

досліджень з метою удосконалення підходів до використання даної методики ідентифікації ґрунтового покриву у виробничій ґрунтознавчій практиці.

Список використаних джерел

1. Полупан М. І. Визначник еколого-генетичного статусу та родючості ґрунтів України: Навчальний посібник. /М.І. Полупан, В. Б. Соловей, В.І. Кисіль, В. А. Величко. – К.: Колообіг, 2005. – 304 с.

2. Полупан М. І. Класифікація ґрунтів України / М. І. Полупан, В. Б. Соловей, В. А. Величко. Київ: Аграрна наука, 2005. 300 с.

4. Зінчук М.І. Сучасні класифікації ґрунтів та проблема їхньої регіональної гармонізації в Україні/М Зінчук, М Шевчук, П Зіньчук - Вісник Львівського університету. Серія географічна, Випуск 47. 2014. С. 24-135.

5. Зінчук М.І., Мерленко І.М., Шворак А.М., Августинович М.Б., Ковальчук Н. С. Апробація еколого-субстантивних критеріїв на ґрунтових відмінах Волинської області. Вісник Національного університету водного господарства та природокористування. Вип. (4(100)). Рівне, 2022. С.91-102.

6. Зінчук М.І., Шворак А.М. Проблеми практичної ідентифікації ґрунтових відмін західного лісостепу за параметричними критеріями.// Проблеми використання, збереження та відтворення ґрунтів в умовах сталого розвитку агросфери: Збірник тез «Подільський державний університет», 2023. С.45-48.

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OPTIMIZATION OF PHOSPHORUS NUTRITION OF CORN ON TYPICAL BLACK SOIL (CZERNOZEM VORONIK, WRB)

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Phosphorus plays an important role in plant nutrition. Throughout the world, phosphorus is second only to nitrogen among all 17 essential nutrients in all soils [1]. In particular, phosphorus plays a significant role in the life of corn plants, although it carries out half as much as nitrogen and potassium [2]. Therefore, providing plants with it, especially during critical periods of their vegetation, this is a very important task. Corn uses up to 15% of the phosphorus requirement in the first weeks of life (from seedlings to 5-6 leaves). The second period of maximum phosphorus consumption by corn is relatively long - from the phase of 8-10 leaves to the end of flowering (corn consumes 65% of the phosphorus requirement). The rest is consumed at the end of the growing season [3].

To ensure corn plants with phosphorus, the content of available phosphates in the soil should be regulated with hydrogen-soluble fertilizers in the initial period of plant growth and reserves should be created for prolonged action in the middle and end of vegetation. The goal of our research was to establish provision of corn crops on typical black soils with available phosphates in critical periods of development and the possibility of their regulation due to the use of microbial phosphate-mobilizing preparation and mineral fertilizers.

Methods of research. Since 2019, stationary field experiments have been conducted on the black soil of the typical low-humus medium-loam of Scientific and Research Centre "Podillia" of the Higher Educational Institution "Podillia State University" to study the reaction of corn plants of hybrids of different maturity to mineral fertilizers. The scheme of the experiment on the study of phosphorus fertilizers include options: control (without fertilizers); $N_{120}K_{150}$; $N_{120}P_{40}K_{150}$; $N_{120}P_{60}K_{150}$; $N_{120}P_{90}K_{150}$; $N_{120}P_{120}K_{150}$; polymyxobacterin; phosphate-mobilizing preparation; combination of biological preparations with mineral nutrition. There are three repetitions in the experiment. The total area of the site is 28 m², the registered area is 14 m². The predecessor of corn was barley.

The growth and development of plants were observed and the yield structure was studied in the experiments. Soil samples were taken from the arable (from a depth of 5-20 cm) and sub-aerial (30-40 cm) layers in the dynamics of the phases of plant development (before sowing, 3-5 leaves, 8-10 leaves, full flowering, milk ripeness, end of vegetation) according to the methodology [4]. The content of mobile phosphorus in the soil was determined according to Chyrykov and Karpinskyi-Zamiatina.

Research results. The phosphorus content in the studied soil was at the level of average supply and ranged from 65 to 78 mg/kg in the areas. Application of phosphorus fertilizers contributed to the increase of the phosphorus content in the soil. The use of 40 kg/ha of phosphorus increased its supply in the soil at the beginning of maximum absorption (8-10 leaves) to 88-94 mg/kg. Increasing the phosphorus rate to 60 and 90 kg/ha increased the phosphorus content in the soil to 112-119 mg/kg, and 120 kg/ha of phosphorus to 134-150 mg/kg (increased provision).

When using phosphoric fertilizers against the background of mineral nitrogen-potassium nutrition, the phosphorus content in the soil increased by 24-33 mg/kg at a rate of applied phosphorus of 40 kg/ha; by 37-46 mg/kg – at 60 kg/ha of phosphorus; by 54-68 mg/kg – at 90 kg/ha; by 71-86 mg/kg - with a rate of phosphorus fertilizers of 120 kg/ha.

The application of a phosphate-mobilizing preparation increased the phosphorus content in the soil at the beginning of the phase of 8-10 leaves of corn to 84-92 mg/kg, which is equivalent to the application of 40 kg/ha of phosphorus with mineral fertilizers. The use of phosphorus fertilizers against the background of the phosphate-mobilizing preparation increased the phosphorus content in the soil by 21-27, 18-26 and 15-23 mg/kg, respectively, according to the standards of phosphorus fertilizers from 60 to 120 kg/ha. That is, there was a tendency to decrease the effect of the preparation with an increase in the rate of phosphorus fertilizers.

The content of active phosphorus in the soil is 14-20% of mobile phosphorus, and in the first half of summer it increases to 27-32%. This indicates an increase in microbiological processes, mobilization of phosphorus and improvement of phosphorus nutrition of corn in a critical period for it.

In 2023, the effectiveness of the microbiological preparation and mineral fertilizers was higher than in 2022, due to better soil moisture availability.

The average yield of corn in the control was 5.62 t/ha, which generally indicates high natural soil fertility. The use of nitrogen and potassium fertilizers increased productivity by 0.81 t/ha to 6.43 t/ha (by 15%). Application of only the phosphate-mobilizing biopreparation increased the yield of corn by 0.47 t/ha.

The use of phosphorus fertilizers on a background of nitrogen and potassium together with a phosphate-mobilizing preparation increased the yield to 7.97-9.32 t/ha, which was an increase from 2.35 to 3.70 t/ha in accordance with the doses of phosphorus application. It should be noted that for each increase in the phosphorus dose, the increase does not increase proportionally: at a dose of 40 kg/ha of phosphorus, the increase was 0.11 t/ha compared to the option without phosphorus, at doses of 60 and 120 kg/ha, the increase is the same - 0.34-0.37 t/ha, and at a phosphorus dose of 90 kg/ha, it is the largest and amounts to 0.63 t/ha of corn grain. Similar trends were revealed by comparing options with the use of phosphorus fertilizers against the background of phosphate-mobilizing preparation and nitrogen and potassium fertilizers in comparison with the option where only phosphate-mobilizing preparation was applied.

Conclusions. 1. The use of a phosphate-mobilizing preparation and mineral fertilizers contributes to a significant increase in phosphates available to corn plants in the soil at the beginning of maximum phosphorus consumption.

2. The effectiveness of phosphorus fertilizers indicates the advantage of their complex application with phosphate-mobilizing preparations and nitrogen and potassium fertilizers, which ensured the highest yield of corn per grain.

3. Phosphorus fertilizers have a higher efficiency against the background of nitrogen and potassium nutrition than when using a combination of nitrogen and potassium fertilizers and a phosphate-mobilizing preparation.

4. The nature of the effect of phosphorus fertilizers is non-linear – the maximum yield increases were obtained when phosphorus was applied at the rate of 90 kg/ha, which indicates the optimal ratio of macronutrients.

References

1. Kozak, H. (2021). Efektyvne vykorystannia fosfornykh dobryv [Effective use of phosphorus fertilizers]. *Propozytsiia*, 11. Retrieved from <https://propozitsiya.com/ua/efektivne-vikoristannya-fosfornih-dobriv-0>

2. Lykhochvor, V. (2014). Systema udobrennia kukurudzy [Corn fertilization system]. *Ahrobiznes sohodni*, 8 (279), Retrieved from <http://www.agrobusiness.com.ua / agronomiia-siogodni/ 2211-systemaudobrennia - kukurudzy.html>

3. Lykhochvor, V. V., & Petrychenko V. F. (2006). *Roslynyntstvo. Suchasni intensyvni tekhnolohii vyroshchuvannia osnovnykh polovykh kultur* [Plant growing. Modern intensive technologies of cultivation of the main field crops]. Lviv : NVF «Ukrainski tekhnolohii» [in Ukrainian].

4. Shpaar D., Hinap K., Kalenska S. (2009). *Kukurudza* [Corn]. Kyiv : Alfa-staviia LTD [in Ukrainian].

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ВПЛИВ МІНЕРАЛЬНИХ ДОБРІВ НА АЗОТНИЙ РЕЖИМ ЧОРНОЗЕМУ ТИПОВОГО І УРОЖАЙНІСТЬ КУКУРУДЗИ НА ЗЕРНО

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