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PECULIARITIES OF PROJECTS MANAGEMENT BY ADAPTIVE TECHNOLOGICAL SYSTEMS OF TILLAGE AND SOWING

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Summary. The initial condition of the adaptation of fertilizer application, secondary soil-tillage and sowing (FSTS) are defined as to the changing conditions of the project environment. The main tasks as to working out the methods and models of project management by adaptive technological systems are identified.

To construct of the FSTS adaptive technological systems in AE it is necessary to have got following elements with ability of decision of the proper task: 1) informative-analytical systems for the quantitative estimation of projects efficiency and their risk; 2) skilled personnel for monitoring of the work object state, conditions of project environment and forming of the computer experiments data base; 3) administrative constituent with the proper equipment – this personnel will use the informative-analytical systems, monitoring information and will evaluate the efficiency of works content and time of the projects; 4) the machinery complex; 5) necessary volume of labour, financial, informative resources and others like that.

Majority of the noted tasks are solved at the organizational level. However to create the informative-analytical systems it is necessary to develop the quantity of methods and simulation models which enable to take into account changeability of project environment conditions and adequately to represent this conditions influence on performance of the proper works. The computers experiments will enable to get the system of functional indexes, determine of their risks and evaluate of the efficiency of cost of the proper machinery and also ground of the parameters of machines adaptive complex in these projects.

Key words: projects, tillage, sowing, technique, conditions, changeability, adaptation, efficiency.

INTRODUCTION

The high harvests of agricultural cultures are the initial condition of projects efficiency of the mechanized growing of agricultural cultures with minimum cost to implement the quantity of agronomic necessary works. Achievement of this purpose during of each certain year of projects realization is complicated by condition changeability of project environment – meteorological conditions, price changes, supply and demand of agricultural production market etc. As a result of this argumentation the agricultural enterprises (AE) have tasks to carry out the permanent monitoring and prognosis of project environment conditions and changes, and also "adapt" to them the quantity of following works: fertilizer application, soil-tillage and sowing (FSTS). The no-till technologies are not considered here through other peculiarities of works and operations.

ANALYSIS OF RESEARCHES AND PUBLICATIONS

Available methods/procedures and models of grounding the parameters of the agricultural enterprises (AE) machinery complexes [7] are based on the norms of requirements in the technique of typical enterprises. The methods enable to set the complex of machines in relation to the agrotechnical fixed rates of doing the proper works in different climatic zones [3]. Application the available procedures for research of indexes of efficiency of the adaptive technological systems [8] does not enable to estimate the machinery complex that functions in changeable conditions. Thus the requirement of different machinery and equipment using is the changeable parameter and form according to current conditions of certain calendar year. The norms of technique requirements also do not enable to take into account efficiency of tactical actions in relation to management by the content and times in the projects of these systems [4]. There fore, during the development and implementation of FSTS projects there is a need to adapt the mechanized works to conditions of the project environment.

THE PURPOSE OF THE RESEARCH

The purpose of the article is to reveal objective features due to the implementation of projects of adaptive technology systems to perform work on fertilization, soil preparation and sowing of crops and also to expose the necessity of systems development as to adaptation to the changeable condition of project environ-

ment. And according to that the main tasks should be described toward to development the methods and models of projects management by these complicated systems.

THE RESULTS OF RESEARCH

The main object of the mechanized technologies of agricultural cultures growing is to ensure the maximal volume of the yield output. Achievement of this purpose depends not only of the state and technical descriptions of machinery park of agricultural enterprise. The biological productivity of agricultural crops depends of the level of plants supplying with the "factors of vital activity" [5], which are predefined by the agricultural and meteorological conditions of single year, the soil condition and nutrients etc. In order the plants maximally use the noted conditions for the growth and development it is necessary to provide timely doing of work operations as to plants growing and in particular the FSTS works.

Results of regression analysis of many years data of multi factorial field experiments allow to get the mathematical models of yield crop due to the factors that determine it - soil moisture, the number of fertilizers rate; depth of plowing. Beside the minimum factors other combined factors or techniques of yield crop increase (plant density, their status etc.) are inserted into equations as well the meteorological parameters (temperature sum or average daily temperature during the growing season) in the case of having of data accumulation during many years.

Input data to build mathematical models are obtained through longstanding multivariate experiment, which studied the normalization factors which not exceeding optimum and change, mostly within the field limiting of response curve.

Under the marked conditions the mathematical model is a polynomial (polynomial) type:

$$Y = b_0 + b_1 x_1 + b_2 x_2 + \ldots + b_n x_n, \qquad (1)$$

where: Y – the yield of the crop variety or hybrid; b_0 – free member of equation; b_1, b_2, b_n – regression coefficients corresponding to the independent variables (yield factors – by land reclamation and agronomic conditions - soil moisture, the number of plants, the depth of tillage, fertilizer rate, the average temperature during the growing season, etc.) accordingly x_1, x_2, x_n.

Thus, based on established patterns of harvest the active steps to implement the program are outlined and developed which is a way of organizing of the agrarian psychogenesis as systems to maximize the plants productivity on the basis of realization of potential opportunities.

Depending of the state of information ensuring and logistical capabilities of the enterprise the different levels of yield may be planned to achieve [5]: potential yield – on the base of the biological capacity of agricultural crop, variety or hybrid, and available photosyn the tically active radiation (PAR); really possible yield – the maximum possible yield under the existing meteorological and soil conditions; yield in a particular enterprise – meet the logistical capabilities of the particular enterprise or economy. The latest one is proposed maximize on the base of the projects of adaptive technology systems.

As a result of application of different FSTS technologies in AE the finite multitude of technological operations is formed and theses operations must be carried out on the fields of AE for growing of the proper yield of cultures. System analysis of the conditions of project environment [6] gives the possibility to assert that the technological and agricultural meteorology reason enables to change the content and time of these works carried out.

Thus, during realization of FSTS projects the necessity of adaptation of the mechanized works to the terms of project environment is raised. In accordance with [1, 2, 9] the adaptive technological system means to adapt of the internal and external conditions to the changes of environment. Thus, it follows to understand under the FSTS adaptive technological system - such constituent of projects of crops growing which enables technologically to adapt to the out of control conditions of project environment and to ensure a timeliness and quality of technological operations. In this case, the maximally favourable soil conditions will be created for productive growth and development of agricultural plant (fig.1.).

Under the conditions of FSTS project environment it results to understand the descriptions of agricultural meteorology conditions of single season of works, soil state, presence the nutrients, plants and their tailings and others like that. A project environment forms requirements to FSTS works, and also as a result of action of agricultural meteorology conditions it predetermines changeability of the naturally settled fund of time to work implementation [6]. Then, to carry out the timely application fertilizers, preparation of soil and sowing of cultures, in the conditions of separate year it is needed in time to get the information about objects of work state, content and volumes of works, agricultural meteorology conditions and fund of time for work implementation. It is also needed to carry out the quantitative evaluation of efficiency indexes as to management by content and times in projects with the adaptive technological complex of machines.

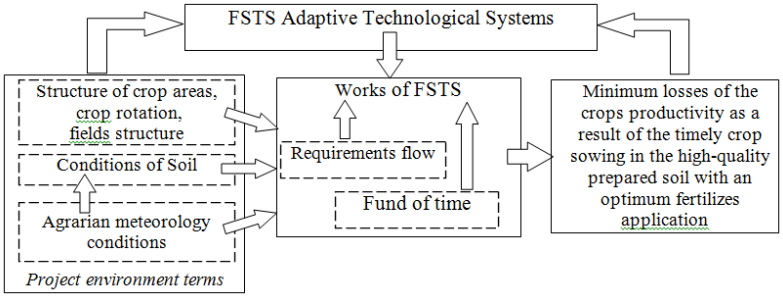

Fig.1. Interaction of projects component of the FSTS adaptive technological systems.

To effectively create the FSTS adaptive technological systems in AE it is necessary to ensure the existence and effective functioning of a number of sub-components (evaluating the effectiveness of projects, monitoring, risk assessment, etc.). The sub-systems allow forming the effective organizational and management system of modern enterprise (Fig. 2).

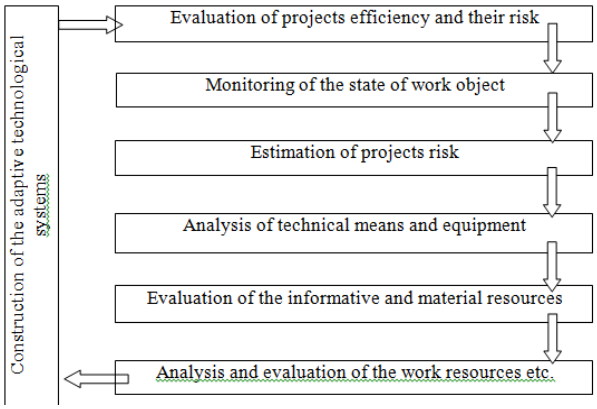

Fig.2. Scheme of construction of the FSTS adaptive technological systems in AE

Consequently, for construction of the FSTS adaptive technological systems in AE it is necessary to have got following elements with ability of decision of the proper task: 1) informative-analytical systems for the quantitative estimation of projects efficiency and their risk; 2) skilled personnel for monitoring of the work object state, conditions of project environment and forming of the computer experiments data base; 3) administrative constituent with the proper equipment – this personnel will use the informative-analytical systems, monitoring information and will evaluate the efficiency of works content and time of the projects; 4) the machinery complex; 5) necessary volume of labour, financial, informative resources and others like that.

Majority of the noted tasks are solved at the organizational level. However to create the informative-analytical systems it is necessary to develop the quantity of methods and simulation models which enable to take into account changeability of project environment conditions and adequately to represent this conditions influence on performance of the proper works. The computers experiments will enable to get the system of functional indexes, determine of their risks and evaluate of the efficiency of cost of the proper machinery and also ground of the parameters of machines adaptive complex in these projects.

The systems analysis of the projects of the FSTS adaptive technological systems enabled to select the amount of procedures and models which must be developed for creation of the afore-mentioned informative-analytical systems (Table 1).

Thus, the development and application of information and analytical systems will enable the agrarian companies to identify the need of technical equipment of the FSTS adaptive technology systems. The system can flexibly "adapt" to the current agrometeorological conditions and to perform the set of specialized works in FSTS mechanized processes. In practice, it will provide the right conditions for productive plant growth and their friendly seedlings, and to perform the necessary scope of work with minimal operating costs.

Table 1. Methods and models for the management by projects of FSTS adaptive technological systems

Methods and models	Descriptions
Monitoring and prognostication of the state of agricultural meteorology conditions and objects of work in the summer-autumn and spring periods	Database monitoring, statistical simulation model
Taking of current decisions as to relation of the content and time of works in accordance with the conditions of project environment	Simulation model
A reflection of peculiarities of FSTS works under act of stochastic conditions of project environment	Statistical simulation model
Quantitative evaluation of functional indexes of efficiency and risk of FSTS works in the projects of the adaptive technological systems	Statistical simulation model
A concordance of content and time of works with the changeable conditions of project environment	Statistical simulation model, data base of the computer simulation results
A concordance of adaptive machinery complex for FSTS operation with the parameters of the AE production program and changeable conditions of project environment	Statistical simulation model, data base of the computer simulation results

CONCLUSIONS

The peculiarities of FSTS projects are the changeability of project environment which predetermines a necessity to adapt content and time of works to the seasonal conditions of their realization. To manage by these projects it is necessary to develop the informative-analytical systems which would enable to carry out the adequate reflection the influencing of external conditions on FSTS works and to get the proper indexes of efficiency. The cost evaluation of these indexes enables to ground the parameters of AE adaptive machinery complex. On the base of parameters of AE adaptive machinery complex it is possible also to estimate the efficiency of manage actions in relation to FSTS works adaptation to the conditions of project environment.

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