

Nutrient regime of the soil depending on the share of sunflower in short-rotational crop

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Abstract. Sunflower requires a sufficient amount of nutrients for growth and development. Therefore, it is important to determine the impact of sunflower cultivation on the soil nutrient regime, taking into account the frequency of its return to the previous place. The aim of the study was to determine the influence of the share of sunflower in short rotation crop rotations on the soil nutrient regime. The research was conducted at the experimental field of the Kharkiv V.V. Dokuchaev National Agrarian University, which is located in the Left-Bank Forest-Steppe of Ukraine. The research and accounting were carried out on typical heavy loamy chernozem in accordance with generally accepted methods. The experimental scheme included five-field crop rotations with sunflower saturation of 0, 20, 40 and 60%. The research results show that an increase in the share of sunflower in short rotation crop rotations does not lead to a deterioration in the nutrient regime of the topsoil. There was no significant difference between the variants in the content of nutrients. The most supplied with nutrients was the topsoil in the control variant (crop rotation without sunflower). With an increase in the share of sunflower in crop rotations, the amount of nutrients in the tilth layer of soil decreased slightly. Regardless of the studied crop rotation options, the availability of easily hydrolysable nitrogen was low, mobile phosphorus was average, and exchangeable potassium was high. Increasing the share of sunflower in short rotation crop rotations led to a decrease in the yield of the crop itself. The yield of sunflower seeds was at the same level in the variants with 20 and 40%. There is a close relationship between sunflower yield and its saturation, which significantly depends on the soil nutrient regime. The yield level is most affected by the content of phosphorus and potassium in the topsoil. The correlation is 0.91 and 0.98, respectively. The practical value of this study is due to the possibility of using the obtained results to justify the feasibility of increasing the share of sunflower in the structure of crop rotations

Keywords: saturation; structure of crop rotation; fertility; correlation dependence; nutrients; typical chernozem

INTRODUCTION

It is known that plants primarily require a sufficient amount of nutrients. Optimising the supply of nutrients during the growing season of crops results in more efficient use of moisture, regardless of the conditions prevailing during the growing years (Pinkovsky *et al.*, 2019). This was determined during research with various crops, including sunflower (Domaratskiy *et al.*, 2019; Gamayunova *et al.*, 2019). Data obtained

by scientific institutions indicate that sunflower should occupy no more than 20% of the crop rotation structure (Tkalich *et al.*, 2018). Under current farming conditions, increasing the share of sunflower in short rotation crop rotations is quite common. Increased profits from sunflower cultivation encourage most farms to abandon science-based technologies, which is manifested in a high degree of saturation of crop rotation

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with sunflower. Under current agricultural conditions, intensive saturation of short rotation crop rotations with sunflower is often practiced. Usually, it can be returned to the previous place of cultivation after 2-3 years (Bojko & Borodan, 2000; Shevchenko *et al.*, 2001). However, in this case, the yield may decrease to 0.9 t/ha in the third year of cultivation (Hanhur *et al.*, 2015).

Some studies show that an increase in the share of sunflower in the crop rotation above the recommended level leads to negative consequences for the water and physical properties of the soil, the phytosanitary condition of crops, and the emergence of infections. In addition, if fertilisers are not applied in the required amount, there is a significant decrease in the content of nutrients (including nitrogen, phosphorus and potassium) in the soil. In this case, the humus content in the soil decreases, which leads to other degradation processes (Poliakova & Topchii, 2013; Tsyliuryk, 2018).

The nutrients in the soil have a significant impact on the growth and development of sunflower, as well as on its productivity. Depending on the phenological stage, sunflower requires different nutrients. At the beginning of sunflower growth and development, nitrogen is needed in the first place. From this point on, it accumulates in the stems and leaves, and later in the baskets. The absorption of nitrogen ends at the time of flowering, after which this element is transported through the plants in the form of amino acids. Providing plants with sufficient nitrogen contributes to the formation of more flowers, slower aging of leaves after flowering and greater accumulation of protein compounds in seeds. Phosphorus provides the energy basis for biochemical processes in sunflower plants. It is a component of nucleic acids, nucleotides, enzymes and products of the photosynthetic and respiratory cycles (Getie *et al.*, 2021). Phosphorus is absorbed by sunflower from germination to flowering. It contributes to the formation of a powerful root system, the laying of reproductive organs with a larger number of embryonic flowers in the basket, accelerates plant development, and increases drought resistance. Despite the high potassium requirement of sunflower, it has an average effect on yields (Hospodarenko, 2018). Many scientists believe that an

increase in the share of sunflower in crop rotation negatively affects the balance of nutrients in the soil.

Scientifically based crop rotation in time and space ensures high yields and productivity of crop rotations. For example, researchers note that crop rotations with 20% of fallow land and 10% of sunflower and corn for silage have the highest productivity. At the same time, out of 60% of grain crops, winter crops accounted for 40% (wheat and barley), and peas and corn for 10% each (Sayko & Boyko, 2002; Giannoulis *et al.*, 2009).

The aim of the study was to determine the effect of short rotation crop rotations with different proportions of sunflower on soil nutrient supply.

MATERIALS AND METHODS

The field research was conducted at the stationary of the O.M. Mozheiko Department of Agriculture of the Dokuchaevske Experimental Field Educational and Research Centre. The soil cover of the experimental field is represented by typical heavy loamy chernozem on loess loam. In terms of agrophysical and agrochemical properties, it is one of the most favourable soils for growing field crops. It is characterised by a high level of fertility. The topsoil (0-30 cm) of a typical black soil contains 4.9-5.1% humus (according to Tyurin), 81 mg/kg of easily hydrolysable nitrogen (according to Kornfield), and 100 and 200 mg/kg of mobile phosphorus and exchangeable potassium (according to Chirikov). The content of exchangeable cations: calcium – 37.8%, magnesium – 6.6%, sodium – 0.49%, potassium – 0.5%. Soil reaction – pH: water – 7.0, salt – 5.2-5.6. Groundwater is located at a depth of about 18 m (Tykhonenko & Dehtiarov, 2016).

The sunflower hybrid is Cruiser LG59580. The experiment was replicated three times, with a sequential arrangement of variants. The size of the sowing plot was 750 m², the accounting plot was 100 m². The research conducted with sunflower was carried out in accordance with international ethical standards, in particular The Convention on Biological Diversity (2022). Variants of short-rotation (5-field) crop rotations with different proportions of sunflower in the structure of sown areas were studied (Table 1). The control variant was a five-field crop rotation without sunflower.

Table 1. Crop rotation structure, %

Peas	Winter wheat	Corn	Winter rye	Pure fallowing	Sunflower
20	20	20	20	-	20
20	20	-	20	-	40
-	20	-	20	-	60
	20	40	20	20	0

Source: developed by the author

The content of nutrients in the soil was determined in accordance with generally accepted methods: the

content of easily hydrolysable nitrogen – by the Kornfield method (DSTU 7863:2015, 2016), the content of

mobile phosphorus and potassium compounds – by the modified Chirikov method (DSTU 4115:2002, 2003). Statistical processing of the data was carried out using the CORREL function, which is part of the data analysis package in MS Office Excel 2017.

Moisture conditions and temperature have a particularly important impact on the efficiency of nutrient fixation in the soil (Liu *et al.*, 2011; Rymuza *et al.*, 2020). The research was conducted in an area with a temperate continental climate. It is characterised by elevated air temperatures and low precipitation compared to long-term averages.

Data from the weather station of Kharkiv National Agrarian University show that during the growing season of sunflower (May-September), the average long-term rainfall was 278 mm and the air temperature was +17.7°C. The peculiarity of the conditions in 2020-2021, during the period of determination of NPK (nitrogen, phosphorus, potassium) in the soil, was insufficient moisture. During the growing season of sunflower in 2020, precipitation was 114 mm less than normal, and the average air temperature was 19.8°C, which is 2.1°C above the climatic norm. The precipitation during the growing season of sunflower in 2021 was of a stormy nature in June – 81.9 mm, which was 22.9 mm above the average long-term norm. In July and August, they were less than

the long-term average by 51.5 and 44.2 mm, respectively. In 2021, precipitation totalled 197.7 mm, which is 81.3 mm less than the long-term average, and the increase in average daily air temperature was 2.5°C above the long-term average. Having analysed the weather conditions, we can conclude that heat and moisture supply significantly influenced the growth and development of sunflower, and ultimately its yield and seed quality.

RESULTS

The research results allow us to determine the level of soil nutrient supply under conditions of different saturation of short-rotation crop rotations with sunflower.

Nitrogen. In the phase of full ripeness of sunflower, the studied samples were characterised by low supply of easily hydrolysable nitrogen in all variants (Fig. 1). Depending on the proportion of sunflower in the crop rotation, this indicator varied within 151-123 mg/kg of soil. Its highest content (151 mg/kg of soil) was found in the surface (0-10 cm) soil layer at 40% saturation of the crop rotation with sunflower, and the lowest (123 mg/kg of soil) in the layer 20-30 cm in the variant with a share of sunflower of 60%. The nitrogen content in the soil in the plots with other variants varied only slightly. The content of this element was relatively higher in the 0-10 cm soil layer – 145-151 mg/kg of soil.

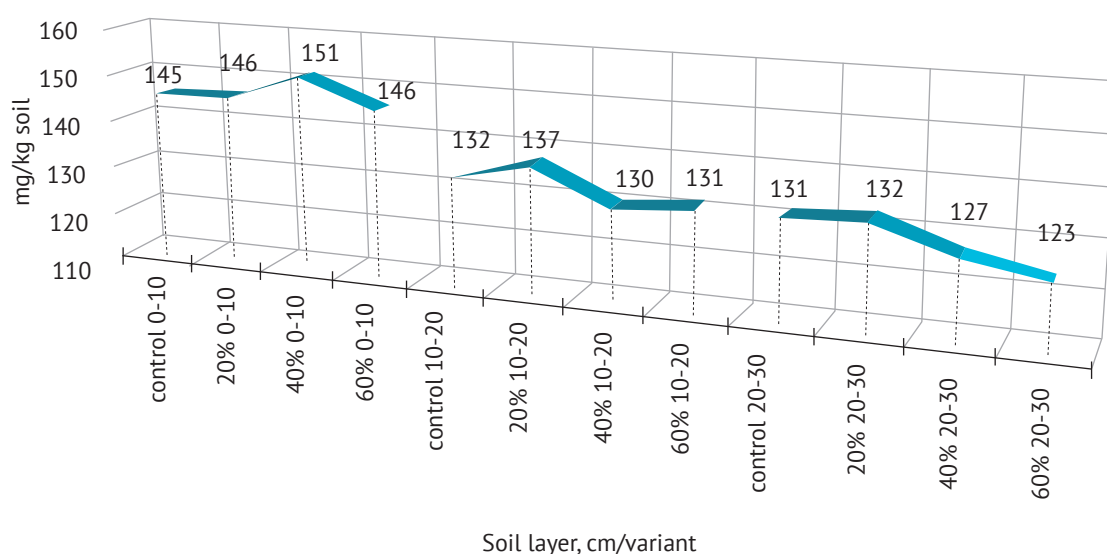


Figure 1. The content of easily hydrolysable nitrogen in the soil depending on the saturation of the crop rotation with sunflower, mg/kg of soil

Source: developed by the author

Phosphorus. The processes of biological accumulation of phosphorus in the bedrock affect the content of its mobile compounds throughout the soil profile. Thus, the studied samples were characterised by an average supply of mobile phosphorus forms in all variants (Table 2). The content of P_2O_5 in the arable layer of typical black soil in sunflower crops was almost equal in

the experimental variants. It should be noted that the content of this macronutrient was significantly higher in the upper (0-10 cm) soil layer than in the lower part (20-30 cm) of the tilth layer. Compared to the control, a significant decrease in P_2O_5 was recorded in the variant with a crop rotation saturation of 60% with sunflower, by 1.4 times.

Table 2. The content of mobile phosphorus in the soil depending on the saturation of crop rotation with sunflower

Share of sunflower in crop rotation	P ₂ O ₅ content, mg/kg by soil layer		
	0-10cm	10-20 cm	20-30 cm
20%	100	66	65
40%	99	64	64
60%	66	63	54
0%	97	73	74

Source: developed by the author

Potassium. Sunflower is known to use potassium intensively. Samples of the tilth layer of typical chernozem were characterised by an increased availability of mobile potassium compounds in all variants, and their content naturally decreased with depth from 81 to 115 mg/kg of soil. In the surface soil layer, the highest content of potassium was observed in the variant without sunflower –

115 mg/kg of soil (Table 3). In the crop rotation with a share of sunflower of 40%, the content of exchangeable potassium compounds in the 0-10 cm soil layer was almost at the level of the control – 113 mg/kg of soil. There was no significant difference between the K₂O content of other variants in this layer: 107 mg/kg soil (20% saturation) and 103 mg/kg soil (60% saturation).

Table 3. Exchangeable potassium content in soil depending on the saturation of crop rotation with sunflower

Share of sunflower in crop rotation	K ₂ O content, mg/kg by soil layer		
	0-10 cm	10-20 cm	20-30 cm
20%	107	85	82
40%	113	86	84
60%	103	83	81
0%	115	94	90

Source: developed by the author

With a depth of 20 cm, a decrease in the content of exchangeable potassium was observed in all variants. In the soil layer of 10-20 cm, the highest content was found in the control variant at 94 mg/kg of soil. Similar results were obtained in other crop rotations and were in the range of 83-86 mg/kg of soil. In short-rotation crop rotations, a decrease in the content of exchangeable potassium compounds was observed in the soil layer of 20-30 cm, depending on their saturation with sunflower. In the soil of the control variant, the content of this element was 90 mg/kg of soil, which is 9 mg/kg more than in the

variant with 60% sunflower saturation. An increase in the share of sunflower in the crop rotation to 40% increased the content of exchangeable potassium in the soil by 2 mg/kg of soil and by 3 mg/kg of soil at 60% saturation.

Sunflower yield. In the course of research in 2020, a relationship was established between the level of sunflower yield and its saturation in crop rotations (Table 4). It is worth noting the high yield of sunflower at 40% of its saturation in crop rotation – 3.77 t/ha. Saturation of the five-field crop rotation with 60% of sunflower reduced the yield to 3.24 t/ha.

Table 4. Sunflower yield in different short rotation crop rotations

Share of sunflower in crop rotation	Yield, t/ha	
	2020 year	2021 year
20%	3.73	3.13
40%	3.77	3.36
60%	3.24	3.17

Source: developed by the author

In 2021, the high yield of sunflower (3.36 t/ha) was ensured by a five-field crop rotation with a share of 40%. When the crop rotation was saturated with sunflower up

to 20% and 60%, there was a slight decrease in sunflower yield by 0.23 and 0.19 t/ha. On average, in 2020-2021, the highest sunflower yield (3.57 t/ha) was recorded in the

five-field crop rotation, where its share was 40%. When the crop rotation was saturated with 20% of sunflower, there was a slight decrease in its yield – by 0.14 t/ha.

Saturation of the crop rotation with sunflower up to 60% led to a significant decrease in its yield by 0.36 t/ha compared to the best variant of the experiment (Fig. 2).

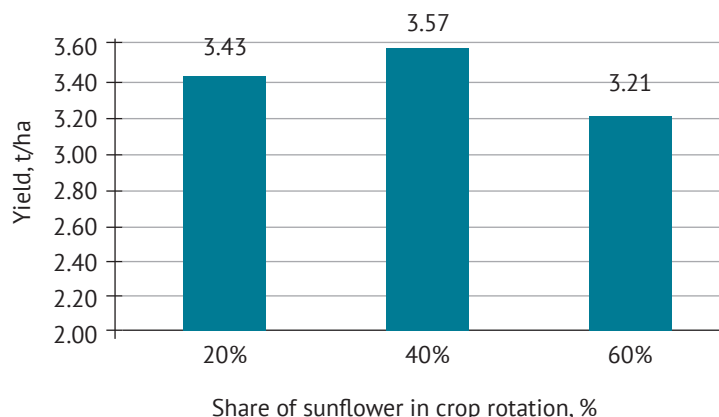


Figure 2. Sunflower yield depending on its share in crop rotation, t/ha (average for 2020-2021)

Source: developed by the author

Dependence of sunflower yield on NPK content. The statistical analysis showed a close correlation between sunflower yield and the content of macronutrients in the soil in crop rotation areas with different soil saturation. The equation for the correlation coefficient between sunflower yield and soil nutrient content is as follows:

$$\text{Correl}(X, Y) = \frac{\sum(x-\bar{x})(y-\bar{y})}{\sqrt{\sum(x-\bar{x})^2 \sum(y-\bar{y})^2}},$$

where x – yield, t/ha; y – nutrient content in the soil, mg/kg soil.

The data obtained indicate that sunflower yields are most closely related to soil K_2O content. The correlation coefficient between these indicators was the highest and amounted to 0.98. The content of mobile phosphorus in the soil was equally important for sunflower yield, with a correlation coefficient of 0.91. There was a direct correlation between sunflower yield and soil nitrogen content – 0.66.

DISCUSSION

It is known that nitrogen assimilation through the symbiosis of microorganisms with plants provides the soil with 90-170 million mg of nitrogen annually (Ishizuka, 1992; Kozłowski *et al.*, 2011; Tsyliuryk, 2018). This is 70-80% of the total amount of nitrogen accumulated in the soil in the process of nitrogen fixation by all microorganisms (symbiotic and free-living) (Peoples & Craswell, 1992; Cheng, 2008; Martyniuk, 2012). The efficiency of atmospheric nitrogen reduction in symbiotic systems usually reaches up to 200 kg N ha⁻¹ (but sometimes even 500 kg N ha⁻¹) per year (Duzdemir *et al.*, 2009; Hauggaard-Nielsen *et al.*, 2010).

Previous studies have shown a significant reduction in nitrogen content under no-till sunflower

cultivation in the 0-20 and 20-40 cm soil layers: 8.9 and 6.6 mg/100 g of soil, respectively. Zonal crop rotation provided a high phosphorus content in the soil: 10.4 mg/100 g in the 0-20 cm layer and 7.7 mg/100 g in the 20-40 cm layer, and the lowest content in virgin soil (5.8 mg/100 g in the 0-20 cm layer and 4.8 mg/100 g in the 20-40 cm layer). The studied variants of crop rotation did not have a significant effect on the content of exchangeable potassium in the soil, and its amount was quite high in all soil samples (8.0 mg/100 g to 13.3 mg per 100 g of soil). It should be noted that permanent sunflower cultivation provided the topsoil with an increased potassium content (Poliakova & Topchiy, 2013).

Soil nutrient regime largely depends on the saturation of crop rotations with sunflower. Researchers say that an increase in the share of this crop in crop rotation causes an increased level of nutrient removal from the soil. This can have a negative impact on the growth and development of subsequent crops. According to the results of research by A. Kokhan *et al.* (2018) found that a crop rotation with 14% sunflower provided a higher content of nutrients in the 0-10 cm soil layer than a crop rotation with 50% of this crop. The total removal of NPK by sunflower was 75.3 kg/ha. It was found that for growth and development during the growing season, sunflower requires the most exchangeable potassium (178.8 kg/ha). At the same time, only 20% of the potassium is removed with the harvest, while the rest remains in the soil with non-commodity products. Therefore, to compensate for the macronutrients removed from the soil by sunflower, it is necessary to leave crop residues on the field. This will help prevent degradation processes and help maintain soil fertility.

Some researchers point out that a significant portion of the total nutrient content absorbed and accumulated

by sunflower plants remains in the field after harvesting in the form of crop residues. After mineralisation of crop residues, these nutrients are easily available to the next crop, which is very important in a crop rotation system (Castro *et al.*, 2014). Depending on the amount of nutrient removal with the crop, the crops included in the studied crop rotations are distributed in the following order sugar beet – 163.2 kg/ha, maize – 97.5-156.5, soybeans – 111.3-115.1, winter wheat – 108.9-131.6, spring barley – 102.1-112.9, vetch-oat mixture – 112.9, sunflower – 85.3-109.7, peas – 72.4-79.6 kg/ha; in terms of phosphorus removal – corn for grain – 37.6-56.2 kg/ha, winter wheat – 41.0-48.9, sunflower – 36.6-45.0, sugar beet – 41.9, vetch-oat mixture – 38.6, spring barley – 32.5-38.0, soybeans – 33.3-33.9, peas for grain – 19.2-31.1 kg/ha; in terms of potassium removal – sugar beet – 187, vetch-oat mixture – 115.3, sunflower – 72.1-103.2, corn for grain – 65.8-103.0 kg/ha

Yu.I. Tkalic (2017) emphasises that the largest biological nitrogen removal is caused by corn (106.06 kg/ha), followed by rapeseed (92.29 kg/ha), winter wheat (82.54 kg/ha), sunflower (73.12 kg/ha), and spring barley (52.4 kg/ha). Corn consumes the most mobile phosphorus compounds (25.78 kg/ha), followed by rapeseed (24.57 kg/ha), slightly less winter wheat (21.16 kg/ha), and even less sunflower (17.68 kg/ha) and spring barley (16.28 kg/ha). Corn also absorbs the most exchangeable potassium (18.35 kg/ha), followed by rapeseed, sunflower and winter wheat (17.89, 14.28 and 14.01 kg/ha), and spring barley (10.78 kg/ha).

In the experiments of S. Kudria (2020), no clear dependence of nutrient content on crop rotation was found. According to O. Tsyliuryk (2018), sunflower removes 120-140 kg/ha of nitrogen, 50-65 kg/ha of phosphorus and more than 300 kg/ha of potassium from the soil to form 2.0-2.5 t/ha of yield. Some authors point out that saturation of crop rotations with sunflower over 50% negatively affects the level of its yield (2.21 t/ha), while a decrease to 33% contributes to an increase in crop productivity by 0.29 t/ha. At the same time, the level of sunflower yield in this variant is 0.12, 0.21 and 0.24 t/ha lower than in crop rotations saturated with the crop, respectively, by 25, 20 and 14.3% (Bilenko & Baranenko, 2018).

Similar results were obtained in the fields of the Institute of Steppe Agriculture of the National Academy of Agrarian Sciences of Ukraine (Pohribnyi & Mashchenko, 2021). It has been established that grain and fallow crop rotations with sunflower saturation of 20% and the use of an organic-mineral fertilisation system provide high stress resistance of plants to abiotic factors. This, in turn, ensures a high yield of 2.63 t/ha.

According to V. Hanhur (2016), high culture of farming, adherence to scientifically sound crop rotations, and the use of highly productive hybrids allow

saturation of field crop rotations with sunflower at the level of 14-15% of the total sown area. Under such conditions, there is no significant decrease in the productivity of both the sunflower and the crop rotation as a whole. At the same time, it allows for the possibility of a one-time increase in the share of sunflower in the structure of crop rotation areas up to 20%.

Some scientists state a decrease in sunflower seed yields (2.19 t/ha) in case of increasing the share of sunflower in crop rotation to 50%. Crop rotations with 33.3 and 25% saturation provided sunflower yields of 2.49-2.61 t/ha. If crop rotations are saturated with sunflower by only 20 and 14.3%, a fairly high yield can be obtained: 2.70 and 2.75 t/ha. This is by 0.26-0.56 t/ha higher than when the crop rotation is saturated with sunflower by 50.0% and 33.3%. These data are confirmed by parallel studies on growing sunflower in crop rotations. Kokhan *et al.* (2015) noted a gradual decrease in yields when the crop rotation was saturated with sunflower to 20, 25, 33.3, and 50%. Especially in two- and three-crop rotations: by 0.55 and 0.27 t/ha. According to long-term data from the Mykolaiv State Agricultural Experimental Station, when sunflower was returned to its previous place in the crop rotation after 10, 6 and 4 years, its yield was 2.01, 1.33 and 1.11 t/ha, respectively (Popova *et al.*, 2004).

The research conducted during 2020-2021 shows the expediency of studying the issue of the share of sunflower in short rotation crop rotations. Analyses of the NPK content in the topsoil show that, in general, an increase in the saturation of crop rotations with sunflower to 60% does not reduce the availability of soil nutrients. In turn, the yield data confirm the results of other authors regarding the inexpediency of increasing its share in crop rotation. After all, the yield slightly decreased in the variant with 60% saturation of crop rotation with sunflower to 3.21 t/ha compared to 20% saturation, where the yield is 3.43 t/ha, and at 40% saturation – 3.57 t/ha.

CONCLUSIONS

The increase in the share of sunflower in short rotation crop rotations did not lead to a deterioration in the nutrient regime of the tilth layer of soil. There was no significant variation in the content of nutrients between the variants. The most nutrient-supplied topsoil was in the control variant (crop rotation without sunflower). With increasing saturation of crop rotations with sunflower, the amount of available forms of nutrients in the tilth layer of soil slightly decreased, but within the limits of availability were at the same level according to the experimental variants: easily hydrolysable nitrogen – low; mobile phosphorus – medium; exchangeable potassium – increased.

It was proved that an increase in the share of sunflower in short rotation crop rotations leads to a

decrease in the yield of the crop itself by 0.22-0.36 t/ha. The yield of sunflower seeds was at the same level at 20 and 40% saturation (3.43 and 3.57 t/ha). The relationship between sunflower yield and its saturation in the crop rotation is noticeable, but it depends significantly on the soil nutrient regime. The yield level is most influenced by the content of phosphorus and potassium in the topsoil, with correlations of 0.91 and 0.98 respectively. Further research will be aimed at determining the NPK content

of sunflower residues to calculate the balance of these elements in the soil, taking into account the frequency of sunflower return to its original place.

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CONFLICT OF INTEREST

None.

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Поживний режим ґрунту залежно від частки соняшнику у короткоротаційних сівозмінах

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Анотація. Для росту і розвитку соняшнику необхідна достатня кількість поживних речовин. Тому встановлення впливу вирощування соняшнику на поживний режим ґрунту, з урахуванням частоти його повернення на попереднє місце, є актуальним. Метою роботи було визначити вплив частки соняшнику у короткоротаційних сівозмінах на поживний режим ґрунту. Дослідження проводилися на дослідному полі Харківського національного аграрного університету ім. В.В. Докучаєва, яке розташоване в Лівобережному Лісостепу України. Дослідження та обліки були проведені на чорноземі типовому важкосуглинковому згідно із загальноприйнятими методиками. Схема досліду передбачала п'ятипільні сівозміни із насиченням соняшнику 0, 20, 40 і 60 %. Результати досліджень свідчать, що збільшення частки соняшнику в короткоротаційних сівозмінах не призводить до погіршення поживного режиму орного шару ґрунту. Не виявлено суттєвої різниці між варіантами у вмісті елементів живлення. Найбільш забезпеченим поживними елементами був орний шар ґрунту у контрольному варіанті (сівозіна без соняшнику). З підвищенням частки соняшнику у сівозінах, кількість елементів живлення в орному шарі ґрунту дещо знижувалася. Незалежно від досліджуваних варіантів сівозмін, забезпеченість легкогідролізним азотом була низькою, рухомим фосфором – середньою, обмінним калієм – підвищеною. Збільшення частки соняшнику в короткоротаційних сівозінах призвело до зниження врожайності самої культури. Урожайність насіння соняшнику знаходилася на одному рівні у варіантах із частками 20 та 40 %. Відмічено тісний зв'язок між урожайністю соняшнику та його насиченням, що значно залежить від поживного режиму ґрунту. Найбільше на рівень врожаю впливає вміст в орному шарі ґрунту фосфору та калію. При цьому кореляційний зв'язок становить 0,91 та 0,98 відповідно. Практична цінність цього дослідження обумовлена можливістю використовувати отримані результати під час обґрунтування доцільності збільшення частки соняшнику у структурі сівозмін

Ключові слова: насиченість; структура сівозміни; родючість; кореляційна залежність; поживні елементи; чорнозем типовий