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STATUS OF SOIL PHOSPHATES AND ALFALFA GROWTH IN SANDY SOILS AS INFLUENCED BY CROPPING PERIODS

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ABSTRACT: The current study aims at investigating the effect of cropping period on the status of soil P and plant growth, thus a pot experiment was conducted under greenhouse conditions. Surface (0-30) soil samples representing the different sandy soils of Egypt i.e. noncalcureous sandy soil (Abu-Hammad Sharkia Governorate), a calcareous sandy soil (El-Nubaria) both soils are under convential agricultural and irrigated with Nile river water while the third one (El-Gabal El-Asfar) is noncalcareous sand irrigated with sewage effluents. Each of the three studied areas was represented by three samples of different cropping periods i.e. 0. (virgin), 20 and 80 years. The indicator plant was alfalfa (Medicaga sativa) from which 3 cuts were obtained.

The main results obtained could briefly listed in the following:

(1) The tested soils could be assendingly according to their native content of available P in the order; Abu-Hammad < El-Gabal El-Asfar < El-Nobaria for virgin soils and 20 years cropped ones. As for the 80 years cropped soils El-Gabal El-Asfar surpassed the other two soils to be ranked as the highest P containing soil while Abu-Hammad was still the least one. Noteworthy observing that the soil total P could not show any unique trend that is, expected because of the high content of the total native P in the soil, however the high rates of P supplementals through the add sewage effluents to El-Gabal El-Asfar soil as compared to the other two soils could raise such soil to be ranked as the 2nd soil under 20 years cropping, and thereafter to occupy the first position at 80 years cropping.

(2) Total soil P, available soil P, Ca-P, Al-P, Fe-P were increased with prolonging the cropping period as compared to the control (soil native status).

(3) While the inorganic P, fraction comprised about 53% and 43% of the soil total P i.e. the organic P was 47% and 57% for the noncalcareous soils at Abu-Hammad and El-Gabal El-Asfar, respectively yet the inorganic fraction comprised about 94% and the organic one is comprising only 6%, a unique property for the calcareous soils suggesting the dominancy of inorganic phosphate fractions in the such soils comparing to the noncalcareous ones.

(4) The native soil Ca-P comprised about 93%, 94% and 93% for Abu-Hammad soil, El-Nobaria soil and El-Gabal El-Asfar, respectively which may give further support to the controlling effect of calcium as a precipitating agent for P even in soils with about $CaCO_3$ content as low as 1.5 (El-Gabal El-Asfar soil).

(5) Dry matter yield of alfalfa and P-uptake by plant were increased with prolonging the cropping period. The greatest values the dry matter yield of alfalfa plants and phosphorus uptake by plants were found in El-Gabal El-Asfar soil cropped for 80 years period which the lowest values were observed in the cropped Abu-Hammad one. The cropped Nubaria calcareous soils lies in between which may suggest that the cultivated El-Gabal El-Asfar soils have the greatest nutrients supplying power including phosphorus.

INTRODUCTION

Phosphorus is one of the vital and essential elements for plants growth yet its availability of phosphorus particularly in the sandy soils is seriously low and hence phosphorus deficiency is a major limiting factor for the productivity of these soils. Accurate predicition of P requirements and correcting P deficiency are still problems need in a more understanding of the chemical behaviour of this nutrient Rietra *et al.*, 2001 and Kreller *et al.*, 2002.

The correct management of the sandy soils undersuitable plants for long times may be improve the nutritive capacity of such soils year by year, particularly with respect to P. Chang and Jackson, 1957 indicated that the formation of the various chemical forms of

phosphate availability in the soil for examples is related to soil pH activities of various solution cations and adsorbed ones, solubility products of the various insoluble phosphates, degree of chemical weathering, and the fertilizer practices. Sakr *et al.*, 1995 showed that the correlation coefficient values (V) were highly correlated with P. uptake by barley plants grown on the studied soils.

It is well established that soil productivity is a net product of so many factors called growth factors among of which one oftenly find P mainly because a plenty of reactions responsible for the so called P-fixation phenomenon which result in reduced the soil P. availability in plant media Bready, 1984 and Foth and Ellis, 1997.

El-Agrodi *et al.* 1998 showed that most of the studied soils are considered to be rich in their total phosphorus content but the available forms are not enough to meet the demand of plant requirements. Therefore, to enhance soil phosphorus availability the more of research will be need to overcoming the problems of high pH values and the phosphorus sorption maximum in these soils. They added that the other fractions i.e., Saloid- P, Fe-P and Ca-P had unappreciable role in supplying barley plants with phosphorus comparing with the inorganic-P (i.e, Al-P, RS-P and Occi-P fractions).

Rao and Chakrabarty 1994 found that the mean relative abundance of inorganic P. fractions followed the order of RSP (Reducant Soluble P) > Fe-P > Ca-P > Al-P > Saloid P in the both depths. However, RSP content was higher in sub-surface soil. Mahmoud, 1997; El-Sherbieny *et al.*, 1998a and Khlefa, 2001 found that the content of humic substance and available phosphorus was soundly higher in the sandy soil irrigated with sewage effluents than in the sandy loam calcareous soil, but the ratio Ca-P/(Al-P + Fe-P) was greater in calcareous soil than in the noncalcareous sandy soil irrigated with sewage effluents.

The objectives of the present investigation were to estimate the soil total phosphorus content and the relative abundance of main inorganic P fractions, which were considered as parameters for monitoring the status of soil P and its availability to alfalfa plants growing on both virgin and cropped sandy soils which were under various cropping periods up to 80 years.

MATERIALS AND METHODS

Soil sampling:

Nine surface soil samples (0-30 cm) were collected from Abu-Hammad country (El-Sharkia Governorate), El-Nubaria country (Northern part of the Tahreer province) and El-Gabal El-Asfar county, (Cairo Governorate), Egypt to represent sandy soils cropped for 20 and 80 years, respectively. In addition, a virgin soil adjacent to studied areas were also included.

Soil samples from Abu-Hammad and El-Nubaria countries were under normal cropping procedures (the soil irrigated with Nile water and manured with organic and inorganic fertilizers) for period of 80 years. Soil samples collected from El-Gabal El-Asfar country were irrigated by sewage effluents for the same period and from an other virgin area through the same location. The soil samples were air dried, gently crushed, sieved through a 2.0 mm plastic screen, thoroughly mixed and stored in plastic bags for analysis and experimental work. The main soil properties were determined according Jackoan, 1958 in Table 1. Soil phosphorus fractions i.e total soil-P, available-P and inorganic soil-P fractions (Saloid-P, Al-P, Fe-P and Ca-P) were determined using the methods outlined by Page *et al.*, 1982.

Biological evaluation of soil phosphorus:

A pot experiment was conducted under greenhouse conditions. The six soil samples selected for this experiment are 3 virgin soil sample and three ones from the same sites, cropped for periods up to 80 years.

Portions of one kg of each soil sample were placed in plastic pots. The total pots being 24 representing four replicates for each of above the six mentioned samples. All pots received nutrient elements required except phosphorus.

Alfalfa seeds of 0.3 g (about 100 seeds) were planted in each pot. Five days after germination, the plants were thinned into to 90. at this stage each pot received the essential nutrients. N and K that were added at the following rates: 75 mg N as NH_4NO_3, 30 mg K as KNO_3. Minor elements were added according to Lindsay, 1972 at the following rates 10 ppm Fe as FSO_4, 10 ppm as Mn SO_4; $4H_2O$, 5 ppm Zn as Zn SO_4. H_2O, 5 ppm Cu as Cu SO_4, 2 ppm as boric acid and 1 ppm Mo as NH_4 Mo_2O_7.

Nutritional elements were added in solution and the soil moisture content of soil was

Table (1): Some properties of the studied soils.

Cropping period in years	Particle size distribution				Soluble ions, me/L								EC dS/m	pH	CEC me/100g soil	$CaCO_3$ %	O.M %
	Sand %	Silt %	Clay %	Textural class	Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3^{-}	HCO_3^{-}	Cl^{-}	SO_4^{--}					
Abu-Hammad soils																	
0 (virgin)	96.55	1.50	1.59	Sand	2.21	2.93	9.31	0.5	0.0	2.00	3.40	9.50	1.49	7.5	1.94	2.1	0.39
20	90.36	5.78	3.86	Sand	3.91	3.97	10.25	0.67	0.0	3.40	2.09	13.31	1.88	7.1	7.00	2.1	0.87
80	77.5	13.86	8.64	Sand loam	1.57	1.00	8.42	0.71	0.0	3.00	1.62	7.08	1.17	7.5	9.25	1.8	1.41
El-Nubaria soils																	
0 (virgin)	99.13	0.68	0.19	Sand	2.70	8.00	24.62	2.53	0.0	5.00	7.70	25.15	3.88	7.2	1.54	13.6	0.02
20	97.46	1.88	0.66	Sand	3.65	11.75	16.45	4.34	0.0	4.90	6.18	25.11	3.60	8.2	3.80	13.9	0.11
80	94.63	4.37	1.00	Sand	1.98	8.44	7.02	2.00	0.0	4.40	7.23	7.81	1.50	8.6	4.80	14.6	0.49
El-Gabal El-Asfar soils																	
0 (virgin)	98.94	0.58	0.48	Sand	2.41	2.00	3.46	0.33	0.0	2.24	3.42	2.54	0.82	7.8	2.35	1.5	0.09
20	97.41	1.94	0.65	Sand	2.41	1.36	5.07	0.66	0.0	2.20	2.08	5.22	0.95	6.6	5.60	1.5	5.74
80	93.43	4.62	1.95	Sand	3.24	3.26	5.05	0.72	0.0	2.20	4.12	5.95	1.23	6.5	9.40	3.8	6.44

maintained almost constant throughout the duration of the experiment at about 70% of the water holding capacity through addition of distilled water.

Three plant cuts were taken, often 60, 40 and 40 intervals days from planting, respectively. Alfalfa shoots were cut at 1.5 cm above the soils surface, N and K were added after each cut. Plant samples or each cut were oven dried at 70°C and the dry matter was estimated. The dried plant samples were ground. 0.2 g of portions the ground material were digested and subject with distilled water ternary acid mixture according to Van Schowenberg, 1968 and then phosphorus was assayed chlormetrically in the digest using ascorbic molybdate-vanandate acid method described by Wilde *et al.*, 1979.

RESULTS AND DISCUSSION

Total soil phosphorus:

Data of the total phosphorus content in the tested sandy soils as affected by cropping periods are presented in Table (2) and Fig. (1).

The data indicate that the native total P content was 325, 250 and 318 mg P_2O_5/kg in the virgin (noncalcareous soil, the calcareous soil and the soil irrigated with sewage effluents), respectively. Such figures are in agreement with those reported by Ahmad, 1982 and Mahmoud, 1997, found that soils having less than 10% silt+clay, i.e. sandy soils had a total phosphorus content variable between 250 and 476 mg P_2O_5/kg with an average of 333 mg P_2O_5/kg.

The total content of phosphorus in the tested soils was markedly increased with extending the cropping periods. This agrees with the results of Khalil *et al.*, 1986, Mohamed *et al.*, 1991a and Khlefa, 2001. Such a trend could be attributed to the increas in the content of fine particles (i.e. clay fraction) and organic matter (see Table 1), particularly the latter was markedly accumulated in El-Gabal El-Asfar soil as a result to the frequency irrigation with the sewage effluents.

The greatest content of total phosphorus was occurred in the cropped El-Gabal El-Asfar soils for 20 and 80 years as compared with the total P amount in the cropped Abu-Hammad and El-Nubaria soil ones. This trend could be due to relatively highest organic matter content in the cropped El-Gabal El-Asfar soils (Table 1).

Table (2): Total and available phosphorus content (mg P_2O_5/kg soil) in the tested soils as affected by cultivation periods.

Cropping period in years	Abu-Hammad		El-Nubaria		El-Gabal El-Asfar	
	Total P	Available P	Total P	Available P	Total P	Available P
0 (virgin)	325	4.3	250	9.5	318	7.0
20	347	7.8	312	13.6	423	12.4
80	475	11.5	434	17.2	653	19.0

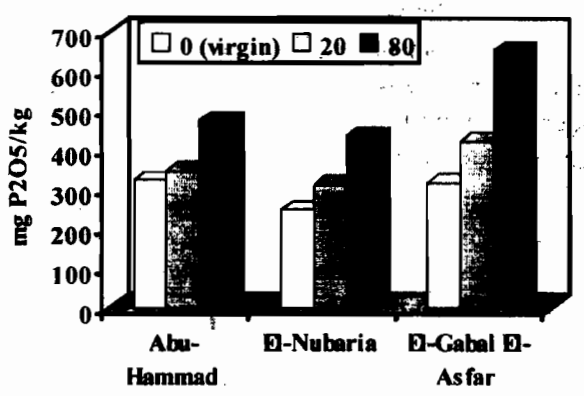

Fig. (1): Total phosphorus content (mg P_2O_5/kg) soil in the studied soils as influenced by cropping periods.

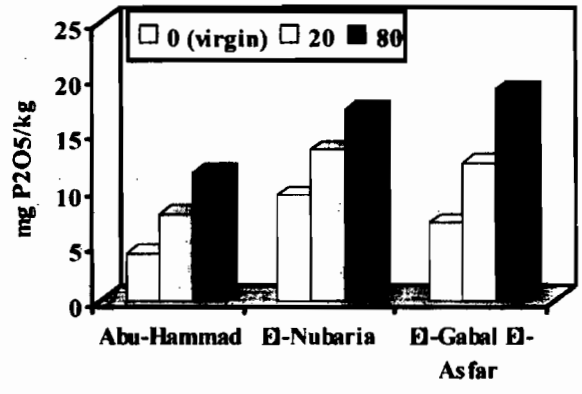

Fig. (2): Available phosphorus content (mg P_2O_5/kg) soil in the studied soils as influenced by cropping periods.

Available soil phosphorus:

Results of the available phosphorus content in the tested soils as affected by cropping periods are presented in Table (2) and illustrated in Fig (2).

Several authors have developed chemical methods to assay the available phosphorus pool, which supply P to growing plants. Of such methods, the Olsen's has been tested an proved to be reliable for measuring especially under the conditions of alkaline and calcareous soils, Taha, 1975; Khalile, 1980 and Mohamed, 1980.

Chang and Jackson, 1957 reported that as a general guide to crop response values of Olsen's available-P below 5 mg P_2O_5/kg are low and response to phosphate application inlikely. Values from 5 to 10 mg P_2O_5/kg are moderate and indicating response is probable, over 10 mg P_2O_5/kg is adequate and response to fertilization is unlikely.

Results obtained for available-P extracted by Olsen's method indicate that the native available-P content was 4.3, 9.5 and 7.0 mg P_2O_5/kg in the virgin Abu-Hammad, El-Nubaria and El-Gabal El-Asfar soils, respectively. This agrees with the results reported by Khalil, 1980. Such data were confirmed by Ibrahim *et al*,. 1980 who found that available-P ranged from 2 and 12 mg P_2O_5/kg in desert sand and calcareous soils. Abu-Hammad virgin soil had the level of available-P less than 5mg P_2O_5/kg. This soil is poor in available-P and likely response to phosphate application. The available-P contents in El-Nubaria virgin and El-Gabal El-Asfar virgin soils lie in between 5 and 10 mg P_2O_5/kg. These soils are of moderate available-P content and indicating response to P application is probable.

The available-P content in the tested soils was markedly increased with prolonging the cultivation periods. This trend could be due to the sound increase in the total soil phosphorus (see Table 2) this agrees with the results Mohamed *et al.*, 1991b; Mahmoud, 1997 and Khlefa, 2001.

Exceptional of Abu-Hammad soil cultivated for 20 years the available-P in all the cropped soils was more than 10 mg P_2O_5/kg. The available-P content in the cropped Abu-Hammad soil for 80 years and the cropped El-Nubaria and El-Gabal El-Asfar soils for 20 and 80 years is inadequate and their response to phosphate fertilization is unlikely. The greatest level of available-P was found in the cropped El-Gabal

El-Asfar soils for 80 years as compared with the available-P level in the Abu-Hammad and El-Nubaria soils for the same period. This a trend could be attributed to the highest applied rates of organic matter and the resulted decrease in soil pH in leading to sound increase in soil P availability to growing, plants.

In fact, these results are supported by many investigators such as Sinha, 1972 who explained the benefits of organic matter supply to the soil on the basis of anion replacement or competition with humate and phosphate ions on the active sites of adsorbing surfaces. Humic substance have solving action on insoluble phosphate leading to the formation of fulvic acid metal phosphates. In spite of that, El-Baruni and Olsen, 1979, found that products of organic decay such as organic acids and humus are thought to be effective in forming complexes with iron and aluminum compounds which are mainly responsible for P fixation in soils.

Inorganic Phosphorus Fractions:

Data of the inorganic-P fractions content in the tested soils as affected by cropping periods are presented in Table (3), since most of the fractions do not represent a definite chemical form of phosphorus the results will be expressed as NH_4Cl-P, NH_4F-P, NaOH-P and H_2SO_4-P extracetable phosphorus or the corresponding terms, i.e., saloid-P, Al-P, Fe-P and Ca-P.

Results showed a great difference but overall relative magnitude to indicated fractions were; Ca-P > Al-P > Fe-P > saloid-P for all the tested soils. These results are in quite agreement with those reported by Mohamed *et al.*, 1991b, Mahmoud, 1997 and Khlefa, 2001.

The saloid-P fraction seems to represent the immediately available phosphorus fraction in the solid. For all the tested soils, this fraction is the least among the inorganic phosphorus fractions. It ranges between 0.3-0.5; 0.5-0.7 and 0.2-1.6 mg P_2O_5/kg for Abu-Hammad, El-Nubaria and El-Gabal El-Asfar soils, respectively. The effect or cropping periods on saloid-P showed a trend similar to that of available phosphorus. The extremely low values of saloid-P (0.7-0.4% of the total inorganic-P) could be explained in view of the high fixing ability of the investigated soils whose properties are conductive to rapid conversion of added phosphate into compounds of low solubility. While the inorganic P. fraction comprised about 53% and 43% of the soil total P i.e. the organic P

was 47% and 57% for the noncalcareous soils at Abu-Hammad and El-Gabal El-Asfar, respectively yet the inorganic fraction comprised about 94% and the organic one is comprising only 6%, a unique property for the calcareous soils suggesting the dominancy of inorganic phosphate fractions in the such soils comparing to the noncalcareous ones. The native soil Ca-P comprised about 93%, 94% and 93% for Abu-Hammad soil, El-Nobaria soil and El-Gabal El-Asfar, respectively which may give further support to the controlling effect of calcium as a precipitating agent for P even in soils with about $CaCO_3$ content as low as 1.5 (El-Gabal El-Asfar soil). Such results may through same light on the general definition of calcareous soils.

The high values of Ca-P, which comprises 71.9-94% of the total inorganic phosphorus are expected under the condition of the tested soils leading to dominance of calcium ions which control the phosphate solubility reactions as to give calcium phosphate compounds of various Ca/P ratios and solubilities Lindsay and Moreno, 1960.

The magnitute of Al-P fraction corresponded to 4.8-19.4% of the total inogrnaic-P content which is in agreement with result reported by Mohamed *et al.*, (991b; El-Sherbieny *et al.*, 1998a and Khlefa, 2001.

Finally, relatively low values of Fe-P fractions, 0.096-8,3% of the total inorganic-P were detected which stands in good agreement with results reported by Mahmoud, 1997 and Khlefa, 2001.

The greatest values of Ca-P were found in El-Nubaria soils as compared with Abu-Hammad and El-Gabal El-Asfar soils. Such a trend could be attributed to the high content of $CaCO_3$ in El-Nubaria soils (Table 1).

The greatest values of both Al-P and Fe-P were recorded in the cropped El-Gabal El-Asfar soils as compared with the cropped Abu-Hammad and El-Nubaria soils. Such a trend may be due to the irrigation of El-Gabal El-Asfar soils with sewage effluents, which contain high amounts of Fe and Al. This agrees with finding of Mahmoud, 1997. For all the tested soils, the content of Ca-P, Al-P and Fe-P in the tested soils was markedly increased with increasing cultivation periods. In general, the total inorganic-P content was markedly increased with cropping periods. This a trend could be attributed to the increase in content of total soil phosphorus with cropping Table 3 is in

agreement with the results reported by Mohamed *et al.*, 1991b and Khlefa, 2001.

The general trend of the relative abundance of Ca-P relative to Al-P + Fe-P was higher in calcareous sandy El-Nubaria soils than in noncalcareous soils of Abu-Hammad and El-Gabal El-Asfar. This holds true because of the highest content of $CaCO_3$ in El-Nubaria soils is compared to the other tested soils (Table 1). However, such the ratio was decreased with cropping periods promotion in all the studied soils.

Such a trend is dependent mainly on soil pH as it is well established that the activity of Ca^{++} increase with increasing soil pH, otherwise that of both Al and Fe are increased with decreasing the soil pH. Accordingly the different forms of Ca phosphates comprise the major P component in alkaline and even neutral or slightly acid soils while the reverse is true with respect to Al and Fe phosphate which represent the major soil P compounds under acid conditions Page *et al.*, 1982 and Sah and Mikklsen, 1986.

Table (3): Inorganic phosphorus fractions (mg P_2O_5/kg soil) in the tested soils as affected by cropping periods.

Cropping period in years	Saloid-P	Ca-P	Al-P	Fe-P	Σ inorganic-P	Ca-P/Al-P + Fe-P	Ca-P/Σ inorganic P. %	Σ inorganic P/total P %
				Abu-Hammad soils				
0 (virgin)	0.3	160	9.1	2.6	172	13.9	93.02	52.92
20	0.3	180	13.3	3.4	197	11.0	91.37	56.77
80	0.5	200	17.8	3.7	222	9.3	90.09	46.74
				El-Nubaria soils				
0 (virgin)	0.5	221	11.4	2.1	235	17.0	94.04	94.00
20	0.6	280	17.6	2.4	300	14.0	93.33	96.15
80	0.7	395	20.2	3.1	419	12.2	94.27	96.54
				El-Gabal El-Asfar soils				
0 (virgin)	0.2	150	8.0	2.8	161	13.9	93.17	50.63
20	0.8	155	35.3	8.9	200	3.5	77.50	47.28
80	1.6	200	54.0	22.4	278	2.6	71.94	42.57

Biological evaluation for soil phosphorus:

Alfalfa was cultivated under controlled conditions to evaluated the effect of available-P or plant growth in terms of dry matter yields, phosphorus concentration and total P uptake.

Dry matter yield:

Table (4) includes data on dry matter yields, for both individual and cumulative harvests of alfalfa grown on the tested soils as affected by cropping periods. The individual and cumulative dry matter yield of alfalfa plants grown on the virgin El-Nubaria soil was relatively higher than those grown on the virgin El-Gabal El-Asfar soil, followed by the virgin Abu-Hammad soil. This a trend may be due to the availability of calcium to the plants form amorphous calcium carbonate and hydrolysis of $CaCO_3$ through root action. Dahiya and Singh, 1982; Mohamed, 1987 and Khlefa, 2001, also came to the same conclusion. Also, $CaCO_3$ presence may be effective in improving the hydrophysical conditions of the sandy soils.

Data in Table (4) show that the individual and cumulative yield of alfalfa plants grown on the cultivated Abu-Hammad, El-Nubaria and El-Gabal El-Asfar soils was significantly greater than those grown on corresponding virgin soils. This could be explained on the basis that available soil phosphorus content in the cropped soils for 80 years was more than that in virgin ones (Table 2).

Data show that the individual and cumulative cuttings of alfalfa plants grown on the cropped sandy El-Gabal El-Asfar soil were relatively higher than those grown on El-Nubaria soil followed by Abu-Hammad soil. This trend may be because El-Gabal El-Asfar soil is enriched with both total and available-P fractions if compared with the other soils under study (Table 2 and 3). This agrees with finding of Radwan, 1991. In all cases the highest dry matter yield was more associated with the first cutting if compared to the others. The decrease in dry matter yield for the second and the third cuts may be due to the reduction in nutrients supply and to the gradual decrease in availability of remaining portions.

Table (4): Individual and cumulative dry matter yield (g/pot) of the successive cuttings of alfalfa plants grown on the tested soils as affected by cultivation periods.

Cropping periods in years	Individual yield of the successive cutting (g/pot)			Cumulative yield (g/pot)
	1st cut	2nd cut	3rd cut	
	Abu-Hammad soils			
0 (virgin)	0.46	0.38	0.40	1.24
80	2.10	1.21	1.28	4.59
L.S.D. 0.05	0.26	0.09	0.11	
0.01	0.60	0.20	0.24	
	El-Nubaria soils			
0 (virgin)	1.10	0.56	0.58	2.24
80	3.60	2.40	2.40	8.40
L.S.D. 0.05	0.09	0.24	0.26	
0.01	0.21	0.56	0.64	
	El-Gabal El-Asfar soils			
0 (virgin)	0.84	0.54	0.54	1.92
80	3.90	2.50	2.60	9.00
L.S.D. 0.05	0.12	0.02	0.09	
0.01	0.28	0.06	0.20	

Phosphorus uptake by alfalfa plants:

Table (5) show data representation both individual and cumulative phosphorus uptake by successive harvest of alfalfa such data are indicative of a trend almost similar to that observed with dry matter yield of plants.

From the obtained results, it is clear that the least phosphorus uptake was produced by Abu-Hammad soil, whereas the highest values were observed in El-Gabal El-Asfar soil followed by the cropped El-Nubaria soil. This indicates that the sandy El-Gabal El-Asfar soil irrigated with sewage effluents have more and continuous supplying power for phosphorus nutrient if compared to the other soils particularly Abu-Hammad soil, of the least P supply. This result could be attributed to the high native content of saloid-P and Al-P fractions as well as the high level of available-P in the cropped El-Gabal El-Asfar soil Tables 2 and 3. This result is in agreement with the finding of Ibrahim *et al.*, 1980; Ahmed, 1982 and Khlefa, 2001

who found that the saloid or Al-P gave significant correlation with phosphorus uptake by either the first alfalfa cut or the cumulative successive cuts.

Table (5): Phosphorus uptake (mg/pot) by successive cuttings of alfalfa plants grown on the tested soils as affected by cultivation periods.

Cropping period in years	P-uptake by successive cuttings			Cumulative P-uptake
	1st cut	2nd cut	3rd cut	
	Abu-Hammad soils			
0 (virgin)	0.28	0.23	0.24	0.75
80	1.47	0.85	0.90	3.22
L.S.D. 0.05	0.04	0.07	0.05	
0.01	0.10	0.70	0.12	
	El-Nubaria soils			
0 (virgin)	0.55	0.28	0.29	1.12
80	2.88	1.92	1.92	6.72
L.S.D. 0.05	0.09	0.12	0.17	
0.01	0.20	0.29	0.40	
	El-Gabal El-Asfar soils			
0 (virgin)	0.59	0.32	0.49	1.40
80	3.90	2.50	2.60	9.00
L.S.D. 0.05	0.09	0.46	0.13	
0.01	0.21	1.06	0.30	

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حالة الفوسفات ونمو نبات البرسيم الحجازى متأثرة بفترات الأستزراع فى الأراضى الرملية

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أجرى هذا البحث بهدف التعرف على تأثير فترات الزراعة المختلفة فى الأراضى الرملية على حالة الفوسفات فى التربة ونمو النبات. جمعت تسعة عينات تربة سطحية (٠-٣٠سم) من أراضى رملية غير جيرية من منطقة أبو حماد بمحافظة الشرقية ومن أراضى رملية جيرية من منطقة النوبارية المزروعة بفترات ٢٠، ٨٠ سنة باستخدام نظم الزراعة التقليدية وتروى بمياه نهر النيل ومن أراضى رملية غير جيرية بمنطقة الجبل الأصفر والتى تروى بمياه المجارى لنفس الفترات بالإضافة إلى عينة أرض رملية بكر من كل منطقة على حدة.

أظهرت النتائج أن قيم الفوسفور الكلى والميسر فى التربة وكذا المرتبط بالكالسيوم والألومنيوم والحديد ووزن المادة الجافة لنبات البرسيم الحجازى وأيضا الفوسفور الممتص بالنبات إزدادت مع امتداد فترات الاستزراع ووجد أن محتوى الفوسفور الميسر فى الأراضى البكر وكذلك المزروعة لمدة ٢٠ سنة فى أراضى أبو حماد كانت أقل من أراضى الجبل الأصفر وأيضاً أقل من أراضى النوبارية. أما فى الأراضى المزروعة لمدة ٨٠ سنة وجد أن أراضى الجبل الأصفر هى الأعلى فى المحتوى من الفوسفور الميسر يليها أراضى النوبارية بينما أراضى ابو حماد هى الأقل فى المحتوى. كما وجد أيضا أن المحتوى الكلى للفوسفور فى الأراضى المزروعة لمدة ٢٠، ٨٠ سنة كان كالتالى: أراضى الجبل الأصفر > أراضى ابو حماد > أراضى النوبارية. ووجد أن أعلى نسبة (للفوسفور المرتبط بالكالسيوم/الفوسفور المرتبط بالامنيوم والحديد) كانت موجودة فى الأراضى الرملية الجيرية فى منطقة النوبارية إذا ما قورنت بتلك المتحصل عليها من الأراضى الرملية الغير جيرية من منطقة أبو حماد والجبل الأصفر. كما أظهرت النتائج أن محتوى الفوسفور العضوى فى الأراضى غير الجيرية (ابو حماد ، الجبل الأصفر) يتراوح ما بين ٤٧% إلى ٥٧% من الفوسفور الكلى على العكس فى الأراضى الجيرية (النوبارية) كان محتوى الفوسفور العضوى يمثل فقط من ٤-٦% من الفوسفور الكلى وهذا يرجع إلى نقص محتوى الأراضى الجيرية للمادة العضوية. وجدت أيضا القيم المتعاظمة من الفوسفور الممتص بالنباتات كانت موجودة فى أراضى الجبل الأصفر المزروعة لمدة ٨٠ سنة يليها أراضى النوبارية ثم أراضى أبو حماد التى أعطت القيم الأقل. وهذا يوضح أن القدرة الإمدادية للفوسفور فى أراضى الجبل الأصفر كانت أكبر من أراضى النوبارية وكانت أراضى أبو حماد الأقل فى القدرة الإمدادية للفوسفور.