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Використання мінеральної системи удобрення дестабілізувало азотний фонд чорнозему типового вилугуваного. Впродовж 3 років вміст загального азоту в орному 0-30-см шарі зменшився до початкового на 6-7 мг/100 г ґрунту. Стабільність вмісту загального азоту в ґрунті спостерігалась за поєднання внесення на 1 га ланки сівозміни $N_{50}P_{20}K_{30} + 13,3$ т гною та $N_{50}P_{20}K_{30} +$ сидерат + побічна продукція. Порівняно з контролем без добрив, органо-мінеральні системи удобрення забезпечили зростання вмісту азоту в усіх фракціях азотовмісних сполук ґрунту: легкогідролізованого азоту – на 1,5-2,4, важкогідролізованого – 1,5,-2,6; негідролізованого залишку – 1,1-1,9 мг/100 г ґрунту.

Ключові слова: азотний фонд, чорнозем типовий вилугуваний легкосуглинковий, ланка сівозміни, система удобрення.

Introduction. Stability of nitrogen fund in black soils becomes an underground of sustainable agricultural. Total nitrogen reserves in the soil to I.V. Tiurin mind [4] it is possible to consider as a main index of its potential fertility, but quantity of nitrogen are used by plants during a year – conventional unit of actual fertility.

Effective way to influence on nitrogen regime of soil becomes application of mineral and organic fertilizers. Manure application strengthens the immobilization processes in the soil and contributes to the stability of organic nitrogen content [3]. According to the investigations of G.P. Gamzikov [1] during first year of manure application the plants use of its composition about 20-30% of nitrogen, other 40% is immobilized, 20-30% are lost and about 10% are used by plants in aftereffect next year.

Application of technical nitrogen of fertilizers violates the natural balance between processes of immobilization-mineralization, causes additional mobilization of soil nitrogen, and increases unproductive nitrogen losses as a result of infiltration and emission [6]. To the opinion of the most scientists the optimal system of fertilizers which provides stability of nitrogen fund of the soil, causes optimal regime of organic matter mineralization and creates favorable regime nitrogen nutrition of plants becomes organic-mineral system of fertilizers [2], [4], [7].

Investigation purpose is to study the influence of traditional and alternative with elements of biologization system of fertilizers on stability nitrogen fund of the leached black soil while growing crops in crops rotation with peas.

Materials and investigation methods. Investigations were carried out in the conditions of stationary experiment (2006-2010 years) of Uladovo-Liulinetska research-selection station on leached black soil, loamy texture in the conditions of sufficient moisture of Forest-Steppe Zone of Ukraine.

Agrochemical and physic-chemical characteristic of topsoil (0-30 cm): organic matter content (for Turin) – 4,0%, mobile phosphoric and potassium (for Chirikov) reciprocally – 140 та 75 mg/kg soil; pH_{KCl} – 5,9; hydrolytic acidity (for Kappen) – 2,2 mg на 100 g of soil.

Site drilled area – 150 м², accounting area – 100 м², repetition – four-times. Investigation was made in rotation chain: peas – winter wheat – sugar beet. Crops growing agrotechnique was common for zone.

Fertilizers used: ammonium nitrate, superphosphate, potassium chloride. Organic fertilizers were applied in form of manure (13,3 t per 1 ha of field) and alternative sources of organic matter – postharvest green manure crop white mustard (medium yield – 25 t/ha) and by-products of plants: leaves of sugar beet, straw of peas and winter wheat.

Ammonium and nitrate nitrogen in the soil were determined for TSINAO methodic; nitrogen of organic compounds in soil for method of two-steps acid hydrolyze under E.A. Andreieva, G.M. Shcheglovym.

Investigation results ant their discussion. Investigations showed that application mineral system of fertilizers by applying per one hectare of rotation chain recommended $N_{50}P_{20}K_{30}$ and increased $N_{66,7}P_{26,7}K_{40}$ norms of fertilizers was insufficient to get stability of nitrogen fund of leached black soil. On completion the rotation chain the content of total nitrogen in arable 0-30 cm layer of soil decreased to initial – reciprocally on 7 and 6 mg/100 g of soil. Increase in recommending rate of fertilizers the norm one of the nutrients in 1,5 times maintained a negative trend of the content of total nitrogen in the

soil. Destabilization of nitrogen fund of leached black soil could be caused by low norm of nitrogen fertilizers application and increasing mineralization of organic nitrogen fractions in the soil (table 1).

Using manure (13,3 t/ha rotation chain), green manure white mustard and combination of applying fertilizers and white mustard ($N_{50}P_{20}K_{30}$ + green manure per 1 ha of rotation chain) associated with a trend to decrease the content of total nitrogen in arable layer of soil on 4-5 mg/100 g of soil and preserved the stability of nitrogen fund in subsurface 30-40 cm layer. This indicates a low rate of nitrogen application with pointed fertilizers.

The highest stability of nitrogen fund of leached black soil, loam texture provided organic-mineral systems of fertilizers which provided a combination of applying fertilizers and manure ($N_{50}P_{20}K_{30}$ + 13,3 t manure per 1 ha rotation chain) or fertilizers in combination with green manure white mustard and by-products ($N_{50}P_{20}K_{30}$ + green manure + by-products per 1 ha rotation chain). On completion of rotation chain the content of total nitrogen in pointed variants was in topsoil – 236, subsurface – 221-224 mg/100 g of soil that corresponded to the nitrogen content in the soil at the beginning of rotation chain.

Systems of fertilizers influenced the distribution of nitrogen in fractions of nitrogen-containing compounds in the soil. In variant without fertilizers on the completion rotation chain the content of organic nitrogen in topsoil (0-30 cm) was 229 mg/100 g of soil (99,6% of the total content), including easy-hydrolyzed nitrogen – 47,2, heavy-hydrolyzed – 88,6, non-hydrolyzed – 93,2 mg/100 g of soil, or reciprocally 20,6%, 38,7% and 40,7% of sum of fractions (table 2).

Mineral system of fertilizers and using for fertilizer of green manure white mustard did not significantly changed the distribution of nitrogen in nitrogen-containing fractions of the soil in comparing with control without fertilizers.

Combining application fertilizers and use for fertilizer green manure white mustard ($N_{50}P_{20}K_{30}$ + green manure per 1 ha of rotation chain) or applying 13,3 t manure per 1 ha of rotation chain increased the content of easy-hydrolyzed fraction of nitrogen in comparing with control without fertilizers – reciprocally 1,9 and 1,8 mg/100 g of soil. Increase the content of easy-hydrolyzed nitrogen in the soil while using for fertilizer white mustard was pointed in the research of Ya.P. Tsvey, F.P. Kacianchuk [5].

Table 1 – Influence of fertilizers system on content of total nitrogen in leached black soil, mg/100 g of soil, ULRSS (2006-2010 years)

№ variant	Applied fertilizers on 1 ha of rotation chain	Soil layer, cm							
		0-30		30-40		0-30		30-40	
		beginning of chain, 2006-2008 years		finishing of chain, 2008-2010 pp.		± to beginning			
1	Without fertilizers (control)	237	221	230	218	-7	-3		
3	$N_{50}P_{20}K_{30}$	238	224	231	222	-7	-2		
15	$N_{73,3}P_{20}K_{30}$	236	222	229	220	-7	-2		
18	$N_{50}P_{30}K_{30}$	238	223	231	220	-7	-3		
20	$N_{50}P_{20}K_{43,3}$	237	222	230	220	-7	-2		
4	$N_{66,7}P_{26,7}K_{40}$	237	222	231	220	-6	-2		
5	$N_{50}P_{20}K_{30}$ + 13,3 t/ha manure	236	223	236	224	0	1		
6	13,3 t/ha manure	236	222	232	222	-4	0		
10	Green manure (white mustard)	237	221	232	220	-5	-1		
11	$N_{50}P_{20}K_{30}$ + green manure	236	220	232	220	-4	0		
12	$N_{50}P_{20}K_{30}$ + green manure + by-products	235	220	236	221	1	1		
	NIR_{05}	6,0	5,7	5,9	5,4	-	-		
	P, %	1,8	1,6	1,7	1,5	-	-		

The systems of fertilizers which provided the combining application of fertilizers and manure or fertilizers in combination with green manure white mustard and by-products were the most effective. Their application increased the content of nitrogen in all fractions of nitrogen-containing compounds in the soil. Combining application of $N_{50}P_{20}K_{30}$ + 13,3 t manure per 1 ha of rotation chain increased the content of easy-hydrolyzed nitrogen to control without fertilizers on 2,4, heavy-hydrolyzed – 1,5, non-hydrolyzed residue – 1,1; $N_{50}P_{20}K_{30}$ + green manure + by-products per 1 ha of rotation chain – reciprocally on 1,5, 2,6 and 1,9 mg/100 g of soil.

Table 2 – Influence of fertilizers system on content of nitrogen fractions in arable layer of leached black soil, mg/100 g of soil, ULRSS (2008-2010 years)

№ variant	Applied fertilizers on 1 ha of rotation chain	Content of mineral nitrogen	Fractions of organic nitrogen			
			sum of fractions	including		
				easy-hydrolyzed	heavy-hydrolyzed	non-hydrolyzed
1	Without fertilizers (control)	1,1	229	47,2	88,6	93,2
3	N ₅₀ P ₂₀ K ₃₀	1,6	229	48,0	87,9	93,1
5	N ₅₀ P ₂₀ K ₃₀ + 13,3 t/ha manure	1,7	234	49,6	90,1	94,3
6	13,3 t/ha manure	1,3	231	49,0	88,1	93,9
10	Green manure (white mustard)	1,1	231	48,5	88,7	93,8
11	N ₅₀ P ₂₀ K ₃₀ + green manure	1,4	231	49,1	88,3	93,6
12	N ₅₀ P ₂₀ K ₃₀ + green manure + by-products	1,1	235	48,7	91,2	95,1
	NIR ₀₅	0,1	6,8	1,6	2,3	2,6
	P, %	1,6	1,8	1,7	1,7	1,8

Thus, the use traditional on the ground of manure organic-mineral system of fertilizers and combining application fertilizers, green manure white mustard and by-products contributed the stability of nitrogen fund of leached black soil.

Conclusions.

1. Use mineral system of fertilizers (N_{50-66,7}P_{20-26,7}K₃₀₋₄₀ per 1 ha of rotation chain) during three years decreased the content of total nitrogen in topsoil (0-30 cm) to initial on 6-7 mg/100 g of soil. Decrease took place at the expense of all fractions of nitrogen-containing compounds in the soil.

2. Applying manure (13,3 t/ha rotation chain) and combining application of fertilizers and green manure white mustard (N₅₀P₂₀K₃₀ + green manure per 1 ha of rotation chain) caused the downward trend of total nitrogen content in topsoil on 4-5 mg/100 g of soil that was mainly due to nitrogen of heavy-hydrolyzed fractions.

3. The stability of total nitrogen content in leached black soil was observed when combined application chain of N₅₀P₂₀K₃₀ + 13,3 t manure and N₅₀P₂₀K₃₀ + green manure + by-products per 1 ha of rotation. In comparing to control without fertilizers the organic-mineral systems of fertilizers provided the increase of all fractions nitrogen-containing compounds in the soil: easy-hydrolyzed on 1,5-2,4, heavy-hydrolyzed – 1,5-2,6, non-hydrolyzed residue – 1,1-1,9 mg/100 g of soil.

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Влияние системы удобрения на стабильность азотного фонда чернозема типичного выщелоченного
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Применение минеральной системы удобрения дестабилизировало азотный фонд чернозема выщелоченного. В течение 3 лет содержание общего азота в пахотном 0-30-см слое уменьшилось к начальному на 6-7 мг/100 г почвы. Стабильность содержания общего азота в почве наблюдалась при сочетании внесения на 1 га звена севооборота N₅₀P₂₀K₃₀ + 13,3 т навоза и N₅₀P₂₀K₃₀ + сидерат + побочная продукция. По сравнению с контролем без удобрений, органоминеральные системы удобрения обеспечили увеличение содержания азота во всех фракциях азотсодержащих соединений почвы: легкогидролизованного азота – на 1,5-2,4; трудногидролизованного – 1,5-2,6; негидролизованного остатка – 1,1-1,9 мг/100 г почвы.

Ключевые слова: азотный фонд, чернозем типичный выщелоченный, звено севооборота, система удобрения.

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