THE NITRATES ACCUMULATION IN SOME VEGETABLES SPECIES UNDER THE INFLUENCE OF SEVERAL FERTILIZERS DOSES

ACUMULAREA NITRAȚILOR IN UNELE PRODUSE VEGETALE SUB INFLUENTA DIFERITELOR DOZE DE INGRASAMINTE

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***Abstract**: After the trials made on the nitrates accumulation with the tomatoes, lettuce, cabbage and potatoes as influenced of different fertiliser doses has resulted that with all fertilised variants there were recorded higher NO_3 content than with unfertilised ones. The fertilisation with $N_{300}P_{100}K_{100}$ has conducted to a higher nitrate content both with the lettuce crop (1.548 mg NO_3/kg) and cabbage leaves (1.008 mg NO_3/kg).*

***Rezumat**:Cercetările efectuate asupra acumulării nitraților în tomate, salată, varză si cartofi sub influența diferitelor doze de îngrășăminte aplicate au evidențiat faptul că în toate variantele fertilizate s-au înregistrat concentrații mai mari de nitrați decât în variantele nefertilizate.*

***Key words:** nitrates, nitrites, fertilisers, MAL*
***Cuvinte cheie**: nitrați, nitriți, ingrasaminte, LMA*

INTRODUCTION

The modern agriculture allows the accumulation of nitrates in crops due to large nitrogen fertilizer doses or to uneven applying of it. In such conditions the nitrates uptake overcome the plant reduction and assimilation capacity. This phenomenon can be enhanced by the unfavourable conditions (clouds, moisture and temperature stress, and unbalance in nutrition with other elements) (Stasiak A., 1988). Excess accumulation of nitrates is not usually toxic for plants. The nitrates become toxic only after they are reduced to nitrites which are, in certain conditions, harmful or even lethal for the human and animal organisms, especially the younger ones.

MATERIAL AND METHOD

The accumulation of nitrates was researched with: lettuce, early cabbage, potato tubers and tomatoes**.**

The determinations have been made at the Vegetable Research Station Isalnita within a 6 variants trial as follows: unfertilized control, N_1=100 kg N/ha; N_2=200 kg N/ha; N_3=300 kg N/ha; $N_4=N_{300}P_{100}K_{100}$ and $N_5=N_{300}P_{300}K_{300}$. The nitrates and nitrites content was determined at 3 dates during the vegetation period.

For the potato crop the determinations have been carried out at the Research Potato Station Marsani, researching the nitrates content in potato tubers, Desire crop-kind, under the influence of the following fertilizer doses: 1. $N_{67}P_0K_0$; 2. $N_{117}P_{50}K_{20}$ +one foliar treatment with 2.5 l/ha; 3. $N_{117}P_{50}K_{20}$+ 2 foliar treatmets with 2.5 l/ha; 4. $N_{150}P_{75}K_{20}$+ 3 foliar treatments with 2.5 l/ha; 5. $N_{200}P_{100}K_{50}$ + 4 foliar treatments with 2,5 l/ha; 6. $N_{250}P_{100}K_{150}$ + 5 foliar treatments with 2.5 l/ha

RESULTS AND DISCUSSION

The applying of the chemical fertilizers conducts to the accumulation of high

quantities of both nitrates and nitrites into the lettuce leaves. In this manner, the nitrites content, with the first determination (20th of April) ranged between 0.39 with the control variant and 0.79 with the fertilized variants. With the following 2 determinations the nitrites content either is constant or records a slight increase with some variants like the unfertilized control and N_{100} with the second determination either decrease with all variants with the third determination. With all variants and with all determination dates the nitrites content was under the admitted limit of 1 ppm (1 mg/kg).

The transformation of nitrates into nitrites is mostly made in roots and leaves (Powlson, 1992) after the reduction of nitrates by the nitrate-reductase.

The lettuce nitrates content with the tree dates of determinations recorded values influenced by the fertilizer doses applied which had different absorption and metabolisation rates of the soil nitric nitrogen by the lettuce plants (table 1). Such way, with the first date of determination, 20.04, there were found reduced soil nitric nitrogen and nitrates in the lettuce plants. With the unfertilized control while at this time the soil N-NO_3 content was 9 ppm, there was accumulated only 792 ppm NO_3 and with the using of N_{100}, N_{200}, N_{300} doses, while the soil N-NO_3 was 18-54 ppm, the lettuce plants accumulated 1,110 ppm of NO_3. There are recorded no obvious differences between the accumulated nitrates quantity and the nitrogen dose used.

With the second determination, the nitrates content with the unfertilized control decreases due to the reduced nitrates soil content and due to the nitrates metabolisation by the lettuce plants. With the fertilized variants there is recorded a higher nitrates accumulation at this date in comparison with the first date, ranging between 960 and 1,584 ppm NO_3 in the lettuce leaves, higher quantities being recorded with N_{300} – 1,425 ppm NO_3 and $N_{300}P_{300}K_{300}$ – 1,584 ppm NO_3 variants.

With the last determination there is recorded a higher nitrates accumulation with N_{100} – 1,663 ppm NO_3, N_{300} – 1,524 ppm NO_3 and $N_{300}P_{100}K_{100}$ – 1,584 ppm NO_3. With the other variants the nitrates accumulation is lower, in correlation with the lower soil content in nitrates.

It can be appreciated that the applied nitrogen doses of N_{100}-N_{300}, both alone and along with phosphorus and potash conducted to the enhancing of the soil nitrates content followed by the accumulation of higher nitrates quantities in the lettuce leaves reaching up to 1,584-1,663 ppm. The nitrates quantity accumulated in the lettuce leaves is under the maximal admitted limit (2,000 ppm).

Table 1

The nitrates and nitrites accumulation in the lettuce plants

Nr.	Variant	NO_2 ppm			NO_3 ppm			LMA ppm	
		20.04	1.05	10.05	20.04	1.05	10.05	NO_2	NO_3
1.	Control	0.39	0.79	0.39	792	555	763	1	2,000
2.	N_{100}	0.39	0.79	0.39	1,092	960	1,663		
3.	N_{200}	0.79	0.36	0.39	937	1,425	1,188		
4.	N_{300}	0.79	0.79	0.39	1,110	1,425	1,548		
5.	$N_{300}P_{100}K_{100}$	0.79	0.79	0.39	1,110	1,110	1,548		
6.	$N_{300}P_{300}K_{300}$	0.79	0.79	0.39	792	1,548	1,118		

The nitrites content in the early cabbage plants at the all determination data, no matter the fertilizer dose, was under the maximal admitted limit (1 ppm). It can be noticed the lower content with the first determination 0.22-0.32 ppm, then an increase with all variants at the second determination 0.61-0.85 ppm NO_2 and a decrease with the third determination.

The nitrates content from the cabbage leaves have evolved as follows (table 2):

- at the first determination, in comparison with the unfertilized control, where the

plants have accumulated 162 ppm NO_3, the all other variants which were fertilized with different nitrogen doses have accumulated large nitrates quantities up to 2 till 7 times higher than the unfertilized control, reaching 450-1,188 ppm $NO_3(N_{200})$.

Under the influence of the nitrogen fertilizer doses, at the second determination, the nitrates from the cabbage leaves when applying N_{100} and N_{200} have accumulated in very large amounts, exceeding the maximal admitted limit, reaching 1,296 and, respectively, 1,116 ppm, values 1.7-2 times higher than of the unfertilized control variant.

At the third determination, when the plants get matured and the cabbage bud is formed, as the nitrates metabolize into protein, the plants content decreases at 162 ppm with N_{100} and is reduced from 956 to 306 ppm NO_3 with the $N_{300}P_{300}K_{300}$ variant.

It can be appreciated that after using increasing nitrogen fertilizer doses in soil, there are recorded higher nitrates quantities which influence their accumulation in early cabbage leaves during the vegetation, after the maximal admitted limits. Yet, when mature, these are metabolised and the content of the early cabbage bud the content decreases much under the maximal admitted limit.

Table 2

The nitrates and nitrites accumulation in the cabbages

Nr.	Variant	NO_2 ppm			NO_3 ppm			LMA ppm	
		4.05	17.05	2.06	4.05	17.05	2.06	NO_2	NO_3
1.	Control	0.32	0.61	0.44	162	648	234		
2.	N_{100}	0.30	0.74	0.55	450	1,296	162		
3.	N_{200}	0.44	0.74	0.70	1,188	1,116	288	1	1,000
4.	N_{300}	0.25	0.85	0.62	1,008	828	252		
5.	$N_{300}P_{100}K_{100}$	0.22	0.72	0.55	1,008	990	288		
6.	$N_{300}P_{300}K_{300}$	0.37	0.61	0.40	990	954	306		

From the upward table (table 3) data there can result the following:

- The nitric nitrogen content in soil when potato is harvested was somehow influenced by applied fertilizer doses. So, with the $N_{67}P_0K_0$ dose it is 33 ppm NO_3 and with the $N_{200}P_{100}K_{50}$ dose it reaches 49 and 78 ppm NO_3. The low values of 21 ppm NO_3 recorded with the $N_{117}P_{50}K_{20}$ are due to the variation of the agrochemical features of psamosoils.

- The accumulation of the nitrates in the potato tubers was obviously influenced by the fertilizer doses. In this manner, with the $N_{67}P_0K_0$ dose there are accumulated 52 ppm NO_3, with $N_{150}P_{75}K_{20}$ dose there are accumulated 141 ppm NO_3 and with $N_{250}P_{100}K_{50}$ dose there are accumulated 177 ppm NO_3, exceeding the maximal admitted limit.

This fact proves that with potato crop, as regard the nitrates accumulation, there can not be exceed N_{150}, N_{200} doses.

With the field tomato crop there was researched the effect of several nitrogen doses applied on the psamosoil from Dabuleni, on the level of nitrates accumulation in the tomato fruits (table 4).

First, there can be noticed a higher accumulation of nitrates in the fertilized variants than in the unfertilized ones: 68.2-84.3 ppm in comparison with 37.2 ppm NO_3 with unfertilized control variant.

The highest nitrates accumulation is recorded when the nitrogen is used alone, in $N_{100} - N_{150}$ dose and the lowest when the nitrogen is used along with phosphorus and potash. No matter the fertilizer dose, the NO_3 quantity is under the maximal admitted limit.

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Table 3

The nitrates accumulation in the potato crop

Nr.	Variant	NO_3 ppm		LMA ppm tubers
		In soil	In tubers	
1.	$N_{67}P_0K_0$	33	52	160
2.	$N_{117}P_{50}K_{20}$+ 1 treatment with foliar nutritive fertiliser 2.5 l/ha	21	134	
3.	$N_{117}P_{50}K_{20}$+ 2 treatment with foliar nutritive fertiliser 2.5 l/ha	21	141	
4.	$N_{150}P_{75}K_{20}$+ 3 treatment with foliar nutritive fertiliser 2.5 l/ha	25	141	
5.	$N_{200}P_{100}K_{50}$+ 4 treatment with foliar nutritive fertiliser 2.5 l/ha	78	117	
6.	$N_{250}P_{100}K_{50}$+ 5 treatment with foliar nutritive fertiliser 2.5 l/ha	49	177	

Table 4

The nitrates accumulation in the tomato crop on sandy soil from the SCCPAN Dabuleni

Variant	NO_3 ppm	LMA ppm NO_3
Control variant	37.20	150
N_{100}	75.37	
$N_{100}P_{60}$	70.61	
N_{150}	84.3	
$N_{150}P_{120}K_{120}$	68.2	

CONCLUSIONS

1. With the tomato crop the NO_3 content has increased yet not much along with the applying of different doses of fertilisers: 37.2 ppm with control variant, 75.07 ppm with N_{100} and respectively 84.3 with N_{150}, the content being under AML.

2. In the potato tubers there were accumulated much more quantities of NO_3 with higher $N_{250}P_{100}K_{50}$ fertiliser doses –177 ppm NO_3.

3. In the lettuce leaves there was recorded a lower NO_3 content with the control variant and higher with the variants where there were applied higher nitrogen doses: N_{300} – 1,425 mg NO_3/kg; $N_{300}P_{300}K_{300}$ – 1,584 mg NO_3/kg in leaves in comparison with 2,000 mg NO_3/kg which is the AML.

4. In the cabbage leaves the NO_3 content was higher with the fertiliser variant in comparison with the unfertilised ones.

LITERATURE

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