Residual Effect of Certain Agrochemicals on the Activity of Dehydrogenase and Urease Enzymes and on the Mineralization of Organic Phosphorus in a Sandy Loam Soil

M. A. Massoud
Department of Plant Protection, Faculty of Agriculture, Saba Basha, University of Alexandria, Egypt. E-mail: drmagdy2@yahoo.com

ABSTRACT

The residual effect of the recommended and the 2-fold recommended rates of abamectin, fluazifop-p-butyl, lufenuron, mefenoxam plus and pymetrozine, in addition to the recommended rate of the mineral and bio-fertilizers (Monoammonium phosphate and Microbine) on the activity of organic dehydrogenase and urease enzymes, and on the mineralization of organic phosphorus was studied in a sandy loam soil. The results showed that the recommended rate of all tested pesticides and fertilizers and/or the 2-fold rate of pesticides reduced the dehydrogenase activity after 7 and 28 days, while after 14 and 21 days, a stimulating effect was observed. However, all pesticides at their recommended and 2-fold rates insignificantly reduced the general means of dehydrogenase activity except lufenuron and pymetrozine at the 2-fold rate, inducing 8.51 and 8.71 ppm of formazan comparing with 11.57 ppm in untreated soil. Meanwhile, both of mineral fertilizer (MAP) and bio-fertilizer (Microbine) reduced the dehydrogenase enzyme, but the significant reduction was obtained by MAP achieving the highest reduction (7.67 ppm) among all agrochemicals. All tested pesticides at both rates and fertilizers increased urease activity% after 7 and 28 days post treatment, while after 14 and 21 days, the tendency effect showed little inhibiting effect. However, all used agrochemicals activated urease enzyme but didn't differ significantly than the untreated check, except mefenoxam plus at its 2-fold rate, whereas it induced 27.66% versus 19.57% in check. Since the mineralization of organic phosphorous is very important factor influencing plant growth, the effect of the tested agrochemicals on soluble inorganic phosphorus in the sandy loam soil was illustrated. Most of used pesticides, at their both applied rates, declined the production of inorganic phosphorus along the four weeks of assay. Only mefenoxam plus is the most deleterious and significant pesticide in depressing inorganic phosphorus formation, where, the general means of inorganic phosphorus were 144.15 and 136.97 ppm at R. and 2-fold rates, respectively compared to 193.88 ppm in untreated check soil. On the other hand, the increase of inorganic phosphorus formation was occurred by mineral fertilizer (M.A.P.) after 7, 14 and 21 days of evaluation and the biofertilizer Microbine after 7 days of treatment. Meanwhile, MAP significantly increased inorganic phosphorus (255.87 ppm) more than check or all other treatments, while, Microbine insignificantly increased inorganic phosphorus (205.16 ppm) than check. Therefore it could be concluded that, the effect on which was appeared at some intervals may be attributed to the formation of metabolites corresponding to more efficient toxic microorganisms. However, the study revealed that the biological activity levels might be recovered to its normal level at some periods or at the end of determination which is probably due to detoxification of the agrochemicals.

INTRODUCTION

Unfortunately, pesticides eventually reach water sources, soil, air and plant by direct overspray, spray drift, agrochemicals run-off and accidental spills. So, this large-scale use of different pesticides has created a biotic factor which affecting almost every ecosystem.

On the other hand, these pesticides may affect the beneficial microorganisms in the soil which play a good role on the fertility and productivity of the agricultural soils, through their effect on the biological processes such as the mineralization of organic matter and soil enzymes (Eno 1962; Gaur and Misra, 1977; Lewis *et al.* 1978; El-Shahaat, 1993 and Beltagy, 2000).

It is well known that the use of urea as an organic nitrogen fertilizer requires an enzymatic hydrolysis to make its nitrogen content available to the plants. Urease enzyme in soil is the enzyme that catalyses the hydrolysis of urea which could be absorbed by plant roots and probably causes a harmful effect on plant cells. Moreover, the urease enzyme can catalyze the hydrolysis of urea to CO_3 and NH_3. Therefore, there is a negative relation between urease activity and the unhydrolysed urea; urea residue.

The soil dehydrogenase activity can be considered as an indicator of the biological activities (Casida *et al.*, 1964), soil respiration (Stevenson, 1959 and Stevenson, 1962) and microbial population (Galstyan and Avundzhyon, 1970).

The safety of pesticides is of a great importance to avoid unwanted side influence either on structure, composition and fertility of soil (Stenersen and Quien, 1980). The aim of the present study is to estimate the influence of certain pesticides and certain fertilizers on the biological processes and some enzymatic activities occurred in sandy loam soil.

MATERIALS AND METHODS

1) Agrochemicals used:

1.1) Pesticides used:

1) Abamectin (Vertimec 1.8% EC) ^{R} (bio-insecticide and acaricide).
2) Lufenuron (Match 5% EC) ^{R} (Chitin synthesis inhibitor).
3) Pymetrozine (Chess 5% EC) ^{R} (insecticide).
4) Fluazifop -P- butyl (Fusilade Super 12.5% EC) ^{R} (Herbicide).
5) Mefenoxam plus (Ridomil Gold Plus 42.5 % WP) ^{R} (systemic fungicide).

1.2) Fertilizers used:

a) Microbine [R] [Commercial multi nutrient (biofertilizer)]:
mixture of P-dissolving and N_2 – fixing bacteria (Azospirillum, Azotobacter,Klebsiella and Bacillus ...et)

b) Mono Ammonium phosphate (mineral fertilizer)
Chemical name: Ammonium dihydrogen phosphate (NPK 12–60– 0).

2) Preparation and treatment of soil samples:

A sandy loam soil was collected free from pesticides area attached to Agricultural Research Station, Sabaheia region, Faculty of Agric. Farm, Alexandria University. Soil samples were air–dried, crushed and sieved through a 2-mm screen.

Soil samples (2 kg each) were placed in perforated black plastic pots, mixed thoroughly with organic manure (0.5 kg fertilizer/100kg soil), sown with broad bean seeds to activate the soil, and then sown another time with tomato seeds (Castlerock variety-5August 2003) which mixed also with Phosphorine (biofertilizer). Thirty days after sowing, tomato plants were subjected to agrochemicals treatment.

In addition, the formulated pesticides and fertilizers were tested according to Ministry of the Agriculture recommendations. The pesticides used in their aqueous dilutions were sprayed on the tomato plants surface using a pot sprayer. All rates were calculated via soil surface area of the experimental pots. The used recommended rates of the pesticides were 40 ml/100L, 1000 ml/feddan area, 160 ml/feddan area, 800 gm./feddan and 240 gm/feddan area for Vertimec [R], Fusilade super [R], Match [R], Ridomil Gold plus [R] and Chess [R], respectively.

The pesticides were applied at two rates of applications (the recommended and 2-fold recommended rates) on the vegetative tomato plants. The moisture content of soil was adjusted to 60% of its water holding capacity (WHC) and maintained during the course of study. As for the bio fertilizer (Microbine) [R]; the recommended rate (500 gm/feddan) was added beside the plant roots, covered with a little of soil, while the recommended rate of the inorganic fertilizer (Mono- ammonium phosphate 200 kg /feddan), was added onto the surface of the experiment pots. The experimental pots were then irrigated just after fertilization. The treated and untreated pots (with 3 replicates) were randomly distributed and exposed to open air conditions for, 2, 3 and 4 weeks. Soil samples were taken periodically to determine the mineralized phosphorus content and the activity of both urease and dehydrogenase enzymes. All results were expressed as the air-dry weight of soil; therefore 2 grams from each pot were subjected to moisture content determination.

3) Determination of some biological activities in soil samples:

3.1) Soluble mineralized phosphorus:

Both extraction and determination of soluble mineralized phosphorus in soil were carried out according to Watanabe and Olsen method (1965) which had been adapted by Murphy and Riley (1962), and Amer *et al.* (1976).

The combined reagents contain sulphoric acid, ammonium molybidate, ascorbic acid and antimony potassium tartarate in single solution, which react with orthophosphate to produce a stable colour within 10 minutes. The produced color was stable for 24 hours.

Soluble mineralized phosphorus was extracted by the extracting solution (ammonium sulphate-sodium bicarbonate solution). The soil samples were extracted by the extractant at 1:25(w/v), w = weight of soil; V=volume of distilled water, and the mixture was shaked by electrical shaker for 30 min. followed by filtration. A 5 ml of the filtrate was treated with 10 ml of distilled water and 5 ml of the combined reagent and well mixed. After 10 min., Spectronic 21 D spectrophotometer was implemented to measure the color intensity at 660 nm. The calibration curve of phosphorus was carried out using series of standard inorganic phosphorus ranged between 5 and 40 µg.

3.2) Dehydrogenase enzyme assay:

Dehydrogenase activity in soil was determined colorimetrically according to the reduction of 2, 3, 5 triphenyl tetrazolium chloride 'TTC' as laboratory substrate to triphenyl formazan 'TPF' which was extracted and measured spectrophotometrically (at wave length of 485 nm) by slightly modified method of Casida *et al* (1964). So, there is a positive correlation between the yield of formazan and dehydrogenase activity.

3.3) Urease enzyme assay:

Urease enzyme in soil was the enzyme that catalyses the hydrolysis of urea to CO_3 and NH_3. Thus, a serious problem may arise when urea fertilizer is added to soil having low urease activity where, unhydrolized urea could be absorbed by plant roots and probably causes a harmful effect on plant cells (Moe, 1967; Burns *et al.*, 1972; Lleoyed and Sheaffe, 1973; Kiss *et al.*, 1975 and Lethbridge *et al.*, 1981). Therefore, there is a negative relation between urease activity and the unhydrolysed urea (urea residue).

Urea residues were extracted according to the method of Pancholy and Rice (1973) with a slight modification. The urea was determined colorimetrically at wave length of 240 nm. The amounts of remaining urea in micrograms were calculated based on a calibration standard curve of urea concentrations ranging from 250 to 2000 micrograms. The urea contents were expressed as micrograms urea/gram air-dry soil. The urease

activity was determined according to Watt and Chrisp (1954) as the following formula:

Urease activity % = [(A-B)/A] x 100

Where;

A = the original urea added (ppm),

B = the remaining urea (residues) in ppm, and

A-B = the converted amount of urea in ppm

4) Statistical analysis of data:

The analysis of variance of treated and check-untreated soils within three replicates x three estimations was carried out using the split-plot design (Steel and Torrie, 1980). The means of treatment effects were compared for significance by a least significant difference (LSD) measured at the probability level of 0.05.

RESULTS AND DISCUSSION

Effect of certain agrochemicals on some biological activities in soil:

1) Effect on dehydrogenase enzyme activity.

The effect of the studied agrochemicals, in ppm, on dehydrogenase activity was shown in Table (1) and Figures (1 and 2). The results showed that the R. rate and 2 fold rate of lufenuron reduced the dehydrogenase activity after 7 days of assay, from 19.93 to 15.52 and 8.23 ppm, respectively, while after the 2nd interval, lufenuron at its recommended rate apparently caused a stimulating effect. However, general means of formazan showed that there was a significant difference between the 2-fold rate (8.51) and the untreated check (11.57 ppm) on the activity of dehydrogenase enzyme in soil (Table, 1 and fig., 2).

Pymetrozine was clearly affected the activity of dehydrogenase enzyme in sandy loam soil. The two rates decreased the enzyme activity to 13.03 and 11.12 in R. rate, and to 8.23 and 8.39 ppm after 7 and 28 days of assay, respectively. However, the two rates of pymetrozine gave an elevation of dehydrogenase activity after 14 and 21 days of treatment, respectively. However, general means of formazan in ppm showed that there is a significant difference between the 2-fold rate of application (8.71) and the untreated on the activity of dehydrogenase enzyme in soil (Table, 1 and fig., 2).

The obtained formazan values indicated that abamectin treatments could affect the dehydrogenase activity indicating that the two rates of treatments reduced the formazan formation after 7 and 28 days of sampling. In contrast, abamectin at double rate enhanced the dehydrogenase activity after 14 and 21 days of application, respectively. The general means of formazan indicated that there was no evidence that

the application of abamectin had any adverse effect on dehydrogenase activity, where there were no significant changes between the check and the abamectin treatments (Table, 1 and Fig, 2). These findings are in the line with Hally *et al.* (1993) who indicated that abamectin possesses no significant antibacterial and antifungal activity in soil.

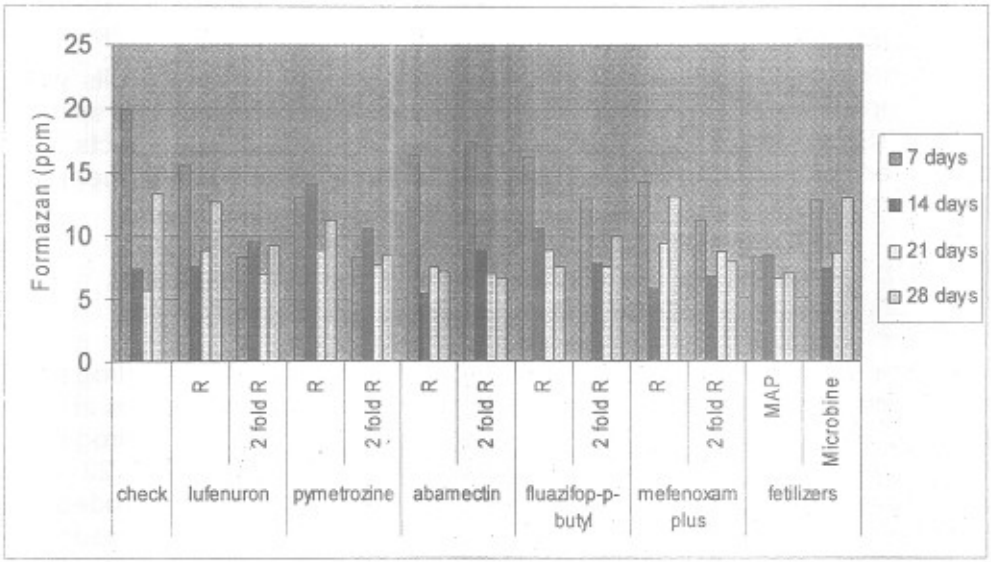

Fig. (1): Effect of certain pesticides and fertilizers on dehydrogenase activity in soil during different bioassay intervals.

The effect of fluazifop-P-butyl on dehydrogenase showed that the R and 2 fold rates of application caused decrease of dehydrogenase activity from 19.93 ppm to 16.17 and 12.83 after 7 days, and from 13.24 ppm to 7.55 and 9.81 after 28 days, respectively. On the other hand, fluazifop-P-butyl at the recommended rate of application increased the formazan values after 14 and 21 days of application. However, general means of formazan showed that there is a significant difference between the double rate of application and the untreated on the activity of dehydrogenase enzyme in soil (Table 1 and Fig. 2).

The obtained data indicated that the two rates of mefenoxam plus reduced the formazan formation from 19.93 ppm to 14.24 and 11.17, from 7.40 ppm to 5.77 and 6.66, and from 13.24 ppm to 13.0 and 7.90 ppm after 7, 14 and 28 days of treatment. However, mefenoxam at both rates enhanced the formazan from 5.71 to 9.35 and 8.65 ppm after 21 days,

respectively. The general means of formazan (Table, 1 and fig., 2) indicated that the 2-fold rate significantly decreased dehydrogenase activity (8.60 ppm) than the check.

Regarding the tested fertilizers, M.A.P. decreased dehydrogenase activity inducing 8.62 and 6.92 ppm of formazan compared with 19.93 and 13.24 ppm after 7 and 28 days of application, successively. The slight elevation of formazan formation (8.62 and 6.53 ppm) was obtained after 14 and 21 days of assay. It is clear that Mono-ammonium phosphate could decline the general mean of dehydrogenase activity inducing 7.67 ppm throughout the whole assay period.

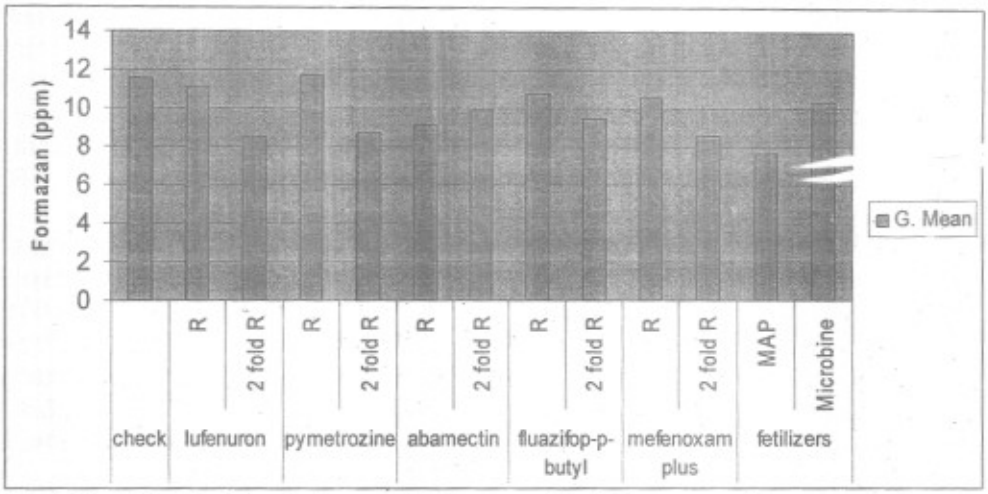

Fig. (2): Effect of certain pesticides and fertilizers on the general mean of dehydrogenase activity in soil throughout the bioassay period (28 days).

Concerning Microbine, slight effect was revealed. The same trend of decrease after 7 and 28 days or increase after 14 and 21 days was also obtained. In respect to the general mean, no significant differences were investigated between Microbine and check during the inspection period.

In general, all pesticides at their recommended rate of application did not affect dehydrogenase enzyme activity in sandy loam soil, while the 2-fold rate of lufenuron, pymetrozine and mefenoxam plus significantly reduced its activity. It is obvious that the mineral fertilizer, MAP, achieved the highest reduction among all the tested agrochemicals. El-Shahaat and El-Okda (1991) found that Carbofuran and aldicarb had no effect on

dehydrogenase activity, while the methiocarb and oxamyl bait elevated the enzyme activity in sandy clay loam soil. Ahmed (1998) reported that carbofuran was an inhibitor to dehydrogenase activity in the two soils without any differences between its rates of application.

2) Effect on Urease enzyme activity.

According to the activity of urease enzyme in soil, urea fertilizer is converted to NH_4–N, which is considered as initial substrate required for the nitrification process. Therefore, there is a negative correlation between the remaining "unconverted urea amount and the urease activity.

Results tabulated in Tables (1) & Figs. (3 and 4) indicate the effect of agrochemicals on urease activity. Both rates of lufenuron treatments increased urease activity% after 14, and 28 days of study. The highest urease activity was obtained by the 2-fold rate after 28 days from application (30.16%). Little decrease was observed by the recommended rate after 7 and 21 days. This pesticide had no deleterious effect at its two rates on urease activity%. The obtained general means of urease activity percent values can get the following trend: the 2-fold R. rate (22.57) > R. rate (19.69) > check (19.57).

In relation to pymetrozine treatments, there was no consistent trend at the mentioned periods of study, but enhance of urease activity percent was observed after 21 and 28 days of study reaching 22.43 and 22.56%, respectively using the double rate of application while, the R. rate recorded an increase of urease activity% (29.90%) after 28 days of assay. According to the general means of enzyme activity% values (19.69 and 22.57%), both rates of treatments, didn't differ significantly than those in untreated check (19.57%).

The results of abamectin treatments on urease enzyme activity indicated that abamectin at the recommended rate caused insignificant increase of urease activity percent (25.56, 19.60, 27.70 and 28.16%) more than those in 2-fold rate (20.06, 19.90, 24.56, 24.60%) or in untreated after 7, 14, 21 and 28 days of treatment, respectively. The obtained general means of urease activity% could be arranged as follows: R. rate (25.26) > 2-fold R. rate (22.28) > check (19.57%).

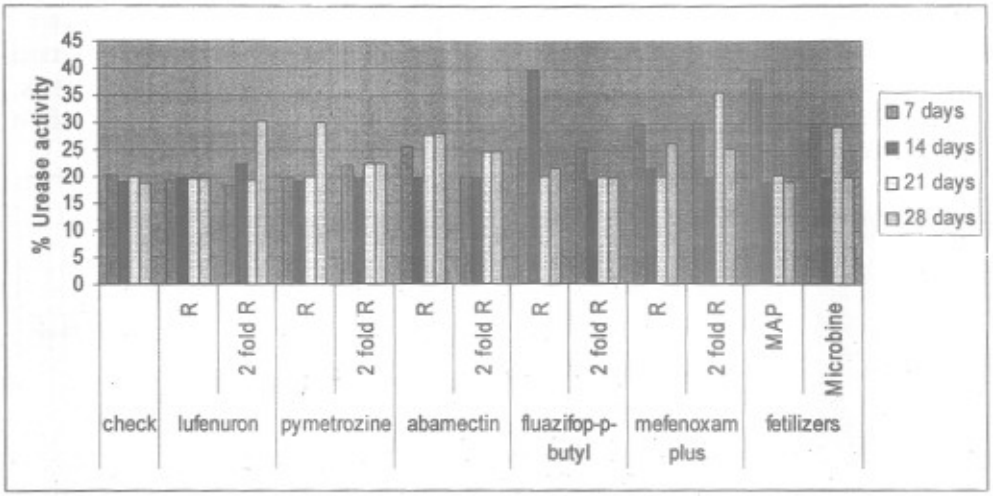

Fig. (3): Effect of certain pesticides and fertilizers on urease activity in soil at different bioassay intervals.

The obtained urease activity% values indicated that fluazifop-P-butyl treatments could insignificantly affect the urease activity% indicating that the treatments generally stimulated the enzyme activity especially after 7 and 14 days (25.20 and 39.66%) by using the R. rate and after 7 days (25.16%) by the double rate of application. After 21 days of the study pots treated with fluazifop-P-butyl were, more or less, close to the untreated pots. At the end of evaluation, there are no significant differences, in the general means of urease activity%, between fluazifop-P-butyl and the control which could be arranged as follows: recommended rate (26.62) ≥ 2-fold recommended rate (21.03) ≥ check (19.57%).

As regards the effect of mefenoxam plus on urease enzyme activity in soil, the two different rates did not cause any adverse effect on urease activity%, but. An increase of urease activity percent was recorded after 7, 14, 21 and 28 days of evaluation compared with the check. That increase was obviously appeared in the treatment with 2-fold rate (29.93, 19.90, 35.66 and 25.16%) than with R. rate (29.76, 21.66, 19.90 and 26.26%) after 7, 14, 21 and 28 days post treatment, consequently. At the end of the study, calculating general means (Table, 1 and Fig., 4) showed that the double rate significantly increased the urease activity% values (27.66) than R. rate (24.40) or control (19.57%).

According to the effect of fertilizers on urease activity percent, the finding results showed M.A.P. enhanced urease activity% comprising 38.26% only after 7 days of evaluation, in the meanwhile the increase was

occurred by Microbine (29.40, 29.50 and 20.13% after 7, 21 and 28 days of treatment, respectively. The general means of urease activity% induced both fertilizers didn't differ significantly together or with untreated check, which could be arranged as follows: Microbine 24.73 ≥ M.A.P. 24.15 ≥ check 19.57%.

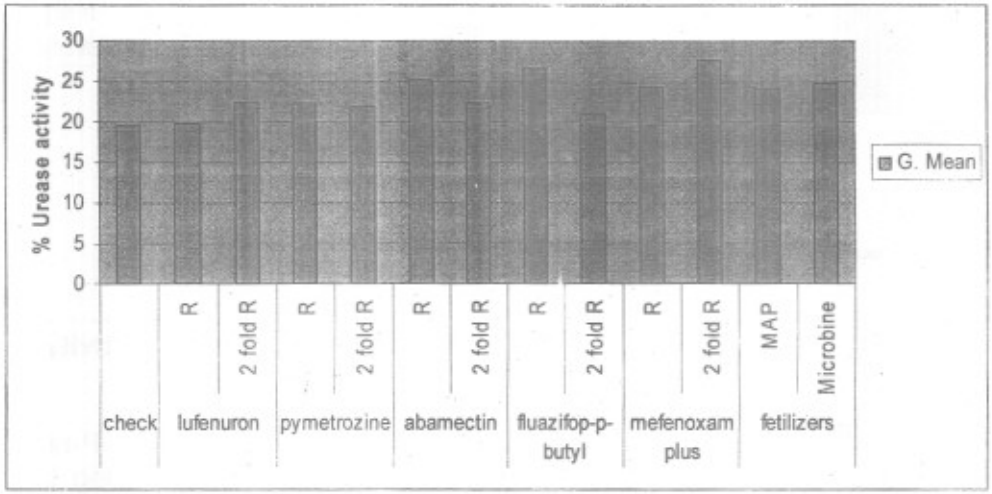

Fig. (4): Effect of certain pesticides and fertilizers on the general mean of urease activity in soil throughout the bioassay period (28 days).

The increase in urease activity probably is due to utilization of the agrochemicals as nutrient source. This may induce an increase in the activity of the urease producing microorganisms that is in agreement with reported by Skujine (1967) and Bartha *et al.* (1967). These problems resulted from rapid hydrolysis of urea to $(NH_4)_2CO_3$ which rise in pH and liberation of N^+H_4–N. They can induce damage germinating seedling and young plants, as well as inducing the ammonia and or nitrate toxicity and loss of urea as gaseous ammonia.

In contrast, the depression of soil enzymes by agrochemicals may be due to the toxicity of the agrochemicals or their degradation products and or their enzymes released into soil (Richey *et al.*, 1977 and Kim and Hong, 1988). However, the moderate reduced activity, which may be occurred, can be desirable, because the heavy use of urea fertilizer produces some problems.

However, many reports stated that urea may be absorbed by plant roots and may cause phytotoxicity to plant cells. Therefore a serious

problem may arise when urea fertilizer is added to soil having low urease activity (Lleoyed and Sheaffe, 1973; Kiss *et al.* 1975 and Lethbridge *et al.* 1981).

The effect of agrochemicals on the biological activities of sandy loam soil could be clearly concluded that these effects varied to some extent, indicating no consistent pattern with sampling periods. This conclusion is in agreement with that obtained by Tu (1980). El-Shahaat and El-Okda (1991) reported that oxamyl bait had no effect on urease activity in the two types of soil. Also, Ahmed (1998) revealed that Carbofuran at different rates of evaluation had no effect on urease activity in sandy clay loam soil while, there were no differences in sandy loam soil.

3) Effect on mineralization of organic phosphorus.

It is well known that the soil organic phosphorus microbially mineralized to available inorganic form which serves as plant nutrient. Therefore, the mineralization of organic phosphorous is very important factor influencing plant growth particularly in soil having a high content of calcium carbonate, which can fix inorganic phosphorus to unavailable nutrient. The effects of the tested agrochemicals on detecting inorganic phosphorus in the treated soil are illustrated in Table (1) and Figs (5 and 6).

It is obvious as shown in Fig. (5 and 6) that lufenuron declined the production of available phosphorus fraction in soil after 7 and 28 days of assay, from 243.62 to 201.84 and 238.38 ppm by R. rate and from 204.98 to 175.08 and 166.46 ppm by 2-fold rate, respectively. However, there is an elevation of the production of inorganic phosphorus was occurred by lufenuron (138.17) using 2-fold R. rate and (218.78) using R. rate after 14 and 21 days of application, respectively. At the end of evaluation, the effect of lufenuron with its both rates of application are merely equal to check where, lufenuron caused no significant differences on the Pi content (Table, 1 and Fig, 6).

The effect of pymetrozine, insecticide on inorganic phosphorus production, indicated that pymetrozine reduced the production of available phosphorus using the two rates of application after 7, 14, 21, 28 days of evaluation (Fig., 5). The general means clearly indicated that pymetrozine caused insignificant suppression of inorganic phosphorus formation and the treatments could be arranged as follows: check (193.88) > pymetrozine at R. rate (163.25) = pymetrozine at the double rate (164.73) ppm (Table, 1 and Fig., 6).

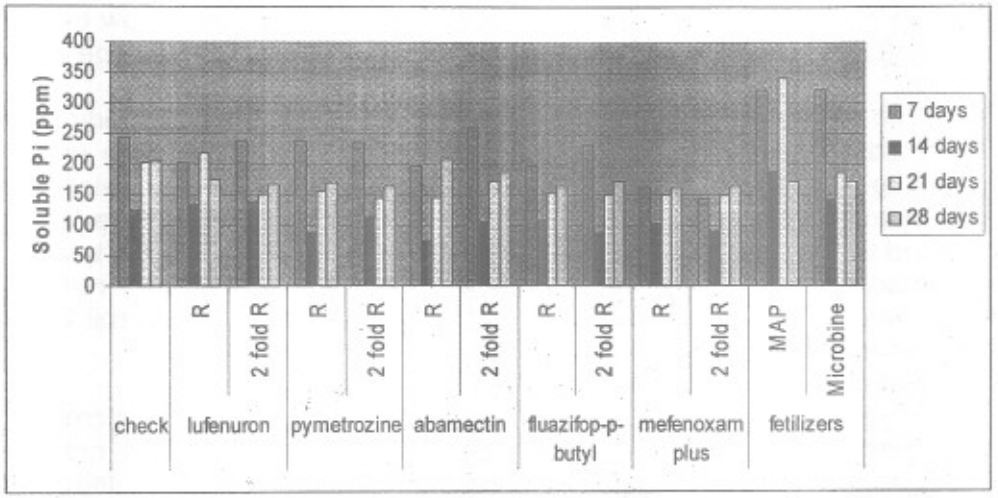

Fig. (5): Effect of certain pesticides and fertilizers on mineralization of organic phosphorus in soil throughout the different bioassay intervals.

The decrease of available organic Pi was revealed in soil treated with abamectin after 14, 21 and 28 days of study. However, the double rate of application recorded the highest enhance among all used pesticides (262.16 ppm) by the 2-fold rate and (207.80 ppm) by the R. rate after 7 and 28 days of application, consequently. At the end of experiment, there are no significant differences between abamectin treatments and control and the general means of determined inorganic phosphorus which could be arranged as follows:

check (193.88) > abamectin at 2-fold R. rate (181.54) > abamectin at R. rate (156.12 ppm).

Also, insignificant decrease of production of available phosphorus was obtained in soil treated with "fluazifop-P-butyl" using the two rates of application and along the 4 assay periods. The evaluated general means of Pi resulted from > fluazifop-P-butyl could be arranged as follows: check (193.88) > 2-fold recommended rate (161.20) > the recommended rate (155.42 ppm).

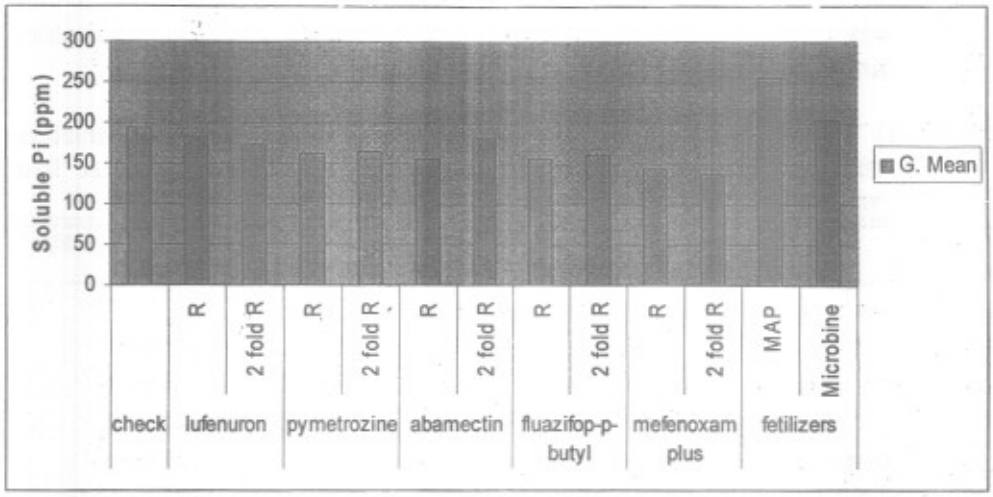

Fig. (6): Effect of certain pesticides and fertilizers on the general mean of soluble inorganic phosphorus in soil throughout the bioassay period.

Regarding the effect of mefenoxam plus on inorganic phosphorus (Pi) content, the obtained data indicated that the two applied rates reduced the production of available phosphorus in soil after 7, 14, 21 and 28 days of application. Moreover, mefenoxam plus induced the highest reduction (163.53 and 145.36 ppm) after 7 days (163.53 and 145.36 ppm) and (144.15 and 136.97 ppm) after 28 days by its R. and 2-fold rates, respectively. Also, the finding results showed that mefenoxam plus, with its both rates, caused a significant decline in the general mean production of Pi than check or the used fertilizers (MAP and Microbine) and the evaluated treatments could significantly be arranged as follows: check (193.88) > mefenoxam at R. rate (144.15) = mefenoxam at 2-fold R. rate (136.97) ppm. In general, mefenoxam plus caused deleterious effect on mineralization of native phosphorus in soil.

According to the obtained results from soil treated with fertilizers; it is clear that the increase of Pi formation was occurred by mineral fertilizer (M.A.P.) after 7, 14 and 21 days of evaluation and the biofertilizer Microbine recorded high increase of Pi content after 7 days of treatment. However, little reduction of Pi production was obtained by both M.A.P. and Microbine only after 28 days of assay.

With opposition of al used pesticides, an increase of general mean production of available inorganic phosphorus was observed by the two fertilizers. Whereas, MAP significantly increased Pi (255.87 ppm) more

than check or all other treatments. On the other hand, Microbine insignificantly increased Pi (205.16 ppm) than check.

Table (1) The general mean of dehydrogenase and urease activities, and the mineralized phosphorus in soil throughout four weeks post treatment.

Treatment	Rate	Dehydrogenase activity (Formazan ppm)	Urease activity (%)	Soluble mineralized Pi (ppm)
lufenuron	R	11.14 ab	19.69 b	182.43 bcd
	2R	8.51 bcd	22.57 ab	173.20 bcd
pymetrozine	R	11.76 a	22.33 ab	163.25 bcd
	2R	8.71 bcd	21.80 ab	164.73 bcd
abamectin	R	9.09 abcd	25.26 ab	156.12 bcd
	2R	9.95 abcd	22.28 ab	181.53 bcd
fluazifop-p-butyl	R	10.77 abc	26.62 ab	155.42 bcd
	2R	9.49 abcd	21.03 ab	161.19 bcd
mefenoxam plus	R	10.59 abc	24.40 ab	144.15 d
	2R	8.60 bcd	27.66 a	136.97 d
M.A.P.	R	7.67 d	24.15 ab	255.87a
Microbine	R	10.37 abc	24.73 ab	205.16 b
Check		11.57 a	19.57 b	193.88 bc
LSD		2.50	ns	45.80

* In a column indicated by the same letter (s) are not significantly different at 0.05 probably level.
* R: Recommended rate * 2R: 2-fold recommended rate
* M.A.P.: Mono ammonium phosphate * ns: no significant differences

The increase of production of the available inorganic phosphorus in Microbine treatment may be due to activating soil micro-flora, while MAP could be act as nutrient source and hence increase the activity of organic phosphorus mineralization. On the other hand, the detrimental effect which was appeared at some intervals may be attributed to the formation of metabolites which may be considered as more efficient toxic to phosphorus mineralizing microorganisms. However, the study revealed that the Pi level might be recovered to its normal level at some periods of determination. This alternation is probably due to detoxification of the agrochemicals. These interpretations are in line with those reported by Fawaz *et al.* (1981) and El-Shahaat *et al.* (1986 & 1987). El-Shahaat and El-Okda (1991) found that the evaluated baits had no effect on available Pi production in a sandy loam soil, while aldicarb gave an adverse effect in clay loam.

REFERENCES

Ahmed, I. A. I. 1998. Studies on some factors affecting the efficacy of pesticides in soil. M. Sc. Thesis, Fac. of Agric. Menouf. Univ.

Amer, F.; I. Garbouchey; E. Neikova; and Milcneva. 1976. A proposed phosphorous and potassium soil test. Agrochemical, 20:246 – 252.

Bartha, R. R.; P. Landzillota and D. Pramer. 1967. Stability and effects of some pesticides in soil J. Appl. Microbiol. Vol.l5(l): 67-75.

Beltagy, M. M. H. (2000). Side effect of certain pesticides on earthworm in soil. M. Sc. Thesis, Fac. Of Agric. Menouf. Univ., PP134.

Burns, R. G.; A. H. Pukite; and A. D. Mclaren. 1972. Concerning the location and persistence of soil urease. Soil Sci. Soc., Amer. Proc. 36:308-311.

Casida, L. E. Jr; D.A.. Klein and T. SAntora. 1964. Soil dehydrogenase activity. Soil Sci. 98:371-376.

El-Shahaat, M. S. A. 1993, The impact of certain pesticides with cotton plants and soil. Effect of several pesticides on cotton leaves and soil biological processes during leaf worm control. Alex. J. Agric. Res. 38(2): 377-398.

El-Shahaat, M. S. A. and M. Kh. El-Okda. 1991. Effects of local formulated carbamates baits as molluscicides on soil microbiological processes. Alex. Sci. Exch. Vol. 12(l): 137- 148.

El-Shahaat, M. S. A.; M.Khattab; A. E. Khamis, H.Rashed and A. S. Marei. 1986. Studies on pyrethroids-5- Effect of synthetic pyrethroids on nitrification process in soil. J. Agric. Soil Mansoura Univ. Vol.11(4): 1581-1585.

El-Shahaat, M. S. A.; M.S. Othman; M. E. El-Halafawy and A. S. Marei. 1987) Effect of carbamates and synthetic pyrethroid pesticides on some microbial activities. Alex. J. Agric. Res. 22 (1): 427-438.

Eno, E. F. 1962. The effect of simazine and atrazine on certain soil microflora and their metabolic processes. Pro. Soil Crop Sci. Soc. Fla. 22:49-56.

Fawaz, K. N.; M. E. El-Halafawy; and M. El-W.Y. Eklas. 1981. Studies on soil urease enzyme. 1- Its presence and distribution in Egyptian soil Alex. J. of Agric. Res. 29(1); 345-350.

Galstyan, A. Sh. and Z. S. Avundzhyon. 1970. Dehydrogenase of the clay fraction of soil Dokl Akad. Nouk. USSR, 195(3):707-709.

Gaur, A. C., and K. C. Misra. 1977. Effect of simazine, Lindane and ceresin on soil respiration and nitrification rates. Plant and Soil, 47(5): 5-15.

Hally, B. A; W. J. A. Vanden-Heuvel; P.G. Wislocki; R. (ed.) Herd; L.(ed.) Strong and K. Wardhaugh. 1993. Environmental effects of the usage of avermectins in livestock. Vet. Parasit. (1993). 48:1-4, 109-125.

Kim, J. E. and J. U. Hong. 1988. Effect of herbicides on enzyme activities in soil environmental. J. of Korean Agric. Chem. Soc.; 31(1): 79-85. (C.F., Weed Abs., 1990, 39(8): 6836).

Kiss, S.; M. Dragan-Bularda; and D. Radulescu. 1975. Biological significance of enzymes accumulated in soil. Adv. Agron., 27:25-87.

Lethbridge, G. A.; T. Bull; and R. G. Burns. 1981. Effects of pesticides on 1,3-b-glucanase and urease activities in soil in the presence and absence of fertilizers, lime and organic materials. Pestic. Sci., 12:147-155.

Lewis, J. A.; G. C. Paravizas; and T. S. Hora. 1978. Effect of some herbicides on microbial activity in soil. Soil Biol. Biochem. 10(2): 133-141.

Lleoyed , A.B.; and M.J. Sheaffe. 1973. Urease activity in soils. Plant and Soil, 79:71-80.

Moe, P. G. (1967). Nitrogen losses from urea as affected by altering soil urease activity. Soil Sci. Soc. Amer. Proc. Vol.31, 380-382.

Murphy, J.; and J. P. Riley. 1962. A modified single solution method for the determination of phosphate in natural water. Anal. Chem. Acta. 27:31-36.

Pancholy, S. K; and E. L.Rice. 1973. Soil enzymes in relation to old field succession: amylase, cellulose, invertase, dehydrogenase and; urease. Soil. Sci. Soc. Amer. Proc., 47-50.

Richey, F. A.; W. J. Bartley and K.P.Sheets. 1977. Laboratory studies on the degradation of (the pesticide) aldicarb in soil J. Agric. and Food Chem.25(l):47-51.

Skujins, J. J. (1967). Enzymes in soil. In Soil Biochemistry Vol. 1 Ed. By Mclaren. A.D. and Peterson G.H. Marcel Dekker, New York.

Steel, R. G. D. and J. H. Torrie. 1980. Principles and procedures of statistics. A biometrical approach. Second Ede. Me. Graw- Hill Kogahusha, Ltd.

Stenersen, J. and N. Quien. 1980. Action of pesticides on earthworms Part IV: Uptake and elimination of oxamyl compared with carbofuran. Pestic. Sci. 11, 396-400.

Stevenson, I. L. 1959. Dehydrogenase activity in soil. Con. J. Microbiol., Ottwa, 5:229-235.

Stevenson, I. L. 1962. The effect of decomposition of various crop plants on the metabolic activity of microflora. Con. J. Microbiol., Ottwa, 8:501-509.

Watt, C. W.; and J. D.Chrisp. 1954. Spectrophotometeric method for determination of urea. Annual Chem., 26:452-453.

Tu, C. M. 1980. Influence of pesticides and some of the oxidized analogues on microbial populations, nitrification and respiration activities in soil J. Bull. Environ. Contam. Toxicol. 24:13-19.

الملخص العربي

الأثر الباقي لبعض الكيميائيات الزراعية على إنزيمي ديهيدروجينيز و يوريز و على معدنة الفسفور العضوي في التربة الرملية-اللومية

مجدي عبد الظاهر مسعود

كلية الزراعة سابا باشا – جامعه الإسكندرية ص. ب ٢١٣١

تم دراسة تأثير المعدل الموصى به و ضعفه من مبيدات: أبامكتين، فلوزيفوب-ب-بيوتايل، ليوفينيورون، ميفينوكسام بلاس و بايميتروزين، بالاضافة الى المعدل الموصى به من السماد المعدني (مونو أمونيوم فوسفات) و السماد الحيوي (ميكروبين) على نشاط إنزيم ديهيدروجينيز و إنزيم يوريز و على معدنة الفسفور العضوي في التربة الرملية اللومية. أدت المعاملة بالمعدل الموصى به لكل من المبيدات أو الأسمدة المختبرة وكذلك ضعف المعدل من المبيدات إلى خفض نشاط إنزيم ديهيدروجينيز بعد ٧ و ٢٨ يوم و تنشيط طفيف بعد ١٤ و ٢١ يوم من المعاملة. انخفاض المتوسط العام لنشاط الإنزيم بكل من المعدلين من المبيدات لم يكن معنويا عن الكنترول، باستثناء ضعف المعدل من ليوفينيورون و بايميتروزين اللذان أعطيا ٨,٥١ و ٨,٧١ جزء في المليون فورمازان مقابل ١١,٥٧ جزء في المليون في التربة غير المعاملة. كذلك أدت المعاملة بالسماد الحيوي إلى حدوث خفض غير معنوي بينما كان معنويا في معاملة السماد المعدني محققا أكبر خفض (٧,٧٦ جزء في المليون فورمازان) مقارنة بكل المعاملات.أدت جميع المعاملات سواء مبيدات أو أسمدة إلى زيادة نشاط إنزيم اليوريز بعد ٧ و ٢٨ يوم من المعاملة، بينما كان لهم تأثير مثبط طفيف بعد ١٤ و ٢١ يوم. كذلك أدت جميع المعاملات إلى زيادة المتوسط العام خلال الأربعة أسابيع بدون فرق معنوي عن الكنترول، فيما عدا معاملة ضعف المعدل من ميفينوكسام بلاس الذي أعطى ٢٧,٦٦ مقابل ١٩,٧٥% في حالة الكنترول.نخفض

الفسفور غير العضوي الميسر المتكون خلال أربعة أسابيع نتيجة المعاملة بمعظم الكيميائيات المختبرة. وكان ميبد ميفينوكسام بلاس هو الأكثر المعاملات ضررا حيث أخفض تكوين الفسفور غير العضوي معطيا ١٤٤,١٥ و ١٣٦,٩٧ جزء في المليون بالمعدل الموصى به و ضعفه على الترتيب مقارنة ب ١٩٣,٨٨ جزء في المليون في التربة غير المعاملة. و على العكس من ذلك أدى السماد المعدني إلى حدوث زيادة بعد ٧ و١٤ و ٢١ يوم، و كان المتوسط العام للفسفور غير العضوي المتكون خلال ٤ أسابيع يزيد معنويا عن المعاملات الأخرى أو الكنترول. و كانت هناك زيادة غير معنوية في حالة السماد الحيوي خاصة بعد ٧ أيام من المعاملة.وتشير الدراسة إلى أن التأثير الضار الناتج في بعض فترات التقييم قد يعزى إلى تكون بعض نواتج تمثيل المركبات المستخدمة و التي قد يكون لها تأثير ضار على بعض الكائنات الحية الدقيقة التي يمكنها بعد ثلاثة أسابيع أن تستعيد نشاطها نتيجة التحطم المحتمل لهذه الكيميائيات الزراعية.