from a complex of harmful organisms in order to limit their harmfulness to an economically insignificant level.

In order to obtain friendly seedlings, to activate the growth and development of plants, to increase the resistance of plants against viral diseases and other harmful organisms, when poisoning or encrusting seeds, recommended plant growth regulators should be added to the working solutions of the poisoner. The positive influence of biopreparations of the company «BTU-Center» on the field germination of winter wheat seeds was revealed. The highest similarity was provided by the biological preparation Organic-Balance®. It has been proven that the use of biological preparations of the «BTU-Center» company solves a number of problems of modern winter wheat cultivation technologies.

Keywords: winter wheat, plant protection, biological preparations, entomophages, ecology.

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ENERGY OF PERENNIAL GRASS PRODUCTION

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Abstract. Data on the state of production of perennial grasses in Ukraine and Latvia are presented. It has been established that in Ukraine, on average for the period from 2000 to 2020, the volume of energy transformation (inflow of biological nitrogen) into the soil decreased annually by 745.6 TJ. In Latvia, an increase in the area under perennial legumes has been noted, which has significantly affected soil fertility and contributed to an increase in the number of farms engaged in organic farming.

Keywords: perennial grasses, sowing areas, biological nitrogen (energy).

The current state of crop production in Ukraine does not have an ecological rationale for crop rotation, namely, the placement of crops according to the best predecessors, compliance with the recommended deadlines for returning crops to their original place and ensuring a deficit-free humus balance [1, 2].

Our research for the period from 2000 to 2020 showed that the basic laws of agriculture are significantly violated, in particular, there is a failure to comply with scientifically based crop rotations, nutrients taken out with the harvest of crops are not returned to the soil, which leads to a deterioration in soil fertility.

Thus, according to the data of the State Statistics Service of Ukraine, in 2000 the share of areas under crops of grains and legumes was 50.2%, industrial crops - 15.4, including sunflower - 10.8%. Ten years later (in 2010), these figures increased to 56.0, 27.1, 17.0%, respectively.

If in 1990 it was the norm to sow sunflower on an area of 8-10%, then by 2010 sowing of this industrial crop on an area of 17-18% was already promoted. The increase in areas under industrial crops continued in subsequent years. So, if in 2010 7296 thousand hectares were allocated for this group of plants, that is, 27.1% in the structure

of the total sown area, then in 2020 these figures increased to 9224 thousand hectares and 32.8%, respectively.

At the same time, the situation in cattle breeding worsened: the number of cattle decreased (from 249 thousand heads in 2000 to 74 thousand heads in 2020), including cows (from 145 to 47 thousand heads), as a result of how many areas were fodder crops. In 2000, the sown areas of this group of plants occupied 26.0% of the total sown area, in 2010 - 9.6%, and in the period to 2020 decreased by another 3.6 percentage points, that is accounted for only 6% in the structure of the total sown area.

In Latvia the area of *Fabaceae* seed breeding fields in 2021 was 2007.89 ha, i.e. 636.11 ha more than in 2020 and the largest since 1995, when they occupied 1525.00 ha. Such species of *Fabaceae* as eastern galega, white clover, bastard clover, hybrid alfalfa, incarnate clover, red clover and seed alfalfa were cultivated [3].

Agricultural land (LIZ) (2001) of the total territory of Latvia occupied 39% or 2475 thousand ha (including unused land), of which 1844 thousand ha is arable land. The rest of the LIZ consists of meadows and pastures, perennial plantations, as well as land not used for agriculture [4]. The areas of unusable land in Latvia are decreasing every year. Organic agriculture is a rapidly growing industry worldwide, and it continues to develop in Latvia as well. At the end of 2021, the number of farms engaged in organic farming reached 4121 - 63 farms more than in 2020 [3].

It has been established that over the period from 2000 to 2020 in Ukraine, the area sown with perennial grasses has significantly decreased (from 7063 to 869 thousand ha), and their share in the structure of the total sown area from 4.6 to 3.1% (according to the norms of 8-10%).

The reduction in the number of cattle affected the production of manure, and the decrease in the area under perennial grasses, mainly alfalfa, led to a decrease in the flow of biological nitrogen into the soil, which did not contribute to the improvement or at least the preservation of soil fertility in Ukraine.

We have calculated that the volumes of symbiotic fixation of atmospheric nitrogen by perennial grasses (inflow of biological nitrogen into the soil) in 2000 in Ukraine amounted to 358.2 thousand tons, which is equivalent to 1042.4 thousand tons in terms of ammonium nitrate. The amount of mineral fertilizers (at 2021 prices) reached UAH 16261.4 million, and the energy input to the soil – 31 124.9 TJ. As of 2020, the mentioned indicators worsened and amounted to 104.3 thousand tons, 303.5 thousand tons, UAH 4734.6 million and 9061.2 TJ, respectively.

To determine the trend in the dynamics of the transformation of grass energy into the soil, we used the most effective method for analyzing changes in the process under study over time - the method of analytical smoothing of a series of dynamics for the period from 2000 to 2020.

It has been established that the process of changing the energy accumulation in the soil can be represented by a 2^{nd} order parabola $y = 1864.1x^2 – 16301x + 44709$ at the approximation confidence level $R^2 = 0.9792$.

An analysis of the graph constructed in order to equalize the series of dynamics of energy input into the soil shows that, on average, over the above period, the volume of energy transformation into the soil decreased by 16301 TJ with an acceleration of

3728.2 TJ every five years, that is, annually by 745.6 TJ which significantly affected the fertility of the soil.

With a current shortage of energy carriers, high prices for agrochemicals, especially for modern expensive agricultural machinery, it is necessary to justify the effectiveness of crop production technologies not only on the basis of economic feasibility, but also on the basis of taking into account energy equivalents [5, 6].

Scientists of the Institute of Feeds and Local Agriculture note that with proper observance of the technology of growing alfalfa, with a two-year use of the herbage, the arable and subsoil layers of the soil are enriched with root and post-harvest residues (comprising 18 t/ha with a nitrogen content of 1.96%, or 352 kg/ha), which is equivalent to 30.6 GJ/ha of nitrogen fertilizer energy [7].

So, based on the foregoing, the main direction of improving the environmental and energy efficiency of crop production in the current economic conditions is the development of environmentally oriented crop rotations, an increase in the area under perennial grasses, especially legumes, providing the soil with environmentally friendly nitrogen.

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Анотація. Наведено дані щодо стану виробництва. багаторічних трав в Україні та Латвії. Встановлено, що в Україні, у середньому за період з 2000 р. до 2020 р., обсяг трансформації енергії (надходження біологічного азоту) в грунт скорочувався щорічно на 745,6 ТДж. У Латвії відзначено збільшення посівних площ під багаторічними бобовими травами, що істотно позначилося на родючості ґрунту і сприяло збільшенню кількості ферм, які займаються органічним землеробством.

Ключові слова: багаторічні трави, площі посіву, біологічний азот (енергія).