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SECTION 23. Agriculture. Agronomy. The technique.

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THE PROVISION OF SUSTAINABLE DEVELOPMENT OF AGRICULTURE

Abstract: *The paper describes economic and mathematical problem model accounting for ecological factors' influence upon economic performances of agricultural enterprise. Suggested economic and mathematical problem model is based on the problem of an optimum relationship of branches and production sectors in an agricultural enterprise in combination with agricultural landscape improvement, conservation of soil fertility and, in particular, the use of cropland in the context of ecological and technological soil kinds.*

Key words: *agricultural landscape, land tenure and use of land, contour land-reclamation, model.*

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Ukraine possesses an extremely highly developing potential of agricultural production. However, the extreme ploughness of agricultural holdings resulted in breaking the relation between the plough-land and natural biotic communities. It activated the development of erosion processes and led to the distortion of ecological balance. In accordance with it, there is a burning need to work out new economic, ecological and social approaches to agricultural nature resource management and overall justification of those priorities, which could define conceptually new ways to rational use of land.

Modern agriculture should not be opposing the ecological factors to economic ones and visa versa, but should view them as two basic components. When analyzing the results of agricultural production, there should be developed a system, accounting for social, economic and ecological factors, providing overall solution to the problem.

The issue of economic and ecological study design decisions of agricultural land and paid lot of attention. In scientific research, instructional materials proposed economic and environmental justification for spending some design decisions, such as organizing the territory of agricultural land, improvement of crop rotation, the forest-reclamation, humus balance, etc. [1, 2, 3, 4].

We propose economic and mathematical problem model, which accounts for ecological factors' influence upon economic performances of an agricultural enterprise.

Suggested economic and mathematical problem model is based on the problem of an optimum relationship of branches and production sectors in an agricultural enterprise in combination with agricultural landscape improvement and conservation of soil fertility [5].

To develop such a problem model, some preparatory works have been done in advance, including detailed examination and thorough analysis of natural and economic factors of the enterprise, the condition of its croplands, standard financial and ecological data etc.

Problem model combines the branches of an agricultural entity, optimizes them and their structure of production, taking into account contour land-reclamation, territory organization and shift of crops.

In the process of economic and mathematical problem model developing, different factors have been taken into consideration. For example, the combination of cattle breeding with crop farming is made by means of balancing fodder assortment, producing and use of organic fertilizers etc. The cropping pattern is connected with surface

topography of enterprises' territory, the demand for a certain type of agricultural production, the demand for the production covering intrafarm needs, the necessity to prevent from the erosion processes. Based on these factors and taking into account contour land-reclamation in territory organization, the crop structure and their location are differentiated according to ecological and technological soil kinds.

Making optimal planning is to select the best solution of all possible options based on specific criteria and optimal of limitations on resources. Optimality criterion is an important indicator that expresses the utmost degree of economic effect, the economic feasibility of production, showing the relation of the result to the costs of its implementation. Problems with determining the optimal outcome is to find the extreme value of the objective function, which in some cases reaches the highest or lowest value compared with other values under certain limitations problem and find the solution of this problem the best [6].

An important condition for solving the problem of optimum is the right choice for optimality criterion objective function. In various literature can be found different opinions about this, is to solve the problem on an optimum combination of fields as the optimality criterion used offer maximum profitability, maximum production output maximum production in terms of value, etc. [7-10].

The profit is viewed as the leading aim and driving force of business activity, because its enhancement results in state and enterprise property growth, also giving an opportunity to expand the revenue for personal use. That is why the key target of model function is the maximum profit combined with ecological priority provision in organization of production:

$$F_{\max} = \sum_{j\in J_k} C^t_{jki} x_{jk} + \sum_{j\in J_h} C^t_{jhi} x_{ih} - \sum_{j\in J_k} q^P_{jki} x_{jh} - \sum_{j\in J_h} q^{Tb}_{jhi} x_{jh} - \sum_{j\in J_h} r^P_{jk} x_{jk} \quad (1)$$

where J is numerous branches of an agricultural entity (crops, grown for different purposes, cattle breeds, other kinds of agricultural production etc.);

j – enterprise branch index;

i – kind of resource index;

k – index of ecological and technological type of plough-land;

x_{jk} – planting acreage of j - crop culture on k - ecological and technological type of plough-land;

x_{hj} – livestock number of h- animal breed in j - cattle breeding;

q^p_{jki} – index number of direct expenditure level for production of i-type of crop per 1 hectare of j-crop culture grown on k- ecological and technological type of plough-land;

q^{TB}_{jhi} – index number of direct expenditure level per one livestock unit of h – age group in j- cattle breeding and i-animal age group;

C^t_{jki} – market price of j-crop culture grown on k- ecological and technological type of plough-land;

C^t_{jhi} - market price of j-livestock production, produced by h-branch, i-animal age group:

r^p_{jk} – part of profit spent on k- ecological and technological type of plough-land improvement when growing j-crop culture.

In the task imposed limitations:

1. Limitations on the rational use of arable land for ecological and differentiated technological groups of soils and farmland:

$$\sum_{j\in J_k} x_{jk} = B_i \quad (k \in K) \quad (2)$$

2. Limitations on the range of commercial agricultural production crop production according to demand:

$$\sum_{j\in J_k} a^t_{ikj} x_{jk} \geq B^t_i \quad (t \in T, k \in K) \quad (3)$$

3. Limitations on range livestock in commercial production in line with demand:

$$\sum_{j\in J^t_h} a^t_{ihj} x_{jh} \geq B^t_i \quad (t \in T, h \in H) \quad (4)$$

4. Limitations on the types and age groups of animals that are scheduled to hold:

$$\sum_{j\in J_h} x_{jh} = B^{TB}_i \quad (h \in H) \quad (5)$$

5. Limitations on the production and the need to feed stock for the planned number of animals:

$$\sum_{j\in J_k} d_{ikj} x_{jk} > \sum_{j\in J_h} b_{ihj} x_{hj} \quad (h \in H) \quad (6)$$

6. Limitations on the balance of crops and the use of crops for each individual eco-technology group arable soils (as crop rotation requirements):

$$\sum_{j\in J_k} x_{jk} \begin{pmatrix} \leq \\ = \\ \geq \end{pmatrix} \alpha_{ki} B_i \quad (k \in K) \quad (7)$$

7. Limitations on the balance of humus in each eco-technology group arable soils:

$$\sum_{j\in J_k} \beta^H_{jki} x_{jk} - \sum_{j\in J_k} \beta^B_{jki} x_{jk} \geq 0 \quad (i \in I) \quad (8)$$

8. Limitation on compliance with the requirements of acceptable soil washout and erosion resistance providing background on each eco-technology group arable land:

$$\frac{1}{B^{TГ}_i} \sum_{j\in J_k} \gamma_{jki} x_{jk} = B^{ke}_i \quad (i \in I) \quad (9)$$

9. Limitation to determine the volumes of run-off of soil by erosion

$$\sum_{j\in J_k} f_{jki} x_{jk} = B^{3Г}_i \quad (10)$$

10. Limitations to determine the volume of gross crop production in the range:production in the range:

$$\sum_{j\in J_k} a_{jki}^{b} x_{jk} = B_i^{b} \quad (i \in I) \qquad (11)$$

11. Limitations to determine the value of gross output of crop enterprises:

$$\sum_{j\in J_k} c_{jki}^{b} x_{jk} = B_i^{bB} \quad (i \in I) \qquad (12)$$

12. Limitations to determine the value of commodity production company:

$$\sum_{j\in J_k} c_{jki}^{t} x_{jk} + \sum_{j\in J_k} c_{jhi}^{i} x_{jh} = B_i^{TП} \quad (i \in I, h \in H) \qquad (13)$$

13. Restrictions on the definition of direct production costs of agricultural production:

$$\sum_{j\in J_k} q_{jki}^{p} x_{jk} + \sum_{j\in J_k} q_{jhi}^{Tb} x_{jh} = B_i^{П3} \quad (i \in I, h \in H) \qquad (14)$$

14. Restrictions on distribution of profits of the company (10%) to improve each eco-technology of soil tillage:

$$\sum_{j\in J_k} 0.1 r_{jk}^{p} x_{jk} = B_k^{pF_{\max}} \qquad (15)$$

15. Limitation inseparable variables:

$$x_{jk} \geq 0, \quad x_{jh} \geq 0 \qquad (16)$$

Economic and mathematical problem model allows finding the ways to create ecological correspondence between crop growing and demands to ecological and technological plough-land management within an agricultural entity. The approach suggested for justification of project solutions to agricultural entity's territory organization and the shift of crops gives the opportunity to evaluate them integrally, relating to economic and ecological factors of an agricultural enterprise activities and their effectiveness.

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