RESULTS AND DISCUSSION

4. RESULTS AND DISCUSSION

Ethoprophos and fluazifop-P-butyl are used as selective nematocide and herbicide in several broad leaf crops. In Egypt, these crops currently include broad beans, tomatoes and potatoes, economically important vegetable crops in Egypt. Efficient production of high yielding tomato and potato with high-quality fruit is dependent upon implementation of an effective weed control program.

4.1. Ethoprophos:

Ethoprophos nematocide are normally esters, amides, or thiol derivatives of phosphoric, phosphonic, phosphorothioic, or phosphonothioic acids. Most are only slightly soluble in water and have a high oil-to-water partition coefficient and low vapour pressure **(Environmental Health Criteria 63, 1986)**.

4.1.1. Persistence of ethoprophos pesticide in soil:

Study residues of ethoprophos nematocidie in clay loam soil at Kafr El-Sharakoa, Mansoura district, Dakahlia Governorate. during winter of 2007 season were carried out under the normal field conditions. The tested pesticides residues in the potatoes root field were also investigated.

Table (3) and Fig. (1) demonstrate the residue, dissipation and depletion % of ethoprophos nematocide (10%) in soil at depth 10 cm after its application with 30 kg/feddan. This table showed that ethoprophos nematocide reach its maximum level after 2 days post application then gradually depletion till become completely undetectable after 51 days from of spray. The pesticide half life was 3.52 days with a line slope -0.3576. This result coincides with that observed in Fig. 1, where soil residues and depletion % crossing at 3.35 days and proved graphically in Fig. 2.

Our results are rather similar to those reported by **Karpouzas *et al.* (1999)** who found rapid degradation of ethoprophos in soil samples when t_{50} of ethoprophos was approximately 4 days. Results also agree with those of **Nasr *et al.* (2001)** who recorded that after ethoprophos application the initial deposit residues in soil surface was 7.30 mg/kg after one hour of treatment and rapid degradation occurred to reach 1.661 and 1.331 mg/kg with a loss of 77.26 and 81.77% three to six days after application. **Nasr and Ghallab (2002)** reported that the initial amount of ethoprophos residues in the soil surface was 7.30 mg/kg one hour after treatment.

More shorter ethoprophos residues half life (36 hours) was observed by **Nasr *et al.* (2001)** and **Nasr and Ghallab (2002)** in loamy and sand soils.

However the current results disagree with those recorded by **Cerna *et al.* (1978)** who reported depletion after 18 months; **Weaver** *et al*. **(1988)** who stated that ethoprophos persisted for 8 months in soil; **Nasr** *et al.* **(2004)** who reported that ethoprophos in the soil surface one hour after application was 201.21 mg/kg. **El-Shregy (2008)** recorded that the initial amount of ethoprophos residues in a clay loam soil was 26 mg/kg.

Table (3): Residues, dissipation and depletion rate of ethoprophos nematocide (10%) in soil at depth 10 cm after its application at a rate of 30 kg/feddan at different sampling times.

Sampling No.	Days after application	Residue in soil (mg/kg)	Dissipation # %	Depletion # %
1	0*	**5.98 ± 0.12**	-	-
2	1	4.25 ± 0.09	28.93	28.93
3	4	2.63 ± 0.07	38.12	56.02
4	7	1.03 ± 0.06	60.83	82.78
5	11	0.44 ± 0.03	57.28	92.64
6	14	0.18 ± 0.012	59.09	96.99
7	21	0.11 ± 0.013	38.89	98.16
8	35	0.04 ± 0.006	63.64	99.33
9	44	0.01 ± 0.005	75.00	99.83
10	51	UD	100	100
-	Slope	-0.3576		
-	Half life ($t_{0.5}$)	3.52		

Notes: Nematocide application occur on the 30th day after cultivation

* Zero time 2 hrs after application UD = undetectable

Data represented as mean ± SE. Number of sample = 3

$$\# \text{Dissipation } \% = \frac{(\text{mg/kg in sampling No. n}) - (\text{mg/kg in sampling No. n-1})}{\text{mg/kg in sampling No. 1}} \times 100$$

$$\# \text{Depletion } \% = \frac{(\text{mg/kg in sampling No. 1}) - (\text{mg/kg in sampling No. n})}{\text{mg/kg in sampling No. n}} \times 100$$

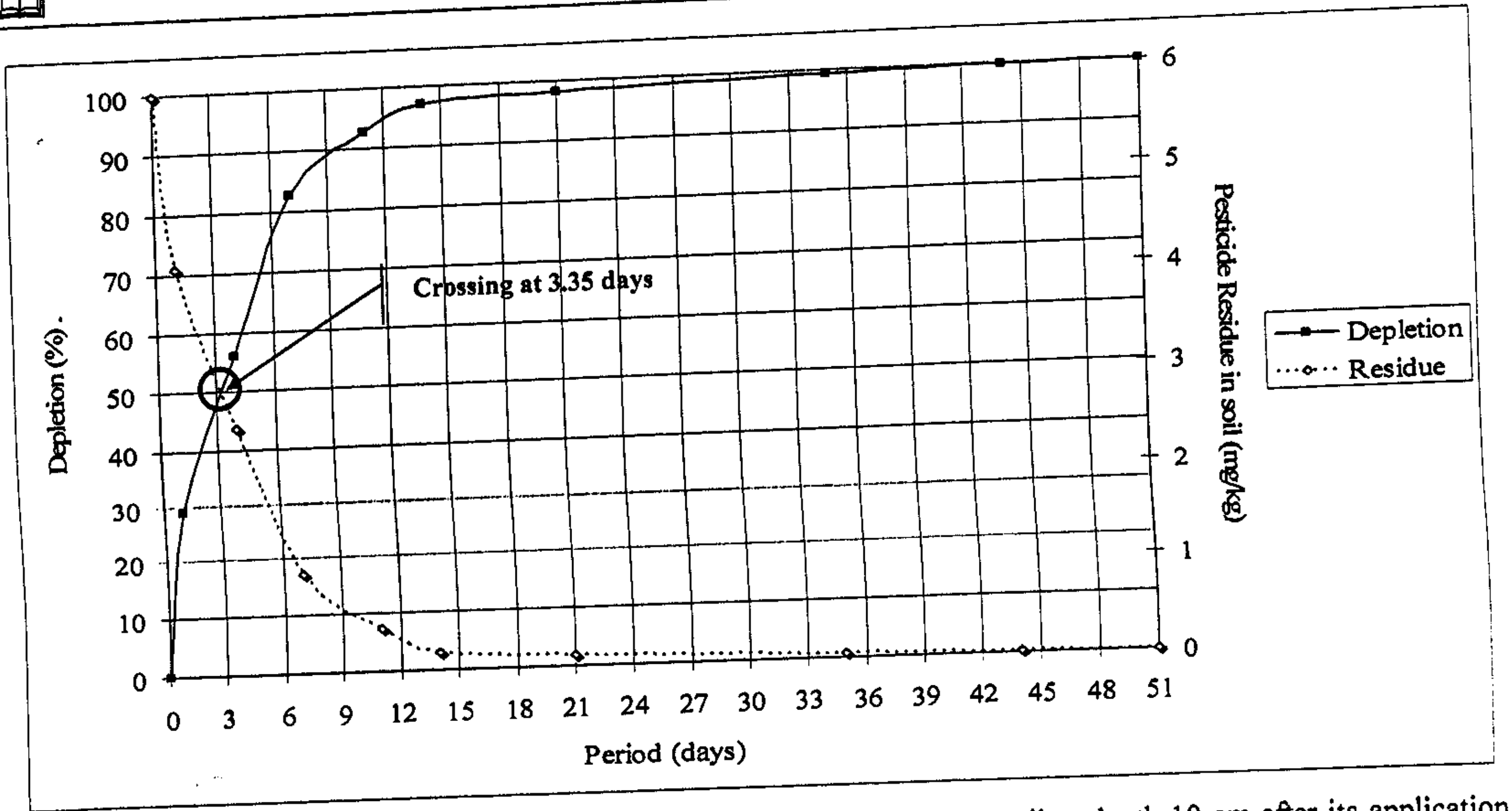

Fig. (1): Dissipation and depletion rate of ethoprophos nematocide (10%) in soil at depth 10 cm after its application with 30 kg/feddan.

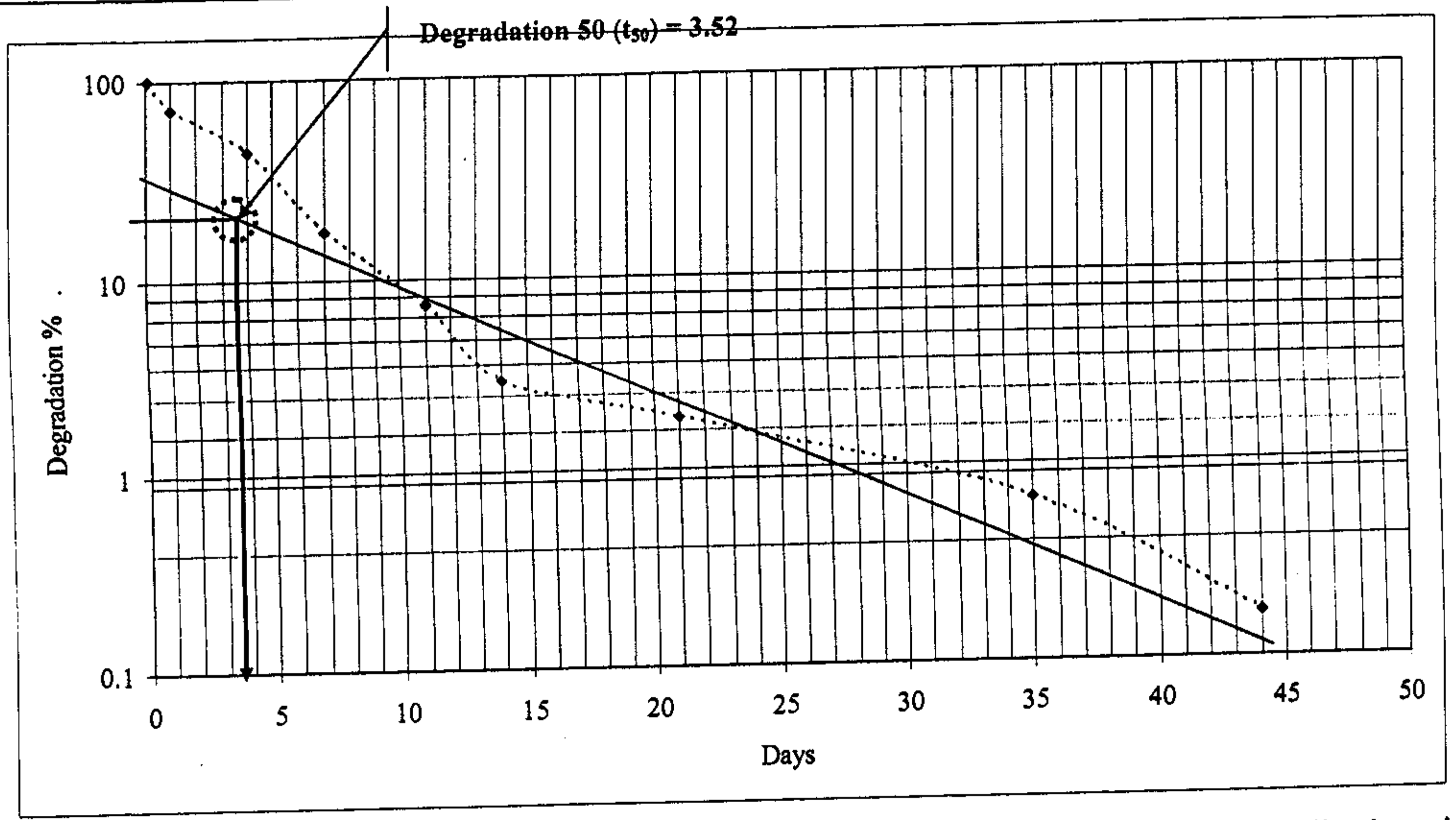

Fig. (2): Degradation and half life of ethoprophos nematocide (10%) in soil at depth 10 cm after its application with 30 kg/feddan.

Table 4 and Figs 3 & 4, describe the residue, dissipation and depletion rate of ethoprophos nematocide (10%) in soil at depth 30 cm after its application at 30 kg/feddan. This table shows that ethoprophos residue was undetectable two hours after application and reached 0.11 mg/kg after 1 day then to a maximum residue level at 0.4 mg/kg after 7 days, then decreased gradually to become undetectable again 51 days after application. The half life was 13.3 day with line slope -0.091. This result is augmented with the observation in Fig. 4 where the half life t_{50} is known at 13.3 days. Whereas results coincide with ethoprophos residue and depletion crossing at 13.62 days.

These observations are nearly similar to those observed by **Norris (1990a)** who reported in a field study on dissipation of ethoprophos, where, Mocap® 10G was applied to a loam soil and ethoprophos residues were detected throughout 88 cm of soil depth for up to one month after application (70 µg/kg).

Nasr *et al.* (2001) mentioned that the ethoprophos residues gradually increased in the 30-40 cm layer reaching a maximum amounting to 0.362 mg/kg after 14 days and treatment, then after decreasing noticeably to 0.01 mg/kg at the end of experiment (95 days). The calculated ethoprophos half life of the current study which is 13.3 days is nearly equal to the one reported by **Norris *et al.* (1991)**, which was 13 days, but very much differ from the one recorded by **Norris (1990a)** which was 23.3 days.

Table (4): Residues, dissipation and depletion rate of ethoprophos nematocide (10%) in soil at depth 30 cm after its application at a rate of 30 kg/feddan at different sampling times.

Sampling No.	Days after application	Residue in soil (mg/kg)	Dissipation # %	Depletion # %
1	0*	UD	-	-
2	1	0.11 ± 0.02	-	-
3	4	0.26 ± 0.02	136.36	-136.36
4	7	0.40 ± 0.03	53.84	-263.63
5	11	0.27 ± 0.007	32.50	-145.46
6	14	0.19 ± 0.005	29.63	-72.73
7	21	0.109 ± 0.003	42.63	0.909
8	35	0.036 ± 0.004	66.97	67.27
9	44	0.014 ± 0.002	61.11	87.27
10	51	UD	100	100
	Slope	-0.091		
	Half life ($t_{0.5}$)	13.3 day		

Notes: Nematocide application occur on the 30th day after cultivation

* Zero time 2 hrs after application UD = undetectable

Data represented as mean ± SE. Number of sample = 3

$$\# \text{ Dissipation } \% = \frac{(\text{mg/kg in sampling No. n}) - (\text{mg/kg in sampling No. n-1})}{\text{mg/kg in sampling No. 1}} \times 100$$

$$\# \text{ Depletion } \% = \frac{(\text{mg/kg in sampling No. 1}) - (\text{mg/kg in sampling No. n})}{\text{mg/kg in sampling No. n}} \times 100$$

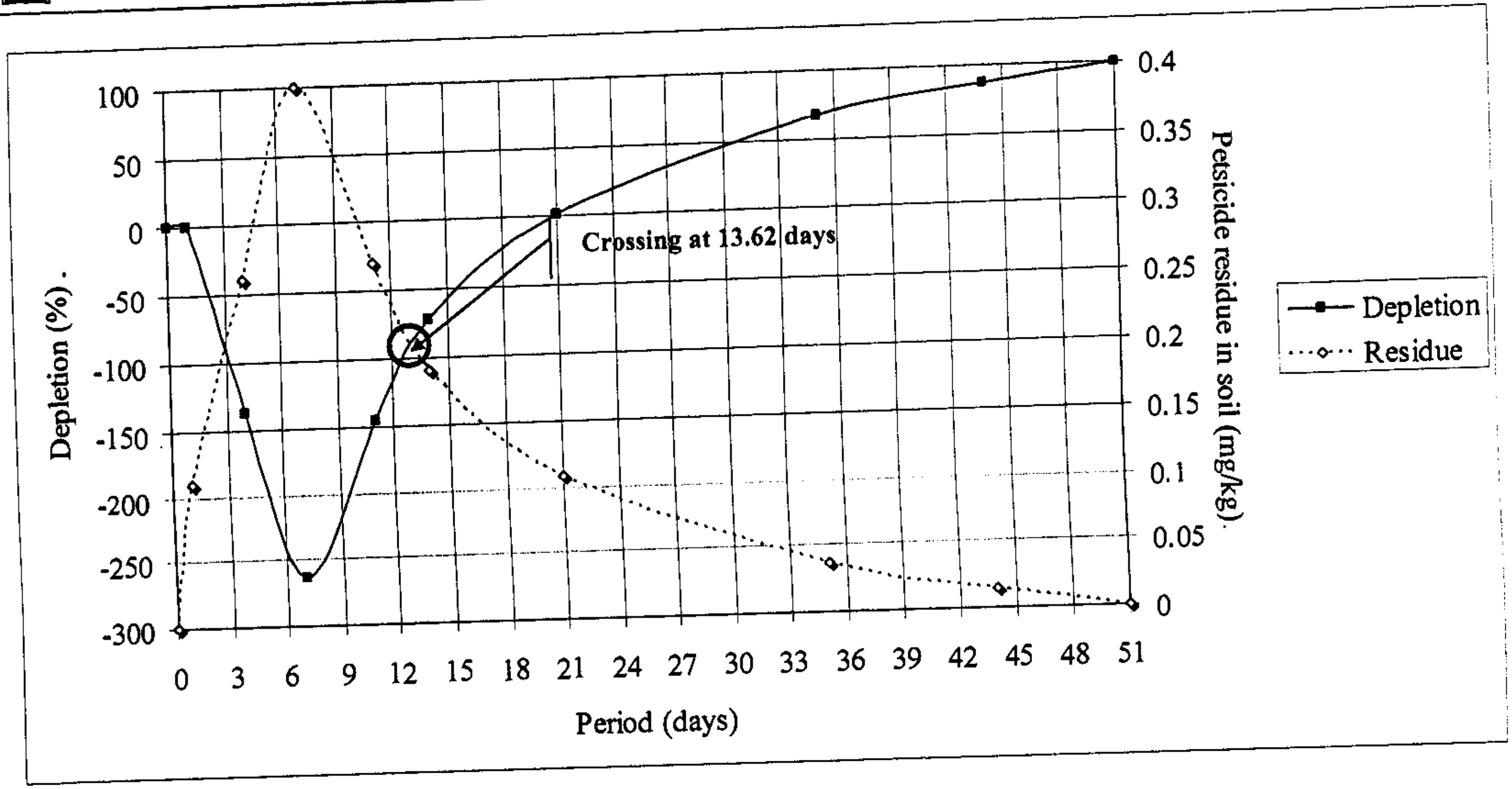

Fig. (3): Dissipation and depletion rate of ethoprophos nematocide (10%) in soil at depth 30 cm after its application with 30 kg/feddan.

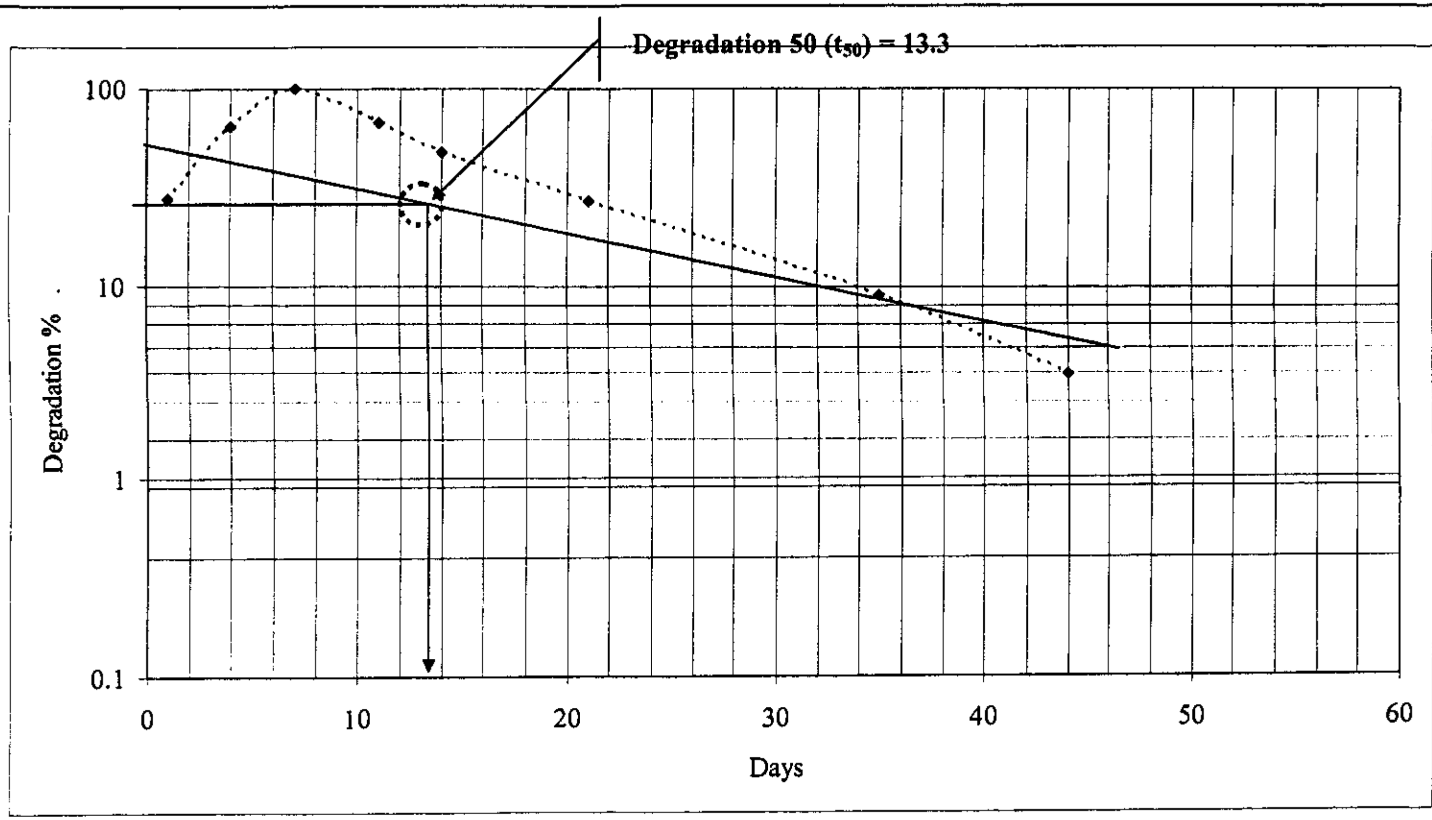

Fig. (4): Degradation rate and t_{50} of ethoprophos nematocide (10%) in soil at depth 30 cm after its application with 30 kg/feddan.

Residues of nematocide in potato root have been recorded in Table 5 and illustrated in Figs 5 & 6. From this table, it is clear that the residue in potato was undetectable after two hours from application, while it reached maximum after 1 day while was 0.215 mg/kg, then gradually declined till it became undetectable 44 days after application. The calculated half life was 9.926 days with a slope of -2.846. This calculated half life was rather comparable with that drawn graphically (9.51 days) but is much longer than meeting the depletion % and potato residues (4.42 days).

Our results parallel those of **Guyton (1982)** who recorded that ethoprophos residues were detectable till 35 days after application in grape vineyards. However, they seem different from those recorded by **Menzer *et al.* (1971)** who recovered ethoprophos from bean plants 63 days after the treatment and 100 days in maise plants after the treatment, and from **Guyton (1985)** who reported that field tests indicate that most crops grown in soils treated with ethoprophos have non-detectable residues at harvesting.

Concerning The half- life of ethoprophos, **Zhang *et al.* (1998)** found in a field experiment carried out during 1994- 1995 that half-life of ethoprophos in rice straw was 3.5 to 4.1 .

Form the results of the current experiment the residue level of ethoprophos on potato roots are below the limits of safe tolerance **(Codex, 2003)**. Thus, potato roots can be safely marketed and consumed by humans.

Table (5): Residues, dissipation and depletion rate of ethoprophos nematocide (10%) in potatoes after its application at a dose of 30 kg/feddan at different sampling times.

Sampling No.	Time of sampling (days)	Residue in Potato (mg/kg)	Dissipation # %	Depletion # %
1	0*	UD	-	-
2	1	**0.215 ± 0.08**	-	-
3	4	0.129 ± 0.06	40.0	40.0
4	7	0.119 ± 0.09	7.8	44.65
5	11	0.097 ± 0.01	18.48	54.88
6	14	0.035 ± 0.008	63.91	83.72
7	21	0.009 ± 0.002	74.28	95.81
8	35	0.006 ± 0.002	33.33	97.21
9	44	UD	100	100
10	51	UD	-	-
	Slope	-2.846		
	Half life ($t_{0.5}$)	9.926		

Notes: Nematocide application occur on the 30th day after cultivation

* Zero time 2 hrs after application UD = undetectable

Data represented as mean ± SE.

Number of sample per each sampling = 3

$$\# \text{ Dissipation } \% = \frac{(\text{mg/kg in sampling No. n}) - (\text{mg/kg in sampling No. n-1})}{\text{mg/kg in sampling No. 1}} \times 100$$

$$\# \text{ Depletion } \% = \frac{(\text{mg/kg in sampling No. 1}) - (\text{mg/kg in sampling No. n})}{\text{mg/kg in sampling No. n}} \times 100$$

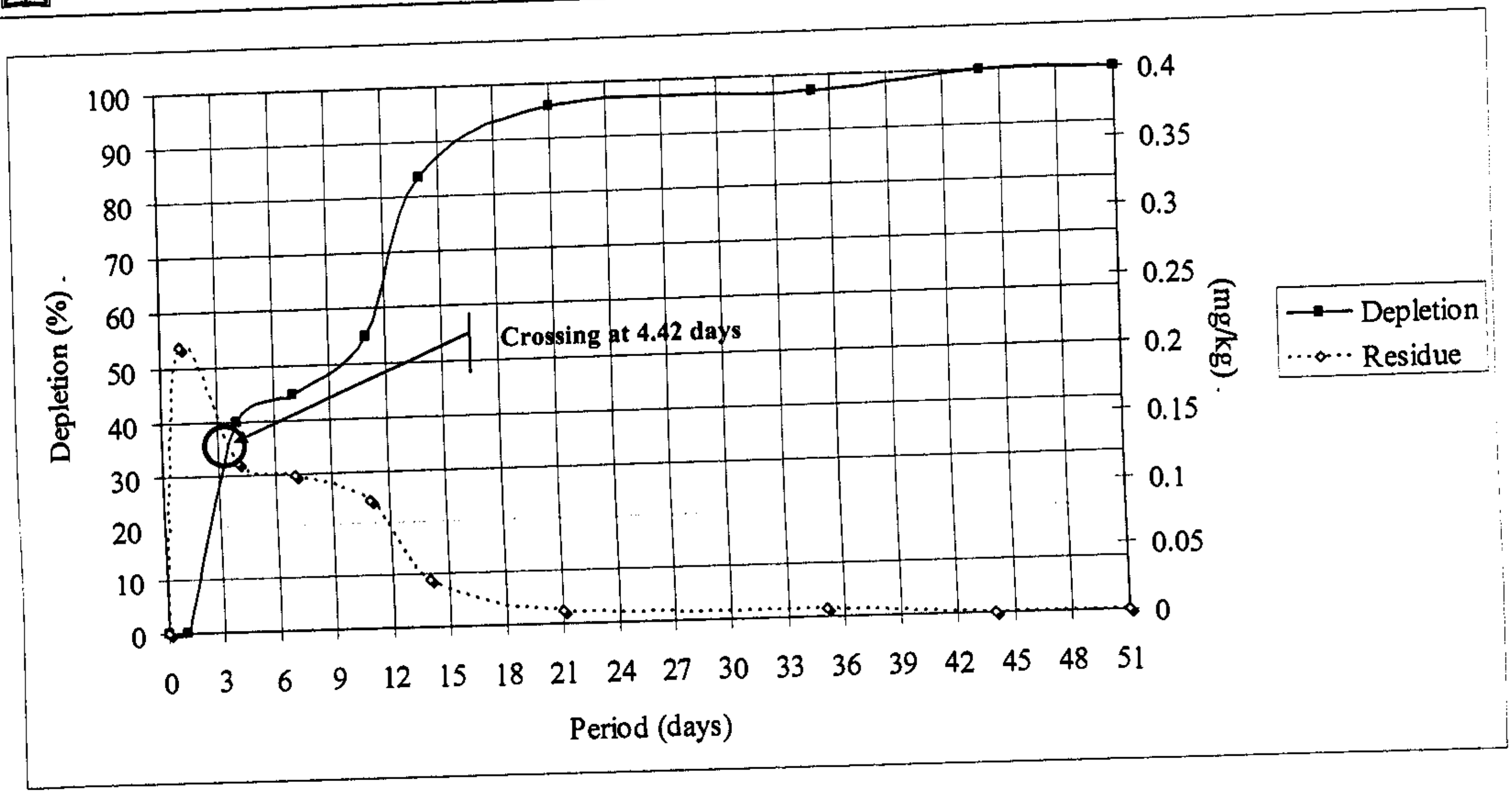

Fig. (5): Dissipation and depletion rate of ethoprophos nematocide (10%) in potatoes after its application with dose 30 kg/feddan.

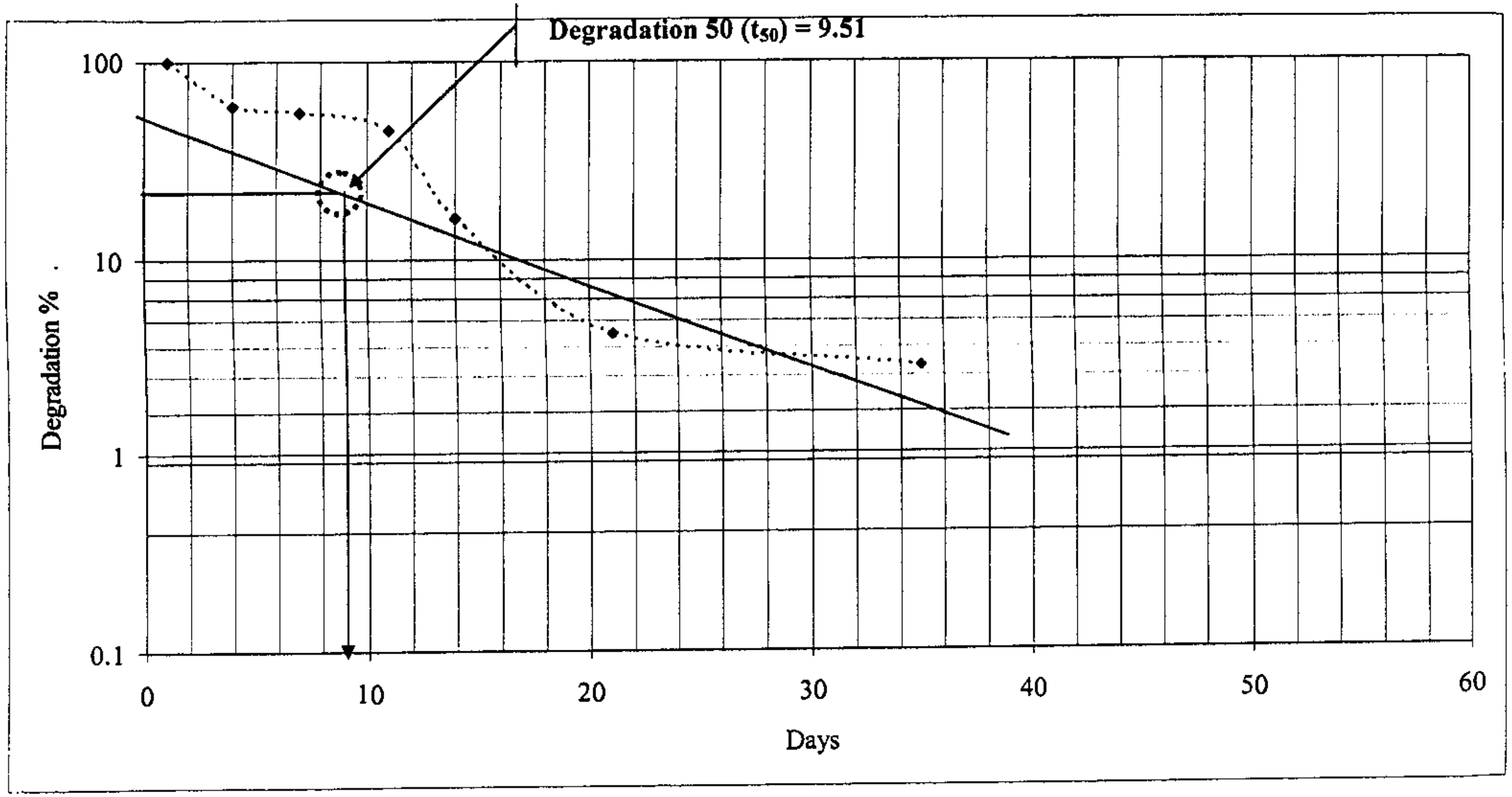

Fig. (6): Degradation rate and t_{50} (half life) of ethoprophos nematocide (10%) in potatoes after its application with dose 30 kg/feddan.

The relation between studied soils and potato root was demonstrated in Tables 6-8 and Fig. 7. Table 6 and Fig. 7 show that the mean residue level of nematoicide at the soil depth of 10 cm is much greater and was shown earlier than at 30 cm depth. Table (7) demonstrates the significant curve regression between residues in soils and potato root. Table (8) shows significant positive correlation ($P<0.05$) between residues at 10 cm or at 30 cm depth as well as at ($P < 0.01$) between potato roots and studied soil depths.

This result seems similar to that reported by **Guyton (1986)** who recorded that ethoprophos residues in the top 30 cm of the soil more concentrated than in the top 30 cm. They concluded that fluctuations in the ethoprophos residues found in the soil from month to month, and lack of residue analysis below 30 cm made it difficult to reach a definite conclusion regarding vertical movement. **Abdel-Razik *et al.* (2001)** found that the initial deposit of ethoprophos in the soil surface in the upper soil layer 0- 10 cm exceeded those in the layer 30- 40 cm at all the sampling dates. Very rapid degradation of ethoprophos was observed by **Karpouzas *et al.* (1999)** and **Nasr *et al.* (2001)** in soil samples had been treated annually with ethoprophos.

The lower significant residue level of ethoprophos in potato roots compared with residue levels in the two soil depth could be attributed to slow uptake of ethoprophos by the plants (**Menzer *et al.*, 1971**). The fluctuated results in ethoprophos residue in potato roots, could be attributed to the effect of continuous increase in volume and weight of potato root, also to an effect of cellular enzyme in biodegradation in addition to nematocide movement from soil to root and *vice versa.*

In conclusion, extreme fluctuations in the ethoprophos residues found in the soil, either between depths or change with time, also the rapid depletion could be regarded to the effect of soil degradation as a result of its low persistence in the environment (**CEC, 1993**; **FAO, 1993**; **Karpouzas** ***et al.*****, 1999**; and **Zhao** ***et al.*****, 2006**).

Table (6): Ethoprophos (10%) residue in soil and potatoes (mg/kg) after its application at a dose of 30 kg/feddan at different sampling times.

Sampling No.	Period (day)	Soil		Potato
		at 10 cm depth	at 30 cm depth	
1	0	**5.98**	0	0
2	1	4.25	0.11	**0.215**
3	4	2.63	0.26	0.129
4	7	1.03	**0.40**	0.119
5	11	0.44	0.27	0.097
6	14	0.18	0.19	0.035
7	21	0.11	0.109	0.009
8	35	0.04	0.036	0.006
9	44	0.01	0.014	0
10	51	0	0	0

Table (7): Regression of Ethoprophos (10%) residues between soil (at 10 and 30 cm depth) and potatoes after its application with dose 30 kg/feddan.

Model		Sum of Squares	df	Mean Square	F	Significance
1	Regression	35885.48	1	35885.48	850.46	0.001 a
	Residual	7848.328	186	42.19531		
	Total	43733.81	187			
2	Regression	36211.16	2	18105.58	445.26	0.001 b
	Residual	7522.651	185	40.66298		
	Total	43733.81	187			
3	Regression	37422.22	3	12474.07	363.65	0.001 c
	Residual	6311.586	184	34.3021		
	Total	43733.81	187			

a Predictors: (Constant), Soil 30 cm

b Predictors: (Constant), Soil 30 cm, Soil 10 cm

c Predictors: (Constant), Soil 30 cm, Soil 10 cm, Potatoes

Table (8): Pearson Correlations of Ethoprophos (10%) residues between soil (at 10 and 30 cm depth) and potatoes after its application with dose 30 kg/feddan.

		Soil 10 cm	Soil 30 cm	Potatoes
Soil 10 cm	Pearson Correlation			
	Sig. (1-tailed)			
	N			
Soil 30 cm	Pearson Correlation	0.5715*		
	Sig. (1-tailed)	0.0452		
	N	188		
Potatoes	Pearson Correlation	0.8404**	0.8738**	
	Sig. (1-tailed)	0.001	0.001	
	N	188	188	

* Correlation is significant at the 0.05 level.

** Correlation is significant at the 0.01 level.

N : number of measurable samples = 10

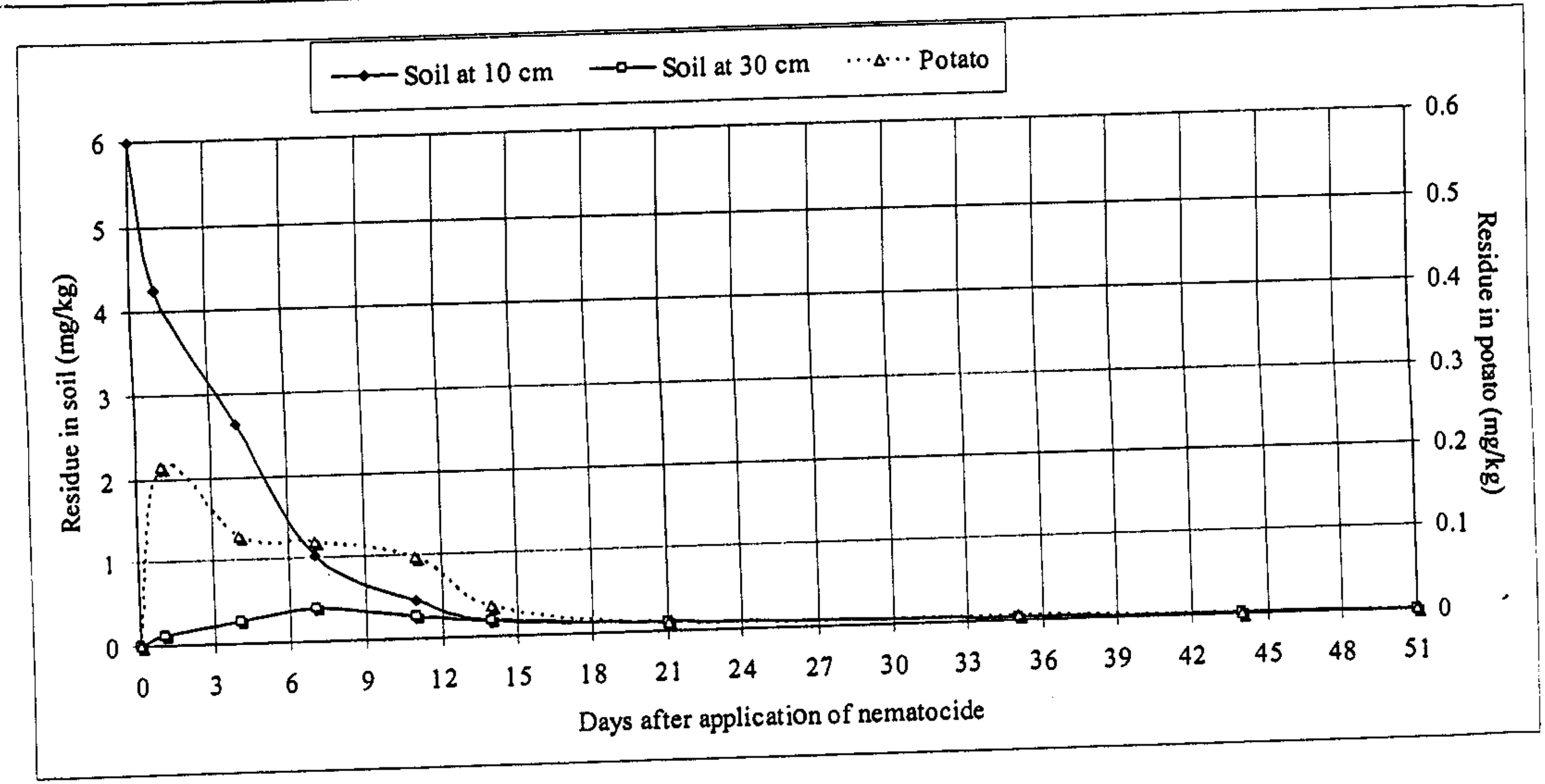

Fig. (7): Mean ethoprophos (10%) residues in soil and potatoes after its application with dose 30 kg/fedden

4.2. Fluazifop-p-butyl:

Fluazifop-p-butyl is a selective postemergence phenoxy herbicide used for control of most annual and perennial grass weeds in cotton, soybeans, stone fruits, potatoes, coffee, and others. It may often be used with an oil adjuvant or nonionic surfactant to increase its efficiency. It has essentially no activity on broadleaf species **(EXTOXNET, 1996).**

4.2.1. Persistence of Fluazifop-p-butyl pesticide in soil:

The present study on residues of Fluazifop-p-butyl herbicide the in clay loam soil at Kafr El-Sharakoa, Mansoura district, Dakahlia Governorate, during winter of 2007 season was carried out under the normal field conditions. Residues in the potatoes root field were also investigated.

Table 9 and Figs 8 & 9 demonstrate residue contents, dissipation, depletion rate and degradation of fluazifop-P-butyl herbicide (12.5%) in soil at depth 10 cm after its application with 2 liters/ feddan. Fluazifop-P-butyl residues began appearing 2 hours after application (1.08 mg/kg), reaching maximum 24 hours after application, then gradually decreasing till become undetectable 51 days after application. The half life of the herbicide in soil at 10 cm depth was 3.78 day, this result was proved graphically from the semi-log curve diagram of Fig. 9 "3.71 day", as well as the depletion percent and residue curve diagram of Fig. 8 "3.1 day".

This result agree with that reported by **EXTOXNET (1996)** which stated that Fluazifop-p-butyl is of low persistence in moist soil environments, with a reported half-life less than 1 week and that Fluazifop-p-butyl breaks down rapidly in most soils to the fluazifop acid, which is also of low persistence. The same report added that Fluazifop-p-butyl and fluazifop-p are of low mobility in soils and do not present appreciable risks for groundwater contamination **(EXTOXNET, 1996).**

This result differ than that reported by **El-Metwally and Shalby (2007)** who recorded that the initial deposits of fluazifop-p-butyl were about 39.89 mg/kg in cultivated soils. The half-life obtained in the current study is higher than that reported by **Edwards (2008)** who mentioned that fluazifop-P-butyl half life is less than one day.

Table (9): Residues, dissipation and depletion rate of fluazifop-P-butyl herbicide (12.5%) in soil at depth 10 cm after its application at a rate of 2 liters of herbicides/ feddan at different sampling times.

Sampling No.	Days after application	Residue in soil (mg/kg)	Dissipation # %	Depletion # %
1	0*	1.08 ± 0.21	-	-
2	1	**3.36 ± 0.14**	211.11	-211.11
3	4	1.59 ± 0.11	52.67	-47.22
4	7	0.46 ± 0.08	71.07	57.41
5	11	0.22 ± 0.06	52.17	79.63
6	14	0.18 ± 0.04	18.18	83..33
7	21	0.11 ± 0.019	38.89	89.81
8	35	0.09 ± 0.008	18.18	91.67
9	44	0.04 ± 0.007	55.56	96.29
10	51	UD	100	100
	Slope	-0.2902		
	Half life ($t_{0.5}$)	3.78 (day)		

Notes: herbicide application occur on the 30th day after cultivation

* Zero time 2 hrs after application UD = undetectable

Data represented as mean ± SE.

Number of sample per each sampling = 3

$$\# \text{ Dissipation } \% = \frac{(\text{mg/kg in sampling No. n}) - (\text{mg/kg in sampling No. n-1})}{\text{mg/kg in sampling No. 1}} \times 100$$

$$\# \text{ Depletion } \% = \frac{(\text{mg/kg in sampling No. 1}) - (\text{mg/kg in sampling No. n})}{\text{mg/kg in sampling No. n}} \times 100$$

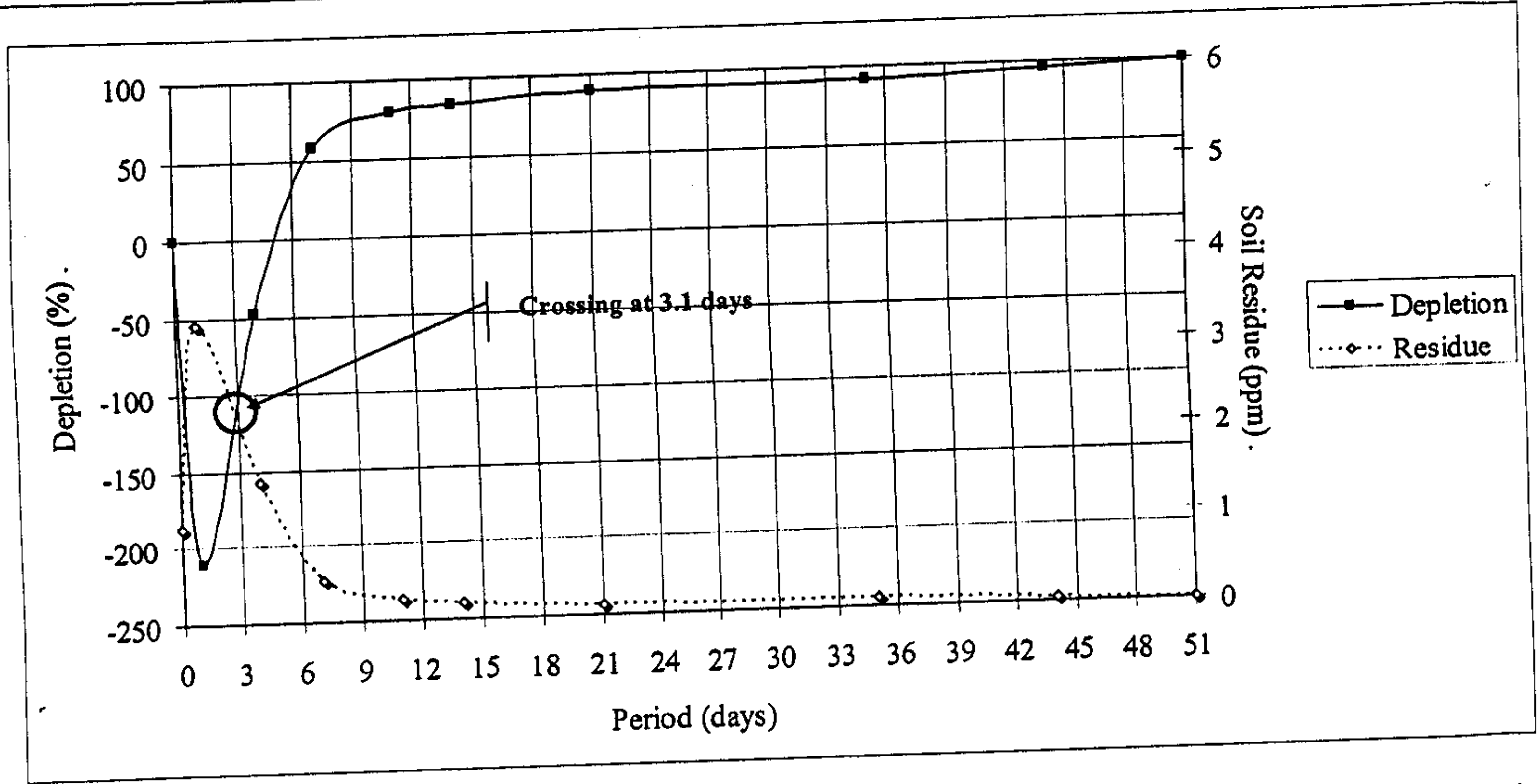

Fig. (8): Dissipation and depletion rate of fluazifop-P-butyl herbicide (12.5%) in soil at depth 10 cm after its application with 2 liters/ feddan.

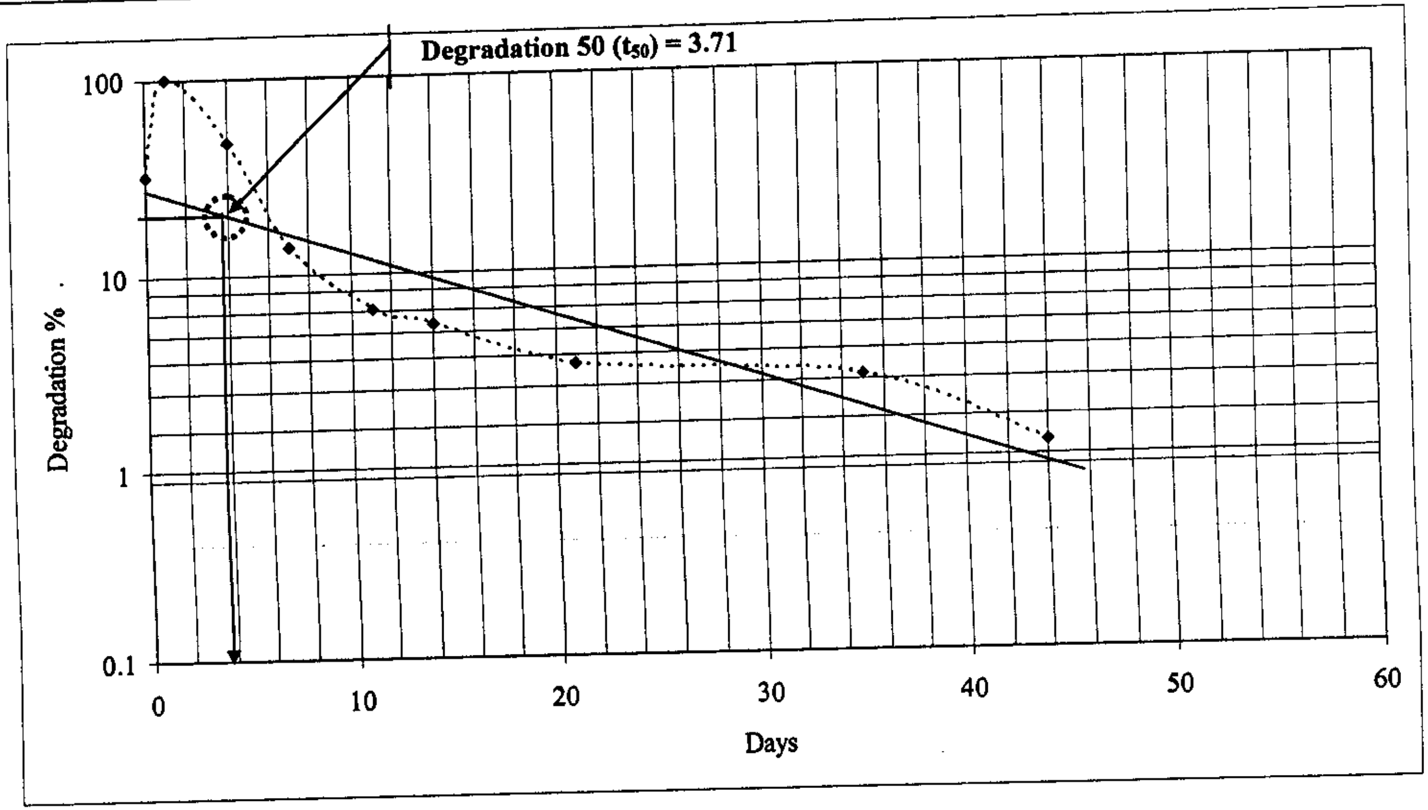

Fig. (9): Degradation rate and t_{50} of fluazifop-P-butyl herbicide (12.5%) in soil at depth 10 cm after its application with 2 liters/ feddan.

Table 10 and Figs 10 & 11, show residues, dissipation and depletion rate of fluazifop-P-butyl herbicide (12.5%) in soil at depth 30 cm after its application with 2 liters/ feddan. Fluazifop-P-butyl herbicide was undetectable after 2 hours from application, then gradually increased reaching 0.19 mg/kg after 4 days then continuously disappearing from soil till became undetectable after 51 days from application. The half life was calculated to be 19.89 day from zero day but this could be calculated as 15.89 day from maximum day level (4 day after application). Graphically it was 19.2 days (Fig., 11), otherwise residue level crossed at 9.35 day (Fig., 10). These variations are due to the manner of the herbicide in soil, especially in more depth and the hydrolysis of the racemic herbicidal ester **(Bewick, 1986)**. Biodegradation of fluazifop-butyl in soil is expected to be important; fluazifop-butyl is rapidly biodegraded in moist soils, with a half-life of less than 1 week; the major degradation product being fluazifop **(Swann, 1983; Humburg, 1989; Lyman, 1990** and **Tomlin, 1994)**.

Table (10): Residue, dissipation and depletion rates of fluazifop-P-butyl herbicide (12.5%) in soil at depth 30 cm after its application at 2 liters/ feddan.

Sampling No.	Days after application	Residue in soil (mg/kg)	Dissipation # %	Depletion # %
1	0*	UD	-	-
2	1	0.115 ± 0.01	-	-
3	4	**0.19 ± 0.006**	65.21	-65.21
4	7	0.16 ± 0.007	15.79	-39.13
5	11	0.12 ± 0.008	25.00	-4.35
6	14	0.11 ± 0.009	8.33	4.35
7	21	0.09 ± 0.005	18.18	21.74
8	35	0.03 ± 0.003	66.67	73.91
9	44	0.01 ± 0.003	66.67	91.30
10	51	UD	100	100
	Slope	-0.440		
	Half life ($t_{0.5}$)	19.89 day		

Notes: herbicide application occur on the 30th day after cultivation
* Zero time 2 hrs after application UD = undetectable
Data represented as mean ± SE.

Number of sample per each sampling = 3

$$\# \text{ Dissipation } \% = \frac{(\text{mg/kg in sampling No. n}) - (\text{mg/kg in sampling No. n-1})}{\text{mg/kg in sampling No. 1}} \times 100$$

$$\# \text{ Depletion } \% = \frac{(\text{mg/kg in sampling No. 1}) - (\text{mg/kg in sampling No. n})}{\text{mg/kg in sampling No. n}} \times 100$$

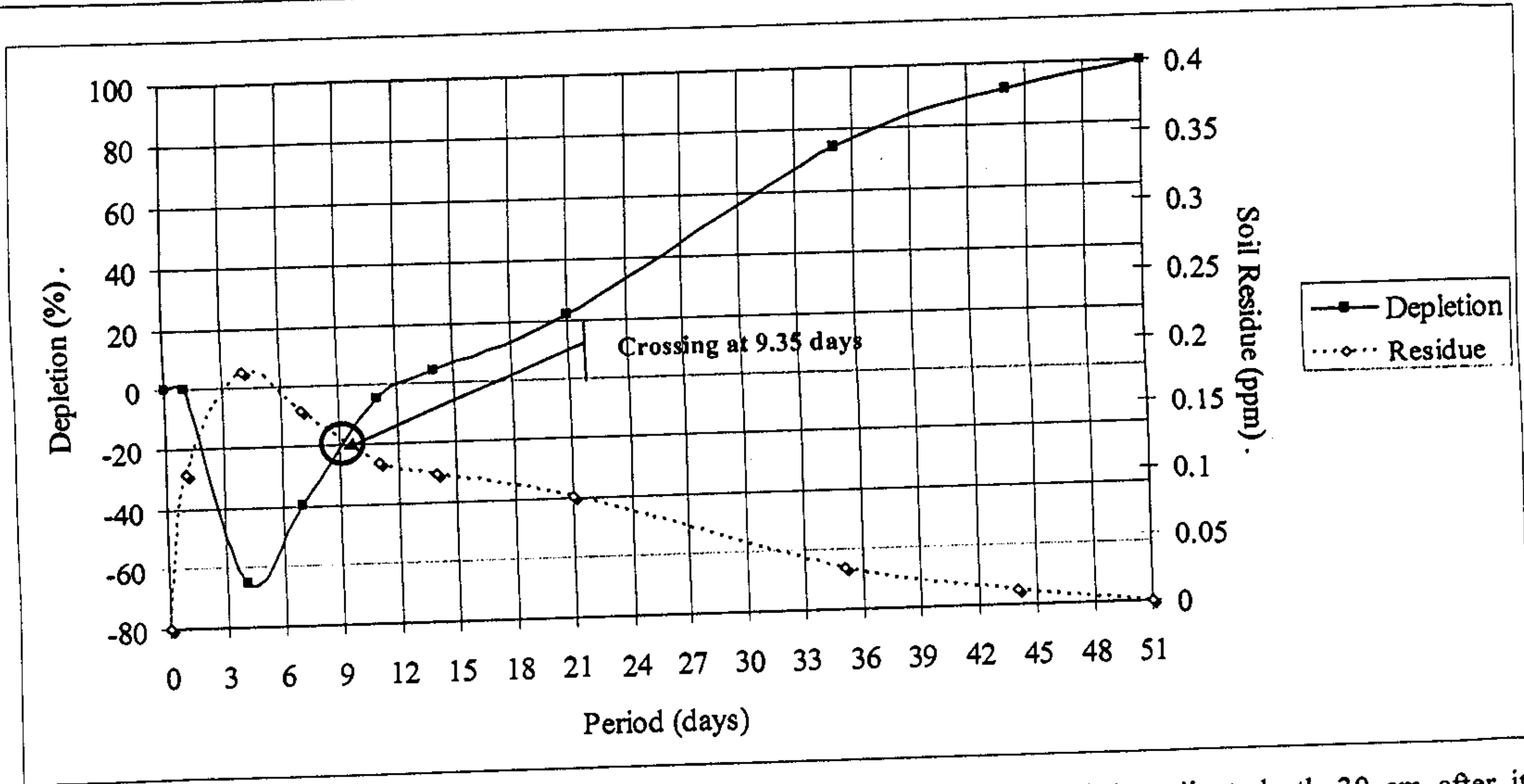

Fig. (10): Dissipation and depletion rate of fluazifop-P-butyl herbicide (12.5%) in soil at depth 30 cm after its application with 2 liters/ feddan.

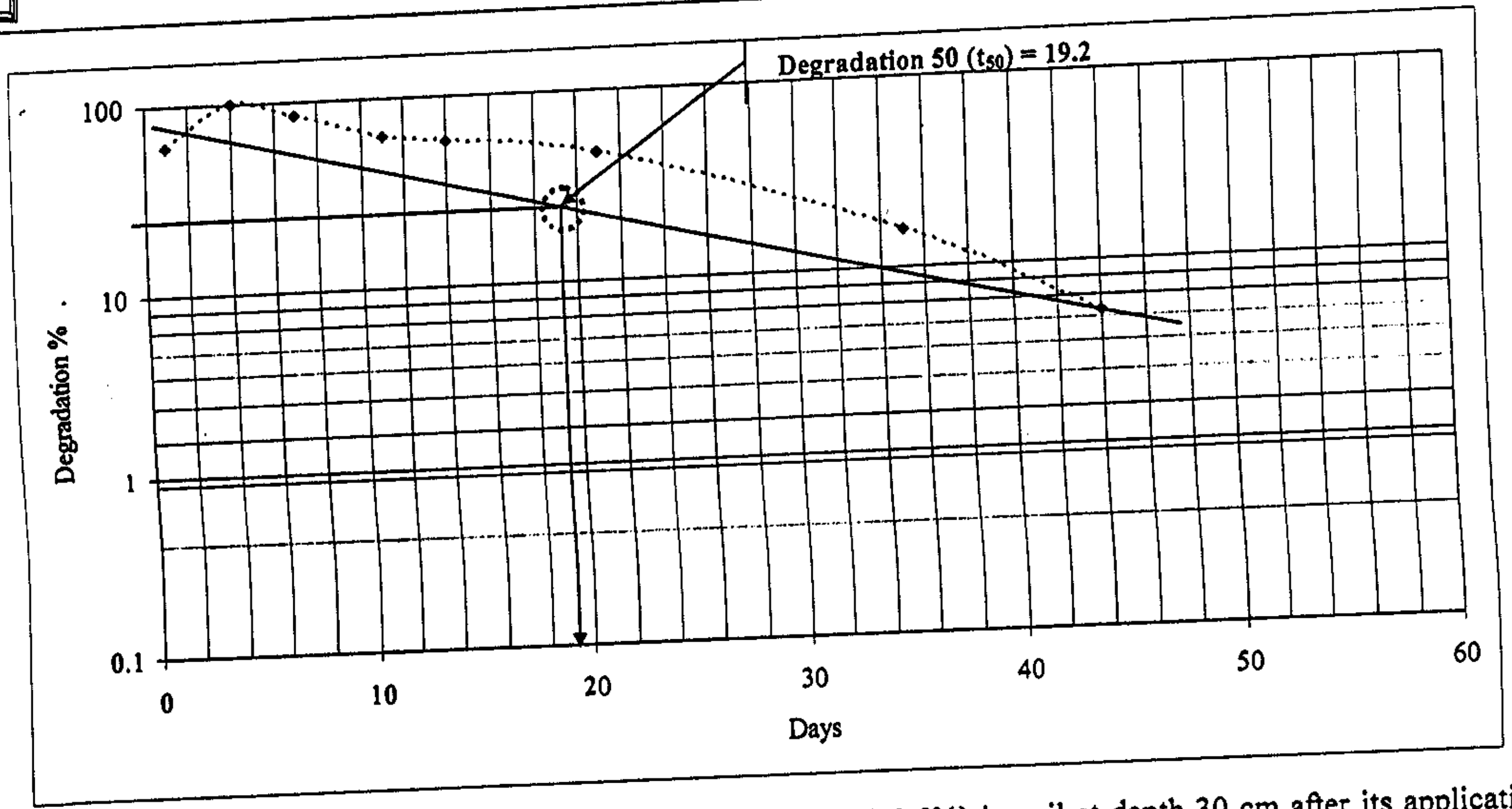

Fig. (11): Degradation rate and t_{50} of fluazifop-P-butyl herbicide (12.5%) in soil at depth 30 cm after its application with 2 liters/ feddan.

4.2.2. Persistence of Fluazifop-p-butyl herbicide in potatoes:

Table 11 and Figs 12 & 13, explain fluazifop-P-butyl herbicide residue contents, dissipation and depletion in potatoes after its application. Data demonstrate that fluazifop-P-butyl herbicide residue was negligible 2 hours after application then it reached a maximum after 24 hours (3.17 mg/kg), then gradually decreased till complete clearance after 51 days. The half life was calculated to be 9.32 day and graphically was 9.3 day (Fig., 13). However, the residue level line and depletion rate line cross each other is at 11.5 day from application (Fig., 12).

These results seem to disagree with that those reported by **Clegg (1987)** who recorded long duration of herbicide clearance when residues of fluazifop-butyl (Fusilade) in treated potatoes reached below 0.05 µg/g at harvest 90 days after herbicide application.

The observed contradictory half-life could be due to the fact that after herbicide uptake by the leaves of plants, Fluazifop-p-butyl is rapidly broken down in the presence of water to fluazifop-p, which is translocated throughout the plant. The compound accumulates in the actively growing regions of the plant (meristems of roots and shoots, root rhizomes and stolons of grass), where it interferes with energy (ATP) production and cell metabolism **(EXTOXNET, 1996)**. In addition, fluazifop-butyl is rapidly hydrolyzed to fluazifop, which acts by interfering with ATP production (**Tomlin, 1994**). This affects herbicide residue in the root in addition to continuous increase in its volume and size, and helps in biodegradation of the herbicide.

The maximum residue level for fluazifop-p-butyl is 0.5 mg/kg in potato root (**US Maximum Residue Levels in Food Commodities, 2004**). Therefore, it is safe to use this herbicide for potato cultivation.

Table (11): Residues dissipation and depletion rate of fluazifop-P-butyl herbicide in potatoes after its application with 2 liters fluazifop-P-butyl 12.5% / feddan.

Sampling No.	Days after application	Residue in Potato (mg/kg)	Dissipation # %	Depletion # %
1	0*	0	-	-
2	1	**3.17 ± 0.28**	-	-
3	4	2.69 ± 0.16	15.41	15.41
4	7	2.07 ± 0.14	23.04	34.70
5	11	1.87 ± 0.11	9.66	41.00
6	14	0.75 ± 0.10	59.89	76.34
7	21	0.49 ± 0.08	34.67	84.54
8	35	0.26 ± 0.06	46.94	91.80
9	44	0.07 ± 0.01	73.08	79.79
10	51	UD	100	100
	Slope	-11.526		
	Half life ($t_{0.5}$)	9.32 day		

Notes: herbicide application occur on the 30th day after cultivation
* Zero time 2 hrs after application UD = undetectable
Data represented as mean ± SE.
Number of sample per each sampling = 3

$$\# \text{ Dissipation } \% = \frac{(\text{mg/kg in sampling No. n}) - (\text{mg/kg in sampling No. n-1})}{\text{mg/kg in sampling No. 1}} \times 100$$

$$\# \text{ Depletion } \% = \frac{(\text{mg/kg in sampling No. 1}) - (\text{mg/kg in sampling No. n})}{\text{mg/kg in sampling No. n}} \times 100$$

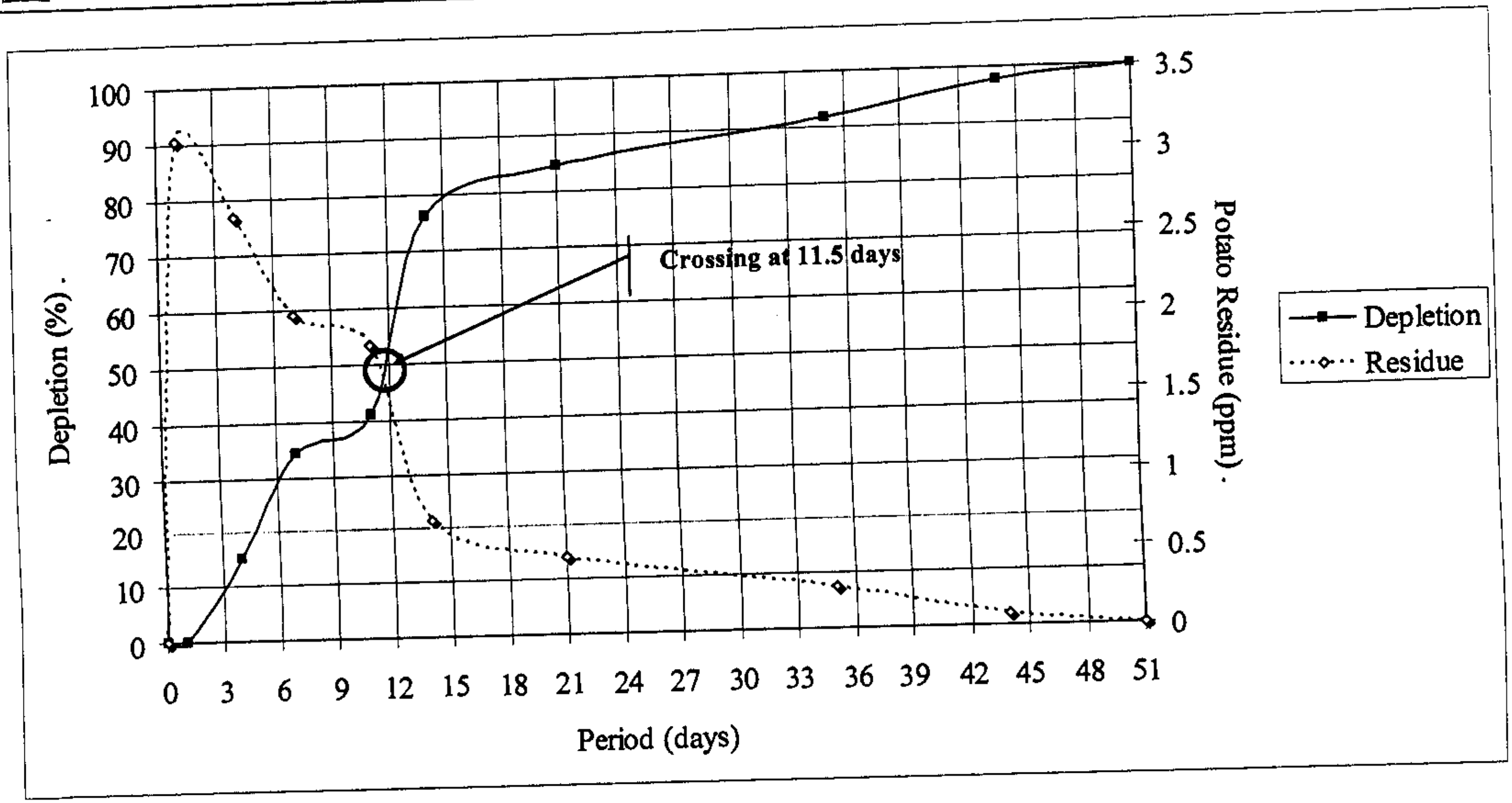

Fig. (12): Dissipation and depletion rate of fluazifop-P-butyl herbicide in potatoes its application with 2 liters/ feddan.

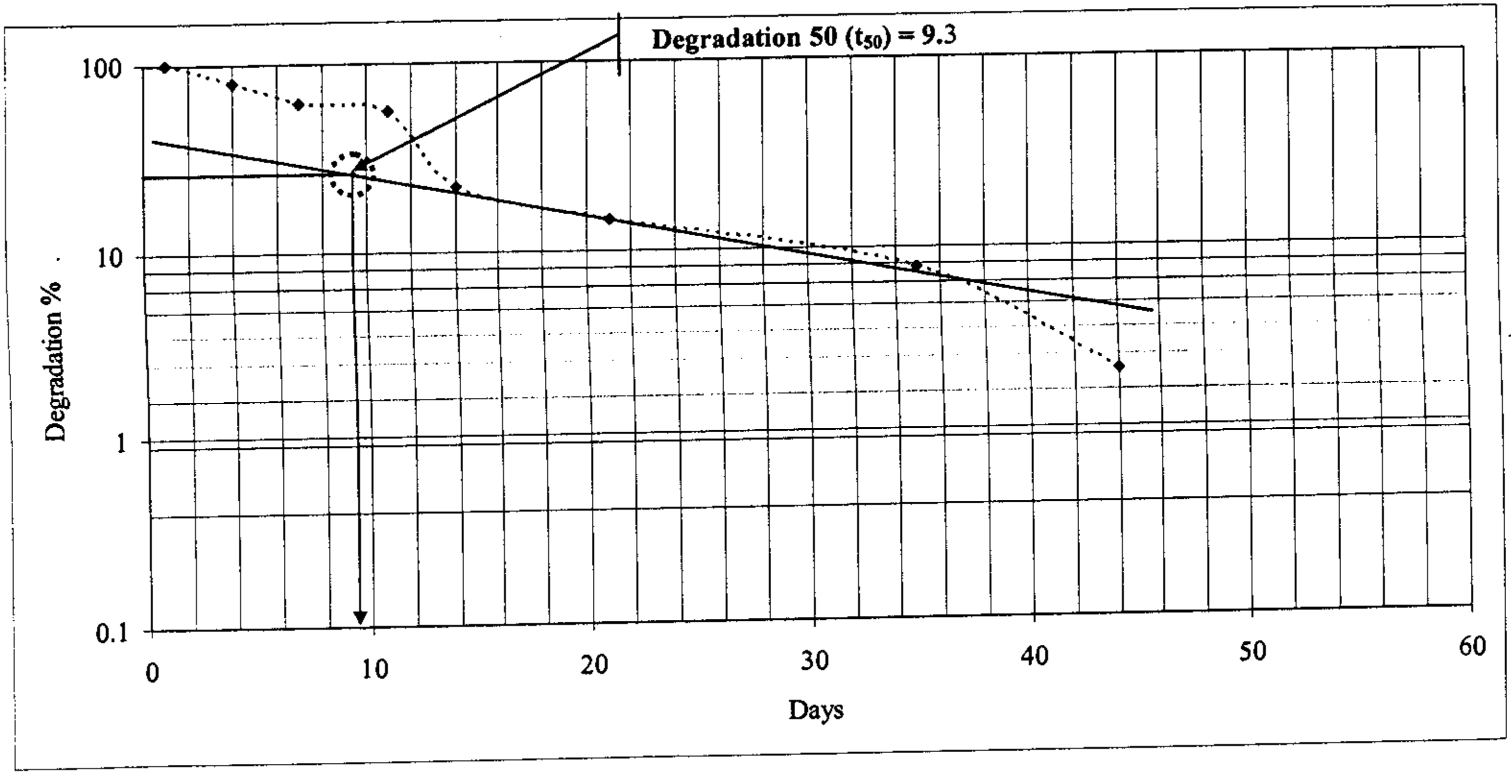

Fig. (13): Degradation rate and t_{50} of fluazifop-P-butyl herbicide in potatoes its application with 2 liters/ feddan.

Relationships between content of herbicide in soil and potato root are demonstrated in Tables 12 to 14 and Fig. 14. Table 12 and Fig. 14 show that the mean residue level of fluazifop-P-butyl herbicide at 10 cm soil depth was higher and appeared earlier than at 30 cm depth. Table 13 shows significant curve regression between residues in soils and potato root. On the other hand, table 14 demonstrate that there is no - significant correlation between residues at 10 cm and residues in 30 cm depth, but, there is a significant positive correlation between residues in soil at 10 cm and there is potatoes, as well as between residues in soil at 30 cm at and in potato.

The fluctuations in the fluazifop-P-butyl herbicide residues in soil and the decrease with time and its rapid depletion reflects its degradation in soil **(EXTOXNET, 1996** and **El-Metwally and Shalby, 2007)**.

Table (12): Fluazifop-P-butyl herbicide residues in soil and potatoes after its application with 2 liters Fluazifop-P-butyl 12.5%/ feddan.

Sampling No.	Period (day)	Soil		Potato
		at 10 cm depth	at 30 cm depth	
1	0	1.08	0	0
2	1	**3.36**	0.115	**3.17**
3	4	1.59	**0.19**	2.69
4	7	0.46	0.16	2.07
5	11	0.22	0.12	1.87
6	14	0.18	0.11	0.75
7	21	0.11	0.09	0.49
8	35	0.09	0.03	0.26
9	44	0.04	0.01	0.07
10	51	0	0	0

Table (13): Regression of fluazifop-P-butyl herbicide residues between soil (at 10 and 30 cm depth) and potatoes after its application with 2 liters Fluazifop-P-butyl 12.5% / feddan.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1983.598	3	661.1992	3.714594	0.08045 a
	Residual	1068.002	6	178.0004		
	Total	3051.6	9			
2	Regression	1779.423	2	889.7116	4.895531	0.04678 b
	Residual	1272.177	7	181.7395		
	Total	3051.6	9			
3	Regression	1246.409	1	1246.409	5.523663	0.04666 c
	Residual	1805.191	8	225.6489		
	Total	3051.6	9			

a Predictors: (Constant), Soil 30 min

b Predictors: (Constant), Soil 30 min, Soil 10 min

c Predictors: (Constant), Soil 30 min, Soil 10 min, Potatoes

Table (14): Correlation coefficient of fluazifop-P-butyl herbicide residues between soil (at 10 and 30 cm depth) and potatoes after its application with dose 2 liters /feddan.

	10 cm	30 cm	Potato
Soil at 10 cm	1		
Soil at 30 cm	0.3539^{ns}	1	
Potato	0.728*	0.8452**	1

* Correlation is significant at the 0.05 level.

** Correlation is significant at the 0.01 level.

ns: non significant

n = sample size = 10

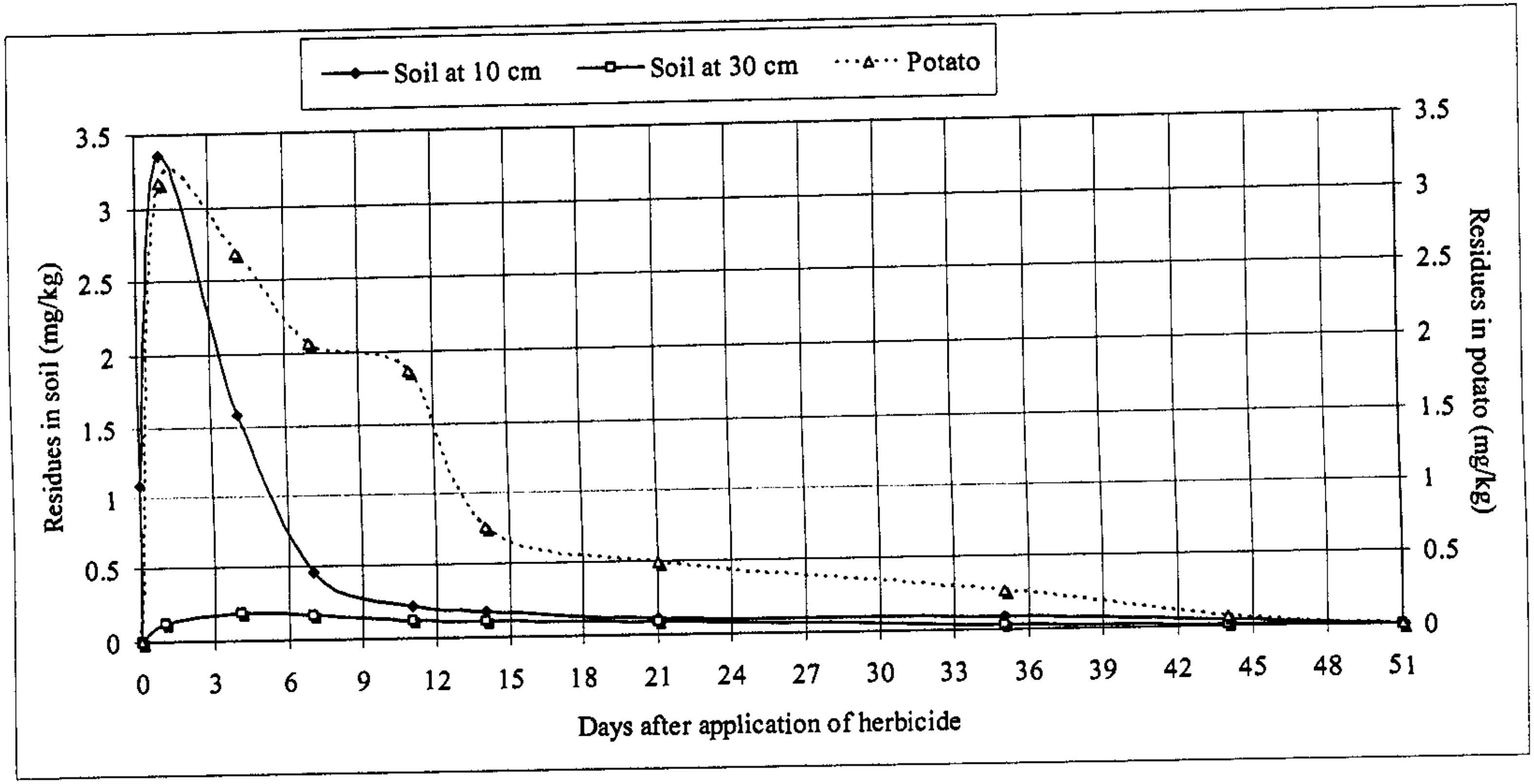

Fig. (14): Mean fluazifop-P-butyl residues in soil and potatoes after its application with dose 40 kg/fedden