

УДК 631.417.4

UDC 631.417.4

4.1.1. Общее земледелие и растениеводство
(биологические науки, сельскохозяйственные
науки)

4.1.1. General agriculture and crop production
(biological sciences, agricultural sciences)

ЭКОЛОГИЧЕСКИЕ ПАРАМЕТРЫ КАЧЕСТВЕННОГО СОСТОЯНИЯ АЗОТА В ЧЕРНОЗЁМЕ ОБЫКНОВЕННОМ В УСЛОВИЯХ РОСТОВСКОЙ ОБЛАСТИ

ECOLOGICAL PARAMETERS OF THE QUALITATIVE STATE OF NITROGEN IN ORDINARY CHERNOZEM UNDER CONDITIONS OF THE ROSTOV REGION

Новиков Алексей Алексеевич

Доктор сельскохозяйственных наук, профессор
Электронная почта: al.al.novikov@gmail.com
ORCID: 0000-0001-9013-2629 SPIN-код: 6421-5833

Novikov Alexey Alekseevich

Doctor of Agricultural Sciences, Professor
Email: al.al.novikov@gmail.com
ORCID: 0000-0001-9013-2629 SPIN: 6421-5833

*Новочеркасский инженерно-мелиоративный
институт имени А. К. Кортунова – филиал
федерального государственного бюджетного
образовательного учреждения высшего
образования «Донской государственный
аграрный университет» Россия, Ростовская
область, Новочеркасск*

*Novocherkassk Engineering and Reclamation
Institute named after A.K. Kortunov - branch of the
federal state budgetary educational institution of
higher education "Don State Agrarian University"
Russia, Rostov region, Novocherkassk*

Статья посвящена итоговым работам, изменениям с анализом процессов, устанавливающих азотный режим черноземов обыкновенных в биogeоценозах в условиях степной зоны Ростовской области с точками зрения экологии. В результате было установлено наблюдение азотного фонда черноземов обыкновенных Нижнего Дона Ростовской области, а также была установлена необходимость разделения азотных соединений на агрономические группы, в зависимости от гумусированности почвы первоначально общего азота было 236, после того как прошло 13 лет, ситуация изменилась. В частности, количество общего азота снизилось до 228 миллиграмм. Изменился видовой состав азотных компонентов, как минеральных, так и легкогидролизующихся, с понижением на 0,8 миллиграмм и 0,44 миллиграмм соответственно. По трудногидролизующему азоту также наблюдается снижение. По сравнению с исходным уровнем обеспечения запаса азота, речь идет о таком виде, как негидролизующий, произошло снижение на 5,25 миллиграмм. каждая из фракций стала лучше, после того как в севообороте включили навоз, а также комплексное удобрение, в составе которого контролируют азот, фосфор и калий

The article is devoted to the final work, changes with analysis of the processes that establish the nitrogen regime of ordinary chernozems in biogeocenoses in the conditions of the steppe zone of the Rostov region from an environmental point of view. As a result, the observation of the nitrogen fund of ordinary chernozems of the Lower Don of the Rostov region was established, and the need was established to separate nitrogen compounds into agronomic groups, depending on the humus content of the soil initially total nitrogen was 236, after 13 years, the situation has changed. Specifically, the amount of total nitrogen dropped to 228 milligrams. The species composition of nitrogen components, both mineral and easily hydrolyzable, has changed, with a decrease of 0.8 milligrams and 0.44 milligrams, respectively. There is also a decrease in hard-to-hydrolyze nitrogen. Compared to the initial level of nitrogen supply, we are talking about the non-hydrolyzable type, there was a decrease of 5.25 milligrams. Each of the fractions became better after manure was included in the crop rotation, as well as complex fertilizer, which controls nitrogen, phosphorus and potassium

Ключевые слова: АЗОТ, ФОРМЫ АЗОТА,
ЗАПАСЫ АЗОТА, ЧЕРНОЗЁМ
ОБЫКНОВЕННЫЙ, СЕВООБОРОТ,
ОРГАНИЧЕСКИЕ УДОБРЕНИЯ,
МИНЕРАЛЬНЫЕ УДОБРЕНИЯ

Keywords: NITROGEN, FORMS OF NITROGEN,
NITROGEN RESERVES, ORDINARY
CHERNOZEM, CROPE ROTATION, ORGANIC
FERTILIZERS, MINERAL FERTILIZERS

<http://dx.doi.org/10.21515/1990-4665-198-035>

<http://ej.kubagro.ru/2024/04/pdf/35.pdf>

Introduction. It should be noted that the value of the total nitrogen reserve in the soil does not indicate the supply of plants with this element; its qualitative composition is important. In developed soils of agrocenoses, organic fertilizers have traditionally served as an important source of replenishment of gross nitrogen reserves.

In recent years, the role of mineral fertilizers has sharply increased as a direct source of nitrogen nutrition for plants and a means of increasing effective soil fertility. It should be noted that nitrogen fertilizers applied to the soil undergo the same transformations as mineral forms of natural nitrogen [1].

Conditions and methods. The studies were carried out on ordinary micellar-carbonate, medium-thick, heavy loamy chernozem on loess-like loams in the conditions of the steppe zone of the Rostov region. The arable layer of the studied soil contains 4.28% humus. The total nitrogen content in the arable horizon is 0.25%. The amount of exchangeable potassium is average. Mobile phosphorus is at a low level.

Acid hydrolysis, which involves 2 stages, was used in order to qualitatively assess, from an environmental point of view, the content of nitrogen compounds that are present in the soil cover; it provides for the determination of a direct source of nitrogen nutrition in the form of salts of nitrate and partly ammonium nitrogen, as well as when the soil is exposed to sulfuric acid of various concentrations to determine the so-called nearest reserve for plant nutrition (these are compounds of easily hydrolyzed nitrogen and partly compounds of difficult to hydrolyze).

This technique allows you to determine potential reserve reserves of nitrogen that can be used by crops in cases of lack of available forms of nitrogen [1].

The fractional composition of nitrogen components was studied in crop rotation: pure fallow - winter crops (wheat) - winter crops (wheat) - peas - winter crops (wheat) - spring grains (barley) - corn (for silage) - winter crops.

crops (wheat) - sunflower in the control variant without fertilizers, as well as with their use over a thirteen-year period, 90 tons of manure, 746 kilograms of nitrogen fertilizers, 760 kilograms of phosphorus fertilizers, 240 kilograms of potassium fertilizers in the active substance.

Results.

Nitrogen fertilizers applied to the soil undergo the same transformations as various forms of natural nitrogen. Nitrogen from fertilizers is not only absorbed by plant roots and fixed in the soil, but it is also lost, being included in the general process of immobilization and fixation, and organic compounds, in turn, are exposed to microbiological effects. This determines the physiological role of nitrogen in the most important processes, the synthesis of many organic and organomineral compounds.

It was revealed that over a long period of cultivation of agricultural crops without proper fertilization, the nitrogen reserve of ordinary chernozems in the steppe zone of the Rostov region has deteriorated, which necessitates the adoption of urgent measures to reproduce soil fertility, primarily through the application of organic and mineral fertilizers.

Therefore, it is important to quickly formulate a number of measures to improve the situation. First of all, nitrogen doses should be differentiated by crops and soil agro groups, and within agro groups depending on the soil humus content, since nitrogen fertilizers activate the nitrogen cycle in agrocenoses. Under their influence, the mineralization of organic compounds in the soil nitrogen fund increases, which leads to the enrichment of the soil with nitrogen components that are easily digestible for plant nutrition.

As a result, it was found that over a thirteen-year period in the control without fertilizers, the content of all forms of nitrogen decreased.

So, if initially in the initial state the total nitrogen in the soil was 236, then after thirteen years it became 228 milligrams per 100 g of soil (Table 1).

Table 1 - Nitrogen composition in the 0-30 cm layer of ordinary chernozem

General, mg/100 g	Mineral		Easily hydrolyzed		Difficult to hydrolyze.		Non-hydrolysable	
	mg/100 g	% from general	mg/100 g	% from general	mg/100 g	% from general	mg/100 g	% from general
Initial soil, at the beginning of the experiment								
236	5.41	2.2	18.02	7.6	29.08	12.2	183.49	78.0
Control, without fertilizers, after 13 years.								
228	4.60	2.0	17.58	7.7	27.64	12.1	178.23	78.2
Manure 90 t + N ₇₄₆ P ₇₆₀ K ₂₄₀ for 13 years								
252	6.81	2.7	18.66	7.4	30.35	12.1	196.18	77.8
NSR0.5 1.4	0.25		0.58		0.48		0.27	

Mineral nitrogen compounds make up a relatively small part of the nitrogen fund, but nevertheless they are of great agronomic importance, because ammonium and nitrate ions are directly absorbed by the roots of cultivated crops and their amount decreased by 0.8 mg per 100 g of soil, in absolute terms. As for the relative value, the decrease here is 0.2%.

The nearest nitrogen reserves for plant nutrition (we are talking about such a fraction as easily hydrolyzed) have become smaller in absolute value, but due to the fact that the overall amount of nitrogen has decreased, in relative value there is an increase in the nearest nitrogen reserves for plant nutrition.

If we talk about the fraction of difficult-to-hydrolyze nitrogen, then by the end of the analyzed period there is a decrease. Specifically, 1.44 milligrams per 100 g of soil.

A decrease of 5.25 milligrams (compared to the initial value) is also noted in relation to the potential nitrogen reserve, which is characterized by the non-hydrolyzable form of nitrogen compounds; the transformation of this fraction made it possible to create, to a certain extent, acceptable conditions for the formation of hydrolyzable fractions.

Long-term systematic use of both organic and mineral fertilizers in crop rotation had a beneficial effect on the nitrogen fund of the soil. In particular, when compared with the control by 9.5%, an increase in the total amount of nitrogen is observed. In the context of this, the most mobile, most accessible fraction of mineral nitrogen for plant nutrition increased by 32.5%, which is a very significant positive factor.

The nearest reserve for feeding crop rotation crops - easily hydrolyzed nitrogen - also became larger, and it increased by almost 6%, in absolute terms its amount was 18.66 mg per 100 g of soil, compared with the control - 17.58 mg per 100 g of soil .

Strategic reserves of nitrogen in the form of a difficult-to-hydrolyze fraction under the influence of the application of 90 tons of manure and N746P760K240 over the duration of crop rotation also increased and this increase was slightly more than 10%; fertilizers provided not only high crop productivity, but also contributed not only to the stabilization of the nitrogen fund, but also to its improvement quality condition. As a result, the nitrogen pool has become of higher quality and is characterized by stability, resulting in increased crop productivity.

The indicators of practically non-recoverable nitrogen in the form of a non-hydrolyzable fraction, providing its potential reserves, have significantly improved; 178.23 mg of non-recoverable (non-hydrolyzable) nitrogen was found per 100 g of soil, and 17.95 milligrams more when using fertilizers. This made it possible to create acceptable conditions for the transformation of nitrogen compounds into a form that is mineral and easily hydrolyzed.

Conclusion. Based on the work carried out, it was established that the cultivation of crop rotation crops without the proper use of fertilizers is accompanied by a deterioration in nitrogen status and, as a result, fertility, so the total amount of nitrogen drops from 0.236 to 0.228%, while with their use its content increased to 0.252%. Thanks to the use of 90 tons of manure and

N₇₄₆P₇₆₀K₂₄₀ in crop rotation, it provided a qualitative improvement in all fractions and forms of nitrogen, including those ensuring stability and potential reserves.

Bibliography

1. Novikov A.A. Humus and nitrogen in ordinary micellar-carbonate chernozems and the balance of nutrients // Diss. PhD. Sci. p. Rassvet, 1985. – 159 p.