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THE EFFECT OF AIR AND SOIL POLLUTION ON THE CONTENT OF CERTAIN NUTRIENTS

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Abstract

A field study was carried out to investigate the effect of K and Na hydroxides emission from oil and soap factories into air and soil as sources of pollution on the macro and micronutrients of clover plants along with some chemical properies of polluted soils.

Obtained results show that the macro and micronutrient contents in the soil and in clover plants increased with the increasing distance from the source of pollution. An opposite trend was obtained for K and Na concentrations as well as pH values of the soil

INTRODUCTION

Plant damage as a result of exposure to air pollutants varies with plant and type of pollutants as with the time of day at which exposure occurrs and concentration of pollution in the atmosphere (Peterson 1987; Thomas 1986; Nofal *et al.*, 1988). Numerous investigators have shown the effect of solil pollution on plant growth (Mills and Zwarich 1973; Klingman and Murray 1976).

Alkalinity is also considered as a source of air and soil pollution , (Miller and Mackay 1980; Nofal 1987).

The aim of the present work is to investigate the effect of potassium and sodium hydroxides as sources of air and soil pollution on the contents of macro and micronutrients in the soils and clover plants.

MATERIALS AND METHODS

Soil and plant samples were collected from the agricutural area located near the oil and soap factory of Kafr - El - Zayat in Behera Governorate, Egypt . The main alkaloids which are released from the factory are K and Na hydroxides.

Samples were taken as followsws:

1. Eight clover (*Trifolium alexandrinum*) plant samples, 1 cm above soil surface , were taken from the factory as well as at distances of 100 to 1000 meters.

2 . Nine soil samples were taken immediately below the sites of plant samples at a depth of 0 - 30 cm.

Plant samples were divided into three parts , the first was washed with 0.1 N HCl followed by distilled water, rinsed to remove HCl, (Nofa/1981) . Both second and third patrs were left unwashed . Plant samples were dried at 70 ^{o}C , the plants matereial was ground and wet ashed using a perchloric - sulphurice acid mixture , with the exception of the third part which was left intact.

Soil samples were analysed to determine pH, available K and Na, available P and micronutrients (Fe, Mn, Zn and Cu) as described by Richards (1954), Olsen *et al.* (1954) and Lindsay and Norvell (1969). Acid digests of plant samples were also analysed to detemine N, P, K and Na as well as micronutrients (Fe , Mn, Zn and Cu) as described previously, with the addition of N determination by kjeldahl method (Jackson 1973).

For the third part of the plant samples , 10 ml distiled water was added to 4 g dry plant tissue to determin the pH as mentioned in soil samples , then the extract of this suspension was used to determine both K and Na by means of flam photometry.

RESULTS AND DISCUSSION

Table 1, represnts values of pH, Na, K, P and micronutrients (Fe, Mn and Cu) in soil samples taken at various distances from the source of pollution which appears to be affected by potassium and sodium hydroxides produced from the source of pollution. Results incicated that values of pH, Na and K decreased with the increase of the distance form the source of pollution. This is due to the accumulation of Na and K hydroxides with the decreasing distance from the source of pollution. An opposite trend was obtained for P and micronutrients (Fe , Mn , Zn and Cu) . pH is known to contribute to the availability of certain macro and micronutrients in soil with low values , an opposite trend was obtained with high values of pH (Nakos 1979; Miller and Mackey 1980; Reddy *et al.*, 1987).

As shown in Tble 2. which represents pH and K and Na percentages in washed water of the dry matter of plant samples taken at various distances from the source of pollution, values of pH as a result of the accumulation of Na and K hydroxides on the surface of the shoots of clover plants were decreased as the distance from the source of pollution increased. Maximum pH values (10.30) was obtained at a distance of 100 m from the source of pollution. Plants grown at a distance of 0 m were dead as a result of the alkalinty on plant tissues (Miller and Mackey 1980; Nofal 1987) . The accumulation of Na and K hydroxides on the surface of the shoots of clover plant increased as the distance from the source of pollution decreased thus causing an increase in the osmotic perssure leading to cell berakdowin of the plants (Nofal 1987).

Table 1. pH , ammonium acetate extracable Na and K, sodium bicarbonate soluble P, and DTPA extractable micronutrients of soil samples taken at various distances from source of pollution.

No. of Sample	Distance from source of pollution (m)	pH of (1 : 2 . 5) Soil - water suspension	NH_c OAc extractable Na and K mg / mg/100g soil		$NaH\ CO_3$ extractable P (ppm)	DTPA extractable micronutrients (ppm)			
			Na	K		Fe	Mn	Zn	Cu
1	0	12.7	7.5	4.9	7.1	3.5	1.5	1.0	0.5
2	100	12.3	7.7	4.5	7.8	3.5	1.5	1.0	0.5
3	200	11.2	7.0	4.2	8.8	3.5	2.0	1.5	0.5
4	300	9.5	6.1	4.0	10.3	5.0	2.0	1.5	1.0
5	400	8.7	5.0	2.5	10.7	7.5	2.5	2.5	1.5
6	500	8.3	2.4	2.2	11.2	8.5	2.5	4.0	1.5
7	600	8.1	1.9	1.9	14.9	9.5	3.5	4.5	1.5
8	700	8.0	1.9	1.2	16.5	8.5	4.0	4.0	1.5
9	1000	8.2	1.8	1.3	15.8	9.0	3.5	4.0	1.5

Table 2. pH, K and Na percentages in washed water of dry matter of plant samples taken at variouse distances from source of pollution.

No. of Sample	Distance from source of polution (m)	pH (1 : 2 . 5) Plant water suspension	K and Na Percentage in washed water of dry matter (1: 2 . 5)	
			Na	K
1	0	---	---	---
2	100	10.3	0.51	0.35
3	200	9.8	0.43	0.31
4	300	8.9	0.24	0.27
5	400	8.2	0.17	0.12
6	500	7.8	0.05	0.10
7	600	7.2	0.03	0.01
8	700	7.1	0.02	0.02
9	1000	7.1	0.01	0.02

ml for the same doses, respectively. It is therefore evident that the three doses had reduced lipid contents in the haemolymph of treated nymphs during the three periods of analysis.

The fat body lipid contents were also affected following the same hormonal treatmens (Table 2). In the 8th day, the lipid amounts were 22.02, 30.4 and 17.17 mg/g for the doses 100 , 50 and 25 ug/nymph, respectively, compared to 100 mg/g for the unreated control. In the nineth day these amounts were reduced to 40.47, 14.67 and 20.45 mg/g for the three tested doses, respectively. The last day of prolongation (day 10) induced a strong decrease in fat body lipid contents after teatment with the same doses (10.54, 11.9 and 14.7 mg/g, in respect).

It could be concluded that the application of the hormone to one or six day old 5th instar nymphs had reduced the lipid contents of both haemolymph and fat body during the last day of the stadium and the following prolonged two days (9 and 10) of the treated nymphs. This could be considered as evidence for juvenilization and solitarization. El-Gammal (1979) demonstrated that isolation in S.gregaria female nymphs had reduced the lipid content in haemolymph and fat body. Carbohydrates and protein however were increased. Similar results were also obtained when 5th instar nymphs of *S. gregaria* were treated with fenoxycarb, (El-Gammal *et al.* 1989).

This behaviour could be due to the indirect effect of the JH analogue on natural JH level in the treated nymphs. Plantevin *et al*, (1991) found that the level of haemolymphatic JH was much higher in fenoxycarb treated larvae of *Bombyx mori* than in the control.

Effect of JHA pyriproxyfen on cholesterol content

Table 3 shows that the application of JHA within the 1st day of the 5th instar female nymphs increased shightly the haemolymph cholesterol at the higher doses (100 and 50 ug/nymph). The two doses induced, 0.44 and 0.66 mg cholesterol/ml haemolymph in comparison with 0.36 mg/ml of the control nymphs during day 8 of this instar. However, the lowest dose (25 ug) decreased the cholesterol level to 0.19 mg/ml as compared with the control (0.36 mg/ml). During day 9 of the stadium, cholesterol concentrations in haemolymph were considerably reduced to 0.23, 0.29 and 0.12 mg/ml for the doses 100, 50 and 25 ug/nymph, respectively in comparison with 0.36 for the untreated control. This reduction continued on 10th day, where the three doses reduced the cholesterol level to 0.37 , 0.22 and 0.17 mg/ml,

Table 3. N, P , K, and Na contents of washed and unwashed clover plant samples taken at various distances from the source of pollution.

No. of Sample	Distance from source of pollution (m)	Element (%)							
		N		P		K		Na	
		A	B	A	B	A	B	A	B
1	0	--	--	--	--	--	--	--	--
2	100	1.7	1.7	0.2	0.2	2.9	3.4	1.2	1.7
3	200	2.4	2.4	0.2	0.3	2.9	3.3	1.1	1.5
4	300	2.6	2.6	0.3	0.3	2.9	3.2	1.0	1.4
5	400	2.8	2.8	0.3	0.3	3.1	3.3	0.9	1.3
6	500	2.8	2.8	0.3	0.4	3.2	3.3	0.7	1.0
7	600	2.7	2.7	0.4	0.4	3.3	3.3	0.7	0.9
8	700	2.7	2.7	0.4	0.4	3.2	3.3	0.6	0.7
9	1000	2.8	2.8	0.4	0.4	3.2	3.3	0.6	0.6

A: Washed plant samples

B : Unwashed plant samples

Table 4. Micronutrients content in both washed and unwashed clover plant samples taken at various distances from the source of polluion.

No. of Sample	Distance from source of pollution (m)	Micronutrients (ppm)							
		Fe		Mn		Zn		Cu	
		A	B	A	B	A	B	A	B
1	0	--	--	--	--	--	--	--	--
2	100	165	165	25	30	30	35	10	10
3	200	210	220	25	30	30	35	10	10
4	300	260	260	30	30	40	45	15	20
5	400	315	320	40	45	50	55	20	25
6	500	375	380	45	45	55	65	20	25
7	600	360	360	55	60	60	65	25	25
8	700	370	370	60	70	65	65	25	30
9	1000	375	380	55	70	65	75	25	30

A: Washed plant samples

B : Unwashed plant samples

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تأثير التلوث الهوائى والأرضى على محتوى نبات البرسيم من بعض العناصر الغذائية

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يهدف هذا البحث الى دراسة تأثير هيدروكسيد الصوديوم والبوتاسيوم المنطلق من مصنع كفر الزيات للزيوت والصابون كمصدر لتلوث الهواء والأرض على محتوى نبات البرسيم المصرى من بعض العناصر الكبرى والصغرى مع دراسة لبعض خواص التربة الكيماوية المتأثرة بهذا التلوث.

وقد أظهرت النتائج المتحصل عليها أن محتوى الأرض وكذلك محتوى نبات البرسيم المصرى من العناصر الكبرى والصغرى قد انخفض مع قرب المسافة من مصدر اطلاق هيدركسيد البوتاسيوم والصوديوم عدا عنصرى البوتاسيوم والصوديوم فقد زادا مع قرب المسافة كما ارتفعت ايضا درجة التركيز الأيدروجينى للتربة مع قرب المسافة من مصدر التلوث.