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MINERAL NUTRITION OF PEAS

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The distribution of peas in Ukraine is driven by its diverse use by the population, namely: food - in the form of mature grain, fresh green peas; industrial - canned green peas; fodder - green fodder, silage, grain forage, haylage, hay; and as green manure [4].

Field pea (Pisum sativum L.) ranks among the top in the structure of legume crops in Ukraine, primarily due to its ability to produce high and stable yields within a relatively short growing period. Field pea grain contains protein with a complete amino acid profile, carbohydrates, fats, and mineral elements. Its ability for symbiotic nitrogen fixation is also important, significantly reducing the need for nitrogen fertilizers. Peas are also considered one of the best precursors for grain crops, including winter crops.

From an agrotechnical perspective, the importance of peas lies in its ability to enrich the soil with organic matter, thereby replenishing the topsoil with nitrogen, phosphorus, potassium, calcium, acting as a good phytosanitary agent, and improving soil fertility and structure [9]. Depending on the yield level, pea straw and plant residues typically leave approximately 60–90 kg/ha of nitrogen, 15–25 kg/ha of phosphorus, and 20–30 kg/ha of potassium in the soil. Pea roots have high nutrient uptake efficiency and utilize nutrients from less soluble compounds. Peas enhance phosphorus mobility in the soil, thereby improving phosphorus nutrition for subsequent crops. It is considered one of the best precursors for most crop rotations and a valuable cover crop [4].

Since peas form symbiotic relationships with nodulating bacteria that fix nitrogen from the air, they can be grown without the need for nitrogen fertilizers, which account for about 30% of energy costs in intensive farming. The nitrogen use efficiency from mineral fertilizers is estimated at 50–80%, with a significant portion contributing to nitrate pollution in groundwater, whereas biological nitrogen is fully utilized by living organisms. Due to active symbiosis, peas can accumulate biological nitrogen in the soil, allowing savings on the application of nitrogen mineral fertilizers [5, 7, 8].

When it comes to the need for phosphorus nutrition, it is no less important than nitrogen. Phosphorus promotes the growth and development of the root system (especially root hairs), activates the activity of nodular bacteria, and can reduce the negative impact of elevated nitrogen levels on nodule formation. Nodular bacteria have high solubility and convert insoluble phosphorus compounds into more available forms for plants. Phosphorus plays a crucial role in the aboveground parts of plants. A deficiency of this element adversely affects the synthesis of proteins, starch, fat, sucrose, glutamine, asparagine, and a range of other compounds [1, 6].

Potassium is of great importance for the life of peas and phosphorus metabolism: with sufficient potassium supply in the soil environment, even minimal doses of phosphorus are significantly utilized, and phosphorus, in turn, substantially affects the absorption of potassium by plants [3]. On soils with low potassium content, especially

on light soils, the plant almost completely utilizes potassium before flowering. Potassium is not a component of enzymes but enhances the activity of many of them [2].

Therefore, peas are an important crop both in terms of agriculture – improving soil properties – and industry – popularity among the population as a food source. To achieve high yields, it is crucial to select the right cultivation technology considering specific soil and climatic conditions, including fertilization.

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ДЕЯКІ КОНЦЕПТУАЛЬНІ АСПЕКТИ І ПРАКТИЧНІ ПРИКЛАДИ ДОСЛІДЖЕНЬ ФРАНЦУЗЬКОГО АГРОЕКОЛОГІЧНОГО ПЕРЕХОДУ

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Агроекологічний перехід сільського господарства Франції викликає методологічні проблеми, оскільки для того, щоб ним керувати, необхідно враховувати динаміку складної системи у мінливому середовищі з сильною неоднозначністю та невизначеністю. Неоднозначність пов'язана з тим, що