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Residual Effect of Used Herbicides in Sweet Potatoes on Some Succeeding Vegetables Crops Establishment and Associated Weeds.

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ABSTRACT

Little information is known about residual effects of herbicides which use in crop rotations crops and succeeded crops especially vegetable crops grown in these rotations. For this reason two field experiments were conducted in clay soil at EL-Serw Agricultural Research Station, Agricultural Research Center, Damietta Governorate during 2012/13 and 2013/14 winter seasons to study the effect of previous herbicides in non-disturbed soil in experimental plots after harvest of sweet potatoes with removing thrones its and their associated weeds. Herbicides used in the preceding crops during 2012 and 2013 summer seasons being Gesagard 50% SC(prometryn) at 1.0L /faddan, Harness 84% EC(acetochlor) at 1.0L /faddan, Stomp45.5% CS(pendimethalin) at 1.0L /faddan, Sencor 60% SC(metribuzin) at 0.3 L/faddan and added post–emergence herbicides i.e., Select super 12.5%EC(clethodim) at 0.5L /faddan and Fusilade fortey15% EC(fluzifop-p-butyl) at 1.0L /faddan treatments on the establishments of succeeding vegetable crops and weed growth associated in onion, pea, snap beans, cucumber, squash, snake melon and cowpea. The main findings of study show big variation in the residual effects of herbicides which applied in sweet potatoes fields varied from one succeeding vegetable crops establishments to another. For example, onion plant stand at 30 days from sowing can tolerate the residual effects of Gesagard 50% SC + Select super 12.5%EC, Harness 84% EC and Stomp45.5% CS. Squash stand can tolerate the residual effects of Stomp45.5% CS and Harness 84% EC. Cucumber stand can tolerate residual effect of Stomp 45.5% CS, snake melon stand can tolerate the residual effects of Stomp 45.5% CS and Harness 84% EC . Pea can tolerate to somewhat Stomp45.5% CS residues in soil on contrary with both snap beans or cowpea stands had effected drastically and considered very sensitive to residual effects of herbicides in soil previously treated with such herbicides. Concerning the effect of previous herbicides applied in sweet potatoes were poorer with no effects on weeds associated with succeeding vegetable during 2013/2014 season. Thus soils treated in crop rotations with herbicides showed be degraded before growing any succeeding vegetable crops by blowing 2-3 times before planting these crops. Depending on this study more attention towards any determination effects of herbicide residues on environment before herbicide registration by bioassay tests or chemicals.

Keywords: Herbicides – Germination of vegetable – Soil –applied herbicides-early post-emergence- Residual effects-Tolerate.

INTRODUCTION

In Egypt, crops usually grown in crop rotations which include two or three crops and sweet potatoes as vegetable crop usually grown among these rotations. There is no herbicides were registered in this crop. Attempts were carried out to find some selective herbicides to control weeds in such crop without residuals effects on succeeding vegetable crops, Gesagard50%SC, Harness 84% EC, Stomp 45.5% CS, Sencor 60% SC, Select super 12.5% EC and Fusilade fortey 15%EC tested in this crop, but, the persistence of these herbicides and their residual effect in soil and following crop are unknown and varied from one herbicide to another and some problems face many farmers as low percentage of germination and growth of seedlings of some cultivated vegetable crops following to this crops.

Moursi *et al.*(1979) mentioned that some herbicides cause harmful effects on sensitive succeeding crops, particularly under the conditions of crops rotation in Egypt where two or three field crops are grown successfully in one year. Soil acting herbicides such as acetochlor at 1.0 L/ faddan is used as pre-plant to control annual weeds in maize (Herbicide Handbook,1994). William(1994) mentioned that dinitroaniline compounds as pendimethalin can be used as pre emergence herbicide to control most annual grassy and some annual broadleaf weeds this herbicide classified as cell growth disrupters and inhibit root and or shoot growth of emerging seedling, (Thomas *et al*., 2002). The same author, mentioned also that clethodim used in controlling emerged annual and perennial grasses in a wide variety of crops, and fluzifop-p-butyl for selective post emergent control of annual and perennial grasses.

Concerning the effect of such herbicides in soil were mentioned as prometryn is moderately persistence in the soil, with a field half-life of 1 to 3 months, (USEPA,1996)and EWG ,2010). Acetochlor (Harness 84% EC) is adsorbed by soil colloids and leaches very little. Although, acetochlor is not expected to leach through most agricultural soils, there is a potential for limited groundwater contamination in areas of highly permeable soils, EFSA,(2011). Pendimethalin is a moderately persistent herbicide that can give rise to long lasting metabolites, mainly through photo degradation, and metabolites bind tightly to soil particles and the leaching potential is negligible. It is lost through photo degradation, biodegradation and volatilization. Half-life in soil range from 30 to 450 days with a recommended average half-life of 90 days. Little is known about its more polar degradation products,(USEPA, 1997). USEPA, (1999), states pendimethalin and its 3,5-dinitrobenzyl alcohol metabolite (CL202347) are the only residues of concern. Half-life in water without sediment is about 7 – 30 days. The water solubility at pH 7 is 0.3 mg/L, and the sorption coefficient is 5000 mL/g, (USEPA, 1999). Metribuzin also adsorbs moderately to soil with high clay and /or organic matter content; adsorption decreases as soil ph increases (WSSA, 1983, cited in Health Canada, 1986). Microbial degradation is the principal route of removal of metribuzin from the soil (Health Canada 1986). It has a

mobility (as Koc) of 60, which indicates that it is weakly adsorbed to organic soil and therefore has the potential to migrate through soil to reach groundwater. Once in groundwater, metribuzin is expected to persist due to its stability to hydrolysis and the lack of light penetration. Conversely, residues of metribuzin are not likely to persist in clear, well-mixed, shallow surface water with good light penetration since parent metribuzin degrades rapidly by aqueous photolysis (USEPA 1998). Clethodim is low persistence in most soils with a reported half-life of approximately 3 days. Breakdown is mainly by aerobic processes, although photolysis may make some contribution. Volatilization loss and hydrolysis are probably not important processes in the soil breakdown of Select super 12.5% EC, (JMPR, 1999). Fluazifop-p-butyl is of low persistence in moist soil environments, with a reported half-life in these conditions of less than 1 week, breaking down rapidly to the acid (fluazifop-p), which has fairly low persistence. Fluazifop-p is then hydrolyses to 5-trifluoromethylpyrid-2-one, and 2-(4-hydroxyphenoxy)propionic acid, both of which are further degraded, ultimately to CO2, (USEPA, 2005).

The aim of this investigation aims to study the residual effect of some used herbicides in sweet potatoes that belong to different chemical groups on germination and establishment of some succeeding vegetable crops which used in the previous sweet potatoes with herbicides used as, Gesagard50%SC, Harness 84% EC, Stomp 45.5% CS, Sencor 60%WP, Select super 12.5% EC and Fusilade fortey 15%EC and their combinations on, onion, pea, snap beans, cucumber, squash, snake melon and cowpea and associated weeds, which used in weed potatoes preceding crops on weeds and establishment of succeeding vegetable subsequent crops.

MATERIALS AND METHODS

Two field experiments were conducted during 2012/13 and 2013/14 winter seasons at EL-Serw Agricultural Research Station, Damietta Governorate Agric. Res. Center, Egypt. The main soil characteristic in heavy clay, soil mechanical composition is shown in Table1, and chemical analysis according to Piper (1950).

Table1: Physical and chemical properties of the soil samples during 2012/13and 2013/14 seasons.

Seasons	Soil Depth cm.	Particle size distribution				Texture Class	O.M. %	Caco3 %	PH (1:2.5) Suspension
		Coarse sand%	Fine Sand%	Silt %	Clay %				
2012/13	0-30	1.74	13.36	21.72	63.60	Clayey	1.22	2.34	7.8
2013/14	0-30	1.67	13.32	21.79	63.17	Clayey	1.23	2.32	7.4

Each experiments of sweet potatoes included fourteen treatments which previously arranged in randomized complete block design with four replicates. The object of this study is to evaluate the effect of previous herbicides applied in sweet potatoes experiments during 2012 and 2013 summer seasons which were as follow:

1- Gesagard50%SC(prometryn) applied at the rate of 1.0 L /faddan pre sweet potatoes transplanting.
2- Harness 84% EC(acetochlor) at the rate of 1.0 L /faddan applied pre sweet potatoes transplanting.
3- Stomp 45.5% CS (pendimethalin) at the rate of 1.0 L /faddan applied pre sweet potatoes transplanting.
4- Sencor 60% SC(metribuzin) at the rate of 0.3 L /faddan applied pre sweet potatoes transplanting.
5- Gesagard50%SC at the rate of 1.0 L /faddan applied pre sweet potatoes transplanting followed by, Select super 12.5% EC(clethodim) at the rate of 0.5 L /faddan at 30 days post transplanting.
6- Harness 84% WP at the rate of 1.0 L /faddan applied pre sweet potatoes transplanting followed by Select super 12.5EC at the rate of 0.5 L /faddan at 30 days post transplanting.
7- Stomp 45.5% CS at the rate of 1.0 L /faddan applied pre sweet potatoes transplanting followed by Select super 12.5%EC at the rate of 0.5 L /faddan at30days post transplanting.
8-Sencor 60% SC at the rate of 0.3 L /faddan applied pre sweet potatoes transplanting followed by Select super 12.5%EC at the rate of 0.5 L /faddan at 30 days post transplanting.
9-Gesagard 50% EC at the rate of 1.0 L /faddan applied pre sweet potatoes transplanting followed by Fusilade fortey15%EC(fluazifop-p- butyl) at the rate of 1.0 L /faddan at 30 days post transplanting.
10- Harness 84% EC at the rate of 1.0 L /faddan applied pre sweet potatoes transplanting followed by Fusilade fortey 15%EC at the rate of 1.0 L /faddan at 30 days post transplanting.
11-Stomp 45.5%WP at the rate of 1.0 L/faddan applied pre sweet potatoes transplanting followed by Fusilade fortey15% EC at the rate of 1.0 L /faddan at 30 days post transplanting.
12-Sencor 60% SC at the rate of 0.3 L /faddan applied pre sweet potatoes transplanting followed by Fusilade fortey15% EC at the rate of 1.0 L /faddan at 30 days post transplanting.
13-Hand hoeing at once post 30 days from transplanting.
14- Untreated check.

Knapsack sprayer CP3 was used with water volume 200 L/faddan in sweet potatoes which harvested by digging at 25 November and 5 December in 2012 and 2013 seasons, respectively. The experimental area were sown after sweet potatoes harvest without soil distribanace, all weeds in experimental field remove, and seeds of, pea(*Pisum sativum*), snap bean(*Phaseolus vulgaris*), squash (*Cucurbita pepo*), cucumber(*Cucumis sativus* L.), snake melon(*Cucumis mela*), onion(*Allium cepa* L.) and cowpea(*Vigna unguiculata*) were sown immediately after that. According to recommendations adopted by the Egyptian Ministry of Agriculture and with fields opening, but, seeds of, snap beans, squash, cucumber and snake melon were sowing under plastic white(tunnels).

Monthly relative humidity as well as maximum and minimum temperatures of Damietta Governorate province(under tunnels) during 2012/13 and 2013/14 growing seasons are presented in Table 2.

Table 2: Mean temperature (C) and relative humidity (percentage) during 2012/13 and 2013/14 seasons.

Month	Temperature (C)				Relative Humidity R.H. (%)	
	2012/13		2013/14		2012/13	2013/14
	Max.	Min.	Max.	Min.		
December	32	27	30	26	82.0	91.0
January	35	29	36	28	79.0	85.0

Data recorded:

1- Emergence% of seeds at some vegetable crops:

Emergence % of seeds were counted after 30 days from sowing seeds.

Number of emergence seeds /m^2 and assessments of survivals seedling

$$= \frac{\text{Number of seedling at treatment - Number of seedling at untreated check}}{\text{Number of seedling at untreated check}} x100$$

Weed assessment:

Weed fresh weight were hand pulled after 30 days from sowing vegetable crops and the identified into species and their fresh weight were recorded. Weeds were air dried for 3 days and then dried in an oven at 70ºC and data recorded as:

1 - Annual broad - leaved weeds (g/m^2).

2 - Annual grassy weeds (g/m^2).

3 - Total annual weeds (g/m^2).

Statistical analysis:

All the obtained data were subjected to the proper statistical analysis as randomized a complete block design according to Steel and Torrie (1980) and method as mentioned by Duncan (1955).

RESULTS AND DISCUSSION

1-Effect of herbicides on emergence percent:

On Onion:

Data in Table 3 show that % of survival at onion tended to decrease result and from residual effect with most herbicidal treatments, except with hand hoeing, Gesagard 50% SC at 1.0 L/faddan + Select super 12.5% EC at 0.5 L /faddan, Stomp 45.5% CS at 1.0 L /faddan and Harness 84% EC at 1.0 L /faddan exerted in establishment %, 97.5, 90.9, 90.6 and 91.2 of survival as compared with which differ significantly untreated check in 2012/2013 winter season and with hand hoeing, Stomp 45.5% CS at 1.0 L /faddan , Sencor 60% SC at 0.3 L /faddan and Harness 84% EC at 1.0 L /faddan which gave, 98.7, 83.4, 98.0 and 92.7% in 2013/2014 winter season as compared with untreated check. Thus, such treatments can be considered as safe for growing onion after sweet potatoes treated without any harmful effects of the above mentioned herbicides.

Table 3: Effect of herbicides treatments on, emergence percent of onion seeds during, 2012/13 and 2013/14 seasons.

Treatments	Rate L /faddan	2012/13		2013/14	
		Number of seedling/m^2	Establishment %	Number of seedling/m^2	Establishment %
Gesagard	1.0	24.0 d	80.8	21.0 d	70.0
Harness	1.0	27.1 a-c	91.2	27.8 ab	92.7
Stomp	1.0	26.9 a-d	90.6	25.0 bc	83.4
Sencor	0.3	25.7 cd	86.5	29.4 a	98.0
Gesagard & Select super	1.0+ 0.5	27.0 a-c	90.9	25.6 b	83.4
Harness & Select super	1.0+ 0.5	25.9 b-d	87.2	25.1 bc	83.7
Stomp & Select super	1.0+ 0.5	19.8 e	66.6	20.3 d	67.7
Sencor & Select super	1.0+ 0.5	11.4 f	38.4	20.0 d	66.6
Gesagard & Fusilade fortey	1.0+1.0	18.9 e	63.6	20.6 d	68.7
Harness & Fusilade fortey	1.0+ 1.0	24.6 cd	82.8	27.3 ab	91.0
Stomp & Fusilade fortey	1.0+ 1.0	21.1 e	71.0	22.0 cd	73.4
Sencor & Fusilade fortey	0.3+ 1.0	25.6 cd	86.2	25.0 bc	83.4
Hand hoeing twice	-----	29.0 ab	97.5	29.5 a	98.7
Untreated check	------	29.7 a	100	30.0 a	100

In a column, values with different letters show significant difference (P ≤ 0.05) as determined by Duncan's Multiple Range Test

Cucurbitaceae crops:

Squash:

The effect of herbicidal or hand hoeing treatments were statistically significant on squash stand at 30 DAS during 2012/13 and 2013/14 seasons. In general, there were many treatments such as, hand hoeing, Harness 84% EC at 1.0 L /faddan + Select super 12.5% EC at 0.5 L /faddan, Gesagard 50% SC at 1.0 L/faddan + Select super 12.5% EC at 0.5 L /faddan, Sencor 60% SC at 0.3 L /faddan, Stomp 45.5% CS at 1.0 L /faddan and Gesagard 50% SC at 1.0 L/faddan in 2012/13, hand hoeing, Harness 84% EC at 1.0 L /faddan + Select super 12.5% EC at 0.5 L /faddan, Sencor 60% SC at 0.3 L /faddan, Stomp 45.5% CS at 1.0 L /faddan Harness 84% EC at 1.0 L /faddan and Gesagard 50% SC at 1.0 L/faddan did not show any injury effects on squash establishment, with some exception, meaning that we can advise to grow squash as succeeding to sweet potatoes crops treated with such herbicides . In 2013/14 season the effect of herbicides treatments on percent emergence at squash, Stomp 45.5% CS at 1.0 L /faddan & Select super 12.5% EC at 0.5 L /faddan, Sencor 60% SC at 0.3 L /faddan & Select super 12.5% EC at 0.5 L /faddan and Gesagard 50% SC at 1.0 L/faddan & Fusilade fortey 15% EC at 1.0 L/faddan, decrease emergence percent at squash to, 33.8, 28.1 and 16.1%, respectively, as compared with untreated check Thomas *et al.*(2002)mentioned that prometryn is usually even less persist and may last from 6 to 9 months. Metribuzin appear to half-life about 2 to 4 weeks under most conditions.

Table 4: Effect of herbicides treatments on, emergence percent of squash seeds during, 2012/13 and 2013/14 seasons.

Treatments	Rate L /faddan	2012/13		2013/14	
		Number of seedling/m^2	Establishment %	Number of seedling/m^2	Establishment %
Gesagard	1.0	47.2 ab	96.7	46.1 a-c	97.5
Harness	1.0	42.7 cd	87.5	43.3 a-c	91.6
Stomp	1.0	45.0 bc	92.2	45.3 a-c	95.8
Sencor	0.3	46.7 ab	95.7	46.3 a-c	95.8
Gesagard & Select super	1.0+ 0.5	46.7 ab	95.7	46.0 a-c	97.3
Harness & Select super	1.0+ 0.5	45.1 ab	92.4	43.6 a-c	92.2
Stomp & Select super	1.0+ 0.5	19.3 f	39.6	16.0 d	33.8
Sencor & Select super	1.0+ 0.5	17.0 f	34.8	13.3 d	28.1
Gesagard & Fusilade fortey	1.0+1.0	11.3 g	23.2	7.6 e	16.1
Harness & Fusilade fortey	1.0+ 1.0	41.0 d	84.0	42.3 bc	89.4
Stomp & Fusilade fortey	1.0+ 1.0	44.0 b-d	90.2	41.6 c	88.0
Sencor & Fusilade fortey	0.3+ 1.0	36.8 c	75.4	41.0 c	86.7
Hand hoeing twice	-----	47.2 ab	96.7	48.1 a	101.7
Untreated check	------	48.8 a	100	47.3 ab	100

In a column, values with different letters show significant difference (P ≤ 0.05) as determined by Duncan's Multiple Range Test

Cucumber:

The effect on cucumber stand obtained with herbicides treatments, Gesagard 50% SC at 1.0 L /faddan, Harness 84% EC at 1.0L /faddan, Stomp 45.5% CS at 1.0 L /faddan, Sencor 60% SC at 0.3 L /faddan and Select super 12.5%EC at 0.5 L /faddan, and Fusilade fortey 15% EC at 1.0 L/faddan, did not effect on cucumber stand at 30 DAS(Table 5). The effect of herbicides or hand hoeing treatments gave reduction in the establishment of cucumber at 30 DAS in both seasons to, 34.1, 38.4, 34.1, 28.9, 36.0 and 29.4%, as compared to untreated check from, Sencor 60% SC at 0.3 L /faddan, Gesagard 50% SC at 1.0 L/faddan & Select super 12.5% EC at 0.5 L /faddan and Harness 84% EC at 1.0 L /faddan & Select super 12.5% EC at 0.5 L /faddan, respectively. This may be attributed as this degradation of acetochlor (Harness 84% EC) is in to soil is microbial breakdown, forming the major soil metabolites t-oxanilic acid, and t-sulfonic acid which exhibited moderate to high persistence, and t-sulfinyl acetic acid which exhibited medium to high persistence and minor soil metabolites s-sulfonic acid which exhibited moderate to medium persistence, EFSA,2011.

The main breakdown products in soils under aerobic conditions are sulfoxide, sulfone and oxazole sulfone. Clethodim(Select super 12.5% EC) and these degradation are weakly bound to soils, thus, while it may be somewhat mobile in the soil environment, it is very short-lived. The USEPA has stated (under present use patterns and under most circumstances clethodim(Select super 12.5% EC) does not appear to threaten groundwater), USEPA (2007).

Thomas *et al.*(2002)reported that, pendimethalin (Stomp 45.5%WP) and acetochlor (Harness 84% EC) compounds, degradation is via microbes, but the long - half-life(100 days) results in long soil persistence, which can effect rotation crop -planting decisions.

Table 5: Effect of herbicides treatments on, emergence percent of cucumber seeds during, 2012/13 and 2013/14 seasons.

Treatments	Rate L /faddan	2012/13		2013/14	
		Number of seedling/m^2	Establishment %	Number of seedling/m^2	Establishment %
Gesagard	1.0	27.0 de	82.8	27.9 c	79.7
Harness	1.0	28.0 d	85.9	28.1 c	80.3
Stomp	1.0	30.5 c	93.6	30.6 bc	87.4
Sencor	0.3	11.1 g	34.1	10.1 e	28.9
Gesagard & Select super	1.0+ 0.5	12.5 g	38.4	12.6 e	36.0
Harness & Select super	1.0+ 0.5	11.1 g	34.1	10.3 e	29.4
Stomp & Select super	1.0+ 0.5	25.2 ef	77.3	24.3 d	69.4
Sencor & Select super	1.0+ 0.5	23.0 f	70.6	22.0 d	62.9
Gesagard & Fusilade fortey	1.0+1.0	27.5 de	84.4	28.3 c	81.9
Harness & Fusilade fortey	1.0+ 1.0	32.6 bc	100.0	33.0 ab	94.3
Stomp & Fusilade fortey	1.0+ 1.0	33.0 bc	101.2	34.0 a	97.2
Sencor & Fusilade fortey	0.3+ 1.0	33.6 bc	103.1	33.0 ab	94.3
Hand hoeing twice	-----	36.1 a	110.7	35.4 a	101.4
Untreated check	------	32.6 bc	100	35.0 a	100

In a column, values with different letters show significant difference (P ≤ 0.05) as determined by Duncan's Multiple Range Test

Snake melon:

The effect of studied herbicides and hand hoeing treatments on establishment of snake melon were highly significant on the two seasons. Both Harness and Stomp did not differ significantly than untreated check or hand hoeing twice and can be used in preceding crops without any a degree effect on the establishments of snake melon as succeeding vegetable crops. Meanwhile the decreases of emergence percent at snake melon caused from, Gesagard 50% SC at 1.0 L/faddan & Select super 12.5% EC at 0.5 L /faddan, Sencor 60% SC at 0.3 L /faddan & Select super 12.5% EC at 0.5 L /faddan and Sencor 60% SC at 0.3 L /faddan & Fusilade fortey 15% EC at 1.0 L/faddan, gave, 44.2, 34.9, 51.2, 52.4, 69.1 and 54.8%, respectively, during, 2012/13 and 2013/14 seasons, compared with untreated check (Table 6).

We can notice that, their no harmful effects on emergence percent of snake melon with the use of, Harness 84% EC at 1.0L /faddan and Stomp 45.5% CS at 1.0 L /faddan, and can concluded that the residual toxicity effects on cucurbitaceae crops of some the above mention herbicides are exposed to the rapid degradation in sweet potatoes fields by leaching, algae and photocomposition ….etc

Table 6: Effect of herbicides treatments on, emergence percent of snake melon seeds during, 2012/13 and 2013/14 seasons.

Treatments	Rate L /faddan	2012/13		2013/14	
		Number of seedling/m^2	Establishment %	Number of seedling/m^2	Establishment %
Gesagard	1.0	2.6 d-f	60.5	3.1 c-e	73.8
Harness	1.0	4.1 a-c	95.4	4.2 ab	100.0
Stomp	1.0	4.8 a	111.6	4.8 a	114.3
Sencor	0.3	2.5 ef	48.3	2.6 ef	61.9
Gesagard & Select super	1.0+ 0.5	1.9 fg	44.2	2.2 fg	52.4
Harness & Select super	1.0+ 0.5	3.4 b-e	79.1	3.7 bc	88.1
Stomp & Select super	1.0+ 0.5	2.5 ef	58.2	3.7 bc	88.1
Sencor & Select super	1.0+ 0.5	1.5 g	34.9	2.9 d-f	69.1
Gesagard & Fusilade fortey	1.0+1.0	3.3 c-e	76.8	1.6 g	38.1
Harness & Fusilade fortey	1.0+ 1.0	3.5 b-d	81.4	3.5 b-d	83.4
Stomp & Fusilade fortey	1.0+ 1.0	2.2 fg	51.2	3.6 b-d	85.7
Sencor & Fusilade fortey	0.3+ 1.0	2.2 fg	51.2	2.3 fg	54.8
Hand hoeing twice	-----	4.2 a-c	97.7	4.1 ab	97.6
Untreated check	------	4.3 ab	100	4.2 ab	100

In a column, values with different letters show significant difference (P ≤ 0.05) as determined by Duncan's Multiple Range Test

Leguminous crops:

Pea:

Data presented in Table 7 indicated that, the effect of herbicidal treatments on emergence percentage of, pea at 30 DAS and the differences arrived to the level of significant in the both seasons. Emergence percentage tended to decrease drastically by, Harness 84% EC at 1.0 L /faddan & Select super 12.5% EC at 0.5 L /faddan, Harness 84% EC at 1.0 L /faddan & Fusilade fortey 15% EC at 1.0 L/faddan and Stomp 45.5% CS at 1.0 L /faddan & Fusilade fortey 15% EC at 1.0 L/faddan to, 37.7, 44.2, 38.9, 34.2, 32.1 and 39.8%, respectively, compared with untreated check, during, 2012/13 and 2013/14 seasons. These results suggest not to grow pea after sweet potatoes fields treated with such herbicides, Harness 84% EC at 1.0 L /faddan, Sencor 60% SC at 0.3 L /faddan, Select super 12.5% EC at 0.5 L /faddan and Fusilade fortey 15% EC at 1.0 L/faddan.

No significant hydrolysis or breakdown in water, was found when prometryn(Gesagard50%SC) was tested over a period of 28 days in water ranging from slightly acidic to slightly alkaline and over a variety of test temperatures. Laboratory mobility data for prometryn(Gesagard50%SC) indicate that it has the potential to leach into groundwater and will be most mobile in sandy, alkaline soils which contain little organic matter or clay, USEPA (1996) and EWG (2010). Fusilade fortey (fluazifop-p-butyl) is rapidly hydrolyses in water under most conditions to the fluazifop acid. It is relatively stable to breakdown by UV or sunlight, and nonvolatile. Solubility in water is about 1 mg/L Fusilade fortey is not a common contaminant of groundwater because it is rapidly broken down in water and has low mobility in soils, USEPA(2005).

Table 7: Effect of herbicides treatments on, emergence percent of pea seeds during, 2012/13 and 2013/14 seasons.

Treatments	Rate L /faddan	2012/13		2013/14	
		Number of seedling/m^2	Establishment %	Number of seedling/m^2	Establishment %
Gesagard	1.0	21.0 d	79.3	21.4 d	75.4
Harness	1.0	18.2 e	68.7	16.7 f	58.8
Stomp	1.0	23.2 c	87.5	24.6 c	86.6
Sencor	0.3	14.3 fg	53.9	14.7 h	51.8
Gesagard & Select super	1.0+ 0.5	16.0 f	60.4	15.5 g	54.6
Harness & Select super	1.0+ 0.5	10.0 i	37.7	9.7 k	34.2
Stomp & Select super	1.0+ 0.5	15.0 fg	56.6	16.0 fg	56.3
Sencor & Select super	1.0+ 0.5	18.5 e	69.8	18.0 e	63.4
Gesagard & Fusilade fortey	1.0+1.0	13.2 gh	49.8	13.9 i	49.0
Harness & Fusilade fortey	1.0+ 1.0	11.7 hi	44.2	9.1 k	32.1
Stomp & Fusilade fortey	1.0+ 1.0	10.3 i	38.9	11.3 j	39.8
Sencor & Fusilade fortey	0.3+ 1.0	13.2 gh	49.8	11.3 j	39.8
Hand hoeing twice	-----	28.5 a	107.5	26.4 b	93.0
Untreated check	------	26.5 b	100	28.4 a	100

In a column, values with different letters show significant difference (P ≤ 0.05) as determined by Duncan's Multiple Range Test

Snap beans:

The effect of herbicides treatments on emergence percent of snap beans was similar to pea, where Gesagard 50% SC at 1.0 L/faddan & Select super 12.5%EC at 0.5 L /faddan, Sencor 60% SC at 0.3 L /faddan & Select super 12.5% EC at 0.5 L /faddan and Gesagard 50% SC at 1.0 L/faddan & Fusilade fortey 15% EC at 1.0 L/faddan, decreasing emergence percent to, 100%, during two seasons, and sowing snap beans after herbicides treatments, cause not to get any harvest what is the reason a big loss when you do not know the name of the herbicide used in the preceding crop, snap beans stand had effected drastically and considered very sensitive to residual effects of herbicides in soil previously treated with herbicides.

The half-life of metribuzin in pond water is approximately 7 days. If present, metribuzin would most likely be found in the water column rather than the sediment, due to its low binding affinity and high water solubility(USEPA 1998).

Table 8: Effect of herbicides treatments on, emergence percent of snap beans seeds during,2012/13 and 2013/14 seasons.

Treatments	Rate L /faddan	2012/13		2013/14	
		Number of seedling/m^2	Establishment %	Number of seedling/m^2	Establishment %
Gesagard	1.0	4.4 c	33.3	4.0 c	29.9
Harness	1.0	4.1 c	31.1	3.9 de	29.0
Stomp	1.0	1.3 d	9.9	1.8 b	13.3
Sencor	0.3	1.8 d	13.6	2.0 ef	15.0
Gesagard & Select super	1.0+ 0.5	0.0 e	0.0	0.0 ef	0.0
Harness & Select super	1.0+ 0.5	4.2 c	31.8	5.7 g	42.5
Stomp & Select super	1.0+ 0.5	2.3 d	17.4	1.8 d-f	13.4
Sencor & Select super	1.0+ 0.5	0.0 e	0.0	0.0 d	0.0
Gesagard & Fusilade fortey	1.0+1.0	0.0 e	0.0	0.0 d	0.0
Harness & Fusilade fortey	1.0+ 1.0	10.5 b	79.6	11.1 g	82.8
Stomp & Fusilade fortey	1.0+ 1.0	10.3 b	78.0	10.2 g	76.2
Sencor & Fusilade fortey	0.3+ 1.0	12.7 a	96.2	12.6 g	94.0
Hand hoeing twice	-----	13.2 a	100.0	14.6 ab	108.9
Untreated check	------	13.2 a	100	13.4 a	100

In a column, values with different letters show significant difference (P ≤ 0.05) as determined by Duncan's Multiple Range Test

Cowpea:

The emergence percentage of cowpea tended to decrease significantly with the use of herbicides treatments in preceding crop by, 33.7, 32.1, 23.2, 46.0, 30.2 and 28.6 %, from Stomp 45.5% CS at 1.0 L /faddan, Gesagard50%SC at 1.0 L/faddan & Fusilade fortey 15% EC at 1.0 L/faddan and Harness 84% EC at 1.0 L /faddan & Fusilade fortey 15% EC at 1.0 L/faddan, respectively, during 2012/13 and 2013/14 seasons, as compared with untreated check. From this study all weed control treatments used cause decreased emergence percent of cowpea and not to get any harvest what is the reason a big loss when sowing cowpea after herbicide treatment, Harness 84% EC at 1.0 L /faddan used in the preceding crop.

These results suggest not to grow cowpea after sweet potatoes crop treated with herbicide Harness 84% EC at 1.0 L /faddan during the two seasons.

Table 9: Effect of herbicides treatments on, emergence percent of cowpea seeds during, 2012/13 and 2013/14 seasons.

Treatments	Rate L /faddan	2012/13		2013/14	
		Number of seedling/m^2	Establishment %	Number of seedling/m^2	Establishment %
Gesagard	1.0	2.6 bc	46.4	4.4 c	69.9
Harness	1.0	0.0 d	0.0	0.0 f	0.0
Stomp	1.0	2.0 c	33.7	2.9 e	46.0
Sencor	0.3	2.6 bc	46.4	2.8 e	44.5
Gesagard & Select super	1.0+ 0.5	4.7 a	83.9	5.0 bc	79.4
Harness & Select super	1.0+ 0.5	4.1 ab	73.2	4.2 cd	66.6
Stomp & Select super	1.0+ 0.5	2.6 bc	46.5	2.9 e	46.0
Sencor & Select super	1.0+ 0.5	2.6 bc	46.5	2.8 e	44.5
Gesagard & Fusilade fortey	1.0+1.0	1.8 c	32.1	1.9 e	30.2
Harness & Fusilade fortey	1.0+ 1.0	1.3 cd	23.2	1.8 e	28.6
Stomp & Fusilade fortey	1.0+ 1.0	2.8 bc	50.0	3.1 de	49.2
Sencor & Fusilade fortey	0.3+ 1.0	2.5 bc	44.7	2.9 e	46.0
Hand hoeing twice	-----	5.3 a	94.6	6.1 ab	96.8
Untreated check	------	5.6 a	100	6.3 a	100

In a column, values with different letters show significant difference (P ≤ 0.05) as determined by Duncan's Multiple Range Test

2-Effect of herbicide residual on weeds associated with succeeding vegetable crop stands:

Predominated weed species in experimental fields were, *phalaris minor*, Retz and *Polypogon monospeliensis*, *L.*; as grassy weeds, and, *Rumex dentatus,L*, *Melilotus indica,L.*, *Beta vulgaris L.*, *Chenopodium* spp. *L.* and *Spergularia marina*, *L.*; as

broadleaf weeds predominated weed species in experimental fields during two winter seasons.

Results in Table 10 show variation from one season to another on different weed categories in both seasons as affected by herbicides applied in preceding sweet potatoes crop. In general , Gesagard50%SC at 1.0 L/faddan, Harness 84% EC at 1.0 L /faddan and Stomp 45.5% CS at 1.0 L /faddan which applied in preceding sweet potatoes crop did not exceed 32.8-39.8% reduction in total weeds than untreated check in 2012/2013 winter season. In 2013/2014 winter season all weed herbicidal treatments did not exert any real reduction (0.0-51.9%) on total weeds associated with vegetable crop plants. These results suggest clearly that the residual effect of herbicides applied in the previous crop are very poor in its effect on weeds associated with succeeding vegetable crop.

Moursi *et al.*(1979)showed that hand weeding of weeds or herbicides applied in rice field had no influence in the growth of the following winter succeeding crops, namely wheat and berseem. Porter, 1990, mentioned that clethodim is as post-emergence grass herbicide. William, 1994 reported that compound, a pre emergence herbicides was active on broadleaf weeds and some grasses, and noticed that the oxime compound [clethodim (Select super 12.5% EC)]a post emergent herbicides was a selective control on a wide range of annual and perennial grasses by roots were relatively few in number and club shaped except, these compounds have water solubility less than one part per million . They bind to soil colloids and are unlikely to leach. These root inhibitors do not translocation ,(Herbicide Handbook,1994).

Thomas *et al.*(2002)mention that prometryn (Gesagard 50% SC)is application PRE or POST(as a pre emergence or post emergence) –directed application in several crops for the control of many broadleaf and grassy weeds, acetochlor(Harness 84% EC) use pre plant incorporated or pre emergence, metribuzin(Sencor 60% SC) is use as a pre plant incorporated, pre emergence, post emergence to control many broadleaf weeds.

Table 10: Effect of herbicides treatments on the dry weight of, broadleaf, grassy, total weeds and controlling% its during assessment in 2012/13 and 201314 seasons.

Treatments	Rate L/faddan	Broad leaves	Controlling % Broad leaves	Grass weeds	Controlling % Grass weeds	Total weeds	Controlling % Total weeds
			2012/13 season				
Gesagard	1.0	735 ab	2.3	0.0 f	100	735 bc	39.8
Harness	1.0	820 a	0.0	0.0 f	100	820 b	32.8
Stomp	1.0	771 a	0.0	0.0 f	100	771 b	36.8
Sencor	0.3	367 ab	34.0	0.0 f	100	367 ab	34.0
Gesagard & Select super	1.0+ 0.5	430 f	57.2	200 b	42.7	630.0 bc	51.6
Harness & Select super	1.0+ 0.5	650 b-d	79.2	0.0 f	100	650 b-d	46.9
Stomp & Select super	1.0+ 0.5	755 ab	0.0	0.0 f	100	755 b	38.2
Sencor & Select super	1.0+ 0.5	772 a	76.5	0.0 f	100	772 b	36.9
Gesagard & Fusilade fortey	1.0+1.0	428 f	43.1	368 b	21.4	796 b	34.8
Harness & Fusilade fortey	1.0+ 1.0	668 b-d	13.8	0.0 f	100	668 b-d	53.7
Stomp & Fusilade fortey	1.0+ 1.0	563 cd	25.1	17 d	96.4	580 c-e	52.5
Sencor & Fusilade fortey	0.3+ 1.0	488 de	35.1	13 e	97.2	501 de	59.0
Hand hoeing twice		145.0 f	80.7	90.0 c	80.8	235.0 f	80.7
Untreated check	--------	752 a	00	468 a	00	1221 a	00
			2013/14 season				
Gesagard	1.0	38 g	63.8	118 b	0.0	156 f	16.6
Harness	1.0	107 e	0.0	52 fg	36.6	159 f	15.0
Stomp	1.0	157 d	0.0	142 a	0.0	299 d	0.0
Sencor	0.3	78 f	25.7	76 de	7.3	154 f	17.6
Gesagard & Select super	1.0+ 0.5	50 g	52.4	40 a	51.2	90 g	51.9
Harness & Select super	1.0+ 0.5	93 ef	11.4	94 cd	0.0	187 f	0.0
Stomp & Select super	1.0+ 0.5	84 ef	20.0	97 c	0.0	181 f	3.2
Sencor & Select super	1.0+ 0.5	74 f	29.5	95 cd	0.0	169 f	9.6
Gesagard & Fusilade fortey	1.0+1.0	75 f	28.6	91 cd	0.0	166 f	11.2
Harness & Fusilade fortey	1.0+ 1.0	477 b	0.0	87 cd	0.0	564 b	0.0
Stomp & Fusilade fortey	1.0+ 1.0	670 a	0.0	60 ef	26.8	730 a	0.0
Sencor & Fusilade fortey	0.3+ 1.0	325 c	0.0	100 c	0.0	425 c	0.0
Hand hoeing twice	-------	150.0 d	0.0	93.0 cd	13.4	243.0e	0.0
Untreated check	--------	105 e	00	82 cd	00	187 f	00

In a column, values with different letters show significant difference (P ≤ 0.05) as determined by Duncan's Multiple Range Test

CONCLUSION

From this study, we can conclude that, there were big variations of the residual effects of herbicides which used in sweet potatoes fields on succeeding vegetable crops from one crop to another . Onion plants at 30 DAS can tolerate the residual effects of, Gesagard & Select super, Harness and Stomp, Stomp, squash can tolerate the residual effect of, Stomp, Harness and Gesagard & Select super. Meanwhile cucumber can tolerate the residual effect of, Stomp, snake melon can tolerate the residual effect of, Stomp and Harness, pea tolerate to somewhat Stomp. Either snap beans or cowpea are very sensitive vegetable crops to herbicides residues in soils of some preceding crops. Thus, treated soils in crop rotation with herbicides should be plowed

two or three times to help in degradation of their residues before planting without any harmful effects on succeeding vegetable crops. In future more attention should be taken in considerations to harmful effect of herbicides residual and how to avoid it before official herbicide recommendations through determination residues of herbicide in soil by bioassay tests or chemical analysis.

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التأثير المتبقي لمبيدات الحشائش المستخدمة في حقول البطاطا على انبثاق بعض بذور محاصيل الخضر اللاحقة و الحشائش المصاحبة لها.

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لا تتوافر معلومات كافية عن الاثر المتبقي لمبيدات الحشائش المستخدمة للمحاصيل المزروعة في الدورة الزراعية على المحاصيل اللاحقة لها مثل محاصيل الخضر، لذا أقيمت تجربتان حقليتان خلال موسمي ٢٠١٢/٢٠١٣ و ٢٠١٣/ ٢٠١٤ الشتويين بمحطة البحوث الزراعية بالسرو في تربة طينية – مركز البحوث الزراعية –محافظة دمياط –مصر وذلك لدراسة تأثير مبيدات الحشائش المستخدمة في محصول البطاطا السابق في الموسمين الصيفين السابقين ٢٠١٢ و ٢٠١٣ و بدون اثارة للتربة في القطع التجريبية لها مع ازالة أي متبقيات من المحصول السابق و الحشائش المصاحبة له و نسبة انبات و انبثاق بذور بعض محاصيل الخضر و منها البسلة ، الفاصوليا ، القرع الصيفي ، الخيار ، القثاء ، مشتل البصل و اللوبيا البلدي اللاحقة له و الحشائش المصاحبة له و ذلك باستعمال مبيدات الحشائش في صورة فردية حيث تم استخدام جساجارد٥٠EC% (بروميترين) بمعدل لتر للفدان ،هارنس٨٤EC% (اسيتاكلور) بمعدل لتر للفدان ، ستومب٤٥.٥SC% (بندايمثالين) بمعدل لتر للفدان و سنكور٦٠SC% (ميتروبوزين) بمعدل٠.٣ لتر للفدان تم استعمال هذه المبيدات قبل شتل البطاطا أو مع توليفات من سلكت سوبر١٢.٥EC% (كلثوديم) بمعدل ٠.٥ لتر للفدان و فيوزيليد فورتي١٥EC% (فلوزيفوب بي بيوتيل) بمعدل لتر للفدان مقارنة بمعاملة العزيق و بدون مكافحه و يمكن تلخيص أهم النتائج المتحصل عليها فيما يلي :١ - أظهرت الدراسة وجود تباين كبير في التأثيرات المتبقية لمبيدات الحشائش المستخدمة في حقول البطاطا السابقة على انبثاق محاصيل الخضر اللاحقة و الحشائش المصاحبة لها.٢ - وجد من الدراسة أن عدد نباتات البصل المنزرع بالبذرة لم يتأثر بالأثر الباقي لمبيدات الجساجارد٥٠% EC + سلكت سوبر١٢.٥EC% - هارنس٨٤EC% و ستومب٤٥.٥SC% بعد ٣٠ يوم من الزراعة. كذلك تحملت نباتات الكوسة الاثر الباقي لمبيدي ستومب٤٥.٥SC% و هارنس٨٤EC% بينما تحملت نباتات الخيار الاثر الباقي لمبيد ستومب٤٥.٥SC% و تتحمل القثاء الاثر الباقي لمبيدي ستومب٤٥.٥SC% و هارنس٨٤EC% في التربة. و على العكس من ذلك فان نباتي الفاصوليا و اللوبيا قد تتأثرا بشدة بمتبقيات المبيدات في التربة المعاملة بها في المحصول السابق بشكل عام. و فيما يتعلق بالتأثير المتبقي للمبيدات المستخدمة في محصول البطاطا فان تأثيراتها ضعيفة أو منعدمة على الحشائش المصاحبة لمحاصيل الخضر اللاحقة.٣ - مما سبق يتضح ضرورة التخلص من التأثير المتبقي المحتمل للمبيدات في التربة المعاملة بها في المحصول السابق بحرثها من ٢ الى ٣ مرات عند خدمة المحصول اللاحق للمساعدة على هدم متبقيات هذه المبيدات مع ضرورة اعطاء عناية كافية نحو دراسة تأثير متبقيات مبيدات الحشائش قبل تسجيلها اما بالاختبارات الحيوية او التقدير الكيماوي.