FUNCTIONING OF NITROGEN FIXATION SYMBIOSIS AND PEAS PRODUCTIVITY UNDER THE APPLICATION OF DIFFERENT TYPES AND DOSES OF FERTILIZERS

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The efficiency of different types and doses of fertilizers and pre-sowing bacterization of pea seeds (Starter variety) on the formation and functioning of symbiotic nitrogen fixation system, crop productivity and protein content in grain was studied in long-term field experiment on the typical black soil for five years. It was shown that fertilizer doses not exceeding $N_{60}P_{60}K_{60}$ were the most appropriate to use in the cultivation technology of pea. The use of manure, compost and organic-mineral fertilizer in crop rotation had positively affected the productivity of peas. Pre-sowing seed bacterization was proved to be an important agricultural practice as its application increases crop productivity and improves product quality.

Key words: *peas, mineral and organic fertilizers, pre-sowing seed bacterization, Rhizohumin.*

Pea is a traditional grain crop of Woodland zone. It is cultivated as a food and forage crops due to high content of proteins, starch, sugars, fats, vitamins, and minerals in the grain. Pea is a good precursor for other crops in rotation, and at the same time, it generates good yields after various crops (excluding grain legumes and perennial grasses due to the common pests and diseases, and they are hosts for causative agents of sclerotinia, for example sunflower).

However, recently, areas under peas in Ukraine reduced. The reason for this is the relatively low level of culture productivity in farms and intensive development of soybean seeding.

It should be noted that the productivity of peas largely depends on the peculiarities of nitrogen plant nutrition. Symbiotic nitrogen fixing bacteria that form specific formations, nodules, on the roots nodules in which the fixation of atmospheric nitrogen takes place play an important role. In the absence of active symbionts, pea plants are not able to adopt atmospheric nitrogen. Accordingly, under these conditions pea becomes a crop that uses nitrogen from the soil. At the same time, the

use of excessive norms of mineral nitrogen for formation and functioning of the plant-bacterial symbiosis mitigates activity of bacteria, even in case of their high population in soil [1]. Thus, activation of nitrogen fixation symbiosis and use of fertilizers within limits that do not hamper its activities, while positively affecting productivity of culture, are required in technology of pea cultivation.

In this regard, the aim of our study was to determine the possibilities of implementation of production capacity for peas under the application of different types and norms of biological preparation.

Materials and methods. Study was performed in 2011-2015 under conditions of stationary filed experiment of the National University of Life and Environmental Sciences of Ukraine and the Institute of Agricultural Microbiology and Agroindustrial Manufacture of the NAAS in typical black soil (humus content – 4.04 %, easily hydrolysed nitrogen – 21.7 mg/kg; exchangeable K_2O – 22.6 mg/kg; P_2O_5 – 52.5 mg/kg; pH_{sal} – 5.37). Experiment was placed in “Agrofirma KOLOS”, LLC, Skvyrskyi district, Region of Kyiv. Pea of the variety Stalker was cultivated in rotation:

pea – winter wheat – winter rape – soybean
– alfalfa – corn.

Experiments provide two equivalent blocks of options - without bacterization and with pre-sowing seed bacterization.

Options for fertilization of culture are the following:

1. Without fertilizer, control;
2. $N_{30}P_{30}K_{30}$;
3. $N_{60}P_{60}K_{60}$;
4. $N_{90}P_{90}K_{90}$;
5. $N_{120}P_{120}K_{120}$;
6. The second year after-effect of litter cattle manure (50 t/ha);
7. The second year after-effect of litter cattle manure (25 t/ha) + $N_{30}P_{30}K_{30}$;
8. The second year after-effect of biocompost (25 t/ha);
9. Corn nutritional residues 8 t/ha.

Repeatability of experiment is four-time, total area of one plot is 200 m², accountable are – 160 m². Placement of plots is systemic.

Microbial preparation Ryzohumin (TU U 24.1-00497360-003:2007) was used for pre-sowing seed bacterization.

Product of manure bioconversion obtained by the method that we developed was used as a compost with utilization of aerator PT-120 and the suspensions of microorganisms (application for the invention was submitted to the State Patent Body of Ukraine).

Number of nodules on the plant roots, their crude weight and activity of nitrogen fixation were measured by acetylene method in the experiment at the flowering stage [2]. Gas chromatographic analyzes of the intensity of C₂H₂ reduction to C₂H₄ were carried out at the Soil Microbiology Laboratory of the Institute of Agricultural Microbiology and Agroindustrial Manufacture of the NAAS Registration of harvest was performed plot-by-plot by the direct combine harvesting. Protein content in the grain was measured by photometry according to DSTU [3].

Statistical processing of the results obtained was carried out by B. Dospiekhov, using analysis of variance [4] and software application (Microsoft Office Excel 2003-2007).

Thus, levels of mineral fertilizer should not exceed $N_{60}P_{60}K_{60}$ in the technologies of pea cultivation in typical black soil according to the biological testing and harvest increase.

Use of manure, compost and organic mineral fertilizer in the system of fertilization of rotation of cultures also positively affects the formation and functioning of nitrogen fixation symbiosis and productivity of culture. Important agricultural method that contributes to the increase in productivity of culture, and, especially improvement of product quality is a pre-sowing seed bacterization.