad.)
2010 season						
Amex at 1.75 % L./fad.	40.00d	3.93d	0.58e	10.63d	10.30d	9.33d
Stomp extra at 1.70 L./fad.	44.36c	4.20bc	0.67c	11.88bc	15.38b	11.57b
Iqupart at 200 cm^3 /fad. + Fusilade super at 0.5L./fad.	47.31ab	4.49a	0.73a	13.49a	17.04a	12.74a
Starane at 150$cm/^3$ /fad,.+ Fusilade super at 0.5 L./fad.	41.01d	3.98d	0.58e	10.78d	10.42d	10.10c
Sencor at 100 g./fad .+ Fusilade super at 0.5 L./fad.	45.95bc	4.33ab	0.68b	12.28b	10.69b	11.77b
Hand weeding twice	41.99d	4.05cd	0.61d	11.10cd	12.16c	11.51b
Unweeded	48.15a	3.20e	0.37f	5.81e	6.82e	6.30e
2011 season						
Amex at 1.75 % L./fad.	40.95e	4.00d	0.50e	10.84e	11.22e	9.86e
Stomp extra at 1.70 L./fad.	43.50cd	4.40bc	0.60c	12.15c	15.71c	11.95bc
Iqupart at 200 cm^3 /fad. + Fusilade super at 0.5L./fad.	46.13ab	4.68a	0.71a	13.98a	18.09a	12.95a
Starane at 150$cm/^3$ /fad,.+ Fusilade super at 0.5 L./fad.	41.50de	4.18cd	0.54d	11.41de	11.64e	10.68d
Sencor at 100 g./fad .+ Fusilade super at 0.5 L./fad.	45.40bc	4.58ab	0.66b	13.20b	16.74b	12.43ab
Hand weeding twice	43.47cd	4.28c	0.58c	12.09cd	13.43d	11.79c
Unweeded	48.10a	3.50e	0.36f	5.86f	6.84f	6.79f

CONCLUSION

Results of this work suggest that onion nursery is very sensitive to weed competition allovers its growing season and need to control weeds through the critical period between 2 – 10 weeks from sowing. Until now there is no herbicide available for weed control in onion nursery. So use Amex, Stomp extra as dinitroanilines, Starane, Sencor, Iqupart and Fusilade super can be advised recommended to solve broad leaved and grassy weeds problems through the mentioned critical period of weed competition in onion nursery fields without any phytotoxicity.

REFERENCES

Abdul Ghafoor; S.; G. Hassan; K. Waseem and, M. A. Nadeem (2000). Growth response of onion transplants against various durations of weed competition sown by different planting methods. Sarhad J. of Agric, 16:489-495.

Babiker, A. G. and M. K. Ahmed (1986). Chemical weed control in transplanted onion (*Allium cepa*, L.) in Sudan Gezira. Weed Res., 26: 133-37.

Bond, W. and S., Burston (1996). Timing the removal of weeds from drilled salad onion to prevent crop losses. Crop Prot. 15:205-211.

Cousen, R. (1991) Aspects of the design and interpretation of competition (interference) experiments. Weed Techn. 5:664 – 673.

Dunan,C.M.;P.Westra;E.E.Schweizer;D.Lybecker and F.D.Moor (1995). The concept and applicationof early economic period threshold :the case of DCPA in onion (*Allium cepa)*.Weed Sci.43:634–639.

Duncan, B. D. (1955). Multiple test range and multiple F tests. Biometrics. 11-142.

Elakkad, M. A. (1983) Environmental stresses induced by natural weed infestation and their effects on corn and soybean. Ph. D. Thesis Univ. Minnesota, 159 pp.

Evans, S. P.; S. Z. Knezevic; J. L.; Lindquist; C. A. Shapiro and E. E. Blankenship (2003). Nitrogen application influences the critical period for weed control in corn. Weed Sci. 51: 408-417.

Everman, W. I.; S. B. Clewis; W. E. Thomas; I. Burk and W. J. Wilcut (2008) Critical period of weed interference in peanut. Weed Techn., 22:63-67.

Ghosheh, H. Z. (2004). Single herbicide treatments for control of broadleaved weeds in onion (*Allium cepa*). Crop Protect. 23: 539-42.

Gomez, K. A. and A. A. Gomez (1984). Statistical procedures for agricultural research . John Wiley & Sons, Inc. New York, USA.

Hall, M. R.; C. J. Swanton and G. W. Anderson (1992). The critical period of weed control in grain corn (*Zea mays*). Weed Sci. 40: 441-447.

Hartley, M. J. (1984). Selective grass weed control. Hort. Res. Sta., MAF, Hastongs, New Zealand, p: 183-86.

Kartofel, I. O. (1991). An alternative variant in weed control. Kartofel-i-ovoschchi, 2: 44-45. (CAB Abst. No. 19922318015).

Kholosy, A.S.; A. El-Abdoh and H.M., Ibrahim (1995) Investigation into weed control in onion nursery. J. Agric. Sci. Mansoura Univ, 20: 4527 – 4535.

Khurana, S. C.; O. Kallo; M. L. Pandita and C. B. Singh (1987). Herbicidal control of weeds in onion nursery. Haryana J. Hort. Sci., 16: 130-33.

Knezevic, S. Z.; S. P. Evans; E. E. Blankenship; R. C. Van Acker and J. L. Lindquist (2002). Critical periods for weed control: the concept and data analysis. Weed Sci. 50: 773-786.

Knezevic, S. Z.; S. P. Evans and M. Mainz (2003). Row spacing influences the critical timing for weed removal in soybean (*Glycine max*). Weed Technol. 17: 666-673.

Mekky, M.S., A. A. Atia and M. F. I. Daie, 2005. Three approches for estmation critical period in onion crop. Egypt. J. of Appl. Sci., 20: 474-489.

Neter, J.; W. Wasserman and M. H. Kunter (1990). Applied linear statistical models3rd ed., IRWIN, Homewood, Boston, U.S.A.

Norsworthy, J. K. and M. J. Oliverira (2004). Comparison of the critical period for weed control in wide and narrow row corn. Weed Sci. 52: 802-807.

Norsworthy, J. K.; J.P. Smith and C. Meister (2007). Tolerance of direct-seeded green onion to herbicides applied before or after crop emergence. Weed Techn. 21:119-123.

Pandey, U.B.; D.K. Singh; J.B. Singh; J.P.N. Pandey and K.P. S. Chouhan (1991). Studies on weed control in onion. Nwesletter. Associated Agricultural Development Foundation; 11 : 4, 2-3.

Qasem, J.R. (2005). Chemical control of weeds in onion (*Allium cepa* L.). J. Hort. Sci. and Biotechnol. 80: 721-26.

Qasem, J.R. (2006). Chemical weed control in seedbed sown onion (*Allium cepa* L.). Crop protect. 25: 618-22.

Robbelen, G. (1957). Untersuchngen an strahlen induzierten Blattarbumutanten Von Arabidopsis Thaliana L. Vere bungslehre 88:189 (Eng. Summary).

Sharma, S. P.; G. S. Buttar; S. Sudeep and D. S. Khurana (2009). Comparative efficacy of pendimethalin and oxyflourfen for controlling weeds in onion nursery. Indian Journal of weed Science; 41: 76-79.

Sieczka, J. B.; J. F. Creighton and W. J. Sanok (1983). Results of onion weed control experiments on mineral soil long Island. Dept. of vegetable crops, Cornell Univ. USA, Proc. of the 37th Ann. Meet of the Northeastern Weed Sci., p: 174-177.

Wettstein, D. (1957). Chlorophyll – Lettal under rubnink. Roskopishe Formivechrel der phasliden Exptl. Cell. Kest, 12: 427-433.

Wilde, S.A.; R.B.,Corey; J.G.L., Yer and G.K., Voigt (1985). Soil and plant analysis for tree culture. Oxford and IBH Publishing Co., New Delhi India.

Zimdahl, R. L. (1988). The concept and application of the critical weed free period. In Altieri, M.A & Liebmann, M., eds. Weed Management in Agroeco system: Ecological Aproaches . PP 145 -155 CRS Press. Boca Roton . Florida ,USA.

الملخص العربي

منافسة مجتمعات الحشائش وبعض طرق مكافحتها في حقول مشاتل البصل

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المعمل المركزي لبحوث الحشائش – مركز البحوث الزراعية.

أقيمت أربعة تجارب حقلية بمحطة بحوث سدس بمحافظة بني سويف مصر العليا – مركز البجوث الزراعية خلال الموسمين الشتويين 2010 و 2011 لدراسة تأثير أربعة عشر معاملة (سبعة فترات لمنافسة الحشائش) تحت ظروف الكثافة الطبيعية للحشائش بأرض التجربة، سبعة فترات من إزالة الحشائش) مدة الفترة إسبوعين تبدأ بعد الأسبوع الثاني من الزراعة لتحديد الفترة التي يجب مكافحة الحشائش بالمشتل (الفترة الحرجة لمنافسة الحشائش لشتلات البصل) علي الحشائش ومحصول مشتل البصل ومكوناته وكذا دراسة كفاءة بعض مبيدات الحشائش منفردة أو توليفة من مبيدين (أميكس بمعدل 1.75 لتر/ف – ستومب أكسترا بمعدل 1.7 لتر/ف – ستارين بمعدل 150 سم3/ف + فيوزيليد سوبر بمعدل 0.5 لتر/ف – سنكور بمعدل 100 جم/ف + فيوزيليد سوبر بمعدل 0.5 لتر/ف – إيكوبارت بمعدل 200 سم3/ف + فيوزيليد سوبر بمعدل 0.5 لتر/ف) مقارنة بمعاملات النقاوة اليدوية مرتين – بدون مكافحة (كنترول) لمكافحة الحشائش الحولية المصاحبة لمشتل البصل. وأثر ذلك علي المحصول ومكوناته لشتلات البصل. أوضحت النتائج أن كثافة الحشائش في أرض المشتل المقامة به التجارب قدرت بحوالي 2.4 ، 2.5 كجم/م2 والتي قد أحدثت نقص في محصول الشتلات بنسبة 80 ، 75.9% في موسمي 2010 ، 2011 علي التوالي عند ترك هذه الكثافة لمنافسة الشتلات طوال الموسم مقارنة بمعاملات أزالة الحشائش طوال الموسم (مشتل خالي من الحشائش). أوضحت دراسة النماذج الرياضة التي تحكم العلاقة بين فترات الإزالة والمنافسة ومحصول مشتل البصل بإستخدام نماذج لمعادلات من الدرجة الأولى والثانية والثالثة أن أنسب النماذج لتقدير النقص أو الزيادة في محصول الشتلات هي معادلات الدرجة الثانية حيث أنها كانت أعلي في معاملات الإرتباط (0.986، 0.962) مع فترات الإزالة WF و (0.984، 0.957) مع فترات المنافسة WC وأقل في الإنحراف القياسي في الموسمين 2010 ، 2011 مقارنة بالنموذجين الآخرين كما أوضح تطبيق النموذج الكلاسيكى في تحليل البيانات وحساب الفترة الحرجة أن الفترة الحرجة لمنافسة الحشائش لمشتل البصل كانت محصورة ما بين 2–10 أسابيع وهي تقارب طوال فترة حياة الشتلات بالمشتل لذا يجب التخلص من الحشائش في حقول مشاتل البصل وترك نباتات البصل خالية من الحشائش طول فترة حياة المشتل لشدة ضعف منافسته للحشائش.

وكان أفضل المعاملات لمكافحة الحشائش تحت ظروف التجربة هو إستخدام مبيد إيكوبارت بمعدل 200 سم3/ف + فيوزيليد سوبر بمعدل 0.5 لتر/ف حيث أعطت أقل وزن غض للحشائش العريضة وضيقة الأوراق ومجموعهما دون حدوث أي ضرر لصبغات البناء الضوئي ونمو شتلات البصل مصحوبة بزيادة في صفات نمو ومحصول شتلات البصل تحت الدراسة.