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Optimization of Norm of Bringing of Technological Material Taking into Account the Agrobiological State of Agricultural Lands

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Summary. The technique method of calculation of optimum norm of bringing of technological material taking into account the agrobiological state of agricultural lands.

One promising direction using indirect information about the state of the soil with a reliable calculation algorithm such information is objectively necessary data are indicators of soil electrical conductivity and magnetic properties. The modern alternative to traditional agrochemical examination - contact and non-contact methods based on electromagnetic phenomena. Often this measurement, registration, processing, analysis and interpretation of conductive and electromagnetic properties of the soil, which makes it possible to determine the particle size (mechanical) composition of the soil, soil organic matter, salts, humidity, soil contours highlight and assess the heterogeneity of soil properties as a whole.

This is possible by obtaining reliable data on the state of the soil environment by reducing errors in determining the value of conductive properties of the soil and reduce the intensity of the destruction of soil structure and stability of electrical contact with the ground electrode, the use of integrating analog-to-digital converters local technical system monitoring conductive properties of the soil environment.

Key words: optimum norm of bringing, technological process, technical systems of the operative monitoring, agricultural production, agrobiological state monitoring of the state of agricultural lands.

INTRODUCTION

For today the question of providing of the proper efficiency of production of agricultural cultures is actual. Strategy of quality management of implementation of technological operation includes technology of variable norms of bringing of technological material, but this only one of numeral elements.

The optimum decision of productions questions lies it is inplane contingently by the technical resources of agrobiological by potential of the agricultural fields. The presence of technical resources enables potential to provide the proper internalss of implementation of technological operations in the plant-grower. Information about the agrobiological state of agricultural lands enable to define strategy of common management by their agrobiological state.

At that rate there will be optimum combination of the use of technical resource for the optimum management and use of the agrobiological state of the ground environment. In addition possibly also to make decision recognition information about the forecast cost of agricultural cultures, expedience of growing of that or other agricultural culture on the fields select to the area.

Subject to the condition these in the conditions of the limited resources it is necessary to carry out the automated technological processes control in agriculture taking into account the agrobiological and technical state of agricultural lands.

Under these conditions, in the conditions of limited resources needed to implement automated process control in agriculture with regard agrobiological and maintenance of agricultural land.

THE ANALYSIS OF RECENT RESEARCHES AND PUBLICATIONS

The aspects of optimum management by the use of resources, varied aspects of management by certainly-measurable linear objects, varied tasks of theory of traffic control, are in-process [1-17] explored, automatic control by the linear (nonlinear) systems. However much the management by the norm of bringing of technological material from the account of the agrobiological state of agricultural lands requires the subsequent comprehensive study.

- stationary electromagnetic fields in dispersive and conducting environments (such as AS) can be formed under the influence of short-wave impulses on these environments. Nowadays the effects of shock excitation and the propagation of such waves attract researchers of the AS electrical conductivity by means of non-stationary electrodynamics. This attention is due to a number of reasons:

1. Recent successes in generating video impulses using broadband radars have stimulated interest in the prospects of using video impulses for the transmission of energy and information through solid media [1]. The structure of such impulses is significantly different from the traditionally studied models with rectangular or Gaussian curvature:

a) the envelope of the video impulse consists of only one or several oscillations, the forms of which are usually far from sinusoidal,

b) the front and rear fronts are asymmetrical,

c) the distances between the points of the zero intersection are uneven.

2. Dispersion and diffraction of finite-duration video impulses on finite-size targets lead to a number of new

effects. In contrast to the usual representations of the stationary dispersion indicatrices and diffraction patterns characteristic of long stretched strings of sinusoidal waves, the field of the dispersive video impulse changes rapidly over time. Classical formulas for dispersion monochromatic waves on a cylinder or diffraction on a slit and circular aperture are only partial instances of expressions describing the non-stationary interaction of short video impulses with such objects [2].

3. Traditional solutions of the Maxwell equations in continuous media are connected with the representation of solutions in the form of product of functions dependent, either on coordinates or on time (i.e., separate solutions), at the same time, the time dependence is usually investigated using the Fourier transformation. For many years, such an approach shaped the language of describing quasi-monochromatic waves in optics, acoustics and radio physics, however, attempts to apply this same approach in the dynamics of the interaction of short video impulses with dispersive media and, in particular, conductors of (AS) encountered unexpected difficulties, both conceptual and computational:

a) due to Fourier transformation of the enveloping signal of finite duration averaged over an infinite interval of time (from $-\infty$ to $+\infty$). The areas of rapid change of envelope are hidden at this time, however, these areas are important for signal registration in the information machines for (AS). On the other hand, to restore the time bending localized signal with the help of a careful Fourier transformation, the fields of harmonics outside the localization area should be excluded, however, to clarify the region of localization should take into account the increasing density of harmonic components,

b) the deformation of the impulse in the dispersive medium is described, as it is known, in the frequency region by the method of decomposition of the phase in a series of degrees of the ratio of the spectral width of the impulse $\Delta\omega$ to the carrier frequency ω [2] However, for short impulses of a broad band consisting of one or more field fluctuations, the ratio $\Delta\omega/\omega$ is not a small parameter, with the amount of spectral components needed to synthesize the field of the impulse in the depth of the environment, it becomes quite large. This situation gives rise to a number of computational difficulties [3],

c) in the expansion of the phase of the wave due to degrees of ratio $\Delta\omega/\omega$, all components have a refractive index in the denominator $n(\omega)$. If in the impulse spectrum there is a cutoff frequency of a dispersive transparent medium ω_0, then $n(\omega_0) = 0$, and the row which represents the phase layout, becomes discrepancy.

It should be emphasized that these difficulties are not related to the Maxwell equations, but with the traditional method of their solution by separating the Fourier transforms and transformations. However, the representation of fields using this method is not a consequence of the Maxwell equations, but only one of the ways of their solution, this method is convenient for describing quasi-monochromatic waves with slowly varying amplitude and phase, but is ineffective for the analysis of non-stationary and non-harmonic fields.

You can obtain information about such fields using new Maxwell equations, built directly in the time domain, without using the standard separation of variables and beyond the limits of Fourier-plans. Such inseparable, precise analytical solutions that are not bound by traditional assumptions about the small value and slowness of the time-varying fields form a mathematical basis for the description of fast-changing non-periodic fields and short impulses in dispersing media. This medium is considered to be stationary in the state of rest and not the stationary space-time structure of the propagating field due to significant changes in its bending characteristic time, which is determined by the microscopic processes of determining the field in the environment, in particular, in AS (for example, the time / duration of the bulk charge relaxation in the conductor). Such unsteady electrodynamics of stationary media is the subject of this study.

Clearly, that the design of optimization of norm of bringing of technological material taking into account the agrobiological state of agricultural lands is the actual task of requires the subsequent deep study.

It should be noted that jobs quoted higher performances will be used in this research.

Modern economic conditions of Ukraine dictate the necessity of structural adjustment of production (both industrial and agricultural) and realization of investment programs of enterprises of various industrial orientation (affiliation). The requirements for quality management are increasing, which necessitates the development, generalization and use of modern methods of strategic management and financial and economic analysis of the effectiveness of planned investment measures in the development, reconstruction and modernization of technical and economic systems of agricultural production (TESAP) in practical activity.

The definition and implementation of the TESAP development strategies are among the extremely complex, labor-intensive and difficultly formalized works, which at the present time are not being implemented at the proper level at the domestic agricultural enterprises. Today, these enterprises should be considered as "open" technical and economic systems of agricultural production, the success of which is primarily determined by how well they are attached to their external economic, scientific, technical, socio-political and other environment, taking into account the current state and available internal capabilities. Methodology, procedures and practice of planning and management at various levels of the Ukrainian economy, which largely retained the features of the administrative-command system, does not fully comply with the principles and practical conditions of the newest economic mechanisms and, as a consequence, do not meet modern requirements.

OBJECTIVE

The purpose of this work consists in development of method of calculation of optimum norm of bringing of technological material from the account of the agrobiological state of agricultural lands, developments of approach to the decision of basic problems of theory of management of the systems, dependency upon the parameters of other systems and also task of complete dirigibility of the similar systems during optimization of management.

THE MAIN RESULTS OF THE RESEARCH

Exposition of basic maintenance of research. Introduction of new technologies entails by additional economic expenses. That is why a primary concern at introduction of these technologies is the necessity of research of economic efficiency of such step.

Only giving an answer to these questions, it will be possible to define – whether technologies of variable norms will be covered a cost at their application. As an example, the analysis of the field area can in general rotin about its useless for agriculture. On such conditions technology of the use of variable norms will be the empty spending of facilities. Exactly for the receipt of such right answer economic advantageous and, a producer must use certain instruments and methods.

For providing of realization of strategy of variable norms of bringing of technological material it is needed that to the state of the ground environment made not less than 20% from the optimum value. Such enables to see effects from realization of such technologies and to collect an effect from introduction of these technologies on the agricultural fields.

To that end it is necessary to develop the complex automated checking system of internalss of implementation of technological process taking into account technical resource and the agrobiological state of agricultural lands. It enables quickly to estimate different combinations of the use of technical resources and agrobiological state of agricultural lands and to optimize the parameters of management by such system.

Such planning will enable to check up expedience of implementation of certain technological operation and to expect the amount of executable technological operations (for example amount of technological operations for a signup).

All these information will be used for the calculation of economic efficiency of implementation of technological operations and in eventual case of construction of areas of management of agricultural lands.

The agrobiological inspection of agricultural lands is the important constituent of this system. As agrobiological to the state of the ground environment is an effective government base by the agrobiological state of the ground environment and decision-making for his management.

The domain by these technologies enables to make effective decisions for the management by the agrobiological state of the ground environment.

Modern agricultural production requires optimizations of norm of the use of technological material in modern technologies of plant-grower from the account of the agrobiological state of agricultural lands.

Such given the agrobiological state of agricultural lands there is information about maintenance of nutritives of got a laboratory method or sensory method by determination of conductivity or with the use of the systems of technical sight (in the or infra-red spectrum of fellow creature).

It is known that the computer-integrated automatic control systems by implementation of technological processes in agricultural production are most perspective. Exactly they must provide creation high-quality new technologies (innovative technologies) which have the newest economic, social and ecological indicators.

Clearly, that for generalization of results of previous researches which touch determination of level of influencing of the varied factors on efficiency of plant-grower, it follows to define the basic technological (norm of bringing, depth of till and other), technical (rate of movement, loading of engine and others like that) and organizational (terms of implementation, load) criteria of high-quality work of agricultural machines, ponderability of influencing of these factors on the size of the collected harvest (end-point), and also probability (possible) level of efficiency of application of the proper hardwares of mechanization with the guided influence on the internalss of implementation of technological operations.

That is why it is necessary more in detail to consider the method of calculation of optimization of norm of bringing of technological material taking into account the agrobiological state of agricultural lands.

For the issue of certain type of agricultural product of kind A on the certain agricultural field n it is necessary to take into account the agrobiological state of agricultural lands, in particular maintenance of nutritives in soil. Taking into account maintenance of certain type of nutritives at soils of nourishing $c_1\ c_2\ c_3\ c_4\ .,c_j$ in soil, we get the amount of products a cost b_0 which annually can produce in the limited amount, taking into account maintenance of nutritives in soil from this area.

Base productivity of agricultural cultures b_0 which can be got from the agricultural field recognition maintenance of certain type of nutritives at soils of nourishing $c_1\ c_2\ c_3\ c_4\ .,c_j$.

For the receipt of the planned productivity $b_1\ b_2\ b_3\ b_4\ .,\ b_i$ it is necessary to to bring in the certain norms of nutritives accordingly $a_{11}\ a_{12}\ a_{13}\ a_{14}.,\ a_{1j},\ a_{21}\ a_{22}\ a_{23}\ a_{24}.,a_{2j},\ a_{31}\ a_{32}\ a_{33}\ a_{34}.,a_{3j},\ a_{41}\ a_{42}\ a_{43}\ a_{44}.,a_{4j}\ .,\ a_{i1}\ a_{i2}\ a_{i3}\ a_{i4}.,\ a_{ij}$ for the certain type of the got productivity $A_c\ A_1\ A_2\ A_3\ A_4\ .,\ A_i$ accordingly, an income makes from realization of which $Y_1\ Y_2\ Y_3\ Y_4\ .,Y_i$.

It is the classic task of the linear programming:

$$\text{Profit} = \text{Revenues} - \text{Costs}$$

$$\text{Costs} \downarrow \rightarrow \text{Profit} \uparrow$$

$$\begin{cases} Z = b_0 - (c_1 \cdot X_1 + c_2 \cdot X_2 + c_3 \cdot X_3 + c_4 \cdot X_4 + ... + c_n \cdot X_j) \to \max; \\ b_1 - (a_{11} \cdot X_1 + a_{12} \cdot X_2 + a_{13} \cdot X_3 + a_{14} \cdot X_4 + ... + a_{1j} \cdot X_j) = Y_1; \\ b_2 - (a_{21} \cdot X_1 + a_{22} \cdot X_2 + a_{23} \cdot X_3 + a_{24} \cdot X_4 + ... + a_{2j} \cdot X_j) = Y_2; \\ b_3 - (a_{31} \cdot X_1 + a_{32} \cdot X_2 + a_{33} \cdot X_3 + a_{34} \cdot X_4 + ... + a_{3j} \cdot X_j) = Y_3; \\ b_4 - (a_{41} \cdot X_1 + a_{42} \cdot X_2 + a_{43} \cdot X_3 + a_{44} \cdot X_4 + ... + a_{4j} \cdot X_j) = Y_4; \\ \ldots \\ b_i - (a_{i1} \cdot X_1 + a_{i2} \cdot X_2 + a_{i3} \cdot X_3 + a_{i4} \cdot X_{i4} + ... + a_{ij} \cdot X_j) = Y_i. \end{cases} \quad (1)$$

$$X_1 \geq 0,\ X_2 \geq 0,\ X_3 \geq 0,\ X_4 \geq 0..\ X_j \geq 0 \quad (2)$$

Income from realization of products:

$$Z = b_0 + c_1 \cdot X_1 + c_2 \cdot X_2 + c_3 \cdot X_3 + c_4 \cdot X_4 + ... + c_n \cdot X_j \to \max \quad (3)$$

For the receipt of the planned productivity b_1 b_2 b_3 b_4 ., b_i taking into account obtained operative state information agrobiological agricultural lands by a cost k_0 k_1 k_2 k_3 k_4 ., k_i it is necessary to bring in the certain norms of nutritives accordingly a_{11} a_{12} a_{13} a_{14} ., a_{1j}, a_{21} a_{22} a_{23} a_{24} ., a_{2j}, a_{31} a_{32} a_{33} a_{34} ., a_{3j}, a_{41} a_{42} a_{43} a_{44} ., a_{4j} ,., a_{i1} a_{i2} a_{i3} a_{i4} ., a_{ij} for certain productivity A_c A_1 A_2 A_3 A_4 ., A_i accordingly on the basis of information about the agrobiological state of the ground environment, an income makes from realization of which Y_1^k Y_2^k Y_3^k Y_4^k ., Y_i^k .

Let the cost of information (annual) about possible interfere nutritives in soil makes k_1 k_2 k_3 k_4 ., k_i that gives to get possibility additional productivity which influences on eventual productivity b_1 b_2 b_3 b_4 ., b_i but accordingly on an income Y_1^k Y_2^k Y_3^k Y_4^k ., Y_i^k .

Then a table will be similar:

$$\begin{cases} Z^k = b_0 - k_0 - (c_1 \cdot X_1 + c_2 \cdot X_2 + c_3 \cdot X_3 + c_4 \cdot X_4 + ... + c_n \cdot X_i) \to \max \\ b_1 - k_1 - (a_{11} \cdot X_1 + a_{12} \cdot X_2 + a_{13} \cdot X_3 + a_{14} \cdot X_4 + ... + a_{1j} \cdot X_i) = Y_1^k; \\ b_2 - k_2 - (a_{21} \cdot X_1 + a_{22} \cdot X_2 + a_{23} \cdot X_3 + a_{24} \cdot X_4 + ... + a_{2j} \cdot X_i) = Y_2^k; \\ b_3 - k_3 - (a_{31} \cdot X_1 + a_{32} \cdot X_2 + a_{33} \cdot X_3 + a_{34} \cdot X_4 + ... + a_{3j} \cdot X_i) = Y_3^k; \\ b_4 - k_4 - (a_{41} \cdot X_1 + a_{42} \cdot X_2 + a_{43} \cdot X_3 + a_{44} \cdot X_4 + ... + a_{4j} \cdot X_i) = Y_4^k; \\ \ldots \\ b_j - k_j - (a_{i1} \cdot X_1 + a_{i2} \cdot X_2 + a_{i3} \cdot X_3 + a_{i4} \cdot X_{i4} + ... + a_{ij} \cdot X_i) = Y_j^k. \end{cases} \quad (4)$$

$$X_1 \geq 0,\ X_2 \geq 0,\ X_3 \geq 0,\ X_4 \geq 0..\ X_j \geq 0 \quad (5)$$

Table 1. Table of optimization of norm of bringing of technological material taking into account the agrobiological state of agricultural lands

Feedstock	Profit from sales, dollar/hectare	The cost of the resulting product, dollar/hectare	Costs nutrients, кg/hectare					
			X_1	X_2	X_3	X_4	.	X_j
A_c	Z	b_0	c_1	c_2	c_3	c_4	.	c_j
A_1	Y_1	b_1	a_{11}	a_{12}	a_{13}	a_{14}	.	a_{1j}
A_2	Y_2	b_2	a_{21}	a_{22}	a_{23}	a_{24}	.	a_{2j}
A_3	Y_3	b_3	a_{31}	a_{32}	a_{33}	a_{34}	.	a_{3j}
A_4	Y_4	b_4	a_{41}	a_{42}	a_{43}	a_{44}	.	a_{4j}
...	.	..	.	.	.	.	.	.
A_i	Y_i	b_i	a_{i1}	a_{i2}	a_{i3}	a_{i4}	.	a_{ij}

Table 2.

Feedstock	Profit from sales, dollar/hectare	The cost of the resulting product, dollar/hectare	The cost information on nutrient dollar/hectare	The cost of wasted nutrients, dollar/hectare					
				X_1	X_2	X_3	X_4	.	X_j
A_c	Z^k	b_0	k_0	c_1	c_2	c_3	c_4	.	c_j
A_1	Y_1^k	b_1	k_1	a_{11}	a_{12}	a_{13}	a_{14}	.	a_{1j}
A_2	Y_2^k	b_2	k_2	a_{21}	a_{22}	a_{23}	a_{24}	.	a_{2j}
A_3	Y_3^k	b_3	k_3	a_{31}	a_{32}	a_{33}	a_{34}	.	a_{3j}
A_4	Y_4^k	b_4	k_4	a_{41}	a_{42}	a_{43}	a_{44}	.	a_{4j}
...	.	..	..	.	.	.	.	.	.
A_i	Y_i^k	b_i	k_i	a_{i1}	a_{i2}	a_{i3}	a_{i4}	.	a_{ij}

Cost of the got products:

$$b_n = S_n \cdot U_n ,$$

where: S_n – cost of one of agricultural product of kind, dollar/hectare,

U_n – productivity of agricultural product dollar/hectare.

Income from realization of products (dollar/hectare):

$$Z^k = b_0 + k_0 + c_1 \cdot X_1 + c_2 \cdot X_2 + c_3 \cdot X_3 + \\ + c_4 \cdot X_4 + ... + c_n \cdot X_i \to \max \quad (6)$$

To specify on how many anymore we will get an income in compared to the task, when no information is.

$$\Delta Z = Z^k - Z . \quad (7)$$

It is necessary for comparison of expedient norm of till of agricultural lands:

$$\Delta Z \geq Y_i . \quad (8)$$

Information which satisfy this requirement it is expedient to use from the point of view the conduct of agricultural production.

The main quantitative characteristics of the target segment are the volume of market demand and the capacity of the market itself. The volume of market demand $R(t)$ (expressed in real or value terms) determines the potential volume of purchase of (agricultural) products, localized in time and space terms. Capacity of the market $Q(t)$ characterizes the maximum possible demand. Thus, at any given time, the volume of market demand constitutes a part (share) of market capacity. The difference between them $\Delta_{QR}(t)$ characterizes the potential perspective of the investigated market (see Fig. 2).

The volume of demand and the capacity of the market (goods/services) are dynamic functions, depending on many factors: market structures, competition from other enterprises, price elasticity of demand, rates of consumption change, distribution channels, etc.

In world practice there is a wide range of methods for forecasting the market, most of which use a rather complicated mathematical apparatus and require the availability of a large amount of diverse information, the collection and processing of which is not always possible [3, 4]. In practice, simplified methods are usually used:

1) simple extrapolation method (determination of stands and their parameters),

2) method of consumption level (the level of direct consumption of a particular product of agricultural production is determined),

3) the method of end (consumption) use (all possible variants of the use of products are determined, the coefficient of its use in the consuming industries is calculated, the level of production in these industries is forecasted, the consumption forecast is made), etc.

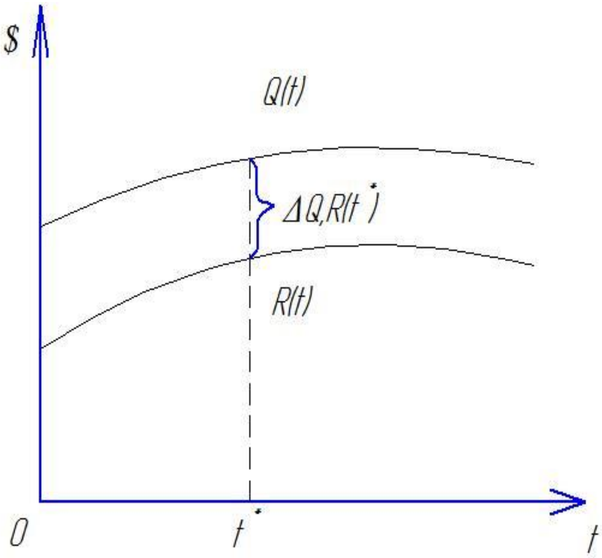

Fig. 1. Potential perspective of the investigated market of sales (agricultural products)

The most widespread methods are based on the principles of regression-correlation analysis. Correlation analysis is used to find the level of interdependence between different sizes and characteristics of the market.

The method of regression analysis is used to find the average of some variable that characterizes the market under study, depending on the value of the second variable by comparing and solving the level of regression.

If the value of the desired variable is dependent on the values of several parameters, then the multi-factor regression equation is formed.

An important stage in market research (Fig. 1) is an analysis of the conditions of competition in the selected market segment and their impact on the magnitude of the potential market niche, which is considered by TESAP in its development.

At this stage, expert methods of qualitative analysis of the situation play an important role, but some formalized means of decision support are also used.

Thus, for example, the possible share (fraction) of specific products (services) of agricultural production of TESAP in the market (specific weight in percentage of total demand or market capacity) at the moment is determined taking into account the competitiveness of products, comparison of the enterprise with the competing, the ratio of supply and demand, and other factors.

Approximately this share can be determined by the formula:

$$\delta^t = \frac{100\%}{\left(\frac{\sum_{j=1}^{J} a_j^t}{\alpha^t} + 1\right) \cdot \frac{m^t}{k^t}},$$

$$m^t = \frac{n^t}{c^t}, \quad (8)$$

where: δ^t – the share of specific products of agricultural production in the market,

J – number of competitors, $\alpha_j \in [0,1]$ - competitiveness index of the enterprise j,

$\alpha \in [0,1]$ – indicator of competitiveness of the investigated enterprise,

n^t, c^t – supply and demand for agricultural products (services) sold, respectively,

$k^t \in [0,1]$ – relative competitiveness of products (services), which is produced, all at the time t.

In determining the potential sales volume of the products being produced by the TESAP under investigation, the methods of game theory (game models of Cournot, Stackkelberg, Forchheimer et al. [2]) are widely used in the selected market segments under the conditions of competition.

Let's consider the basic idea of these methods on the example of the simplest model of Cournot in the conditions of a duopoly (on the investigated segment of the market two firms compete).

Each firm determines its level of sales (production) q_1 and q_2, respectively

Market price – the linear function of the sectoral volume of production:

$$P(Q) = a - b \cdot Q, \quad (9)$$

where: $Q = q_1 + q_2$.

The profit Π_1 of the firm 1 is the difference between total income $P(Q) \cdot q_1$ and total expenses equal to the product of constant average costs "C" on the volume of production q_1:

$$\Pi_1 = (a - b \cdot Q) \cdot q_1 - c \cdot q_1. \quad (10)$$

Since the price also depends on the volume of output by firm 2, as well as on its own production, firm 1 can not determine the level of sales (production) that maximizes profits without the assumption of how the firm 2 will react. The Cournot model is based on the assumption , that each firm proceeds from a constant volume of release by another firm. In this case, the firm 1 maximizes its profit, differentiating Π_1 to q_1 and equating the obtained expression to zero (the condition for the existence of the maximum function of profit of the first order):

$$\frac{d\Pi_1}{dq_1} = P(Q) + \left(\frac{dP}{dQ}\right) \cdot q_1 - c = a - 2 \cdot b \cdot q_1 - \quad (11)$$
$$- b \cdot q_2 - c = 0.$$

Converting this equation, you can get a function that indicates the maximizing profit level of sales (production) of firm 1 with the object of sales (production) of firm 2:

$$q_1 = \frac{(a - c)}{2 \cdot b} - \frac{1}{2} \cdot q_2. \quad (12)$$

This equation is a function of the reaction or the reaction curve, because it registers maximizing the profit of the firm 1 and response to the decisions of the firm 2 (see Fig. 1).

Firm 2 solves the exact same problem and has its own reaction function:

$$q_2 = \frac{(a - c)}{2 \cdot b} - \frac{1}{2} \cdot q_1. \quad (13)$$

The solution that corresponds to the equilibrium (Fig. 1), that is, the solution to the problem of maximizing the profit of each firm, which does not leave any of them an incentive to change the volume of sales (production) of agricultural production, lies at the intersection of two reaction curves. It was found by the substitution of the expression for the function of the reaction of firm 1 and is solved in the following way:

$$q_1 = \frac{(a - c)}{3 \cdot b}. \quad (14)$$

Similar considerations apply when determining the volume of sales (production) of agricultural production and in more generalized models that reflect a more complex market structure (oligopoly, dominant firm, etc.).

CONCLUSIONS

1. Due to the use of such technologies it is possible to decrease the common amount of fertilizers 25% not reducing general efficiency of their use here is their optimization. Thus possible increase of productivity to 20%.

2. Clearly, that on the fields with high maintenance of nutritives their influence on eventual productivity and accordingly and general efficiency it will be minimum.

3. Subject to the condition these the increase of exactness of leadthrough of the fields works is carried out with the use of software which constantly is perfected.

REFERENCES

1. **Sendreev J. N. 1976.** Management / J. N. Sendreev. Moscow. Nauka. 424. (in Russian)
2. **Krasovskyy N. N. 1968.** Motion Control Theory / N. N. Krasovskyy. Moscow. Nauka, 474. (in Russian)
3. **Roytenberh Y. A. 1978.** Automatic Management / Y. A. Roytenbarh. Moscow. Nauka, 551. (in Russian)
4. **Egorov A. I. 1988.** Management systems / A. I. Egorov. Kiev. High School. 276. (in Russian)
5. **Pontryagin L. S. 1961.** Mathematic theory processes / L. S. Pontryagin, V. G. Boltyanskyy, E. F. Mishchenko. Moscow. Nauka, 391. (in Russian)
6. **Vladimir Donets. 2014.** Spectral-field studies satellite validation remote vegetation / Vladimir Donets, Svetlana Kochubey, Vitaly Yatsenko, Alexander Brovarets Taras Kazantsev, Vadim Brovchenko // Teka. Vol. 16, No 3. 195-201.
7. **Brovarets A. A. 2013.** Monitoring devices for field parameters at AIC / Alexander Brovarets // Teka. № 11 (50). 131-141.
8. **Brovarets A. A. 2011.** Analysis of the disturbing irregularities ahrofoniv / A. A. Brovarets // Motrol. №13B. 161-166.
9. **Robson M. A. 1996.** Practical guide to business process re-engineering / M. Robson, P. Ullah. London. Gower Publishing Std, 96.
10. 10. **Scherer F. M**. **1990.** Industrial market structure and economic performance / F. M. Scherer, D. Ross. Boston, USA: Hongliton Mifflin Co. 90.
11. **Erlich A**. **1996.** Technical analysis of commodity and financial markets / A. Erlich. Moscow: INFRA. 196.
12. **MacConnel L. 1993**. Ekonopis: Principles, problems and politics / L. MacConnel, S. Brew. Moscow. Manager, 103.
13. **Karibskiy A. V. 1989.** Modeling the development of the structure of large-scale production and transport systems. I, II / A. V. Karibsky, A. D. Tsvirkun, Yu. R. Shishorin // Automatics and telemechanics. №2. 116-131, №4. 139-154. (in Russian)
14. **Karibskiy A. V. 1996.** Business plan: financial and economic analysis and performance criteria. (methods of analysis and evaluation) / A. V. Karibsky, Yu. R. Shishorin // Preprint. Moscow: Institute for Control Sciences, 19. (in Russian)
15. **Karibskiy A. V. 1991.** Managing the development of large-scale system / A. Karibsky // Mathematics and Computers in Simulation. 287-293.
16. **Shestakov N. V. 1991.** Use of computer modeling methods in the investment planning of petrochemical industries / N. Shestakov // Abstracts of the International Scientific and Practical Conference "Management of large systems." M.I.PU. 391.
17. **Karibskiy A. V. 1998.** Information technologies and features of financial and economic analysis of large investment projects in the oil industry / A. V. Karibskiy // World of Communication. № 7-8. 72-77.
18. **Bakhrakh L. D., Bliskavitsky A. A. 1993.** The successes of physical sciences. V. 162, No. 2. 160.
19. **Landau L. D. 1982.** Electrodynamics of continuous media / L. D. Landau, E. M. Lifits. Moscow. Nauka. 624.
20. **Brovarets O. O. 2011.** Analysis of the structure of perturbing roughnesses of agrofones / Brovarets O. O. // Motrol. No. 13B. 161-166.

ОПТИМИЗАЦИЯ НОРМ ВНЕСЕНИЯ ТЕХНОЛОГИЧЕСКИХ МАТЕРИАЛОВ С УЧЕТОМ АГРОБИОЛОГИЧЕСКОГО СОСТОЯНИЯ ЗЕМЕЛЬ СЕЛЬСКОХОЗЯЙСТВЕННОГО НАЗНАЧЕНИЯ

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Аннотация. Определена методика расчета оптимальной нормы внесения технологических материалов с учетом состояния агробиологические сельскохозяйственных земель.

Одним из перспективных направлений, используя косвенную информацию о состоянии почвы с надежным алгоритм расчета такой информации это объективно необходимые данные показатели почвы, электропроводность и магнитные свойства. Современная альтернатива традиционной агрохимическое обследование – контактные и бесконтактные методы, основанные на использовании электромагнитных явлений. Часто это измерение, Регистрация, обработка, анализ и интерпретация кондуктивных и электромагнитных свойств грунта, что позволяет определить гранулометрический (механический) состав почвы, органическое вещество почвы, соли, влажности, почвенных контуров, выявления и оценки неоднородности свойств почв в целом.

Это возможно путем получения достоверных данных о состоянии почвенной среды путем уменьшения ошибки при определении стоимости проводящих свойств почвы и снижению интенсивности разрушения почвенной структуры и стабильности электрического контакта с электродом заземления, использование интегрирующих аналого-цифровых преобразователей локальной технической системы мониторинга электропроводящие свойства почвенной среды.

Ключевые слова: оптимальные нормы внесения, технологический процесс, техническая система, оперативный мониторинг, сельскохозяйственное производство, агробиологическое состояние земель сельскохозяйственного назначения.