Preface

INTRODUCTION

Nowadays circumstances year by year put forward new problems and challenges. Mankind food and other vital goods consumption steadily grows. To meet these requirements constant involving in economic circulation of new lands and territories, suitable for the economic activities organisation is required.

As a rule these territories and pieces of lands disposed far of main populations activity and in the same time from centralized centres of energy supply. The most suitable activity for these territories is agriculture

Start a business in such territories is easiest if you are engaged in the production of agricultural products on small-scale enterprises, with a small number of employed people. Small scale production makes it possible to quickly deploy work, easier and faster to ensure the sale of products.

Such activities require special technical support measures both for the livelihood of people living there and for organizing a highly efficient and cost-effective production process. Naturally, in such territories it is easiest and quickest to deploy activities related to the production of agricultural products. Such enterprises are easier to provide with energy resources, in particular, using renewable energy sources.

Existing technologies of energy supply, cropping and processing of crops can not always be easily adapted to use in small and medium-sized enterprises.

There was such a situation that information of this kind is needed not only directly by the worker in the village. The manufacturers and developers of such technical facilities and technologies and scientific organizations that are engaged in the development of technologies and equipment for the power industry of the village, production processes of various types, as well as the problems of housing and communal solutions, are showing great interest in new efficient means of conducting agricultural business, especially on a small scale, problems of the rural population.

An important issue is the organization of reliable power supply in an autonomous mode. The use of renewable energy sources can play an important role in this issue. And this means that information on the possible technologies of autonomous generation of electric and thermal energy, its rational consumption through the use of energy-saving technologies will inevitably be in demand. Of great importance in the organization of active activities in rural areas can also be the use of intensive technologies for the cultivation of products and its processing on site with the least expenditure of energy, the amount of which at remote sites may be critically small.

OBJECTIVE OF THE BOOK

The book includes a description of a series of technological methods and a number of technical means that ensure the organization of production of various products in the territories newly allocated for economic activity or recultivated for these purposes. The specified technologies and technical means are adapted to application in production of small scale, at the enterprises of small and medium business.

Much attention is paid to work aimed at organizing an efficient production process and social comfort in the face of scarcity of energy resources and the need to rationally use them.

It is an obvious fact that any similar published books complied altogether issues of rural business development concerned in the intended mode doesn't exist. No doubts that the book being published attract attention of a huge number specialists related to rural agribusiness activity on remote territories and looks to be very interesting for wide range of practical managements and businessman as well as scientists involved in activity connected with considered in the book technical field.

The particular interest to the book may be connected with the fact that the materials represented in the book, mainly was not published in English yet and consequently was not available for readers throughout the world.

TARGET AUDIENCE

The book will be useful to a wide range of persons, such as students of agroengineering and power specialities, experts and heads of municipal unions, managers of the ministries and other organisations responsible for development of new territories, the separate large businessmen beginning business at new territories and many others as for organisations like large international consortia specializing in various business in rural areas, primarily related to but not limited to the production of agricultural products, including food. A very useful book will be for small commodity producers in the countryside, various entrepreneurs of medium and small businesses as well as for inter-regional public organizations for assistance to advancement of new technologies in social sphere in view of environmentally friendly sustainable development. In general the book is intended for representation of the wide public advanced achievements in the field of agroengineering and related to the rural business energy technical means which will be useful to a wide range of readers and doubtless positive impact on a solution of a problem of a sustainable development of new rural territories.

Topics reflected in the book:

- Advanced technologies in the production of grain
- Innovative technologies in the agricultural production
- Energy-efficient thermal processes in agroengineering
- Innovative technologies in the production of milk and meat
- Advanced technologies for processing agricultural products
- Intensification of technical processes by electric, magnetic and other influences
- Solar thermal energy installations
- Energy saving system for illumination of greenhouse plants
- Energy efficient electric equipment for heat supply in Agriculture

- Electric pulse cultivation
- Pre-sowing Seed Treatment in a Magnetic Field
- Use of Microwave Energy at Thermal Treatment of Grain Crops
- Scientific and methodological support of rural electric system operation
- Biological Objects Reactions Management
- Solutions for diesel, wind and solar power plants joint use

A significant part of the book is devoted to the issues of application of electrical technologies in agroengineering processes that provide increased yields, increased productivity, improved working conditions, etc.

It is necessary to note the fact that a significant amount of the material presented in the book is devoted to works made in different countries, but not published in English. This will allow the English-speaking reader to get to know them. The creators of the book hope that these sections of the book will be useful to English-speaking readers and will be in high demand.

In Chapter 1, the Application of Electrophysical Effects in the Processing of Agricultural Materials is considered. Crop production is largely associated with a number of external factors that affect productivity, quality and cost of production. A significant part of the cost (20-40%) occurs on post-harvest processing, storage and preparation for feeding. These processes include drying, decontamination, steaming, micronisation, etc. The work describes the electrotechnology impacts and their use in processes of grain processing. The article deals with the classification of electrophysical methods of influence, correlated with the processes in which they can be applied. It is described the required levels of exposure and the resulting values of productivity, intensity and other parameters, qualitatively describing the specific processes. The factors which can positively affect grain production include: the use of ozone, ions, infrared and microwave fields, etc.

Chapter 2 is devoted to the consideration of theoretical Prerequisites for Subsurface Broadcast Seeding of Grain Crops in the Conditions of Pneumatic Seed Transportation to the Coulters. Only 30 – 40% of the plant productivity potential is realized in crop production technologies, which leads to a situation where the growth of field yields lags behind the growth of production costs. Increasing the realization of the productivity potential of cultivated plants is a way to improve the efficiency of the crop industry. The task of sowing machines is the uniform placement of seeds on the field area, while plants get their living space and, accordingly, form a crop. The practice of using such working bodies has shown that to achieve the necessary seeding regimes under the coulter elements, the use of additional sources of kinetic energy is required.

The Chapter 3 considers the UV-based indoor disinfecting system. It is shown that when contagious diseases occur, there is a tangible threat of rampant spread of infection, incurring huge economic losses in animal deaths and decreased animal productivity. Thus, preventing pathogenic flora concentration in rooms where birds and animals are raised from exceeding permissible levels ranks first among veterinarian and sanitary concerns. When birds are kept on the floor during feeding, germ and dust concentration increases nine to ten times against normal. Ample research shows that ultraviolet (UV) radiation possessing a bactericidal effect is the most promising and environment-friendly method of cleansing the air from harmful germs.

Chapter 4 considers energy-saving electrical installations for heat supply of agricultural objects. Electrical energy in the thermal processes of agricultural production has a number of technical and

technological advantages in comparison with other energy carriers. At the same time electricity is the most high-quality, but expensive type of energy. The effective use of electrical energy in thermal processes is possible with the implementation of all its advantages over fuel energy. This requires a system of technical, economic and energy analysis and the selection justification of the most effective systems and technical means of heat supply of stationary agricultural technological processes. The paper presents functional and technological schemes, physical models, the experimentally obtained dependencies, parameters and operating regimes of the developed energy-saving electrical equipment and systems for the main thermal technological processes.

In Chapter 5, a method for solving the problem of the uniform led illumination for the floor maintenance of birds is proposed. On the basis of physical modeling, the dependences have been obtained between the geometric dimensions of the poultry house and the coefficient of uniformity of illumination with the purpose of optimization of the parameters on which the energy consumption and quality of illumination depend. The method has been used to estimate the values of the optimal parameters of the functioning system. Thus, in the poultry house of 78m x 18m four lines of led lamps have been installed for illumination, 40 pieces per each line. With the computer calculations of illuminance, estimates of the optimal values have been obtained: the total number of LEDs is equal to 1920 and allocated over 120 lamps instead of 160 previously used, that allows predicting a fall in actual energy consumption by 25% with an irregular illumination coefficient being 1.13. Based on the developed and manufactured led lamp the applicability of the mathematical model has been experimentally justified.

In Chapter 6, it is shown that each modern tractor should be adapted to perform an increasing number of various traction, transportation and other works. Therefore, their designs are becoming more complex. To improve tractor productivity, the power-to-weight ratio and the speed of its units are constantly increasing. This inevitably improves dynamic loading of the chassis and the transmission parts, the level of the generated oscillations, which increases the vibration load of the transmission. One of the promising ways to solve this problem is to introduce elastic links into the tractor transmission closer to an engine or a clutch. Installed closer to the engine, the elastic element in the transmission of the tractor absorbs the impact of the shocks, protecting the tractor engine from large dynamic loads. The material of the chapter contains studies confirming the efficiency of the use of an elastic mechanism (closer to the engine) in the tractor transmission of a small class of traction (14 kN).

Chapter 7 is devoted to consideration of Electric robotized organic technology for livestock production on a pasture field. The concept and principle solutions create breakthrough elektrorobotized technology organic food ECO-1m used in plants for the production of ecologically clean meat and dairy food. Breakthrough technology overcomes competition and international sanctions, providing export expansion due to the novelty of domestic solutions, supported by patents for new robotic machines and equipment. ECO-1m for the first time used highly reliable, technically advanced serial technique of the sectors of the defense industrial complex, aerospace, and electrified railways. The stages and results of fundamental research on the improvement of technical solutions and a list of implemented automated farms, where the parameters of breakthrough technology ECO-1m. Technology is a modular plant consisting of 12 departments placed on 2500ga of arable land, and 3000 head of mixed aged cattle, which contains on cultural pastures. According to the indicators of the developed business plan, the plant has 3-3.5 times higher productivity, with a profitability of 30-40%.

In presented at Chapter 8 material, both informational and system-based approaches have been applied to the analysis of grain drying process as an interaction of two systems, namely, ‘drying agent’ and

'grain layer'. It made it possible to evaluate the information content of the process. Analytic expression has been obtained for grain layer informational entropy variations which enabled to make the conclusion that an adequate physical description of grain drying process has to include ambient air parameters control, as well as that of drying agent's parameters in its exit out of a grain layer, as well as parameters of both drying agent and grain in one point of grain layer. Besides, a mathematical model of heat-and-moisture exchange in dense grain layer has to be applied. As a result of modeling, it has been proved that the sensors of both drying agent and grain parameters have to be located at a distance of 10 to 11 cm from the central cylinder of the forced-aerated drying bin.

Chapter 9 presents an analysis of factors influencing the heat and moisture exchange for their further use in experimental research to study the process of grain drying with active ventilation. The temperature and velocity of the drying agent and grain moisture content are determined. One centimeter (1 cm) thick layer is considered to be a thin layer. This size appears to be very manageable to transfer the regularities of the drying process to a thicker layer when modeling the drying process in a thick layer. The experiment was carried out for three drying modes: classical mode, i.e. drying of grains with natural and heated air; with a constant concentration of air ions in the drying agent; with cyclic (periodic) presence of air ions in the drying agent. Using the regression equations produced a so-called electro-activation criterion can be described. The dependencies obtained would help to optimize the drying process with respect to drying time criterion.

Chapter 10 is dedicated to consideration very important issues concerning innovative approaches for agricultural processes intensification. The reclamation of new areas and distant lands with limited energy and material resources demands using resource- and energy-saving technologies. One of such technologies can be magnetic treatment of irrigating water and artificial manure solutions, and presowing treatment of seeds of agricultural crops in magnetic field. We found out that magnetic field accelerates the velocity of chemical reactions, enhances salts and fertilizers solvability, and increases oxygen concentration in a solution. Magnetic field improves membrane cells permeability which accelerates molecules and ions diffusion through it. This process improves the ability of a seed to absorb water and increases the concentration of oxygen in a cell. Presowing treatment of seeds increases their ability of germination by 26–50%, sprouting by 20–30%. The best regime of water solutions and seeds of agricultural crops treatment in magnetic field is when magnetic induction is 0.065 Tl and the velocity of a solution is 0.4 m/s.

The reviewed problem in Chapter 11 deals with the metrological support of sensory equipment using cameras with standard and infra-red lenses. Own elaborated method to use UAVs for remote shooting of agricultural crops and obtaining images is to be used to determine the level of nitrogen provision for grain crops has been developed. For radiofrequency correction of lighting changes while mineral nutrition state monitoring, it is recommended to use a method with the application of official data to be calculated on the basis of camera's regular camera exposure meter measurements. It is advisable to use infra-red lens for monitoring the state of individual crops using digital non-specialized cameras instead of optical one. Exampling GoPro hero 4 digital camera it has been found that there are three channels to use IR lens which have the characteristics of fixing radiation either in the infrared range or in the red area of the optical range.

In Chapter 12, an application of solutions of the Electrochemical Processed Mineral "Bishofit" in Plant Production is considering. Hexaqua magnesium chlorine – bishofite, almost never occurs in the fossil salt deposits until recently, while industry has used artificially produced magnesium chloride. The discovery of bishofite deposits in the Lower Volga region (both for raw materials purity of MgCl2 up to

95-98%, and for reserves about 500 billion tons) was an unique event. The use of bischofite consists in the salt compositions of sand to protect roads from icing yet. The report represents the results summary of the bishofite solutions electrochemical processing with the purpose of obtaining solutions with the antibacterial properties complex the use of which can be recommended for pre-plant seeds treatment, plant protection from fungal effects, which allowed, as shown by experiments on the crops cultivation, to increase yields up to two - three times, and also to use for disinfection of domestic and industrial wastewater in agricultural enterprises. The technological characteristics of the using electrochemical device are considered in the chapter.

In Chapter 13, electric robotized organic technology for livestock production on a pasture field is considering. The concept and principle solutions create breakthrough elektrorobotized technology organic food ECO-1m used in plants for the production of ecologically clean meat and dairy food. Breakthrough technology overcomes competition and international sanctions, providing export expansion due to the novelty of domestic solutions, supported by patents for new robotic machines and equipment. ECO-1m for the first time used highly reliable, technically advanced serial technique of the sectors of the defense industrial complex, aerospace, and electrified railways. The stages and results of fundamental research on the improvement of technical solutions and a list of implemented automated farms, where the parameters of breakthrough technology ECO-1m. Technology is a modular plant consisting of 12 departments placed on 2500ga of arable land, and 3000 head of mixed aged cattle, which contains on cultural pastures. According to the indicators of the developed business plan, the plant has 3-3.5 times higher productivity, with a profitability of 30-40%.

In Chapter 14, important factor of impact on decrease in operational injuries is considered. It is also production the caused incidence of employees of the agro-industrial organizations and enterprises high-quality and timely training, certification, preparation and retraining of personnel in safety of production are. Procedures of training and control of knowledge of various directions of safety of production are regulated by the existing normative documents developed by authors of the present chapter now. The systems of e-learning of personnel for safety of agro-industrial production have to be built in digital technologies of management of agro-industrial production, have the modular structure allowing customizing systems on requirement of concrete production.

The object of research in the Chapter 15 is the plant tissue of weeds, fruits, vegetables, melons etc. The purpose of the presented research is to study the process of electroimpulsive irreversible damage of plant tissue as the basis for energy saving, efficient electrotechnologies with minimal negative effects of chemical components on the environment and food products. The chapter presents the results of experiments carried out by the team of researchers that allowed us to determine the technological indices of the irreversible electroimpulse damage of plant tissue (weeds, fruits, vegetables, melons, etc.), which is the basis for developing the technology of electroimpulse destruction of weeds, electroimpulse plasmolysis of fruits and melons cultures. This research was conducted in the southern region of the country and combined the efforts of several scientific groups of researchers.

The subject of Chapter 16 is the Control Of Advanced Fodder Disinfection In Terms Of Economic Criteria consideration. Upon long-term storage germinated grain with 50-60% humidity begins to mold and rot. Therefore, it should be fed off to livestock as soon as possible after its germination. To extend storage life of germinated grain it is necessary either to dry it to 14% relative humidity, or to carry out its disinfection. Grain forms the basis of combined fodder in agriculture. Some technological solutions are available to provide fodder disinfection optimized in technological or economic terms, as well as rational

energy use, including disinfection by high-speed electron bunches, ultra-high frequency electric waves, combined IR and conductive (contact) electric heating, and toxic ozone gas. There also exists a similar solution for fodder premises disinfection through controlling excessive pressure of their internal air. In control by technological (production) criterion, the mode of minimal integrated cost of calculated loss of quality (expenditures) of products being disinfected (fodder) is determined, so the highest livestock productivity in the current context is obtained.

The editors express strong confidence that the results presented in this book will undoubtedly be in demand by a wide circle of readers and will help spread the information presented in the book to a wide circle of specialists all over the world, and the exchange of scientific knowledge through this book will contribute to the overall progress of the agro-engineering industry in many countries.

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