

ACCUMULATION POTENTIAL OF NITRATES, IN CASE OF SOME VEGETABLES SPECIES CULTIVATED IN THE FIELD

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Abstract

In this paper are presented results of the performed researches, for to establish the influence of fertilization treatments on nitrates content of some vegetable species, cultivated in the field: cabbage, carrots, bell peppers and onion. In the culture technology of these vegetables, they were applied the following fertilization variants (fertilizer being ammonium nitrate with 33% nitrogen): V1 = 0 kg nitrogen/ha; V2 = 100 kg nitrogen/ha; V3 = 200 kg nitrogen/ha; V4 = 400 kg nitrogen/ha; V5 = 800 kg nitrogen/ha. For to establish the accumulation potential of nitrates in vegetables cultivated in the field, it was used an enzymatic method. In the case of the high fertilization level, cabbage has the higher nitrates content (698.19 mg NO₃⁻/kg), and bell peppers the lower nitrates content (61.70 19 mg NO₃⁻/kg).

Keywords: onion, bell peppers, carrots, cabbage, fertilization

1. INTRODUCTION

Nitrates and nitrites are natural components of the soil from nitrogen mineralization of organic substances of plant and animal origin. Nitrogen mineralization takes place primarily through existing micro-organisms in soil. In areas with temperate climate, this process is carried out with maximum intensity in hot season (Bibicu, [1]).

A part of nitrate and nitrite is absorbed by plant roots and serves as feedstock for the synthesis of proteins and other nitrogen compounds, and the other is caused by surface water or crossing the land, retrieval – in rivers, lakes or into groundwater (especially in cloth water groundwater).

Plants absorb nitrogen from the soil, mainly in the form of nitrates or ammonia. On may intervenes and legumes fixing nitrogen gas by symbiotic bacteria, which is used in the synthesis of amides and amino acids. These organic compounds are then retrieve plant, which in turn ensures bacteria, the synthesis necessary carbohydrates.

The first changes that have nitrates in plants consist of two successive reductions, catalised by nitrate-reductase and nitrite-reductase. Both

enzymes are metallo-flavo-enzymes. Nitrate-reductase contains molybdenum, nitrite-reductase, iron and copper.

Conversion of nitrates into nitrites is, mainly in roots and leaves. The amount of nitrates in the existing in plant at a time, is the result of balance between the amount absorbed and used in proteino-genesis. A main cause of nitrate accumulation in vegetables is the use of nitrogenous fertilizers on crop land (Popa et al., [4]).

Depending on nitrates content of vegetables and fruits, these can be grouped in the following way (Gherghi et al., [2]).

- with high nitrates content (over 1000 ppm): onion, green garlic, beetroot, cabbage, orache, patience, leaves lovage, greenhouse lettuce
- with average nitrates content (100 – 1000 ppm): yellow melons, cucumbers, field lettuce, potatoes, celery
- with low nitrate content (under 100 ppm): cherries, morello cherries, strawberries, raspberry, tomatoes, green pea

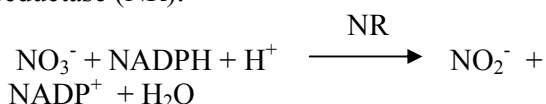
Field vegetables have a lower accumulation potential of nitrates, in comparison with those

cultivated within protected environments (Bibicu, [1]).

2. MATERIAL AND METHODS

Within the performed researches for determination of nitrates content of some vegetable species, cultivated in open field, to which they were applied different fertilization variants, they were used: cabbage (*Buzoiană* variety), carrots (*Nabuco* variety), bell peppers (*Splendens* variety), onion (*De Buzău* variety). Samples were supplied by the Vegetable Research Development Plant for Horticulture Buzau. In culture technology of these vegetables, they were applied the following fertilization variants (fertilizer being ammonium nitrate with 33% nitrogen): V1 = 0 kg nitrogen/ha; V2 = 100 kg nitrogen/ha; V3 = 200 kg nitrogen/ha; V4 = 400 kg nitrogen/ha; V5 = 800 kg nitrogen/ha. For each fertilization variant, they were realised 4 repetitions.

For determination of the accumulation potential of nitrates in vegetables cultivated in open field, studied, it was used an enzymatic method. In this method, nitrate is reduced by the reduced nicotinamide adenine dinucleotide (NADPH), to nitrite, in presence of nitrate-reductase (NR):



Amount of oxidized NADPH is stoichiometrically equal with nitrate amount. Decreasing of NADPH amount is measured through absorbance at $\lambda = 340 \text{ nm}$.

3. RESULTS AND DISCUSSION

Within experimental variant V1 (without fertilizer adding), nitrates content of cabbage is in the range 79.52 – 84.08 mg/kg. The average value of the accumulation potential of nitrates in this case is 80.76 mg/kg.

When is applied fertilizer, nitrates content of cabbage increases once with increasing of fertilizer dose (ammonium nitrate with 33% nitrogen). Thus, in the case of fertilization

variant V2 (100 kg nitrogen/ha) cabbage has a nitrates content in the range 136.75 – 138.08 mg/kg, and the average potential of nitrates accumulation is 137.38 mg/kg, with 41.21% much more than in the case of none fertilizer applied.

Within fertilization variant V3 (200 kg nitrogen/ha) cabbage has a nitrates content in the range 288.94 – 290.75 mg/kg, and the average potential of nitrates accumulation is 289.95 mg/kg, of 3.59 times higher, than in case of none fertilizer applied.

Application of a fertilizer dose of 400 kg nitrogen/ha (fertilization variant V4), it determines increasing of 5.51 times of the average potential of nitrates accumulation in cabbage cultivated in these conditions, comparative with those non-fertilized. In the case of this fertilization variant cabbage has a nitrates content in the range 444.54 – 445.92 mg/kg, and the average potential of nitrates accumulation is 445.32 mg/kg.

Use in the culture technology of a fertilizer dose of 800 kg nitrogen/ha (fertilization variant V5), it determines increasing of 8.65 times of the average potential of nitrates accumulation in cabbage cultivated in these conditions, comparative with non-fertilized cabbage. In the case of this fertilization variant cabbage has a nitrates content in the range 697.63 – 698.85 mg/kg, and the average potential of nitrates accumulation is 698.19 mg/kg.

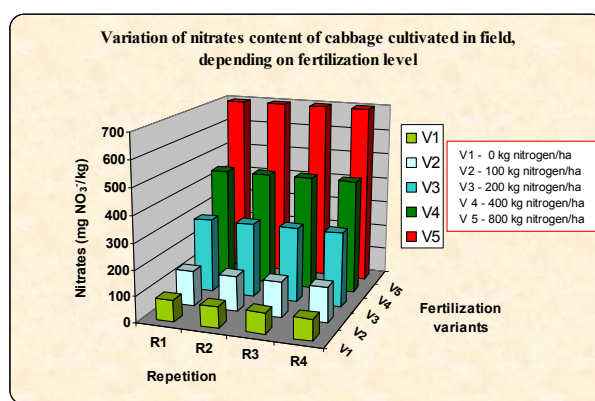


Figure 1. Variation of nitrates content of cabbage cultivated in field, depending on fertilization level

According to the obtained results, cabbage is a vegetable species with an average potential of nitrates accumulation.

Within fertilization variant V1 (without fertilizer adding), nitrates content of carrots is in the range 90.18 – 91.88 mg/kg. The average value of the accumulation potential of nitrates in this case is 90.85 mg/kg.

When is applied fertilizer, nitrates content of carrots increases once with increasing of fertilizer dose (ammonium nitrate with 33% nitrogen). Thus, in the case of fertilization variant V2 (100 kg nitrogen/ha) carrots have a nitrates content in the range 159.55 – 161.93 mg/kg, and the average potential of nitrates accumulation is 160.98 mg/kg, with 77.19% much more than in case of none fertilizer applied.

Within fertilization variant V3 (200 kg nitrogen/ha) carrots have a nitrates content in the range 199.85 – 201.85 mg/kg, and the average potential of nitrates accumulation is 200.83 mg/kg, of 2.21 times higher, than in case of none fertilizer applied.

Application of a fertilizer dose of 400 kg nitrogen/ha (fertilization variant V4), it determines increasing of 2.87 times of the average potential of nitrates accumulation in carrots cultivated in these conditions, comparative with those non-fertilized. In the case of this fertilization variant carrots have a nitrates content in the range 260.53 – 261.44 mg/kg, and the average potential of nitrates accumulation is 260.62 mg/kg.

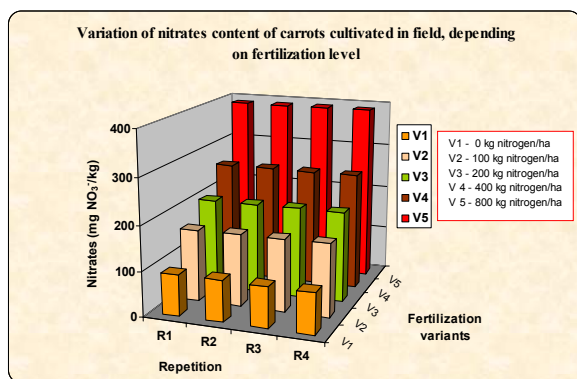


Figure 2. Variation of nitrates content of carrots cultivated in field, depending on fertilization level

Use in the culture technology of a fertilizer dose of 800 kg nitrogen/ha (fertilization variant V5), it determines increasing of 4.3 times of the average potential of nitrates accumulation in carrots cultivated in these conditions, comparative with non-fertilized carrots. In the case of this fertilization variant, carrots have a nitrates content in the range 389.72 – 391.50 mg/kg, and the average potential of nitrates accumulation is 390.49 mg/kg.

According to the obtained results it can be concluded that carrots are a vegetable species with an average accumulation potential of nitrates.

Within fertilization variant V1 (without fertilizer adding), nitrates content of bell peppers is in the range 11.53 – 14.04 mg/kg. The average value of the accumulation potential of nitrates in this case is 12.63 mg/kg.

When is applied fertilizer, nitrates content of bell peppers increases once with increasing of fertilizer dose (ammonium nitrate with 33% nitrogen). Thus, in the case of fertilization variant V2 (100 kg nitrogen/ha) bell peppers have a nitrates content in the range 17.03 – 19.25 mg/kg, and the average potential of nitrates accumulation is 18.17 mg/kg, with 43.86% much more than in case of none fertilizer applied.

Within fertilization variant V3 (200 kg nitrogen/ha) bell peppers have a nitrates content in the range 27.10 – 29.35 mg/kg, and the average potential of nitrates accumulation is 28.08 mg/kg, of 2.22 times higher, than in case of none fertilizer applied.

Application of a fertilizer dose of 400 kg nitrogen/ha (fertilization variant V4), it determines increasing of 3.22 times of the average potential of nitrates accumulation in bell peppers cultivated in these conditions, comparative with those non-fertilized. In the case of this fertilization variant bell peppers have a nitrates content in the range 39.67 – 41.55 mg/kg, and the average potential of nitrates accumulation is 40.67 mg/kg.

Use in the culture technology of a fertilizer dose of 800 kg nitrogen/ha (fertilization variant V5), it determines increasing of 4.88 times of the average potential of nitrates accumulation

in bell peppers cultivated in these conditions, comparative with non-fertilized bell peppers. In the case of this fertilization variant, bell peppers have a nitrates content in the range 60.85 – 63.08 mg/kg, and the average potential of nitrates accumulation is 61.70 mg/kg. According to the obtained results, bell peppers are a vegetable species with low potential of nitrates accumulation.

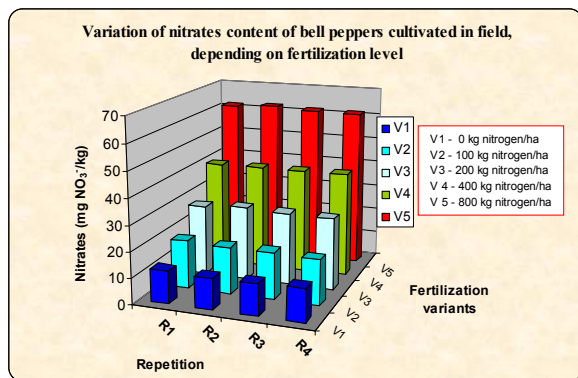


Figure 3. Variation of nitrates content of bell peppers cultivated in field, depending on fertilization level

Within fertilization variant V1 (without fertilizer adding), nitrates content of onion is in the range 28.35 – 31.15 mg/kg. The average value of the accumulation potential of nitrates in this case is 29.46 mg/kg.

When is applied fertilizer, nitrates content of onion increases once with increasing of fertilizer dose (ammonium nitrate with 33% nitrogen). Thus, in the case of fertilization variant V2 (100 kg nitrogen/ha) onion has a nitrates content in the range 49.21 – 51.45 mg/kg, and the average potential of nitrates accumulation is 50.27 mg/kg, of about 1.71 times much more than in case of none fertilizer applied.

Within fertilization variant V3 (200 kg nitrogen/ha) onion has a nitrates content in the range 66.35 – 68.21 mg/kg, and the average potential of nitrates accumulation is 67.32 mg/kg, of about 2.28 times higher, than in case of none fertilizer applied.

Application of a fertilizer dose of 400 kg nitrogen/ha (fertilization variant V4), it determines increasing of 2.38 times of the

average potential of nitrates accumulation in onion cultivated in these conditions, comparative with those non-fertilized. In the case of this fertilization variant onion has a nitrates content in the range 69.20 – 71.35 mg/kg, and the average potential of nitrates accumulation is 70.21 mg/kg.

Use in the culture technology of a fertilizer dose of 800 kg nitrogen/ha (fertilization variant V5), it determines increasing of 2.78 times of the average potential of nitrates accumulation in onion cultivated in these conditions, comparative with non-fertilized onion. In the case of this fertilization variant, onion has a nitrates content in the range 80.62 – 83.05 mg/kg, and the average potential of nitrates accumulation is 81.81 mg/kg.

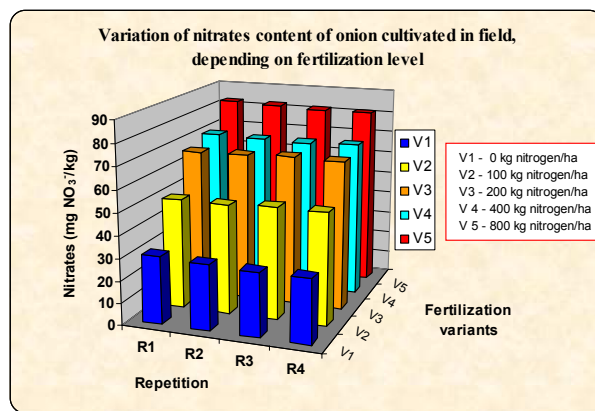


Figure 4. Variation of nitrates content of onion cultivated in field, depending on fertilization level

4. CONCLUSIONS

1. Cabbage samples obtained in field culture, through application of 5 fertilization variants, have a potential of nitrates accumulation in the range: 80.76 mg NO₃⁻/kg – 698.19 mg NO₃⁻/kg. The minimum value of nitrates content is for non-fertilized cabbage, and the maximum value is for fertilized cabbage with 800 kg nitrogen/ha.
2. Carrot samples obtained in field culture, through application of 5 fertilization variants, have a potential of nitrates accumulation in the range: 90.85 mg NO₃⁻/kg – 390.49 mg NO₃⁻/kg.

The minimum value of nitrates content is for non-fertilized carrots, and the maximum value is for fertilized carrots with 800 kg nitrogen/ha.

3. Bell pepper samples obtained in field culture, through application of 5 fertilization variants, have a potential of nitrates accumulation in the range: 12.63 mg NO₃⁻/kg – 61.70 mg NO₃⁻/kg. The minimum value of nitrates content is for non-fertilized bell peppers, and the maximum value is for fertilized bell peppers with 800 kg nitrogen/ha.

4. Onion samples obtained in field culture, through application of 5 fertilization variants, have a potential of nitrates accumulation in the range: 29.46 mg NO₃⁻/kg – 81.81 mg NO₃⁻/kg. The minimum value of nitrates content is for non-fertilized onion, and the maximum value is for fertilized onion with 800 kg nitrogen/ha.

5. ACKNOWLEDGEMENTS

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