

More Yield is Better - Less Nitrate is Better

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Abstract: The article describes the impact of nitrogen fertilizers on the environment, especially on human health. Excessive use of fertilizers is highlighted on the basis of data obtained when the permissible concentration of nitrates in the product is exceeded. The increase in nitrates in the composition of the product depends on the type of nitrogen fertilizers, as well as their use during the growing season, as well as external and internal factors that affect the accumulation and decrease of nitrates in the plant body. For example, it has been found that the amount of nitrate nitrogen in root crops depends on the number of their stems and the size and size of root crops. The influence of tillage on the content of nitrates in vegetable crops was also revealed.

Keywords: nitrogen fertilizers, product quality, nitrates, vegetable crops, vegetation, fertilization, nitrate concentration, norm.

Relevance of the topic. Nitrates are salts of nitric acid, a plant nutrient that is essential for building cells and making chlorophyll. A high concentration of nitrates in the soil is not completely toxic to plants, on the contrary, it contributes to their growth, more active photosynthesis and higher productivity. Therefore, farmers can use "a little more" fertilizers. Nitrates are not dangerous to humans and animals in normal amounts, but can cause poisoning and even death at levels above REM. Once in the body, in the large intestine, under the influence of microflora, nitrates turn into nitrites - they are toxic to humans. Nitrites have a harmful effect on hemoglobin, and as a result, it cannot transfer oxygen to tissues and organs - oxygen deficiency occurs. According to the standards of the World Health Organization, the permissible daily intake of nitrates for a person should not exceed 1 mg per 5 kg of body weight, that is, for a person weighing 70 kg - no more than 350 mg per day. If you take 600-650 mg of nitrates at one time, poisoning may occur in adults. In children, the synthesis of substances responsible for the restoration of hemoglobin decreases, so nitrates are more dangerous for babies than for adults. The degree of nitrate exposure to humans depends not only on their quantity, but also on the state of the body as a whole. In a healthy body, the conversion of nitrates to nitrites is slower than in a weakened body. Nitrates are nutrients for plants, but people should reduce their consumption of nitric acid salts from agricultural products (vegetables, dairy products). How to protect yourself from nitrates?! Of course, the easiest way is to eat only vegetables whose nitrate content has been tested [6].

In addition to the negative effects of nitrates on the human body, the outbreak of nitrate poisoning as a result of eating feed containing a large amount of nitrates has also been observed in farm animals around the world. Nitrate poisoning often occurs in cattle and sheep. In ruminants, nitrate is reduced to nitrite under the action of microbial reductases. Rumen microbes

use this nitrite as a nitrogen source by converting it to ammonia. At the same time, excess nitrite accumulates in the abdominal cavity, from where it is easily absorbed into the bloodstream, and combines with the iron ion of hemoglobin (Hb) to form met-hemoglobin (met-Hb). Met-Hb is a poor carrier of oxygen in the body and the animal suffers from oxygen deficiency [4].

Research results and their discussion. Anthropogenic activities aimed at increasing food production can contribute to the accumulation of undesirable substances in plants and negatively affect the quality of soil and water resources. Application of high-nitrogen fertilizers to crops protects against crop loss and economic losses. However, when the introduction of nitrogen exceeds the requirement, plants cannot absorb it and nitrogen accumulates in the soil, mainly in the form of nitrates. This disrupts the balance of nutrients in the soil and increases the level of nitrate in groundwater, affecting the nitrate content of plants. Approximately 72% to 94% of the total daily intake of nitrate by humans is obtained from vegetables [1].

In addition to the above factors, weather conditions have a significant impact on nitrate accumulation in plants. Weather conditions that are unfavorable for plant growth, such as drought, cold, extreme cold, and cloudy weather, can increase nitrate accumulation in plants. In this study, field nitrate concentrations were significantly higher than those found uniformly under adverse weather conditions, i.e., cloudy, cold, wet in winter, and very hot and dry in summer. For example, one of the reasons people often get nitrate poisoning in India is because crops and frost are affected by severe frosts in December and January. In a very hot summer, the nitrification process of soil bacteria increases, which leads to the accumulation of nitrate in forage. Cold and cloudy weather reduces nitrate reductase activity and therefore increases nitrate accumulation in plants [4].

Nitrate concentration in vegetables depends on various factors, such as the amount and type of nitrogen fertilizer application for soil fertility, growing conditions, weather conditions, season, temperature, light intensity, type of cultivation (conventional and relative to greenhouse) depends on harvest time, humidity, stress, plant species, plant age, soil pH, storage conditions and post-harvest storage.

So far, many studies have been conducted on nitrate concentration in vegetables. For example, scientists have shown that the highest amount of nitrates is found in parsley and spinach, and the lowest amount of nitrates is found in tomatoes. Another study by scientists found that boiling reduced the nitrate content of fresh leafy vegetables by 47-59%, but frying in soybean oil increased the nitrate content by 159-309%. In addition, a slight change in the nitrate content of leafy vegetables was observed for 7 days when the flash freezing method was used. The presence of nitrates in food has led to various manifestations [3].

Factors influencing the accumulation of nitrates. Vegetables and forage crops are the main source of nitrates for humans and animals. In turn, nitrogen fertilizers used in high amounts have the strongest effect on the accumulation of nitrates in vegetable products. Thus, at the Czechoslovak Research Institute of Soil Science and Plant Breeding (Prugar. Prugarova 1990), with an increase in the nitrogen dose from 80 to 160 kg/kg, the amount of nitrates in spinach increased from 1338 mg/kg to 2160 mg/kg, and in lettuce from 1445 to 1641 mg, that is, it exceeds the permissible concentration [5].

The accumulation of nitrates in plants depends not only on the amount of nitrogen fertilizers used, but also on their type. Studies conducted on ammonium sulfate and calcium nitrate have shown that when nitrogen fertilizers in the form of ammonium are applied to radishes, less nitrates accumulate in the roots than when nitrogen fertilizers contain nitrate. Similar results were expressed in experiments with lettuce leaves. Batch application of nitrogen fertilizers with irrigation, especially if they are carried out in the second half of the growing season, leads to an increase in the amount of nitrates in the cultivated products (diagram 1). At the same time, in all crops, the amount of nitrates in cabbage heads, beets and carrots was significantly reduced when

potassium fertilizers were applied late. Also, when the amount of phosphorus fertilizers is increased, the amount of nitrates in vegetables often increases [5].

Nitrate concentration varies in different plant species. In general, leafy vegetables (such as kale and spinach) have higher nitrate concentrations, while root vegetables (such as potatoes and carrots) and root vegetables (such as onions and garlic) have relatively lower concentrations. As for nitrite, its average concentration in vegetables is usually low [5].

Nitrates in the harvest of agricultural crops enter the human body and poison it, the most effective way to prevent this is to grow products that have an amount that does not have a negative effect on human health in vegetables and fruits. According to the World Health Organization, the harmless daily amount of nitrates for humans is set at 300-350 mg, in addition, the permissible amount of nitrates in drinking water is 10 mg/dm³, and in European countries it is 22 mg/dm³. defined as The rate of accumulation of nitrates in crops is influenced not only by fertilizers, but also by agrotechnics of cultivation, light, moisture, fertilizer application systems, etc. These include: Optimum number of plants per hectare. It is clear that if a field with a sparse crop is applied with a high amount of nitrogen fertilizers, excessively large tubers with a high content of nitrates will be formed. The content of nitrates is low in vegetables grown on soils with a high mineral nitrogen content (200-250 kg/ha) or on soils with high mineralization of humus. According to the data obtained from the field experiments, the minimum amount of nitrate content in carrots was achieved when there were 1.5 million root fruits per hectare. In Oshlavlagi, 719,000 units per hectare were obtained. Reducing the amount of nitrates in vegetables is also achieved by reducing the number of tillages before planting and the number of inter-row tillages. It is achieved by selectively planting varieties with low nitrate content. When full amounts of nitrogen fertilizers are applied under the soil (locally) at a depth of 10-15 cm and at an interval of 15-20 cm, the coefficient of use of soil and fertilizer nitrogen is increased by 1-4 times, productivity increased by 20-30%, loss of gaseous nitrogen decreased by 2 times due to slowing down of microbiological processes in the place where fertilizer was applied. When band-applied nitrogen fertilizers in the form of ammonium, vegetable and forage crops use ammonium nitrogen longer. This was especially evident in white cabbage, carrots, dill and salads, which resulted in a 1.5-fold decrease in nitrate content of the crop.

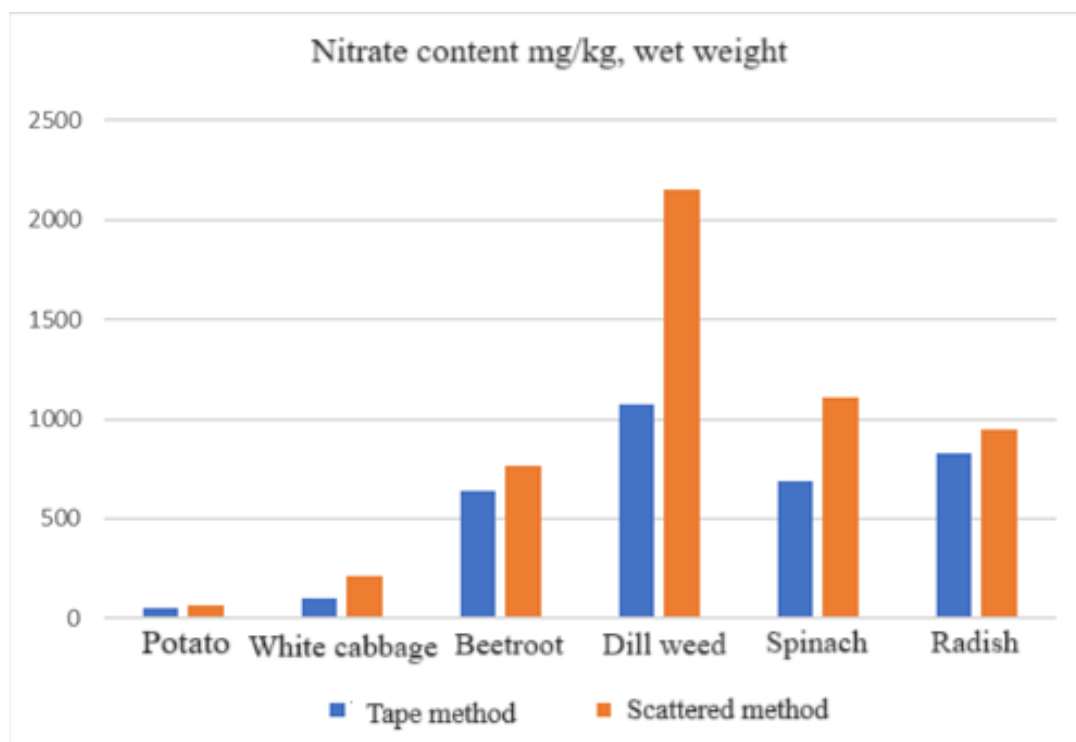


Fig 1. The effect of fertilizer application methods on the content of nitrates in agricultural crops

Various conflicting information has been received regarding the distribution and use of nitrogen fertilizers in certain periods. Especially if feeding with nitrogen is applied late, the amount of nitrogen in the form of nitrates in the commodity part of the product is increased. Taking this into account, the last nitrogen feeding should be completed 1.5-2 months before harvesting.

Crops that accumulate more than the allowed rate of nitrates can be reduced by extending the growing season. If the tubers are harvested immature, they contain a lot of nitrates. Therefore, the extension of the vegetation period leads to a decrease in the period.

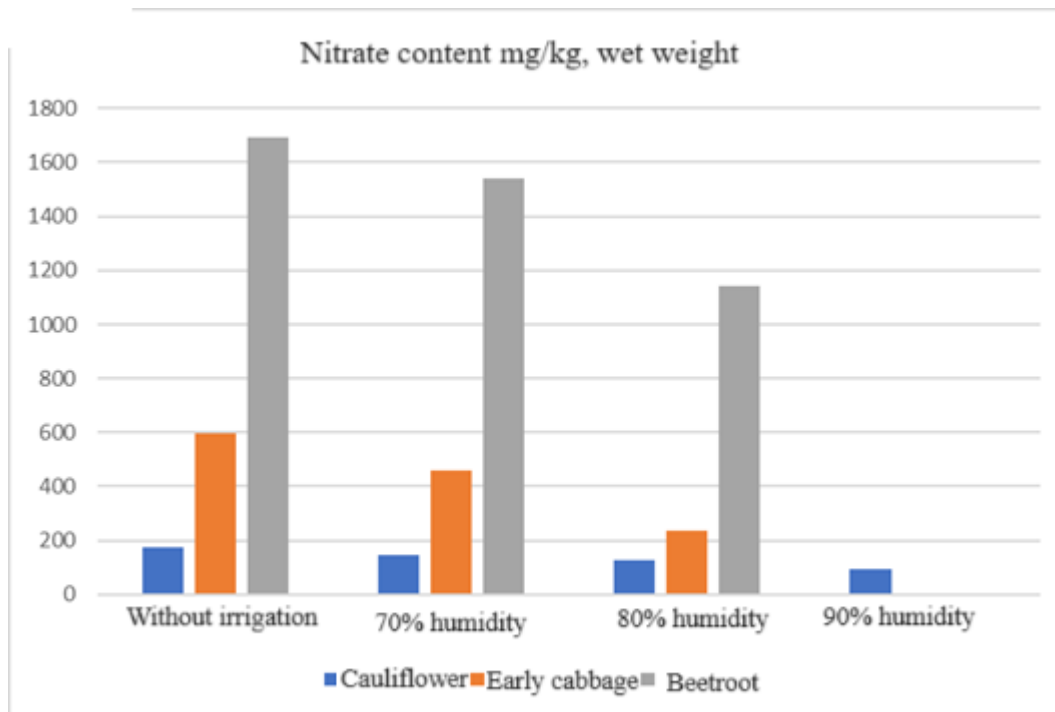


Fig 2. Effect of irrigation regime on nitrate content of vegetable products (NIIOX)

However, extending the growing season of vegetables grown in the autumn months, when fed abundantly with nitrogen, gives the opposite result. That is, in dry, cold and cloudy weather, the process of photosynthesis slows down and the metabolism of nitrates in the plant slows down.

Conclusion. From the experiments, it was concluded that by watering the crops abundantly, it is possible to reduce the amount of nitrate in the product from the permissible standard level.

Nitrogen in the form of nitrate contained in nitrogen fertilizers is easily washed away under the influence of irrigation water and pollutes the environment. Nitrate leaching increases significantly in early spring and late fall. Nitrates move up through the soil capillaries after irrigation in dry climates. Therefore, it is very important to know the timing of application of nitrogen fertilizers and the rate of nitrification of nitrogen in the form of ammonia in agriculture. Nitrate-nitrogen fertilizers are more leached than other types of nitrogen fertilizers. The combined use of organic and mineral fertilizers optimizes the application of nitrogen fertilizers to crops and prevents unnecessary loss of nitrogen fertilizers.

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