RESEARCH ON THE ROLE OF PEA CULTIVATION IN AGRICULTURAL TECHNOLOGIES FOR ORGANIC PRODUCTION

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Abstract

The use of fertilizers and soil improvers in organic farming is limited to certain types of fertilizers and is one of the most important practical actions on which the efficient use of mineral nutrients depends. Organic farming uses organic or mineral compounds containing nutrients in forms that are relatively far removed from the forms that can be directly assimilated by plants as fertilizers. In organic farming, 'fertilization' is not carried out directly for the plant but for the mobilization of the microbiological complex in the soil to release nutrients through biological processes, making them accessible to plants throughout the growing season. An important role is played by annual and perennial legumes in the soil. The nitrogen they fix is released into the soil slowly, as organic matter from the body of nitrogen-fixing micro-organisms mineralizes.

Keywords: organic farming, organic fertilizers, peas, legumes

In organic farming it is forbidden to use chemical synthetic fertilizers because they damage the living part of the soil. At the same time, any fertilizer should only be applied after agrochemical soil mapping has been carried out and the potential amount available and the ratio of elements in the soil is known.

Fertilization is the key technological link in organic farming. In organic farming, the basis of fertilization is the use of organic fertilizers and natural mineral fertilizers. In organic farming, the use of chemical synthetic fertilizers is forbidden because they damage the living part of the soil. At the same time, any fertilizer should only be applied after agrochemical soil mapping has been carried out and the potential amount available and the ratio of elements in the soil is known.

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Organic fertilization. Organic fertilizers contribute to increasing the humus content of the soil and raising its fertility as a result of:

- increased nutrient content;
- increased microbiological activity;
- improving soil structure;
- increasing the soil's water-holding capacity;
- improving air circulation in the soil.

The organic matter that gets into the soil through the application of organic fertilizers is broken down by soil micro-organisms, releasing nutrients in forms readily available to plants. The organic fertilizers accepted for use in organic farming under Commission Regulation (EC) No 889/2008 are the following:

- fermented manure, dried manure and dehydrated poultry manure;
- compost from animal excrements, including poultry manure and manure compost;
- liquid animal excreta;
- composted or fermented household waste;
- turbine;
- waste from mushroom cultivation;
- manure;
- composted or fermented plant matter (from biogas production);
- animal products or by-products: blood meal, hoof meal, horn meal, bone meal or gelatinized bone meal, fish meal, meat meal, meat meal, flake meal, wool, fur, hair, dairy products;
- organic products and by-products of plant origin (e.g. oilseed cake meal);
- seaweed and seaweed products; - wood chips and shavings;
- bark compost.

Mineral fertilization in organic farming. The particular importance of organic fertilizers in organic farming does not preclude the use of

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chemical fertilizers, but they must be hard soluble fertilizers from natural rocks.

The mineral fertilizers accepted for use in organic farming according to Commission Regulation (EC) No 889/2008 are the following:

- soft natural phosphate and aluminum-calcium phosphate;
- alkaline lime;
- crude potassium salt or kainite;
- potassium sulphate, possibly containing magnesium salt;
- residue resulting from the distillation of alcohol and extract from the residue;
- wood ash;
- calcium carbonate (chalk, marl, pulverized limestone, sand deposit with limestone-impregnated algae, phosphate chalk);
- calcium magnesium carbonate; - magnesium sulphate (kieserite);
- calcium chloride solution; -calcium sulphate (gypsum);
- industrial vacuum from sugar production;
- industrial vapor from the vacuum salt manufacturing process;
- rock dust and clays.

Use of green manures. Green manures or green crops are plants that are incorporated into the soil to improve its properties. Green manures have the following beneficial effects:

- they enrich the soil in organic matter;
- they increase the microbiological activity of the soil;
- they enrich the soil in nitrogen, especially in legumes;
- improves soil structure;
- reduce soil erosion by wind or water;
- prevent nutrient leaching, especially of nitrates.

MATERIAL AND METHOD

The present work aims to investigate the biology and capacity of autumn pea to fix nitrogen in the soil in comparison with spring pea cultivation under field conditions, in order to assess its adaptability to natural and organic conditions.

The experiment was equated in crop years 2020-2022 on a cambic chernozemic soil.

Location: Central Moldovan Plateau, Elan-Horincea Depression.

Relief: foothills, hilly;

Microrelief: gently sloping plateau with a slope of 3% -5% and eastern exposure.

Bioclimatic zone: forest-steppe

Vegetation (cultivated grassland): wheat

Climatic data: temperate continental steppe climate (classified in Koppen's formula D.f.b.x)

Settlement method - single row linear settlement

No. of replications - 3 (harvest plots)

Plot area - 5 ha

Experimental factors: Pea crop

a1 - autumn pea

a2 - spring pea.

The experiment aimed to:

Humus: by wet oxidation following Walkely-Black in the Doughnut modification.

Total nitrogen: by Kjeldahl method with disaggregation with H2SO4 at 3500 C, catalyst potassium sulphate and copper sulphate;

Mobile phosphorus: by extraction in ammonium acetate lactate (P-AL) solution and dosage variant by reduction with stannous chloride and ascorbic acid mixture, after Nikolov.

Mobile potassium: by extraction in ammonium acetate lactate solution (P-AL) according to the Egner-Riehm-Domingo method and determination by flame photometry.

Nitrogen index (N.I.) estimated on the basis of the humus content value correlated with the degree of saturation value.

RESULTS AND DISCUSSIONS

Use of leguminous plants. Leguminous plants play a particularly important role in organic farming. In agriculture, the favorable effect of legumes on successor plants has been known since ancient times. This effect derives from the symbiosis of leguminous plants with bacteria of the genus Rhizobium, which fix atmospheric nitrogen, enriching the soil with 100 to 300 kg nitrogen per ha and making a significant saving of conventional energy. The nitrogen remaining after legumes in the soil is in organic form, easily accessible and slow-acting. Being spread at different depths in the soil, it favors the development of the root system of the successor plant. Legumes with a high solubility for phosphates (lupin, peas, etc.) make this element available to successor plants in a more accessible form. As all parts of leguminous plants are richer in nitrogen than other crop plants, they can be used as a green manure for soil fertilization.

In grain legumes, annually:

- *Vicia faba* fixes 210 kilograms of nitrogen, with limits ranging from 45 to 552 kilograms;
- *Pisum sativum* fixes 65 kilograms of nitrogen, with limits ranging from 52 to 77 kilograms;
- *Glycine max.* fixes 85 kilograms of nitrogen, with limits between 1 and 168 kilograms;
- *Lupinus sp*. fixes 176 kilograms of nitrogen, with limits between 145 and 208 kilograms;

- *Phseolus sativum* fixes 202 kilograms of nitrogen, with limits between 63 and 342 kilograms;
- *Lens culinaris* fixes 101 kilograms of nitrogen, with limits between 88 and 114 kilograms;
- *Arachis hypogea* fixes 98 kilograms of nitrogen, with limits between 72 and 124 kilograms;
- *Cicer arietinum* fixes an average of 103 kilograms of nitrogen per hectare per year.

For forage legumes, annually,

- *Medicago sativa* fixes 236 kilograms of nitrogen, with limits between 10 and 463 kilograms;
- *Trifolium pretense* fixes 359 kilograms of nitrogen, with limits between 45 and 673 kilograms;
- *Trifolium subterane* fixes 190 kilograms of nitrogen, with limits ranging from 45 to 336 kilograms (Nutman, 1976)

Soil samples taken from the field were received at the ICAM laboratories by the research team, following the preparation and conditioning process according to the applied research methodology.

An average agrochemical sample was taken from each harvest plot, consisting of 25 partial samples.

After conditioning the samples, pH in aqueous suspension, P and K soluble in AL were determined. To assess the nitrogen supply status, the sum of exchangeable bases (SB) and hydrolytic acidity (Ah) were determined, both necessary to calculate the degree of saturation in bases, an indicator used together with the humus content value to calculate the nitrogen index (IN).

Samples were taken at the end of the growing season of the two pea cultivars and a comparison of the level of soil supply in macroelements and especially the indicators of nitrogen supply status was then made (*Table 1*). The results confirmed that compared to the initial supply status the soil accumulated potential nitrogen available to the succeeding crops in both variants, i.e. spring pea and autumn pea. From the data analysis it was found that autumn peas have a higher capacity to fix nitrogen in the soil compared to spring peas. Also, the higher organic matter content correlates with the leaf and root mass, respectively, specific to the autumn pea crop. Differences were also found in the consumption of secondary macro- and micro-nutrients (*Table 2*).

Table 1

Nutrient content - end of vegetation

	pH		**Mobile P, ppm**		**Mobile K, ppm**		**Humus %**		**IN**	
	Peas spring	Peas Autumn	Peas spring	Peas Autumn	Peas spring	Peas autumn	Peas spring	Peas Autumn	Peas spring	Peas Autumn
Value	6.5	5.9	8	12	196	Value	6.5	5.9	8	12
Stay	Low acid	Lowacid	Weak	Weak	Hi	Stay	Low acid	Lowacid	Weak	Weak

Table 2

Contents of secondary macro- and micro-nutrients

	Sulf – IAS %		**Zinc, ppm**		**Cupru, ppm**		**Mangan, ppm**		**Fier, ppm**		**Bor, ppm**	
	MZpr.	MZtm.	MZpr.	MZtm.	MZpr.	MZtm.	MZpr.	MZtm.	MZpr.	MZtm.	MZpr.	MZtm.
Value	5.78	10.04	0	2.71	0.57	0.57	9.1	11.11	7.21	9.93	0.27	0.35
Stay	lean	middle	lean	lean	middle	middle	lean	lean	Mijl.	Mijl.	middle	middle

CONCLUSIONS

Pea varieties used as pre-emergence crops, called catch crops, can save more than 60 kg/ha of chemical nitrogen fertilizer requirements. The organic nitrogen left by the pea plants gradually mineralizes and provides food for post-emergent crops throughout the growing season. This explains why about 50% of chemical nitrogen fertilizers are converted into plant mass by the plants, while the nitrogen remaining after the leguminous crops is fully used, also avoiding groundwater pollution.

Peas are high in protein (8-15%), three to five times higher than cereal straw. All the plant residues left in the soil (1500-2000 kg/ha after peas), through decomposition, provide nutrients for the plants, but also form the humus so important in increasing fertility and rebuilding soil structure.

The pea plant's tap root system is vigorous and penetrates deep into the soil, and after decomposition these roots remain in the soil, leaving grooves that favor better infiltration and accumulation of water in the soil. At the same time, the roots of post-emergent plants penetrate through these channels, ensuring that more soil is used and that they are more resistant to drought. The roots of legumes have the ability to use phosphorus from the more difficult soluble combinations and bring it to the surface to the post-emergent plants. They also bring in calcium from depth, which is very important for the formation of stable soil structural aggregates.

These amounts of nitrogen fixed by leguminous plants are dependent on other crop factors and on strict adherence to the cultivation technology. The nitrogen quantities remaining in the soil as a result of the cultivation of leguminous plants by individual farmers can be an alternative to the use of chemical fertilizers, which are quite expensive and which add value to the cost estimate sheet for the establishment and care of profitable agricultural crops.

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