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EFFECT OF SALINITY OF SOIL ON THE CONTENT OF Fe, Cu, Zn, B AS WELL AS ON THE PRODUCTION OF MORPHINE IN PAPAVER SOMNIFERUM L

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ABSTRACT

The effect of higher salinity with addition of sodium chloride and sodium sulphate in the soil, on the distribution of some microelements (Fe, Cu, Zn and B) in different organs and in different stage of development as well as content of morphine in capsule, was examined. The salinity in soil has verious influence on the amounts and distribution of some elements in different organs and in different stage of development, but morphine production increases with the increasing of salinity, especially of sodium chloride.

It was concluded that it is possible to grow Opium Poppy on arid and semiarid regions.

INTRODUCTION

Salinity is a serious problem in the arid and semiarid regions of the world. The ions which contribute the most to salinity are: Cl^-, SO_4-2, HCO_3-, Na, Ca^{2+} and Mg^{2+} (Bernstein, 1975).

Tolerance to salinity varies among different species. *Sorghyum* lines differed significantly in salt tolerance (Taylot et al., 1975), and Pinto beans (*Phaseolus vulgaris* L.) were more tolerant to salinity than the Top Crop variety (Ayoub, 1974).

Rush and Epstein (1976) compared salt tolerance of *Lycopersicom cheesmanii ssp minor* with *L. esculentum* and found that the Galapagos ecotype is more tolerant to salinity than VF 36 cultivar.

Salts like sodium chloride and sodium sulphate are present in Macedonia in arid and semiarid reigons.

Continuing our investigations on the effect of soil salting on the growth of the poppy plant (Spasenoski, 1986-87; 1988; Spasenosk and Jordanovska, 1988) in this paper we investigate the effects of soil salting with sodium chloride and sodium sulphate on the concentration and distribution of microelements Fe, Cu, Zn and B in different phases

of development and production of morphine in dry capsule. Although the content of alkaloids in opium poppy is generically caused, it is evident that changes are possible under the external conditions, too (Bernath and Teteny, 1979; Tookey and al., 1976; Spasenoski and Mulev, 1984-85; Spasenoski, 1988).

MATERIAL AND METHODS

Opium poppy plants were planted in Micherlih pots with 5 kg of cinnamon-forest soil. Three plants were planted in every pot. At the sowing time, water solution of 2.012 g of ammonium nitrate, 1.387 g of potassium dihidrogenphosphate and 0.925 g of potassium sulphate were added. During the vegetation the humidity of soil was kept at 70% of retention capacity of soil, and 22 mg of ammonium nitrate, 5 mg of potassium dihidrogenphosphate, 7.7 mg of magnesium nitrate and 7.3 mg of calcium nitrate were added in six portions.

Sodium chloride and sodium sulphate were added in pot at the beginning of vegetation of the plants in quantities of 0.025, 0.05, 0.1 and 0.2% of soil in the parallel samples for every concentration. Control samples were without soil salting of sodium chloride and sodium sulphate.

The contents of iron, copper, zinc and boron were determined in the plants in e phase of rosette, blossom and ripe capsule in different organs: root, stem, leaf, blossom and capsule. For determination of iron, copper and zinc atomic absorption spectrophotometer, Perkin-Elmer Model 404 was used. Boron was determined with quinalizarin and Eppendorf photometer. The content of morphine was determined with differential spectrophotometry.

RESULTS AND DISCUSSION

The results from determination of microelements: Fe, Cu, Zn, and B are given in Tables 1 and 2. As can be seen from Table 1, the soil salting has not influence in stage of rosette only on distribution of copper and boron, but contents of iron and zinc became lower with higher soil salting and only the concentration of 0.025% NaCl increases content of both elements.

It is evident from Table 2, that the content of iron in control samples is higher in the stage of blossom in the root and the stem but lower in the leaves and the blossom compared to the values in a tage of of ripe capsule. That means that iron during the time of the growth distributes to a direction of leaves and capsule in a treated samples.

In a stage of ripe capsule, content of iron changes and becomes higher in the root by treating with NaCl and with two lower concentrations of Na_2SO_4, compared to that obtained in the control samples. In the stem the content of iron decreases in all cases of soil salting with an exception of the lowest concentration of sodium chloride and sodium sulphate. In the leaves the content has not a great influence. In the capsule, the values of iron are generally similar as in control samples, but in all cases are higher than in the blossoms.

Table 1. Effect of soil salting with sodium chloride and sodium sulphate on the content of iron, copper, zinc and boron in ppm of dry material in a rossete stage of poppy plant

Concentration of: in %	Concentration of: in ppm			
	Fe	Cu	Zn	B
Control	510	17.20	151.60	29.60
0.025 NaCl	540	21.60	167.70	36.30
0.050 "	424	19.20	144.30	32.60
0.100 "	327	20.80	147.90	30.00
0.200 "	374	14.10	135.50	26.60
0.025 Na_2SO_4	375	18.70	129.20	29.80
0.050 "	342	17.50	135.70	32.60
0.100 "	325	17.40	133.50	32.00
0.200 "	314	16.40	120.70	31.60

By the determination of copper it was evident that its concentration in all organs is smaller than of iron. The content of copper in the control samples is higher in the stage of blossom than in the stage of ripe capsule in all organs with exception of capsules. The salinity of the soil changes the concentration of copper only in the leaves by treating with sodium sulphate and in all cases in the blossoms compared to the values of control samples. In the stage of ripe capsule the concentration of copper in the root decreases in all cases of salinity, but there is not remarkable influence in other organs.

The concentration of zinc in control sampels varies and raises from the root to the blossoms in the stage of blossom and from the root to the leaves and decreases to the ripe capsules in the stage of ripe capsule. By treatment of the soil with sodium chloride a higher concentration of zinc appears in the root and leaves, lower in the blossoms and almost unchangeable in the stem. In the stage of ripe capsule there is not regularity in appearing of Zn in the root, but there is a tendency of increasing with increasing of salinity with sodium sulphate. In the stem the content of Zn is a little lower in all cases of salinity and increases in leaves compared to the control smaples. In the capsules the concentration of Zn decreases with increasing of salinity with NaCl, but Na_2SO_4 has not remarkable influence.

As can be seen from the Table 2, in the stage of ripe capsule compared to the stage of blossom, the concentration of boron in control samples became hiher in the stem and the leaves, lower in the capsule compared to the blossoms and unchangeable in the root. In the stage of blossom the concentration of boron, with the salinity of soil, is not remarkably changed in the root and the stem, became higher in the leaves and lower in the blossoms. In the stage of ripe capsule the soil salinity has not remarkable influence in the root and the stem. Lower values are evident in the leaves in all cases of salinity and in the capsule there is not regularity in chaning of the concentration of boron.

Table 2. Effect of soil salting with sodium chloride and sodium sulphate on the content of iron, copper, zinc and boron in ppm of dry material in different parts of poppy plant: in stage of blossom-in a stage of ripe capsule

Concentration in%	In			
	Root	Stem	Leaf	Blossom-Capsule
		Fe		
Control	358-171	379-120	529-885	20.6-62.0
0.025 Na Cl	258-378	236-136	643-900	13.0-59.0
0.050 "	266-436	229- 86	614-513	14.1-85.0
0.100 "	301-276	186- 65	686-604	26.2-75.0
0.200 "	340-555	203- 65	612-427	32.0-45.0
0.025 Na_2SO_4	296-334	132-131	648-695	12.7-58.0
0.050 "	298-395	106- 96	688-672	26.0-62.0
0.100 "	579-162	210- 88	493-905	18.3-66.0
0.200 "	634-135	152-116	437-604	16.5-81.0
		Cu		
Control	19.0-12.7	12.2-4.0	17.9-7.6	10.2-14.6
0.025 Na Cl	15.7-9.0	10.0-2.6	17.9-7.8	6.2-14.6
0.050 "	17.9-4.9	9.5-2.0	18.2-3.6	5.8-10.8
0.100 "	19.7-4.6	14.1-5.9	17.5-3.5	3.0-9.7
0.200 "	15.5-4.1	8.6-1.4	19.6-4.6	5.0-7.4
0.025 Na_2SO_4	12.4-6.7	9.5-3.7	68.2-5.1	3.8-12.7
0.050 "	18.9-5.4	9.4-2.7	63.7-14.6	4.4-13.7
0.100 "	15.2-2.9	7.8-1.8	65.8-8.9	4.3-11.7
0.200 "	15.2-4.5	8.1-7.1	62.0-15.7	3.6-211.8
		Zn		
Control	54.4-30.7	76.9-70.7	206-140	282-71.6
0.025 Na Cl	96.3-49.4	82.1-56.0	250-137	303-70.6
0.050 "	84.0-30.0	76.7-54.8	277-163	243-66.3
0.100 "	80.8-36.0	80.6-69.5	245-191	214-57.6
0.200 "	73.2-48.1	74.5-57.2	265-253	242-48.8
0.025 Na_2SO_4	73.0-34.4	68.2-63.4	251-139	243-72.9
0.050 "	77.9-40.2	63.7-55.7	196.139	232-62.8
0.100 "	58.4-42.0	65.8-58.8	234-214	211-64.0
0.200 "	15.0-56.7	62.0-42.5	216-184	224-68.2
		B		
Control	15.3-15.0	17.3-21.0	41.3-65.3	65.0-42.0
0.025 Na Cl	12.0-16.3	17.3-21.0	43.6-54.6	57.5-40.0
0.050 "	19.6-14.6	17.0-20.6	50.6-54.0	40.0-34.0
0.100 "	17.6-14.0	19.6-25.3	50.3-54.0	46.0-32.0
0.200 "	18.3-15.2	19.8-26.0	51.3-52.6	36.0-32.0
0.025 Na_2SO_4	14.0-14.6	19.8-17.6	55.3-56.6	47.0-37.0
0.050 "	13.0-18.0	18.0-22.0	55.6-57.0	57.0-42.0
0.100 "	13.0-13.0	16.1-26.0	56.3-54.0	46.0-38.0
0.200 "	15.2-13.0	17.6-26.0	62.6-57.3	55.0-42.0

The concentration of morphine increases ith the salinity in both cases (Fig.l) but the increasing is bigger in the case of sodium chloride.

From all mentioned above it can be concluded that, the soil salinity has a different influence on the distribution of microelements, iron, copper, zinc and boron but generally increases the amount of morphine. A conclusion is drawn that it s possible to grop poppy plant on arid and semiarid soils.

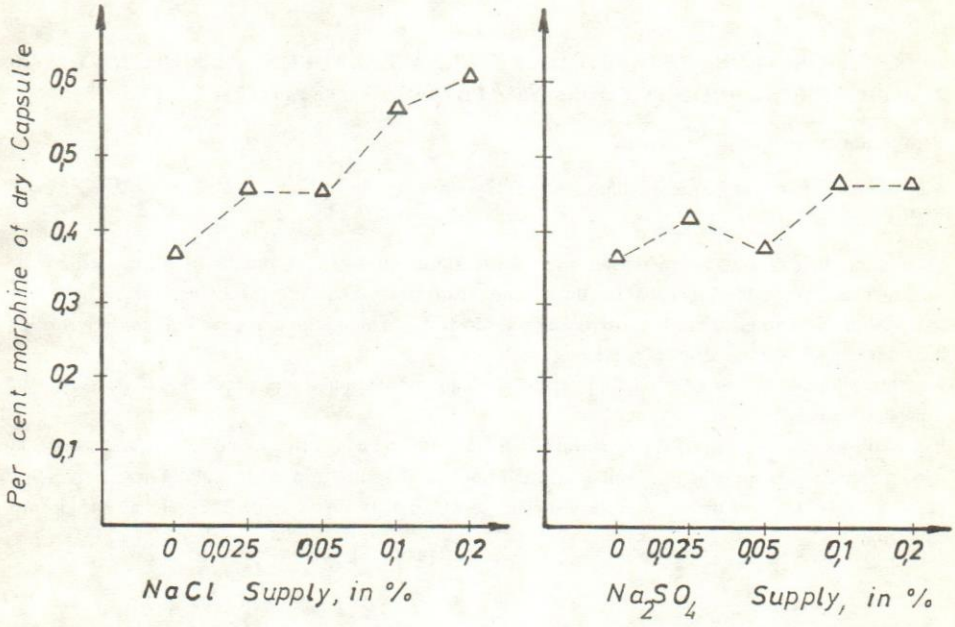

Fig.1. Effect of the increased concentration of NaCl and Na2SO4 in soil on the content of morphine in ripe capsule.

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Rezime

NDIKIMI I PËRQENDRIMIT TË SHTUAR TË KRIPËRAVE NË TOKË NË PERMBAJTJËN E Fe, Cu, Zn dhe B SI DHE NË KRIJIMIN E MORFINËS TEK *Papaver Somniferum* **L.**

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Është hulumtuar ndikimi i përqëndrimit të shtuar të klorurit të natriumit dhe të sulfatit të natriumit në tokë, në përmbajtjen dhe shpërndarjen (distribuimin) e disa mikroelementeve: Fe, Cu, Zn dhe B në organe të ndryshme bimore gjatë zhvillimit të hashashit. Mostrat per hulumtim janë marrë në fazën e rozetës, lulëzimit dhe në fazën e kapsollës së pjekur.
Po ashtu është hulumtuar edhe ndikimi i kriperave të përmendura në tokë, në prodhimin e morfinës në kapsollën e hashashit.
Është konstatuar se saliniteti i shtuar në tokë ka njëfarë ndikimi në distribuimin e hekurit, ndërsa te B ky ndikim është i parëndësishëm. Përmbajtja e morfinës në kapsollat e pjekura zmadhohet me rrijten e përqëndrimit të kriprave në tokë dhe kjo është me e shprehur në rastin e shtimit të përqëndrimit të klorurit të natriumit.

Izvod

UTICAJ POVEČANE KONCENTRACIJE SOLI U ZEMLJIŠTU NA SADRŽAJ Fe, Cu,Zn, I b KAO I NA STVARANJE MORFINA U PAPAVER SOMNIFERUM L.

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Proučavan je uticaj povećane koncentracije natrium hlorida i natrijum sulfata u zemljištu na sadržaj i distribuciju nekih mikroelemenata: Fe, Cu, Zn i B u različitim biljnim organima u toku razvoja maka, Uzroci za istraživanje uzimani su u fazi rozete, cvetanja i zrele čaure.
Ispitivan je takodje uticaj navedenih soli u zemljištu na produkciju morfina u čauri maka.
Pokazalo se da povečan salinitet zemljišta ima izvesnog uticaja na distribuciji Fe dok kod B je skoro neznatan. Sadržaj morfina u zrelim čaurama se povečava sa povečanjem koncentracije soli u zemljištu i to je izraženije u slučaju zasolavanja sa natrium hloridom.