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Content of modern systems of farming agriculture in Ukraine and suggestions for their classification

Objective. Development of a unified classification of modern systems of domestic agriculture based on the main differentiated features and experimental detection and scientific substantiation of their rational options, adapted to the natural-agricultural zones and specific agro-landscapes. Methods. Descriptive-generalization, computational, statistical, field experiment. Results A differentiated classification of agricultural systems in three groups of basic characteristics - agronomic, economic and ecological and algorithm of their integrated name with a more complete reflection in it of the contents of concepts is offered. The long-term stationary studies (2002-2014) confirmed that the rational for the Forest-Steppe of the Right Bank is a fruit-changing system of high-intensity ecological agriculture on typical black soil with a politsevo-bezpolatov basic soil treatment and organo-mineral system of its fertilization. Conclusions The worked out classification of agricultural systems enables objective identification with a more complete reflection in the title of their content. The rationality of the fruit-changing system of high-intensity ecological agriculture is certified by a system of criteria.

Key words: system of agriculture, classification, rationality, adequacy, intensity, ecologization, stability, energy efficiency.

The implementation of the content of the national idea in the agrarian sector of Ukrainian society will find expression in ensuring a high stable material and spiritual well-being of the Ukrainian people, the development and prosperity of the Ukrainian nation. Analysis of the results of recent research and publications. According to the national standard of Ukraine DSTU 4691: 2006 [3], 10 names of agricultural systems were identified, of which - on the basis of the intensity of land use - 2, the structure of the sown area - 6 and the functional load - 2. This list does not sufficiently take into account the basic classification characteristics of the content concept. In particular, gradations of such features as the way of reproduction of soil fertility, economic, economic, ecological and energy efficiency of land use are not defined. There is no standard in the basic objective of identifying a number of agricultural systems - natural-agricultural zoning, which is the only possible argument for calculating the adequacy of the actual energy produced by the agricultural product for the costs of energy and material resources for its production.

It deserves attention and methodological support for evaluating the rationality of specific farming systems. The criteria for such an assessment are indicators of economic, economic, environmental and energy efficiency of the industry. The economic efficiency of agriculture is estimated by the adequacy of the actual productivity of the arable land (Pf) with its resource-secured value (Pr) by the share Ka = Pf: Pr (if Ka = 0.9, then the adequacy is high, Ka = 0.7 - 0.8 - average, Ka <0.7 - low) and its stability. Stability of the industry is estimated by means of a definite variational analysis of the stability coefficient Kc and its gradations: Ks> 90% - high, Kc = 89 - 80 - average, Ks <80 - low [4]. Indicators of economic efficiency of agriculture are intensity and profitability. The intensity ratio (KI) is calculated by the ratio of the value of gross output (Bp) to the cost of anthropogenic costs for its production (BZ, UAH / hectare). The intensity is high for the values of Ki> 1.5; The average - Ki = 1,1- 1,4; low - Ki <1 [5]. Energy efficiency of agriculture is calculated by dividing the energy intensity of the grown products Ep by the costs of non-renewable energy for its production Ez, GJ / ha, which is called the energy efficiency coefficient Kee = Ep / Ez. Energy efficiency is high in Kee> 5, medium -> 4 - 6

and low - <2 [12]. To assess the level of environmentalization of the field of agriculture, the index of ecologization of the Ie is used, which is a fraction of the division of the amount of active substances taken from the mineral fertilizers RK (kg / ha) to the sum of organic substances introduced into the soil in the form of fertilizers and surface and root plant residues, X 0, T / ha [4, 10]. Between the module of Index I and the level of ecologization of agriculture there is an inverse relationship: for maximum ecologization, the value of Ie = 0, increasing its level, ie = 15 -> 0, downward IE = 16 - 25 and low IE => 25. An additional criterion for the ecological examination of the field of agriculture is the agroecological and toxicological index (AETI), calculated on the basis of arguments for the level of safety of pesticide application [4]. The current state of the field of agriculture in the country does not meet the above parameters of its rationality. According to the actual productivity of arable land in the last 10 years, 3.8 t / ha of k.o. The main products with bioclimatic potential of 6 t / ha this state can be estimated as low-adequate (Ka = 0.63). Criterion of arable yield stability of Ks = 77% and production intensity Ki = 1.1 testify to the low stability and average intensity of the industry. Calculations are also confirmed by the average energy efficiency of agriculture (Kee = 3.9). The probable negative annual humus balance in Ukraine's agriculture is estimated at 0.66 t / ha. The analysis confirms the relevance of zonal research in the direction of identifying rational agricultural systems.

Materials and methods of research. For the methodological substantiation of the proposed classification of agricultural systems, the existing laws of development of this field of knowledge have been applied: the law of biotechnological priority in the production process of agriculture; The law of determining the productivity of the land by the ecological capacity of a specific agro-landscape; The law of extended reproduction of soil fertility; The law of limitation and standardization of anthropogenic influence on agrolandscape [4, 6, 14]. There is a need for differentiation in key areas: agronomic, economic and environmental, which facilitates the detection of differences between their graduation, without violating the principle of systematic studies [6, 14]. To identify the optimal combination of the resource content industry system of mechanical tillage in the rotation, the level of greening agriculture in terms of field of stationary two-factor experiment on Agronomic Experimental Station of the National Agricultural University of Ukraine during 13 years (2002 - 2014) was conducted Efficiency of 3 variants of agricultural systems and 4 systems of basic cultivation of soil in field crop rotation with the following alternation: alfalfa - winter wheat - beet sugar - corn silage - winter wheat - maize - peas - winter wheat - sugar beet - barley. The research is carried out in typical weather and soil conditions, its results are addressed to the natural-agricultural zone of the forest-steppe. Soil research field - typical black earth serednosuhlynko-tion of the content of humus layer, 0 - 30 cm 4% leh- kohidrolizovanoho nitrogen Turin - 40 mg / kg soil mobile phosphorus by Machyhinym - 70, exchange potassium Maslov - 80 mg / kg Soil, pH of saline extract - 6,9 - 7,3. During 13 years of research typical weather conditions have been observed for 9 years (69%), significantly damp - 2 years (2002 and 2006), aridity significantly differed 2 years (2007 and 2009).

A characteristic feature of the agricultural system's variants in the experiment was its resourcefulness. In the version of industrial agriculture (control) priority was given to 1 hectare of arable land of industrial mineral fertilizers in the norm of 300 kg d.r. ^ 92P100K108) on the background of organic 12 tons provided 2 minds are present. Goal. Livestock on 1 hectare of arable land with an ecologization coefficient of 25 (300: 12) and intensive use of industrial pesticides for effective crop protection. The resource filling of this system with nutrients ^ 81P59K155 is focused on the achievement of arable land productivity of 9 t / ha К.од. Basic and by-product that is adequate to the bioclimatic potential. In the version of ecological agriculture, to achieve this productivity of arable land, organic fertilizers were combined in the norm of 24 t / ha (manure, 12 t / ha + sideral fertilizers, 6 t / ha + byproducts and plant residues, 6 t / ha) and The compensatory rate of mineral - 150 kg / ha (^ eP ^ K ^) with a coefficient of ecologization of 6.2 (150: 24). The control of harmful organisms is carried out by a system of priority mechanical, phytocoenomic and biological means, combined with the removal of pesticides under the control of the ecological and economic thresholds for their availability. In the variant of biological agriculture only natural resources are used: organic fertilizers in the norm are 24 t / ha and biological preparations for control of harmful organisms against the background of mechanical and phytocoenomic measures. Consequently, in conditions of biological farming in the experiment, the productivity of the arable land will be limited to a deficit of nutrients of 53 kg / ha ^ 24P16K13) and will be standardized at 7.8 t / ha. (9 t / ha * 0,87). The systems of basic cultivation of soil in crop rotation in each variant of agriculture in a stationary experiment are represented by 4 gradations on the basis of measures and depth: • differentiated (control) with the performance during the rotation of 6 mixed deep plows, 2 discs for 8 - 10 cm for wheat Winter after peas

and corn for silage and 1-st rotational loosening for barley; • planar multi-deep loosening for all cultures, except for discarding under winter wheat after the precursors indicated on the control; • politsevo-bezpolatsevy, combining during the rotation 2 tiered plows under sugar beet at intervals of 4-5 years, 2 cats under the control of wheat of winter and flattening loosening for the rest of the crops; • Dissection superficial to a depth of 8 - 10 cm under all crops of crop rotation.

Research results. Farming systems - is environmentally sound way of using terrestrial and solar energy for crop production, which integrates economically sound agronomic and reclamation, organizational and economic measures soil fertility restoration and environmental protection. We proposed a differentiated classification for the 3-groups of symptoms: by way of land use, severe crop pattern and method of fertility restoration and protection of soil, composed classification farming systems with code name agronomic identifying their main options and distribution in natural and agricultural areas : grassland, plodozminna, Rotary-grain, grain-vapor Rotary, Rotary and grain of soil. For economic characteristics nayob'yektyv- feel much interest is attracted criteria available in the European Union intensity factor defined by the ratio of the value of gross output to the costs of its production [5]. By extensive farming system is owned by a factor less than 1 second serednointensyvno- - 1- 1.5, high-intensity - greater than 1.5.

Comparative efficiency of agricultural systems options in a stationary field experiment of NUBiP of Ukraine (2002-2014)

Agricultural indicators Indicators industrial (control) ecological biological NIR05,% ±% to control Productivity of arable land, main and by-products, k.od. T / ha Economic efficiency 10,7 -4,6 -21,3 10,4 Stability of productivity,% 82,5 - 2,0 - 0,6 10,0 Adequacy of productivity for resource supply 1,15 - 4,4 7, 8 10,0 Energy efficiency Energy efficiency coefficient, Ke 4,9 +16 +41 10,0 Fuel consumption per hectare, kg 117 - 4,3 - 10,3 10,0 Economic efficiency Intensity of production, coefficient 1,75 + 6 +20 10,0 Profitability,% 74,5 +15 +49 10,0 Conditionally net profit, UAH / ha 4017 +3,6 - 2,5 10,0 Environmental efficiency Index of environmentalization, Ie 25 6.2 0 - Carbon nitrogen index in the soil layer 0-30 cm, C 13.7 14.3 14.4 - Annual balance of humus, T / ha [2] +0,48 +1,5 +0,98 - Balance of gross forms of NPK in the soil layer 0-30 cm, kg / ha +77 +7 -57 - The content of heavy metals in the green mass of perennial grasses, Mg / kg of dry mass Copper 4.4 - 18.2 - 25.0 - Zinc 19.7 - 16.3 - 19.0 - Lead 3.2 -6.3 -6.0 –

The criterion for assessing the level of environmental compatibility of agriculture, its ecological characteristics may be the conditional index of ecology of the branch of the Ie, calculated by the ratio of the amount of active substance (kg / ha of mineral fertilizers) to the amount of organic substances entering and in the soil (root and surface vegetable remnants , Manure, compost, unpopulated part of the crop of cultivated crops, sideral mass, sapropel). Identification of agricultural systems according to this criterion can be carried out on a scale: biological (organic) agriculture without industrial mineral fertilizers and pesticides, if *Ие* = 0; Ecological agriculture - with the priority of organic means and compensatory application of mineral fertilizers and ecologically sound pesticides for the values of Ee => 0 - 15; Industrial agriculture with priority of industrial mineral fertilizers and pesticides for the value of Ee => 15. The proposed classification of agricultural systems makes it possible to objectively identify the names of a large number of their variants. For a more complete reflection of the content of a particular system in its name, the presence of the main features of the proposed triple differentiated classification of agricultural systems in the following sequence is important: the way of land use; Intensity of production; The level of ecologization of the industry and the ecological address of its effective implementation with the obligatory name of the type of soil and the natural-agricultural zone. The title may indicate individual functional orientations of systems. For example, we will propose the following possible names of agricultural systems, compiled according to the above algorithm: grain-growing high-intensive system of ecological agriculture on black soil typical of the Forest-steppe Livoberezhny; Grassy medium-intensive system of ecological agriculture in conditions of water erosion on black earths of the evacuated Forest-steppe of the Pravoberezhny. Long-term stationary researches of 2002 - 2014 3 ecological gradations in the conditions of the Forest-steppe of the Right Bank confirmed that the ecological variant of the fruit-changing system of agriculture is economical, energy, economic and ecological efficiency (table). The system of industrial agriculture (control) is inferior to energy, economic and environmental criteria, in particular in terms of humus balance, and the biological model is associated with a significant decrease in arable land productivity.

Conclusions

A differentiated classification of modern agriculture in Ukraine based on 3 basic criteria: agronomy - the method of land use, economic - the intensity of production and environmental - in terms of greening industry and its adaptation to the natural and agricultural areas. The results of long-term (2002-2014 gg.) Comparative studies of economic, energy, economic and environmental performance versions of Agriculture confirmed that the rational model in black zemah Right-Bank Forest-Steppe is plodozminna ecological agriculture system during treatment systems polytsevo-bezpolytsevoho primary tillage, organic -mineral system for its fertilizer crop rotation area saturated organic fertilizers 24 t / ha of nutrients and fertilizers 150 kg / ha ^ 46R49K55) and environmental And economically justified plant protection measures.

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