RESULTS CONCERNING THE POSSIBILITY OF DETERMINING BY CHEMICAL ANALYSIS THE PENETRATION OF NUTRIENT ELEMENTS FOLIARLY APPLIED IN SOME VEGETABLES SPECIES

REZULTATE PRIVIND POSIBIITATEA DETERMINĂRII PRIN ANALIZĂ CHIMICĂ A PĂTRUNDERII ÎN PLANTE A UNOR ELEMENTE NUTRITIVE APLICATE PE CALE FOLIARĂ LA CÂTEVA SPECII LEGUMICOLE

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Abstract. *In order to elaborate of a new methodology by cuantification of the nutrient elements penetration applied by foliare way, through the leaves teguments and of their translocation in others organs of plants were organised some experiments in the green house of ICPA. As the plants test were used some vegetables (tomatoes and peppers). The data obtained confirm the possibility created by to study and determine the penetration of mobile nutrient elements from foliar nutrient 's solutions in plants the influence of nitrogen chemical sources and of the pH of their diluted solutions on the penetration of mineral nutrients in the organs of some vegetables plants; the increase of the content of nutrient elements in the opposite untreated leaves with CFF is more substantial and easier to be analyticaly emphasised in plants.*

Rezumat. *În ideea elaborării unei metodologii de cuantificare a pătrunderii elementelor nutritive, aplicate pe cale foliară, prin tegumentele frunzelor şi translocării acestora în organele plantelor au fost organizate în casa de vegetaţie a ICPA experienţe, care au avut ca plante test unele specii legumicole.Datele obţinute confirmă posibilitatea creată de studiul şi determinarea pătrunderii elemetelor nutritive mobile din îngrăşămintele complexe foliare în plante: influenţa naturii chimice a surselorde azot şi a pH-ului soluţiilor diluate asupra pătrunderii elementelor nutritive în plantele de legume; creşterea conţinutului de elemente nutritive, în frunzele opuse celor tratate cu îngrăşăminte complexe foliare, este mai substanţială şi mai uşor de evidenţiat pe cale analitcă.*

MATERIAL AND METHODS

-Plants test: the tomatoes and the peppers**.**

-Soil: unfertilized cambic chernozem from Oltenita: humus 3,0 %, pH_{H2O} 6,5; available P and K; 45 ppm P and 250 ppm K (ammonium lactate acetate extraction), clay 30 %.

-Treatments and experimental design:

-Nitrogen source: $CO(NH_2)_2$ (0,377 g / 1000 ml solution); $(NH_4)_2SO_4$ (0,817 g/1000 ml solution); KNO_3 (1,25 g/1000 ml solution); NH_4NO_3 (0,51 g/1000 ml solution)

-pH of the 1,5% diluted solutions: 5, 6, 7 and 8.

The experimental schemes were:

-for the tomatoes crop

1. Control
2. CFF +$CO(NH_2)_2$ (0,377 g / 1000 ml solution)
3. CFF + $(NH_4)_2SO_4$ (0,817 g/1000 ml solution)
4. CFF +KNO_3 (1, 25 g/1000 ml solution)
5. CFF +NH_4NO_3 (0, 51 g/1000 ml solution)

-for the peppers crop

1. Control
2. CFF with the pH of the diluted solution - 5
3. -//- -//- - 6
4. -//- -//- - 7
5. -//- -//- - 8

-CFF application: the 1, 5% CFF diluted solutions were applied 5 times (5 day between 2 treatments) on the same 3 developed leaves of the plants, leaving all the rest untouched.

-Plant sampling and analyses: after all the 5 treatments, it was sampled from each plant 3 leaves untouched with CFF solution (the opposite leaves of the treated ones). It was determined the N, P,K, Ca, Mg, Zn, Cu, Mn, Fe content of these plant organs.

-Statistical processing of the data: analysis of variance (Fischer method, 1958); test of the lowest significant differences, LSD (Tukey test). All data are relative values as compared with the control (treated only with water) considered equal 100 %.

RESULTS AND DISCUSSIONS

The absolute data concerning the content of the fresh and the dry matter content and the content of the nutrients elements in the opposite leaves (untreated leaves) of the tomatoes plants are given in table 1. Generally, the leaves of the treated plants with CFF accumulate more quantity of the fresh and dry matter than the control treated only with water. Also, the absolute values from the table 1 show an increase in the nutrients concentrations in the opposite leaves as compared with the control.

The absolute data reveal that the most efficient nitrogen source was NH_4NO_3, which added in the solution of CFF (0,51 g/1000 ml solution) had a positive influence on nutrients elements concentration in the untreated (the opposite leaves) leaves of the tomatoes plants, the differences against control, generally being statistically significant to a 5% level.

The penetration of the potassium in the untreated leaves of the tomatoes plants was more evident as effect of the influence of different source of nitrogen from the diluted solution of CFF, the differences against control being statistically significant to a 5% level to all the sources of N treatments.

Table 1

The effect of local application on certain leaves of the solution 1,5 % on fresh and dry matter and on nutrients elements concentration in the untreated leaves of tomatoes plants after 5 foliars CFF applications depending on the chemical form of the nitrogen (source)

Experim. variant	Contro	CFF+ urea	CFF + $(NH_4)_2SO_4$	CFF + KNO_3	CFF+ NH_4NO_3	DL 5 %
Fresh matter (g)	48,99	49,47	54,53	58,60	56,97	13,50
Dry matter (g)	9,08	9,03	11,99	9,14	10,30	3,28
N (% s.u.)	2,16	2,31	2,38	2,59	2,95*	0,75
P (s.u. %)	0,15	0,17	0,16	0,20	0,18	0,06
K (s.u. %)	0,65	1,17*	0,91	1,23*	1,34*	0,30
Ca (s.u. %)	5,42	3,18	5,67	5,82	5,24	1,63
Mg (s.u. %)	1,02	0,74	1,04	1,05	1,07	0,33
Zn(ppm s.u.)	33	26	39	36	32	12
Cu (ppm s.u.)	6,21	6,16	8,05	7,83	8,51	2,99
Mn (ppm s.u.)	142	107	151	182	162	56
Fe (ppm s.u.)	287	2,99	346	354	329	115

The nutrients concentrations analytically determinated in the dry matter of the vegetal materiel were multiplied by the value of the ratio between the fresh matter of the treated and the fresh matter of the untreated leaves, the values obtained revealing more clear how much accumulated for each element, as effect of 5 foliars CFF applications depending on the chemical form of the nitrogen source (table 2).

Table 2

The effect of local application on certain leaves of the solution 1,0 % on nutrients elements accumulation in the untreated leaves of tomatoes plants after 5 foliar CFF application depending on the chemical form of the nitrogen (source)

Experim. variant	Control	CFF+ urea	CFF + $(NH_4)_2SO_4$	CFF + KNO_3	CFF+ NH_4NO_3	DL 5 %
N (mg/100)	196	207	287	248	287	143
P (mg/100)	13,60	14,90	18,77	18,97	18,80	11,21
K (mg/100)	59	104	109	116	140*	60
Ca (mg/100)	492	289	680	559	541	309
Mg (mg/100)	92	67	125	101	110	61
Zn (mg/100)	0,30	0,24	0,47	0,34	0,33	0,22
Cu (mg/100)	0,05	0,05	0,10*	0,08	0,08	0,05
Mn (mg/100)	1,29	0,95	1,82	1,75	1,67	0,99
Fe (mg/100)	2,60	2,77	3,92	3,40	3,17	2,28

The relative data show the positive influence on the accumulation of the nutrients elements in the opposite leaves after 5 foliars CFF applications

depending on the chemical form of the nitrogen. The ammonium ion from NH_4NO_3 and $(NH_4)_2\ SO_4$ has been shown the most efficient nitrogen sources,

the relative data values being among the greatest. This demonstrate that the nutrients absorption through the leaf teguments of the tomatoes plants is an active process, controlled metabolically and the nutrients are translocated in the organs of plants. The addition of NH_4NO_3 and $(NH_4)_2\ SO_4$ in the diluted solution of CFF generally determine the highes accumulations of the nutrients in the opposite leaves, especially the potassium element.

As regards the pH influence on the penetration and accumulation of nutrients elements, the data show a change place of the optimum area from slowly acid (ph 6) to slowly alkaline (pH 8), the concentrations and the accumulations of the nutrients in the opposite leaves of the pepper plants, decreasing with the pH decrease (tabele 3 and 4).

Table 3

The effect of local application on certain leaves of the CFF solution 1,5 %, with the different levels of pH, on nutrients elements concentration in the untreated leaves of the pepper plants after 5 foliar CFF application

Experim. variant	Control (apa)	pH 5	pH 6	pH 7	pH 8	LSD 5%
Fresh matter (g)	15,24	11,64	18,84	18,0	17,13	4,3
Dry matter (g)	3,21	2,57	4,10	3,80	3,64	0,98
N (%su)	4,04	3,56	4,99*	5,05*	5,02*	0,48
P (% su)	0,24	0,21	0,27*	0,27*	0,26	0,03
K (% su)	3,58	2,92	4,15*	4,87*	4,84*	0,26
Ca (% su)	3,27	2,81	4,18*	4,28*	3,03	0,50
Mg (% su)	0,77	0,63	0,91*	0,96*	0,73	0,14
Zn ppm su)	36,33	35,00	40,00	42,33	40,00*	7,04
Cu (ppm su)	9,89	9,97	9,52	11,04	13,05*	1.34
Mn (ppm su)	184	122	217	223*	131	37
Fe (ppm su)	209	189	278*	252*	212	37

The highest absorptions and accumulations were obtained in the treatments when the pH of the CFF solutions foliarly applied were between the 6 and 8 levels. The absolute and relative values registered in the 3 and 4 tables show an increase of the nutrients elements at the 6 and 8 pH levels of CFF solutions. These levels of pH seems to favorise the penetration and absorption of the nutrients in the opposite leaves of the pepper plants, the concentrations increasing with the increase of pH solution. The pH 5 of the CFF solution determine a decrease of the absolute and relative values of the nutrients in the opposite leaves of the pepper plants, the values obtained being smaller than the value obtained in the control variant.

Table 4

The effect of local application on certain leaves of the CFF solution 1,5 %, with the different levels of pH, on nutrients elements accumulation in the untreated organs of the pepper plants after 5 foliar CFF application

Experim.variant	Control	pH 5	pH 6	pH 7	pH 8	LSD 5%
N (mg/100)	129	109	164	161	175	47
P (mg/100)	7,51	6,17	8,95	8,58	7,87	1.93
K (mg/100)	114	92	134	156	147	26
Ca (mg/100)	119	84	136	137	91	46
Mg (mg/100)	23,90	18,90	29,03	30,77	22,00	8,98
Zn (mg/100)	0,11	0,11	0,14	0,14	0,12	0,03
Cu (mg/100)	0,03	0,03	0,03	0,03	0,04	0,01
Mn (mg/100)	0,53	0,36	0,66	0,90	0,40	0,21
Fe (mg/100)	0,66	0,58	0,92	0,81	0,60	0,24

The absolute and relative data obtained in this experiment showed that from the total amount of elements contained by plants, a very considerable proportion is represented by the elements penetrated by leaves as a result of the foliars treatments.

In the table 5 were calculated the relative increases realised in the opposite leaves of the pepper plants as effect of local application on some leaves of the CFF diluted solutions, with the differents leveles of pF.

Table 5

Nutrient elements increases (mg) obtained in untreated organs of ardei plants as effect of local application of the CFF dilution solution (1,5%), with the different pH levels

Experim.variant	pH 5	pH 6	pH 7	pH 8
N (mg/100)	-20	35	32	46
P (mg/100)	-1,3	1,44	1,07	0,36
K (mg/100)	-22	20	42	33
Ca (mg/100)	-35	17	18	-28
Mg (mg/100)	-5	5,1	6,9	-1,9
Zn (mg/100)	0	0,03	0,03	0,01
Cu (mg/100)	0	0	0	0,01
Mn (mg/100)	-0,17	0,13	0,17	-0,13
Fe (mg/100)	0,08	0,26	0,15	0

The data show that the acide reaction of the CFF solution had a depressive effect on the absorption and the accumulation of the nutrients in the opposite leaves, the values obtained being smaller than in the control variant. The increase of the pH solution favorise the penetration and accumulation of the nutrients elements. The data emphasize an increase of the elements accumulation with the pH increase toward slowly alkaline. As for N, P and K, the optimum pH

of the CFF solutions is neuter to alkaline level, the accumulation increasing with the neuter pH.

CONCLUSIONS

The absolute and relative data obtained in this experiment showed that from the total amount of elements contained by plants, a very considerable proportion is represented by the elements penetrated by leaves as a result of the foliars treatments.

The addition of NH_4NO_3 and $(NH_4)_2\ SO_4$ in the diluted solution of CFF generally determine the highes accumulations of the nutrients in the opposite leaves, especially the potassium element.

The highest absorptions and accumulations were obtained in the treatments when the pH of the CFF solutions foliarly applied were between the 6 and 8 levels.

The pH 5 of the CFF solution determine a decrease of the absolute and relative values of the nutrients in the opposite leaves of the pepper plants, the values obtained being smaller than the value obtained in the control variant. In practice, the pH have not to be decreased to much, because it can produce necroses on plants.

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