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GENESIS AND PERSPECTIVES OF PHYTOSANITARY MONITORING IN THE SYSTEM OF TRANSFER OF COMPLETE PRODUCTION TECHNOLOGIES

The purpose. To determine regularities in becoming of phytosanitary monitoring in plant growing and to analyze its efficiency in the system of transfer of complete production technologies. **Methods.** Monitoring, systems analysis and generalization of absolute and relative parameters, forecasting, graphical modelling. **Results**. In modelling transfer of complete production technology it is necessary to be oriented on the following: implementation of genetic potential of productivity (IGPP); level of the standardized source of raw materials; integration in processing; directions of organic production and power efficiency. The step-by-step logistical circuit scheme of updating directions of innovative-and-transfer process for selection of algorithm of effective phytosanitary monitoring as an element of complete production technology is generated. **Conclusions.** Acknowledgement is gained of urgency and efficiency of methodological approach to formation of complete production technologies by modular principle at the level of phytosanitory monitoring. It is noted that phytosanitory monitoring can be used as basic structural element at formation of complete production technologies by modular principle.

Key words: phytosanitory monitoring, stages of genesis, complete production technologies, transfer.

The global practical experience proves that modern innovative technologies make a stable agrarian production quite real [1-3]. Instead, fulfillment of the genetic potential of productivity (FGPP) only reaches 70-75% in advanced farms in Ukraine [4]. In this regard, implementation of top-to-bottom technologies is strategically important for Ukraine. The organization and design of phytosanitary monitoring as a process and a system deal with multifactor groups and must strictly adhere to the interconnection principles both endogenously between constituents and exogenously, taking into account grouping with other areas of top-to-bottom technologies [5,6]. Assessing the current situation in plant production, analysis of the phytosanitary monitoring development and its prospects in the view of implementation of top-to-bottom technologies is of vital importance [7, 8].

Objective. To establish patterns of the phytosanitary monitoring development in plant production and to analyze its efficiency in the transfer system of top-to-bottom technologies.

Methods. The research was conducted in compliance with the tasks of the thematic plan of the Plant Production Institute named after VYa Yuriev NAAS in 2011-2017. The study subject was periods and vectors of the domestic phytosanitary monitoring development in the transfer system of top-to-bottom technologies. The research results were analyzed by periodization of stages, prospects, type of data and sphere of application. Designing working models, we proceeded from the current status and prospects, structural and hierarchical construction of systems, formalization and a systematic approach on the basis of cross-cutting coordination. The analysis used absolute and relative indices, forecasting, tabular and graphical methods for result presentation.

Results and Discussion. Taking into account the previously selected modularity of triplets, for example, "pathogen – host - environment", we formalized such factors as plant, disease and environment as model objects. The “plant” factor (the level of natural cenoses), in its turn, was divided into agricultural crops and weeds (the level of anthropogenic agrophytocenoses) [9, 10]. Here, on the one hand, universal physiological assessing approaches and parameters were considered as the most promising ones, because they are directly or indirectly related to photosynthesis. On the other hand, assessment by the type of raw materials via the resulting factor – an agricultural plant as s transfer object is not a less pragmatic or adapted approach. To determine the regression coefficient (R^2), the first option is more pragmatic, since all paired interactions are involved in the analysis. Designing logistic approaches to estimating and simulating phytosanitary monitoring in the transfer system of top-to-bottom technologies by type of raw materials with the step-by-step algorithm, we selected indices and groups of factors that should be further taken into account in order to adhere to the generalization principles (Fig. 1).

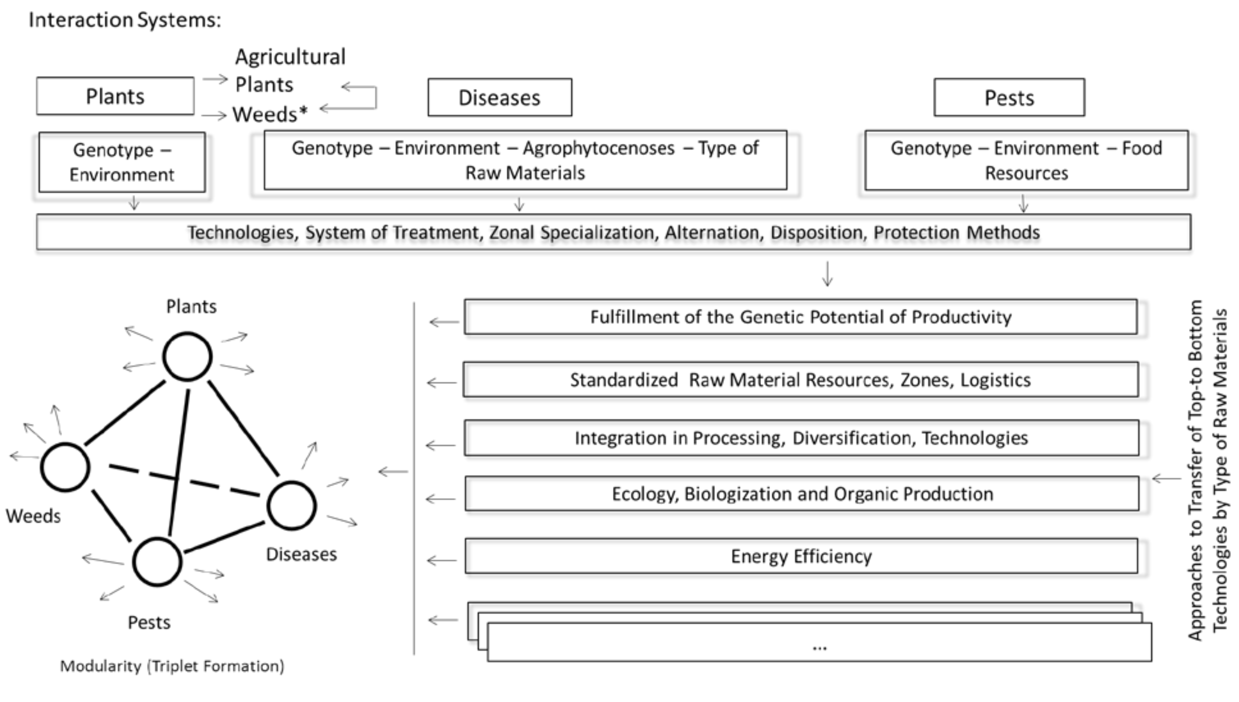

Fig.1 Logistic Approaches to Estimating and Simulating Phytosanitary Monitoring in the Transfer System of Top-to-Bottom Technologies by Type of Raw Materials.

The basic 'genotype – environment' interaction with corresponding transformation through types of raw materials and agrophytocenoses was taken as the starting point. For the 'pest' factor', the type of raw materials is analyzed through food resources, as a constituent of the 'genotype – environment - food resources' triplet. With this approach, after summarization we expectedly face technologies (technology components), tillage and crop care systems, zonal specialization and concentration of production, disposition and alternation of crops, and practical means and measures of plant protection. Among the approaches to simulation of top-to-bottom technology transfer, which should be focused on in order to comply with the generalization principles, the most significant ones were highlighted, in particular: fulfillment of the genetic potential of productivity (FGPP); level of standardized raw material resources; integration in processing; trends in organic production; and energy efficiency. Additional factors were highlighted at later stages upon refinement of modules and technology orientation.

In order to understand the essence of phytosanitary monitoring, depending on the technological level of production, we distinguished four formalized model stages of the genesis of the phytosanitary monitoring system and analyzed in relation to formation of integrated technological solutions (Table 1).

1. Formalized Model Stages of the Phytosanitary Monitoring Genesis for Integrated Technological Solutions

Stage	Periods	Prospect	Data type	Scope of Application
1st	Past historical stages of production and use		Retrospective, historical and statistical	Analysis, establishment of dynamics patterns and mechanisms
2nd				
3rd	Close to the current status of production and use	Near- and mid-term	Factual	Analysis, refinement, running-in, prediction, simulation and strategic planning
4th		Mid-term and long	Factual and predicted	

The assessment was carried out by periodizing the stages, prospects, type of data used and the scope of application. Upon periodization, a modelly formalized approach was used, and here we did not distinguish chronological periods with year dynamics. Although such historic-chronological research by itself is a priority from a pragmatic point of view and topicality. Assessing the prospects of the 1st and 2nd stages of the phytosanitary monitoring genesis, which according to the data type are retrospective, historical and statistical, we decided that these genesis stages were indeed of interest, but required additional research and effective info-analytical bases.

At the 3rd stage, the practical significance of the data is seen in the near- and mid-term prospects, but, starting from the 4th stage, the possibility of long-term predictions and simulations of processes through formation and processing of large volumes of information using information technologies (IT) arises [11]. That is, the transition to the 4th stage is strategic, since the phytosanitary monitoring becomes more intellectualized and technologized and is characterized by greater compliance with the requirements to the transfer objects.

To understand the mechanisms and resources involved, each of the four formalized stages was analyzed. Taking into account the importance of climatic changes, climatic conditions were highlighted among the leading factors. For the 1st stage, natural cenoses, gathering and low nutritional value of crop products are typical (Fig. 2).

In addition, the 1st stage is characterized by natural biodynamics of processes, low concentration of production and scattered plant areals. Consumption is minimal and does not correspond to the system level.

Pest and disease concentrations are generally low; the development of diseases and spread of pests do not reach critical levels.

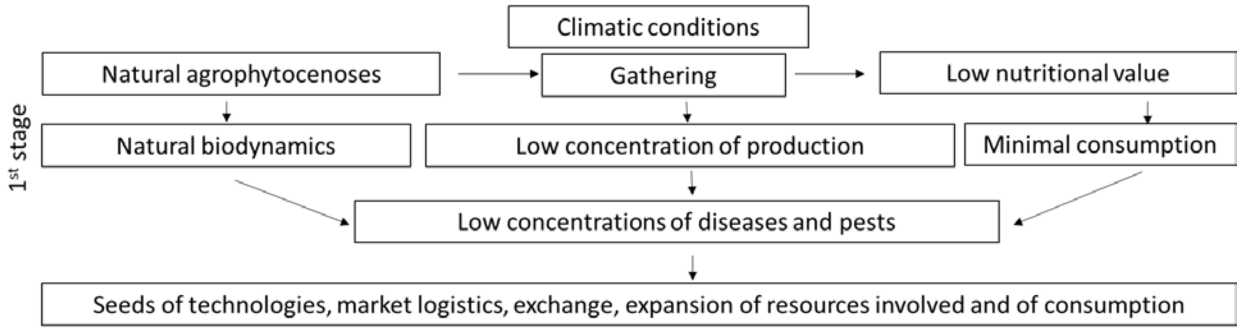

Fig. 2 Analysis of the Factors of the 1st Stage of the Phytosanitary Monitoring Genesis.

In addition, the 1st stage is noticeable for seeds of technologies as individual components, certain logistics and expansion of resource provision to support the practical implementation of market relations and more active consumption.

This approach was used to analyze other formalized stages. At the 2nd stage, anthropogenic agrophytocenoses, rise in production and increase in nutritional value were highlighted (Fig. 3).

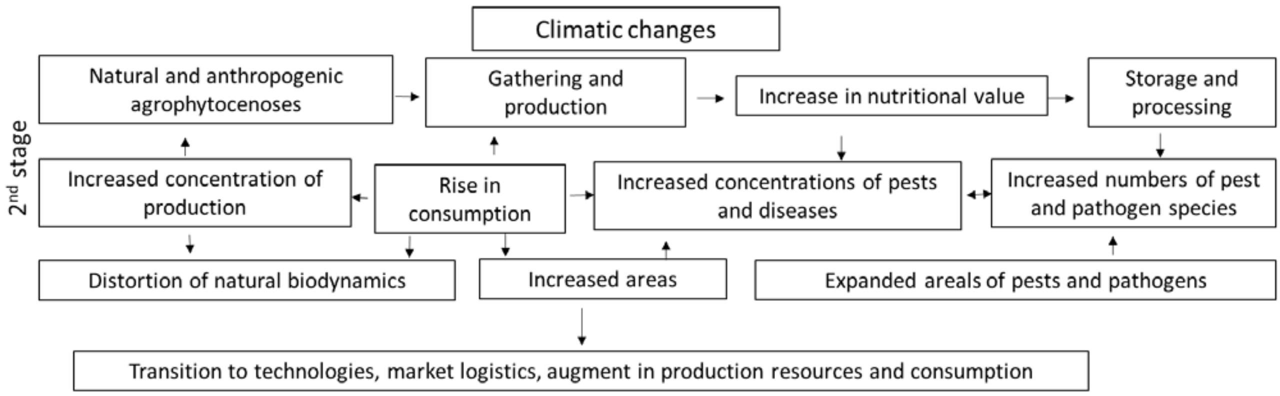

Fig. 3 Analysis of the Factors of the 2nd Stage of the Phytosanitary Monitoring Genesis.

Here, storage and processing vectors become conspicuous and particularly important, because they significantly transform the requirements to the triplet factors of the modular system of technology formation. It also affects the increase in concentration of production and in consumption, but in its turn, contributes to the increase in the pest and disease numbers as well as to the expansion of pest and pathogen species diversity. Due to enlarged areas and expanded areals both of agricultural plants and of harmful organisms, distortions of natural biodynamics become noticeable. The analysis of the 2nd stage of the phytosanitary monitoring genesis suggests that conditions for implementation of technologies and logistic schemes of market functioning arose.

At the 3rd stage, agro-industrial production (AIP) emerged, nutritional value and parameters of specialized market-oriented technologies are regulated (Fig. 4). High concentrations of pests and diseases as well as orientation of the market to ecological production and consumption are responsible for accentuation of the economic injury level (EIL) with appropriate monitoring and predicting system.

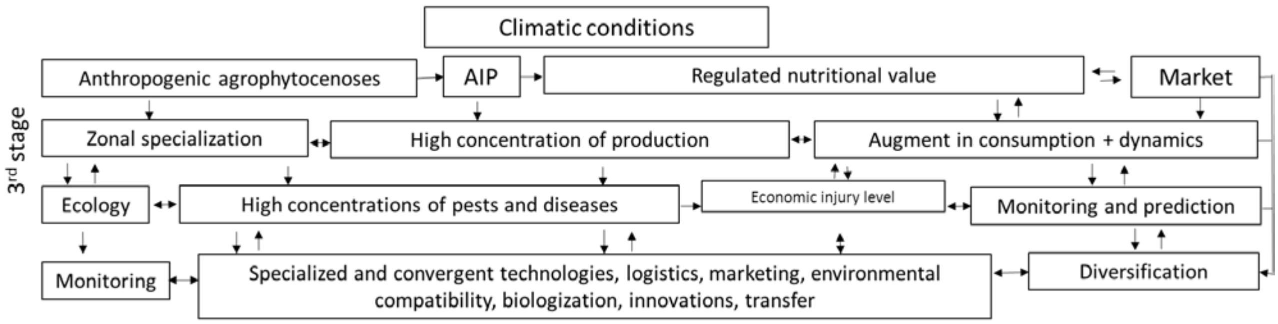

Fig. 4. Analysis of the Factors of the 3rd Stage of the Phytosanitary Monitoring Genesis.

At the 3rd stage, it is expedient to raise the issue of environmental monitoring and diversification as independent trends that cause transition to convergent technologies, and the latter, in their turn, help launch logistics and marketing. At the same time, a negative impact on the environment prompts to search for environmental and biological trends. Thus, at the 3rd stage, several previously insufficiently active areas, which had been transformed into independent and structure-forming ones, were identified. This further requires a systematic approach and considerably strengthens the importance of cross-cutting coordination, which is crucial for optimizing production aimed at the final result and at fulfilling all existing potential of competitive advantages. It was at the 3rd stage, when prospects of a growing role of methodological approaches in different directions, including in phytosanitary monitoring, stood out brighter.

All this is clearly ghettoized at the 4th stage of the phytosanitary monitoring genesis, with its specific issues, approaches and solutions (Fig. 5).

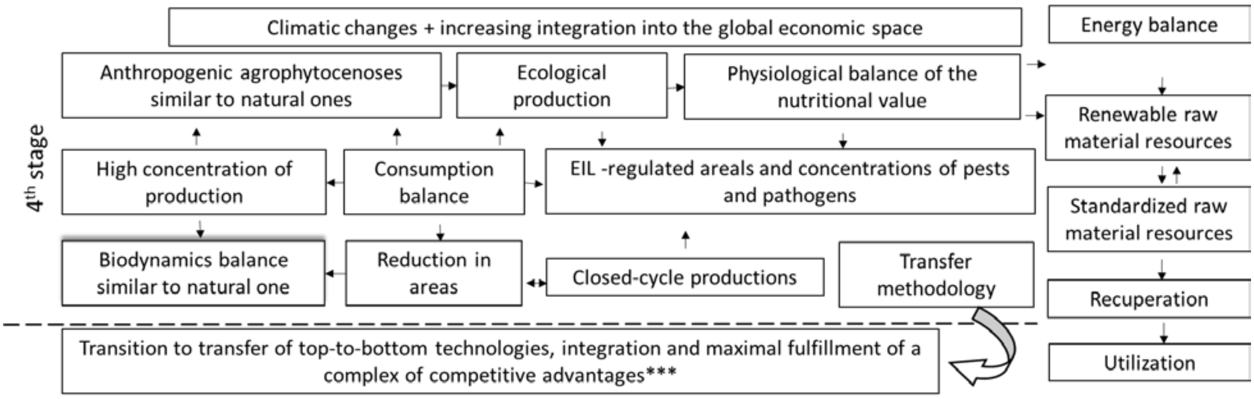

Fig. 5. Analysis of the Factors of the 4th Stage of the Phytosanitary Monitoring Genesis.

For the 4th stage, open and latent groups of trends become more typical, and integration into the global economic space exacerbates problems, increasing the number of challenges and solutions and raising their level to the global one. This paradigm of the AIP development leads to transformation of agrophytocoenoses, making them similar to natural ones and distinguishing trends of ecological production and physiological balance of the nutritional value of plant products.

In other words, it can be considered as a starting point for transition to the level of standardized raw materials and zonal specialization of production as factors of the national security, globalization and as factors of fulfillment of a complex of competitive advantages in the system of the national food, raw material, technological and environmental safeties.

Analysis of the factors of the phytosanitary monitoring genesis resulted in development of a logistic scheme of step-by-step consideration and correction of trends in the innovation transfer process to choose an effective phytosanitary monitoring algorithm as a top-tobottom technology component (Fig. 6).

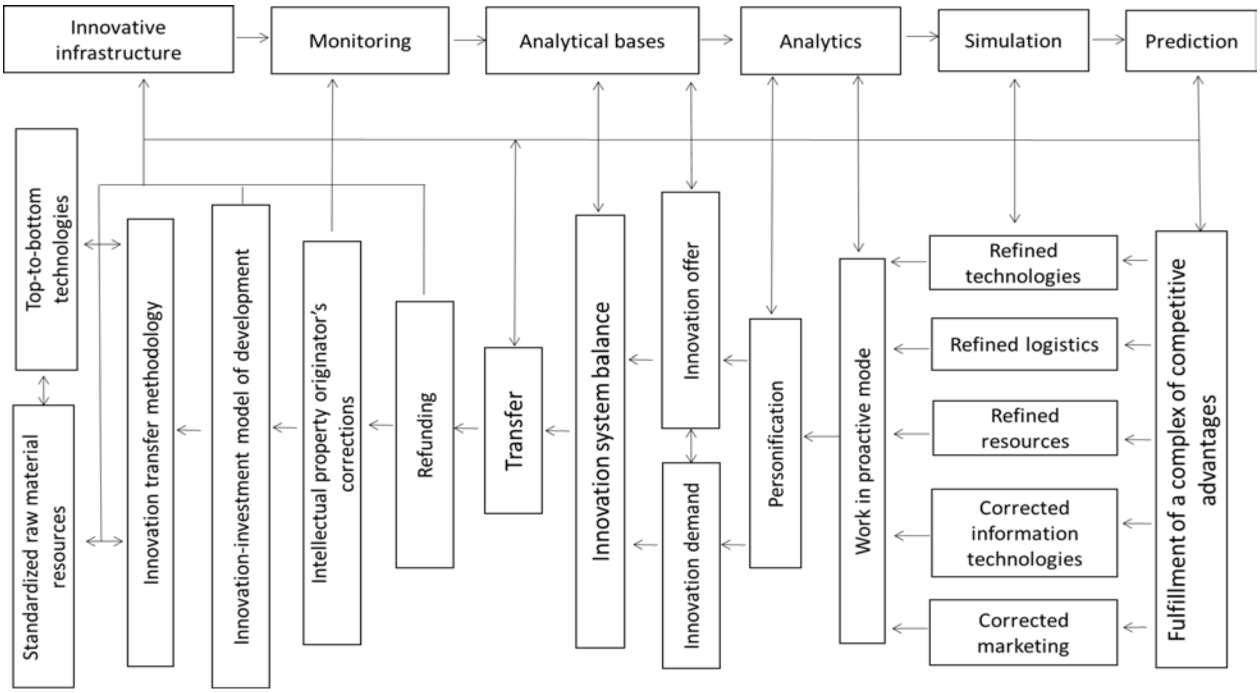

Fig. 6. Logistic Scheme of Step-by-Step Consideration and Correction of the Innovation-Transfer Process Factors to Choose an Effective Phytosanitary Monitoring Algorithm as a top-to-bottom technology component.

Granting appropriate infrastructure, due to monitoring and analysis, there is a possibility of operative simulation and prediction, that is, of obtainment of results required by the system of consulting and transfer support. With this option, phytosanitary monitoring, as part of top-to bottom technologies, can effectively fulfill the commercialization potential and actively promote fulfillment of a complex of competitive advantages. Enhanced efficiency is achieved through a systematic approach and IT, which allows you to work in proactive mode with a higher personification of service provision. Under such conditions, transformation of state-owned research institutions into intellectual property originators and systemic refunding due to implementation of the innovation-investment model of development according to the vectors of standardized raw material resources and transfer of top-to-bottom technologies becomes quite justified and real. Methodological approaches, which begin and complete the stages of this process, are a unifying element in this case.

As practice shows, these trends can be implemented through:

- Knowledge and operation of mechanisms and tools of genetics, biochemistry, physiology, marketing, logistics, economics etc. as specific transfer objects and production resources;
- Formation and implementation of integrated inter-branch and interdisciplinary innovation-investment solutions and functional structures within regional innovation systems;
- Transfer of top-to-bottom technologies via refinement of approaches and algorithms of the transfer methodology, modular system of technology formation and an I^4 algorithm [7,8]

As for phytosanitary monitoring, the need to operate not only the available information but also the creation of new information as a specific productive resource is quite clearly seen. Among the factor interactions, transition from the antagonistic level to a tolerant one in the mid-term prospect and to a synergistic one in the long-term prospect is topical (Fig. 7).

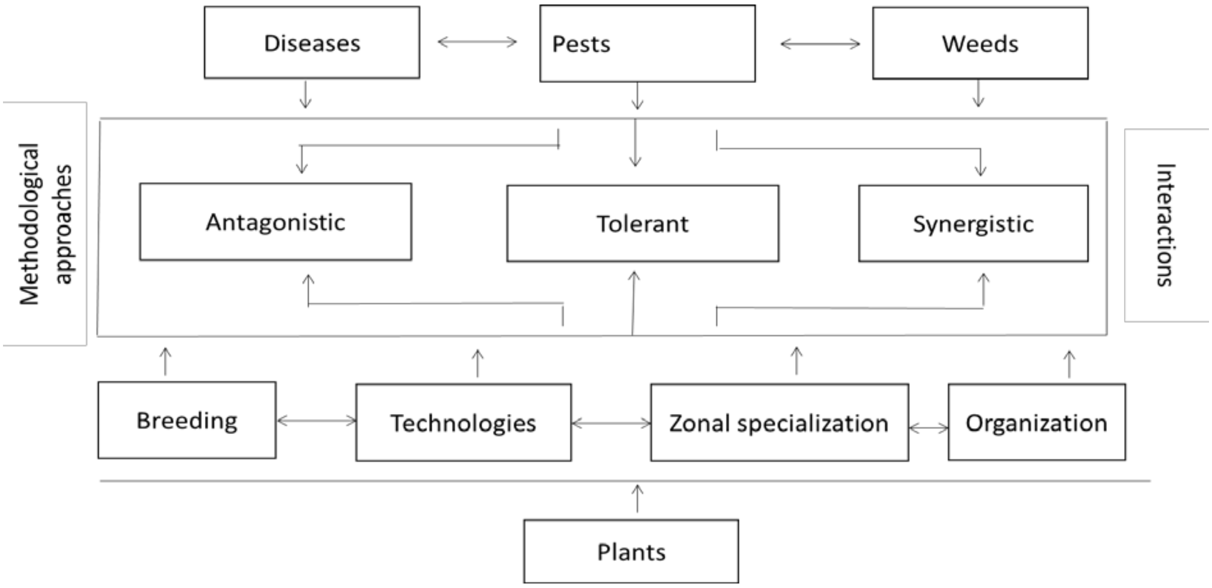

Fig. 7. Logistic Scheme for Increasing the Phytosanitary Monitoring Efficiency.

The task is ambitious and far-reaching, because it requires a large amount of information and faces interdisciplinary and interdisciplinary forms of the process organization. Possible options for its fulfillment are, first of all, the university science model, which is sufficiently tried and tested in leading innovatively-developed countries and the creation of appropriate cluster groups. However, there are new issues of concern, such as assignation of effective managers and independent experts. It is clear that a new science-driven product and its support will not be freely available in the future, which once again confirms our justification concerning the need for transformation of state-owned research institutions into intellectual property originators and transfer centers.

In this coordinate system, phytosanitary monitoring is a basis for many areas [1, 5, 10]. At the same time, in organizational and methodological respects phytosanitary monitoring needs a large-scale and strategic transformation, since the proposed approaches reveal a significant potential for implementation of this trend.

Nevertheless, implementation of such large-scale tasks at an individual research institution is impossible. Therefore, based on the above, we note the need to combine resources and potentials of a wide range of branches, disciplines, institutions, researchers and businesses in order to effectively implement the innovation-investment model of development and to fulfill a complex of competitive advantages.

Conclusions

1. The relevance and efficiency of the methodological approach to formation of top-to-bottom technologies according to modularity exemplified by phytosanitary monitoring were confirmed.

2. Phytosanitary monitoring can be used as a basic structure-forming component in formation of top-to-bottom technologies according to modularity.

3. Among the factor interactions, transition from the antagonistic level to a tolerant one in the mid-term prospect and to a synergistic one in the long-term

prospect is strategically important for effective using the potentials of phytosanitary monitoring and agro-industrial production.

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