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AIR PHOTOGRAPHY WITH USE OF UNMANNED AERIAL VEHICLE FOR SOLUTION OF AGRICULTURE AND CADASTRE TASKS

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ABSTRACT

Issues of information provision for agriculture and cadastre according to air photography materials from unmanned aerial vehicle are considered in the article. Materials of experimental air photography from air plane and copter were used. The work suggests technology of executing works on photography and processing of materials. Air photography parameters were proposed according to image quality and requirements for ground images resolutions for solving tasks of cadastre and agriculture.

KEY WORDS

Information; Cadastre; Air photography; Unmanned aerial vehicle; Unmanned airplane, Copter; Air photography parameters; Work execution technology.

Effective and efficient use of land resources is an urgent problem of our time. Acquisition of material values, providing people with food and shelter, allocation of industrial enterprises, social, cultural, communal and other institutions are related with land resources. Territorial documentation of the organizational structure of agriculture sector and its subdivisions shall be performed in the land management system. The economic essence of the land management as a public measure changes and expands, but precision of engineering geodetic base and its conducting remain unchanging. With the help of the main ways of use the results of geodetic, air photography geodetic and other surveys and studies, both in industry and in agriculture the land development projects are drawn up.

The use of electronic maps for precision farming helps to save energy costs for technical operations, to reduce the amount of fertilizer. The use of soil electronic maps allows you to place agricultural crops with due account for land suitability. The use of agrochemical electronic maps allows you to define the need for application of mineral and organic fertilizers. The [1] and [3] shows in detail the theoretical foundations of the traditional plan and map providing of agriculture and cadastre.

The present work is devoted to plan and map providing of agriculture and real estate cadastre with air photography materials obtained with use of an unmanned aerial vehicle (hereinafter - UAV) by the example of the shooting of urban area and irrigation apparatus «Frigat», located in the city of Engels, Saratov region.

Unmanned aerial vehicles (UAVs) are used in different countries for air photography for military and civilian purposes, as an inexpensive alternative to traditional satellite imagery and air photography from airplanes, helicopters, moto-deltaplan, aerostats [2].

The advantages of air photography from unmanned aircrafts over space and traditional air photography are the following: low-level photography (from 10 to 500 meters); high ground resolution; the ability to photo at an angle to the horizon (oblique photography); the ability to make panoramic photos; efficiency: the total cycle starting from departure to the site for shooting until the final results is a few hours; low cost: it is cheaper than traditional methods of air photography for several times (up to 10); the work in urban conditions is possible; complicated procedure of permits obtaining and flights coordination is not required.

There are some hinders of UAV market development. Currently, the development of civil UAV market, including for needs of air photography, hampered by the absence of the

legal framework for the integration of UAVs in a common airspace. This problem is not completely solved in any country of the world. Russia is taking the first steps in this direction. For now, before creation of the legal framework, unmanned systems are purchased by the entities with special authority (border guards, police, emergency). Currently, legal launching of UAV for commercial purposes is subject to the authorization obtained as per procedure tried and tested by UAV supplier companies. Provided that the responsibility for the flight is imposed on the operator who controls the start-up.

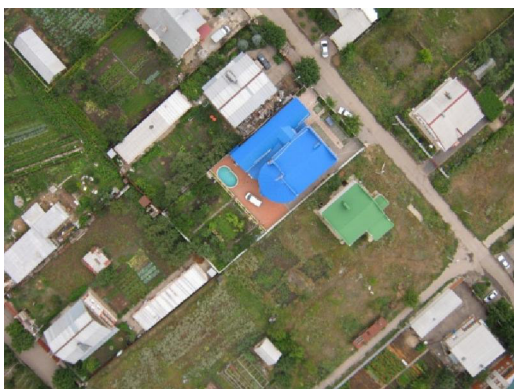
Currently UAVs are not supplied with the system of recognition of obstacles and avoiding of collisions, in addition, many models have not quite perfect autopilot (to reduce the costs and reduce the weight of aircraft equipment). The risk of loss of the aircraft and equipment leads to the fact that many companies may choose not to buy UAVs and buy the flight hours in organizations that have specialized in unmanned launches.

Despite these abovementioned constraints the development of air photography with use of UAVs is perspective enough for agriculture and cadastre. To perform the research we selected air photographs of the settlement "Privolzhsky" and fields with "Frigat" irrigation apparatus installed therein (Figure 1).



Figure 1 – Part of the settlement «Privolzhsky» and fields with «Frigat» irrigation apparatus installed therein

Air photography was performed with two unmanned vehicles (plane and copter) using three digital cameras Canon PowerShot A490, Sony Cyber-shot DSC-W300 and the Pentax Optio A40. Figure 2 shows fragments of pictures obtained.



(a) Fragment of the settlement



(b) Fragment of «Frigat» irrigation apparatus

Figure 2 – Examples of fragments of images used for experimental work (a, b)

Cameras' parameters are shown in Table 1. In technical terms the process air photography with use of UAVs consists of three stages: preparation, the survey and post-processing of obtained data.

Table 1 – Some parameters of cameras

Full name	Canon PowerShot A490	Sony Cybershot DSC-W300	Pentax Optio A40
Effective resolution, millions of pixels	10	13.6	12
The minimum focal length (mm)	6.6	7.6	7.9
The maximal focal length (mm)	21.6	22.8	23.7

With regard to the technology of air photography from UAV we proposed a flow diagram of maps and plans printing with use of this type of air photographs (Figure 3).

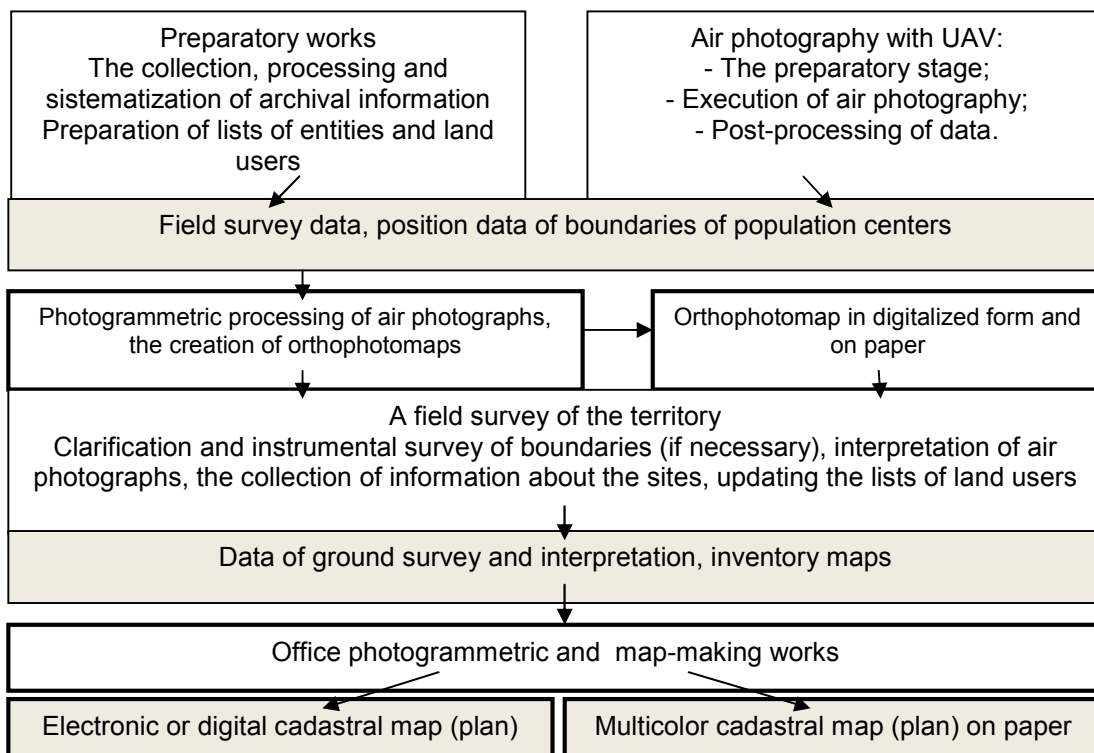


Figure 3 – A flow diagram of maps and plans printing with use of data of air photography made with UAV

For the development of technology and the choice of shooting parameters, we performed the work on definition of the resolution and grand resolution of obtained materials by use of frequency-tonal characteristics and Equation 1. Knowing the resolution of the image, we can determine the spatial resolution (or ground resolution) using the equation:

$$R_m = \frac{m}{2 * R_{ch} * 1000}, \quad (1),$$

where m is the denominator of the picture scale, R_{ch} is the resolution of the image.

Summarized results are shown in Table 2. On the basis of performed works and analysis of available data the propositions on information provision for agriculture and real estate cadastre according to air photography materials from unmanned aircraft are offered.

– To improve the accuracy of measurements on the grounds of air photographs using consumer digital cameras it is necessary to calibrate the cameras in order to consider the distortion and errors at image processing.

– At surveying on the site with a «Frigate» having moving parts it is necessary to mark the point on the ground. We have developed a sketch of the marker with dimensions (Fig. 3).

Table 2 – Calculation of ground resolution for three camera

Camera	Date of survey	Denominator of survey scale	The resolution of the image MM^{-1}	Ground resolution, m
Canon Power Shot A490	4.08.2011	272	51.84	0.0026
Sony Cyber-shot DSC-W300	7.08.2011	72	29.96	0.0012
Pentax Optio A40	21.07.2011	191	46.54	0.0021

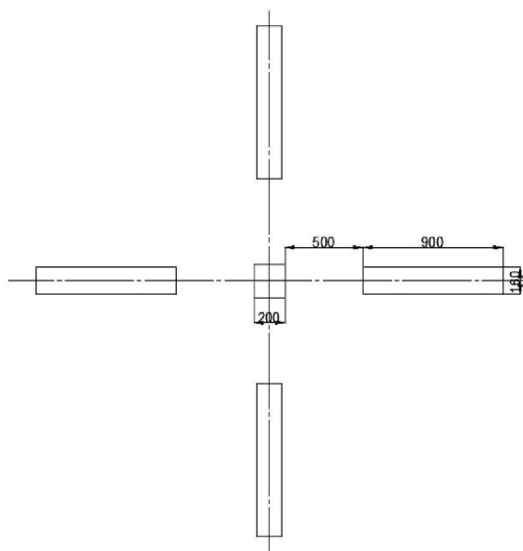


Figure 3 – Sketch of the marker, the dimensions are given in mm

Table 3 – Parameters of air photography

Survey parameters	Indexes
Scale of survey	1:4000
Height of survey	87 m
Survey camera model	Canon Power Shot A490
Focal distance of Air camera	21.6 mm
Images size	520*390 mm
Ground image base-line:	
Bx	832 m
By	936 m
Scale of creating plan	1:1000
Overlapping:	
Px	60%
Py	40%
Images number	3
Scanning pixel size	1,7 micron

– To take a photo of objects provided in the article we offer to select the following snap parameters (Table 3).

– We propose to define the images resolution using ground test objects (mire).

In addition we carried out the calculation of economic efficiency of the proposed technology. For this purpose we compared the cost of a survey using mass-produced UAV and UAV assembled at the Moscow State University of Environmental Engineering.

The cost of UAV used for experimental air photography, according to information of the staff of the Moscow State University of Environmental Engineering, amounted to 50,000 rubles, and the average cost of mass-produced aircraft for air photography is 500 thousand rubles to 3 million rubles.

When ordering the air photography from UAV the cost of snapping is about 30,000 rubles per 1 sq.km (for the minimum scope of work.) The cost is affected by the distance of snapping object from basing site of the executor, the scope of work, the complexity of the terrain and the object, as well as the requirements of the customer to the products.

The costs of air photography with use of aircraft vehicle of Moscow University of Environmental Engineering is calculated.

The snapping object is a field with «Frigat» sprinkling machines and part of the urban village «Privolzhsky». The object size is 47 hectares. The object is located 30 km from the city of Saratov. The task is to make images with a spatial resolution of 10 cm, with overlapping 60% in the route and 40% between the routes. Proceed from task the cost of air photography performance is calculated:

- Travel time to the work site from Saratov and back (for road transport) - 1.5 hours;
- Costs of moving within the study area (search for sites for takeoff/landing, fixing support and tie points, as well as the mire of necessary) - 2 hours;

– Preparing for the flight (aircraft assembly, setting the parameters of flight, site preparation for takeoff/landing) - 0.5 hours;

– The flight (including takeoff / landing) - 0.5 hours.

Thus, the survey takes 4.5 hours or 0.56 of workday. All process steps in organizing and carrying out the air photography are carried out by two specialists. Below you will find a table 4 showing the calculation of costs of survey.

Table 4 – Calculation of costs of survey

N	Expense item	Calculation	Amount, rub	Notes
1	Transportation expenses (POL)	60km * 0.08 l/Km = 4.8 liters 4.8 liters * 27.30 rub = 131 rub	131	The car VAZ-2104
2	Wage pool	0.56 days. * 2 pers. = 1.12 pers./day 1.12 pers./day * 1500 rub = 1680 rub	1680	–
3	Per diem	1.12 pers./day*500 rub = 560 rub	560	–
4.	Accruals for maintenance and repair of the UAV	1 flight*250 rub = 250 rub	250	Resource of airframe is about 200 flights, then airframe is subject to be replaced. The cost of airframe - 50,000 rubles.
	TOTAL		2621	

The calculation shows that the costs of air photography of the given site using the aircraft of the University is 2,621 rubles. The calculation of the cost of work in the given site using mass-produced UAV is amounted to 58357 rubles.

We are currently conducting research dedicated to the optimization of the parameters of photography from UAV based on the resolution of the materials and the requirements to work accuracy. We are also planning to improve the technology of planning and mapping software taking into account the obtained results on the basis of accuracy, productivity and cost-efficiency.

We show our appreciation to Professor Zeyliger A.M from Moscow State University of Environmental for providing the survey materials and scientific advice.

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RESEARCHES PROVE: SCARLET, BENEFIS AND POLARIS ARE IRREPLACEABLE

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ABSTRACT

In the article diagnostics of harmful organisms by means of polymerase chain reaction (PCR) is considered. The comparative assessment of herbicides Scarlet, Benefis and Polaris is given. It is shown how pathogens behave after interaction with the herbicides. The system effect of preparations application is proved.

KEY WORDS

PCR; Scarlet; Benefis; Polaris; herbicides.

In the conditions of intensive maintaining agricultural production dependence of a yield on optimization of agricultural crop protection methods from weed plants and other harmful organisms increases. It is very important that this protection will be based on the regulation of number of harmful organisms to the economically reasonable and environment-friendly level. This approach is impossible without using in the industry the most progressive technologies and innovations of modern science. Nowadays polymerase chain reaction (PCR) is the most powerful tool for finding and qualitative analysis of wide spectrum of phytopathogens in agricultural crops.

PCR diagnostics is based on finding the area of genome specific for every concrete pathogen. In biological laboratory «Schjolovo Agrochim» the comparative analysis of efficiency of three seeds herbicides Scarlet, Benefis, Polaris was carried out by means of PCR. The essence of experiment consisted in the following: dressed seeds of wheat variety «Moskovskaya 56» were grown in the conditions aggressive infection background, created with fungus mycelium *Fusarium culmorum*, during 2 weeks. At the end of this period the assessment of quantity of pathogen organism in the grown plant and in the substrate round its seeds was done. Due to the degree of leaves infection we concluded the system influence of pesticide on plant in general. Dynamics of accumulation of fungus DNA in the substrate testified to impact of an herbicide on the infectious background surrounding seeds. As test plants were used plants grown from undressed seeds: positive test group were infected with *Fusarium culmorum*, negative test group remained uninfected.

The principle of PCR operation consists in copying specific for every concrete pathogen area of deoxyribonucleic acid (DNA) by means of special enzyme (polymerase) with artificial way in a glass-tube. During reaction the number of copies of a diagnostic fragment of DNA increases in million times, to easily revealed quantities.

PCR diagnostics includes three main procedures: sample preparation (DNA allocation), actually reaction and detection (visualization) of its products.

First of all, it is necessary to receive object which it is necessary to analyze - DNA. Cells of plants contain a huge amount of organic chemicals. Polysaccharides (cellulose of cellular walls, starch, protopectin, hemicellulose), proteins, lipids and lipoproteins, nucleic acids, secondary metabolites (polyphenols, alkaloids, terpenes, etc.) are referred to them. Elements of these multicomponent mixtures can physically connect and chemically degrade molecules of nucleic acid that significantly complicates its isolation and can lead to inhibition (stop) of polymerize chain reaction. Therefore the choice of a technique of allocation of DNA has huge value for receiving adequate result in PCR. As a whole, procedure of allocation of DNA represents serial processing of vegetable fabric by various chemicals with the subsequent centrifugation for division of the fractions containing different intracellular

components, including nucleic acids. For DNA isolation from plants the set of techniques is offered but among them there is no universal, equally suitable for work with any vegetable fabrics. It is connected with features of their chemical composition.

Concentration of DNA is defined by a way of spectrophotometric measurement of quantity of the ultra-violet light absorbed by the nucleobases. The method is based on ability of DNA in solution as much as possible to absorb ultra-violet waves of 260 nanometers long. This photometric absorption directly correlates with concentration of DNA.

Indicators of purity of the emitted nucleic acids are so-called «the relations of invading quantities». So, proteins absorb with a wave length of 280 nanometers therefore the relation of 260/280 nm is used for identification of protein impurity. Pure DNA has to have the relation value of 260/280 nearly 1,8. Decrease in this indicator speaks about availability of protein impurity, phenol or other contaminating agents. At the RNA presence in preparation the value 260/280 increases. Other indicator of preparation DNA or RNA purity is the characteristic value dependences of absorption of 260/230 nm. In case of a pure preparation it is usually 2.2. Smaller values testify to preparation pollution with salts and other components of the solutions used for procedure of allocation of DNA.

Table 1 presents the results of DNA allocation with methods of cetyltrimethylammonium bromide (CTAB) (Murray, Thompson, 1980). Spectral characteristics of preparations testify that the received samples contain DNA, in different degree contaminated with impurities. Degree of contamination is low and they can be used for carrying out PCR.

Table 1 – Concentration of total DNA, allocated from different plant organs

N	Plant characteristics (14-day wheat), 20.03.13.	Concentration of DNA in plant organs ng/mcl.					
		leaves			grain, roots, coleoptile		
		Concentration	260/280 ¹	260/230 ²	Concentration	260/280 ¹	260/230 ²
1	Healthy	743,0	1,8	2,6	165,0	1,7	2,4
2	Dressed Scarlet and infected <i>F.culmorum</i>	571,0	1,9	2,6	111,0	1,6	1,8
3	Dressed Benefis and infected <i>F.culmorum</i>	506,0	1,9	2,7	284,0	1,8	2,6
4	Dressed Polaris and infected <i>F.culmorum</i>	812,0	1,7	2,2	267,0	1,8	2,3
5	Undressed and infected <i>F.culmorum</i>	490,0	1,9	2,5	195,0	1,8	2,4
6	Mycelium <i>F.culmorum</i> , used for infection	10,9	2,1	0,8	-	-	-
7	K+ (<i>F.culmorum</i> All-Russian Research Institute of Bioorganic Chemistry)	10,0	1,8	1,8	-	-	-

The obtained data illustrate the dependency of allocation quality of DNA from chemical content of plant fabric. For example, from 500 mkg of leaves, we obtained DNA in the concentration of 500-800 ng/mcl, from grains rich in carbohydrates and proteins – in a total 100-280 ng/mcl. The fungus parasitizing on a plant does not strongly influence quality of DNA allocation. So, the quantity of total (cumulative) DNA from infected *Fusarium culmorum* wheat is lower than concentration of DNA from a healthy plant less than twice (490 ng/mcl and 740 ng/mcl respectively). Also the presence in a sample of small amount of active substance of herbicides does not influence allocation process. Also we can stress that the obtained DNA is more that enough for doing the number of amplifications with sensitivity that positive result can be obtained having at the beginning of the reaction one molecule of the detective DNA (determined). The obtained nucleic acid serves as a matrix for replication (doubling) of new chains in the process of PCR. In diagnostic practice several reaction varieties of PCR are used: PCR with reverse transcription (RT-PCR), inserted PCR (Nested PCR), PCR with usage of hot start (Hot-start PCR), PCR with detection by the terminal point (FLASH PCR), quantitative PCR (PCR in real time), etc. The presented work was done on the equipment and test-systems, designed for setting PCR in real time.

Method PCR in real time (RT-PCR) significantly exceeds precision, peculiarities, efficiency and safety of PCR diagnostics. Unique peculiarities of this method are possibility of direct observation of amplification of DNA-target by means of monitoring of the formed product. The reaction mixture composition except enzyme Tag-polymerase and defined by us DNA-matrix includes deoxynucleoside triphosphates (dNTP) – building material of future amplicons, two synthetical oligonucleotides – direct and reverse primers, terminating the succession-target from two sides and hybridization probe, additional oligonucleotide, on different ends of which there are fluorophor-colourant and fluorescence-stabilizator of this colourant.

Design of oligonucleotides for test-system with which research associates of «Schjolovo Agrochim», is developed with LLC «Agro Diagnostics». Test-system is intended for finding fungus *Fusarium culmorum*. Fluorometric detection of amplification products in RT-PCR is done in the course of their accumulation. During amplification at the account of 5-exonuclease activity of Taq- polymerase fluorescent tag transfers into the solution, releasing from neighborhood of stabilizator and generates fluorescent signal increasing in real time proportionally accumulation of amplificat (Figure 1).



Figure 1 – Scheme of fluorescent signal formation

PCR results can be expressed in the form of graphs and in relative digital quantities. One channel of device DT-96 after every amplification cycle records the signal, testifying accumulation of the DNA fragment *F. culmorum*. By these data the kinetic curve PCR is built. If fluorescence of this investigated sample definitely exceeds the value of background fluorescence (threshold value), reaction result is positive. The more the initial number of copies of specific DNA in the analyzed sample (star concentration of DNA-target), the less amplification cycles are necessary to get the threshold value.

Table 2 – Report on the results of the PCR analysis:
Determination of relative concentration of DNA *Fusarium culmorum* in different wheat fibers

Hole number	Glass-tube indentificator	Ct, Fam	Concentration
C4	Negative test, leaves	–	нд
C5	Scarlet, leaves	–	нд
C6	Benefis, leaves	–	нд
C7	Polaris, leaves	–	нд
C8	Positive test, leaves	21,8	2,9
C9	Negative test, seeds	–	нд
D4	Scarlet, seeds	21,4	1,87
D5	Benefis, seeds	24,3	0,46
D6	Polaris, seeds	23,3	0,96
D7	Positive test, seeds	17,5	24,0
D8	K- (water)	–	нд
D9	K+ (mycelium <i>F.culmorum</i> , 10 ng/mcl)	18,5	10,0

* Manual (threshold) method of analysis (B,F) Threshold_FAM = 10,0 Threshold_HEX = 0,0

Algorithm of definition of amount of target-oriented DNA in the sample is based on simultaneous analysis of the researched samples and compared test sample having the DNA-target in the known concentration. As the standard we used DNA *F. culmorum* in the concentration 10 ng/mcl (D9). The fungus DNA in concentration of 2,9 ng/mcl (C8) appeared in the leaves of plants from the positive test group. In the leaves of plants grown from the dressed seeds fungi are not detected (C5, C6, C7). The remarkable changes occurred in the substrate. In untreated grain considerable number of DNA fusarium – 24,0 ng/mcl (D7) is accumulated. Infection background round dressed seeds is significantly lower. So, the processing with Scarlet decreases it in 10 times (D4), with Polaris – in 25 times (D6), with Benefis – in 50 times (D5) (Table 2).

Thus, the results of the carried out experiment prove the presence of the system effect from herbicides application and their control influence on the infection background round seeds. At that, innovative three-components Benefis and Polaris exceed two-components Scarlet by these parameters.

Researches on the DNA level have become already routine practice in medicine, veterinary, selection, taxonomia, bioengineering, etc. Modern level of PCR-diagnostics application in plant breeding is not high. Implementation of molecular methods into this branch allow analyzing great amount of plant organisms to find genetically modified plants, precise and fast identification of phytopathogens, to control the efficiency of anti pests stoppers, sorting out unfavorable seeding material, monitoring of infection background of sown areas, etc.

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AGROFOOD FIELD OF UKRAINE

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ABSTRACT

The state of the art and problems of evolution of an agrofood field is observed. Dynamics of manufacturing and milk consumption in Ukraine is analyzed. Principal causes of a low level of consumption of milk are fixed.

KEY WORDS

Agrofood field; Milk cattle breeding; Manufacturing; Milk consumption; Efficiency.

The cattle breeding is the major branch of animal husbandry. There are several reasons of the formed situation in animal husbandry. At first, for years of reforms the rise in prices for the electric power, agricultural machinery, lubricants, production equipment for stock-rearing farms, feedstuff and feed additives considerably outran a rise in prices for agricultural products. Secondly, converting and trade enterprises purchase prices, thus a selling price exclusively fixed did not ensure reimbursing of expenditures for manufacturing. Thirdly, sharp cutting-down of the state support and rise in price of credit resources have led to collapse of a potential production of animal husbandry, transition to primitive technics with growth of inputs of work and production net costs. Fourthly, lack of money resources for facilities has sharply reduced implementation of young breeders and agency of the pedigree operations on a commodity production. As a result many facilities do not perform qualitative reconditioning of flock, and high-priced on genetical potential the cattle is implemented on meat. Fifthly, uncontrolled import of the food has made negative impact not only on a domestic commodity producer, but also on saturation capacity of the market, determining a price situation on him. The matter is that as well imperfect state customs policy.

THE ANALYSES OF RESEARCHES

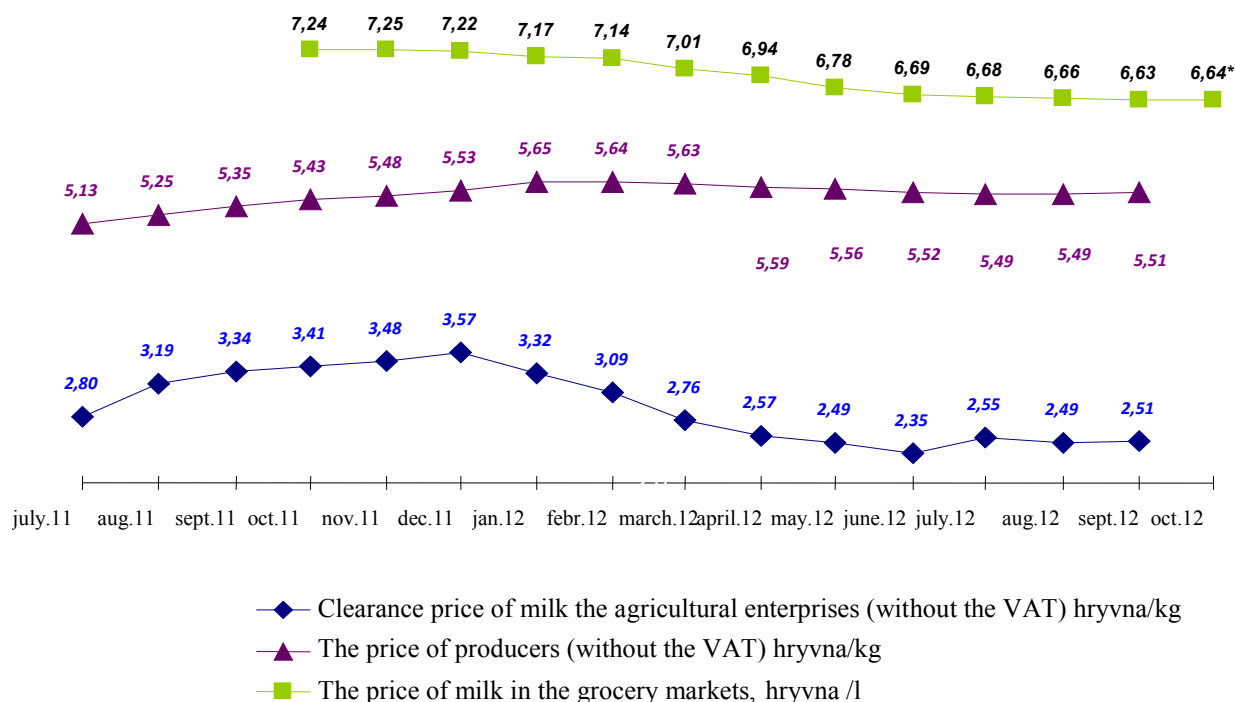
Problems of evolution of a competitive agrofood field were studied by such Ukrainian scientists, as M.J.Malik, P.T.Sabluk, U.F.Melnik, V.J.Mesel-Veseljak, M.V.Zos-Kior and other scientists. But many unsolved problems of evolution of branch and its reconstruction still remain. Paper purpose consists in detection of paths of accretion of production of an agrofood field as a whole across Ukraine and development of measures on support of evolution of branch.

RESULTS OF RESEARCHES

The milk manufacture in Ukraine is augmented, and consumption remains to one of the lowest in Europe. Despite lacking privileges and livestock cutting-down, a milk manufacture in Ukraine grows. But Ukrainians consume it a little - in one and a half time less than, for example, Russians. Heavy prices for milk food and stereotypes about their poor quality prevent.

In 2012 in Ukraine the milk manufacture of all aspects has notably grown. So, for January-April, 2012 volumes of production were augmented by 2,8 % year by a year. Experts of the company Tetra Pack claim, that the milk manufacture is augmented at the expense of decrease of a fraction of facilities of a private sector and increasing of a fraction of farms, where efficiency above.

With milk increase in production in Ukraine prolongs to decrease quantity of a livestock (for January-April, 2012 on 1,2 %, to 2624 thousand goal.). Purchase prices of the milk, fixed for quotients household, can be in times more low, than for agricultural productions. Furthermore a capital recovery factor of a milk manufacture has decreased after a cancellation of subsidies in 2011. Milk increase in production in country was ensured with agricultural productions: in January-April the increase in them has compounded 14,7 % whereas in facilities of the population decay on 0,8 % has been noted. Today investors insert tools in large goods manufacturing with account, that from the cow will gain not 3, and more narrow 5,5-6 tons of milk a year. In Ukraine at last there was an understanding of that should gain qualitative commodity from which one it is possible to get out not only on domestic on a runout, but also on international the markets. Capital recovery factor of a milk manufacture in 2011 has decreased on the average from 27 % to 17 %. But the landslide of purchase prices this year forces producers to work is unprofitable. It is possible to speak about attractiveness of business, if the purchase price of milk was 4,5-5 hryvna /l (in 2012 - 3,1-2,6 hryvna./l).



* a status for 30.10.2012

Figure 1 – Price development on milk in Ukraine

The prices milkprocessing industry in September, 2012 compounded 5,51 hryvna /kg, or on 3,0 % it is more than in September, 2011, apparently about fig. 1. The average price of implementation of milk the agricultural operations in September, 2012 compounded 2,51 hryvna /kg (without the VAT), that on 24,9% it is less than for a relevant period of the last year. In comparison with August of a current year the milk clearance price the agricultural operations in September has grown on 0,8%. As fig. 2 stands, in January - September, 2012 all grades of facilities is effected 8948,4 thousand permanently delete milk, that on 2,6 % it is more than in January - September, 2012. The milk manufacture the agricultural operations in January - September, 2012 compounded 1974,3 thousand permanently delete, that on 13,4 % it is more than for a relevant period of 2012.

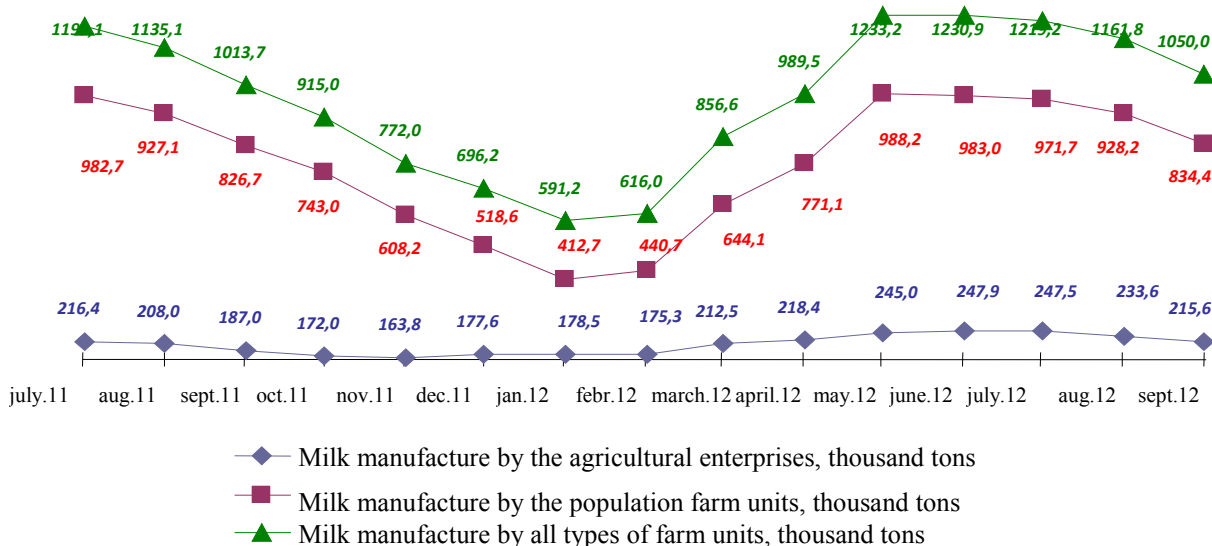


Figure 2 – The changes of a milk manufacture in Ukraine

According to sizes of consumption of milk commodity Ukraine occupies one of last places among the European countries. On the average one Ukrainian consumes about 34 litres of milk a year (not including other milk food), that almost four times it is less, than in Finland, and in 1,5 times it is less, than in Russia.

Ukrainians consume not enough milk and milk food. As of today a consumption level of the produced commodity in Ukraine below recommended approximately on 30 %. According to international advisories, the adult person should consume the order of milk of 700 ml and milk food in day.

The subsequent years the trend even will gain in strength. For 2011-2014 consumption will grow from 275, 4 million l to 300,2 million l, in annual gauging - on 2,9 %, forecast in the company Tetra Pack. The chief driver there is a growing demand from inhabitants of developing countries with a low level of incomes (\$2-8 in day). Active demand is expected in Asia, Africa and Latin America - here consumption will grow from 70 billion l in 2011 almost to 80 billion l in 2014 Most of all (+20,8 %) will grow consumption of milk commodity in Asian-Pacific locale. In the Eastern Europe the market will grow all on 0,6 %, and in the Western Europe - will display stagnation (-0,3 %).

As to the most popular milk food, it is the activest in 2008-2011 such grades grew: flavoured milk (+4,5 % a year), milk for children and teenagers (+9,5 %) and sour-milk beverages (+12,5 %). In 2011-2014 saving of active growth in the named segments is expected, but the strongest indexes can display potable yoghurts (an increase on 4,7 % a year) and fat-free cream (an increase on 4,5 %).

The ministry of an agrarian policy and the food of Ukraine forecasts milk manufacture accretion this year in 3-4 % - up to 11,5-11,7 million tons.

In facilities of all grades the common milk manufacture was augmented in 19 locales, and is essential - in husbandries of Poltava (on 11,7 %), Kharkov (on 9,7 %), Cherkassk (on 7,1 %), Rovnensky (on 6 %), Ternopol (on 5,6 %) regions.

The average milk yield of milk from one cow for I planning quarter in the agrarian operations compounds about 1050 kgs, that on 16 % more than for a relevant period of 2011 So, high milk yields of milk in I planning quarter were in husbandries of Kiev (1372 kgs), Cherkassk (1284 kgs), Poltava (1208 kgs), Kherson (1153 kgs), Kharkov (1149 kgs), and also Vinnitsa regions(1124 kgs) and in Crimea (1113 kgs).

The segment of milk and milk food in Ukraine occupies third of all food market of country. So significant sizes make branch by installation of steadfast attention, both from operators of the food-processing industry, and from the state frames which one undertake the measures routed on adjustment of the market.

On a findings of investigation, conducted by company Research and Branding Group in April, 2012 (data acquisition was spent by a method of personal interview in 24 ranges of

Ukraine and o Autonomous Republic of Crimea on quota sample to a thinning, representative country for adult population on the place of residence, a floor and age), 75 % of inhabitants of Ukraine purchase milk food at least once a month and more often. According to a findings of investigation, more often Ukrainians purchase milk of 1 time in two weeks (30,8 %) or 2-3 times in a week (29,3 %). Sour cream and yoghurt - once a week (33,1 % and 23,8 % accordingly), chocolate glazed curd bar, every fifth purchases curds 1-2 times a month. At the same time fermented baked milk, yoghurt, cream yogurts and glazed curd bar are not included into the enumeration of yields of the first consumption - much less often and much less Ukrainians buy them. Thus the bulk of Ukrainians - over half of population - for last month at all did not purchase cream yogurts, chocolate glazed curd bar (68 %), yoghurt (56,8 %) and fermented baked milk (55,7 %). In a ration almost every second Ukrainian for last month was not cheese and curds, and third of citizens did not use such significant for health a sour-milk yield as yoghurt.

Competitive medium so tight, that a consumption level specified trademarks does not exceed 8,8 % (on findings of a public opinion poll of exploratory company Research and Branding Group). Trademark leaders who purchase more often steels: «President», «Dobrynya», «Vesioly molotchnik», «Dobriana», «Prostokvashino», «Zlagoda», «Galichina».

In 1998 in Ukraine the program of state support for producers of milk in the form of the subsidy at the expense of backstock of the VAT from implementation of off-the shelf milk commodity has been entered. Agricultural productions peasants - two times a month through milk processing plants gained it monthly, and peasant farmers two times in a month. In 2010 they have decided to change this principle - after coming into force the new Tax code landowners have started to enumerate the VAT in special fund of the state budget. And in 2011 of a means for reimbursements for milk also have at all stopped to designate (year before the subsidy have compounded 970 million hryvnas.).

In 2012 the Cabinet council was occupied again by the solution of problems in the milk market. In March prime minister Nikolay Azarov has entrusted with the agrarian policy and foodstuffs Ministry to develop the strategy of the target address subsidy to producers of milk, and also the program of price reduction of feedstuff. In April the minister of an agrarian policy Nikolay Prisjzhnjuk has presented the program of accretion of a livestock of cows according to which one the government has designated from special fund of the state budget 1,08 billion hryvnas on the subsidy to peasants for cultivation of young plants of large horned stock. It is expected, what is it will allow to augment a livestock which one cultivate in a private sector, in 30%, up to 2,65 million cows.

Initiating the growth a livestock, the government does not boost milk manufacture accretion in Ukraine, market participants are assured. Giving of subsidies for cultivation of young plants of large horned stock can lead to that in the milk market the situation which one was watched in due course in sugar field will be stacked. In one year from the state budget means for are designated sowing a beet, and following year because of overproduction of sugar the state has been compelled to redeem this sugar in a state spare CUZ owing to overflow of commodity in the market and falls in prices sugar factories failed to pay off with landowners.

Initiating the growth a livestock, the government does not boost milk manufacture accretion in Ukraine.

Boost of consumption of milk and milk food in country should become the government main task. For example, today France and the Scandinavian countries consume over 590 kgs of milk per capita in a year. Baltic countries - more than 300 kgs. Russia – about 250 kgs. In Ukraine this index is about 200 kgs. In many EU countries advertising campaigns on popularisation of milk food are spent.

The accretion of export of commodity could become the significant incentive 4 the market 2. Milk in Ukraine is manufactured in sufficient size. In particular, Ukraine cannot deliver now milk commodity in EU as for this purpose it is necessary to drive a type certification of all cycle of manufacturing: from the field on which one feedstuff for cows is cultivated, up to end production - milk and milk food which one are manufactured on milk processing plants.

For developing of milk cattle breeding in Ukraine the state should take up expenditures of producers partially at least. The dairy husbandry requires a high level of investment cost. By our appraisals, investment cost on one cow in Ukraine compound \$10-12 thousand

Not waiting state supports, milk processing plants have started to invest in manufacturing. Now the producer and milk processor plays each the district, and it has jogged to create such project, as "Milkyland Agro", merging 16 co-operative societies from 17 thousand terms which one in 2011 have fabricated 24 thousand permanently delete milk. In Danone, for example, there is a development programme of supply contractors which one envisions the partial financing of acquisition or animals, or reefer equipment installations. Thanks to this program is volplanned to augment deliveries of milk from the produced facilities by 25 % the proximal three years.

Implementation of genetical potential of the majority of species in our country is restrained by a weak food supply. The charge of all aspects of feedstuff on one conditional head of large horned stock in 3-4 times is less, than it is required at intensive support of milk cattle breeding. Despite livestock decrease, security sterns does not improve, and to the contrary, it is aggravated.

Boost and adjustment purchasing, wholesale and consumer prices should become the relevant link in a support system of the operations on manufacturing, waste-handlings and milk implementation.

Each agricultural operation can successfully pursue the scheme on production if will have enough of productive animals. Ground of increase in production of commodity in the conditions of intensification is increasing of productivity of animals. The basic radiant of refill of flock is obtaining of an increase from a parent livestock. Plot underfulfilment can be the result of a barrenness of cows, a mortinatus increase. The relevant radiant of refill and flock reproduction is purchasing of breeding animals. The basic index of an intensification of production of milk is productivity of animals. The productivity accretion will allow to raise the level at minute expenditures of a capital recovery factor of manufacturing.

CONCLUSION

One of the major paths of an improvement of the organisation of production of cattle breeding - a justification of the most rational in the conditions of the concrete agricultural operation of modes of a contents of animals and system of support of branch. They make defining impact on making up of a machine system 4 mechanisation of work flows and organisation of these processes, sampling of a form of organisation of transactions depends on them on girders and complexes, their economic indicators.

Therefore, the combination of mentioned organizational - business factors with the state support of evolution of agriculture will be created by possibilities to manufacture competitive and high-quality commodity of milk cattle breeding.

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TO THE PROBLEM OF BIOFORTIFICATION AND DIVERSIFICATION OF LENTIL CROP

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ABSTRACT

In the review the lentil role as the most valuable pulse crop for consumers is shown. It is noticed that biochemical structure of lentil grain leads it to the class of irreplaceable dietary products used both in daily ration, and in medical, children's and vegetarian food. Directions of biofortification and consumer diversification of crop are specified.

KEY WORDS

Lentil; Crop; Biochemical structure; Biofortification; Consumer diversification; Breeding; Varieties.

Lentil (*Lens culinaris* subsp. *culinaris*) is one of the most popular grain legumes, demand or it is continuously increasing. The increase of lentil consumption is considerably ahead of the relative growth of the world population. In 1960-s lentil world production corresponded to about 1 mln tons at the population of 3,3 bln people. Now 6,7 bln people live on the Earth who produce and consume about 4 mln tons of lentil. This kind of condition is not typical for the majority of other leguminous crops. It is supposed that by 2030 lentil consumption will be doubled [55].

The main lentil producers are Canada (1947 thous. t), India (900 thous. t) and Turkey (447,4 thous. t) [36]. Russia being at the beginning of the XX century the world leader in this crop grain production, in 2010 occupied only 17th place and mostly due to the cultivated area reduction. Their maximum decrease was marked in the last ten years of the XX century. At present lentil sowing in the country occupy altogether 6...11 thous. ha.

The main reason of the real situation is low economic efficiency of production. That is why it is necessary to understand what market potential the crop has and what perspectives are to be realized in the conditions of Russia Agro Industrial Complex. This article is devoted to the reference data analysis and the results of research of lentil grain performance in the aspect of its biofortification and diversification.

RESULTS AND DISCUSSION

Lentil is one of the first domesticated crops. Its cultivation is connected with the beginning of so called "agricultural revolution", took place about 10000 years ago in the Middle East [33]. The most ancient findings of the wild growing lentil remnants are found in settlement Mureybit (Syria), domesticated forms are found in the Neolithic age layers in Turkey [37]. Alo together with colleagues [29] on the basis of PCR-analysis of 308 species from collection ICARDA, presenting all seven taxons of family Lens, determined that the factual area of domesticated lentil appearance can be South Turkey. The maximum variety of wild growing species and primitive domesticated forms are typical for these territories. They

prove that the Middle East is the primary center of lentil domestication. According to the researchers' opinion lentil domestication was done by selection of subspecies *L. culinaris* subsp. *orientalis* inside wild populations [37]. On the basis of research of the chromosome polymorphism and the DNA the suggestion was done that this process was realized simultaneously or during the short period [58].

Lentil spreading from centre of origin was done in the period of agriculture active development in several directions [37]. The cultivating areal extension took place in complex with such crops as barley, wheat, chickpea, pea, broad beans, etc. It is stated that about 8000 years ago lentil was in Greece; 5000-7000 years ago in the Central Europe and in Egypt. On the territory of modern Spain it appeared approximately 7500 years ago in the content of typical group of the Middle East crops (*Triticum monococcum*, *T. dicoccum*, *T. aestivum*, barley, pea, peavine, broad beans). Then (4000 years ago) lentil transferred to the Indian subcontinent. There as the result of reproductive isolation specific endemic variety group was formed. It was characterized with asynchronous flowering [34]. To the ancient Russia lentil came from Greece through Italy, Germany and Lithuania, being one of the main peasants' food in the middle centuries [14].

The wide areal of lentil extension is explained with its valuable high protein content and its role in food and provision of food safety of millions of people [35]. Also as for many other leguminous crops the protein content is the most important criterion of lentil grain quality. At the result of the regionalized and perspective varieties study in competitive variety trial in All-Russian Research Institute of Legumes and Groat Crops it was stated that their protein content is 27,9% in the average [18]. Its maximum content is observed in large scaled seed (MTC >60g) varieties Л-68, Vekhovskaya 1 and Svetlaya (in the average 28,6%), that contradicts to the well-known fact: there is negative correlation between seeds size and protein content [3]. In the selection process it is typical for the majority of leguminous crops that mass of 1000 seeds is the leading factor of their productivity growth. But at the same time the relative protein content in seeds decreases [1, 2]. Lentil can be considered an exception from this rule. The results of our research demonstrate that this crop protein content correlates positively with seeds size though the level of the correlation is not high [17, 28]. Analogical data are obtained by B. Sharma [51]. This points out to definite perspective of increase not only in seed size but also in consumption indicators of their quality of new lentil varieties.

To improve this or that plant indicator with selection methods is necessary to know the genotypic variation. As the investigation result in 2001...2003 and in 2007...2009 (54 and 63 species, correspondingly) prebreeding collections of lentil species of different ecological and geographical origin obtained from genofonds of All-Union Research Institute of Plant Breeding under the name of Vavilov of Russian Academy of Agricultural Sciences and Ukrainian Centre of Genetic Plant Resources of Ukraine Academy of Agricultural Sciences, we demonstrate that the protein content of genotypes *Lens culinaris* subsp. *culinaris* varies in a wide range – from 21,7 to 32,2% [15, 16]. The species with steady high protein content are differentiated. They considerably increased regionalize standard by this indicator: κ-1700, κ-224 (Russia), κ-2821, κ-2824 (France); Luganchanka, κ-1973 (Ukraine), they are recommended as sources for selection for high quality of crop grain.

It is known that lentil protein is referred to biologically valuable, because its content includes all essential amino acids [14, 46, 47]. It is a good lysine source but it is poor in sulfur containing amino acids and tryptophan [5, 57]. Thus combined usage of cereals grain (lysine deficient but well provided with methionine, cysteine and tryptophan) and *n* leguminous (including lentil) creates well balanced by the protein content food mixture [35, 55]. It is possible to give many examples of complex usage of grains of these crops in nutrition of different continents peoples: maize and beans in America, sorgo and vigna in Africa, different types of wheat and beans, pea, lentil, peavine in Europe and in the Middle East, rice and pigeon pea in Asia.

Besides protein, seeds of different lentil varieties have about 67 % carbohydrates, 2,5 % - fat, 12,2 % - dietary fibers. Energy value of 100 g of lentil seeds corresponds to 1,638 kJ [6, 10, 18, 21, 22, 39].

Lipids have great value for person's nutrition. They are important source of bioactive

components – phytosterols, squalenes and tocopherols [48]. Lentil seeds have many phenol compounds with high antioxidant activity [30]. From fatty acids the considerable number corresponds to unsaturated acids – linolic and oleic acids [57].

Besides, lentil seeds have carotenoid pigments, in particular beta-carotene, which has antioxidant properties and is necessary for normal vision, immunity improvement. Also it participates in protection from toxins and cancer formation. Beta-carotene content fluctuates from 1 to 6 mg/g and seed consumption 100 grams per week meets person's consumption completely [54].

Lentil seeds contain such vitamins as inositol, nicotinic and ascorbic acids, that are necessary for balanced nutrition [31, 49, 50].

Lentil is included into top-50 of vegetal products with maximum content of prebiotics – physiologically functional food ingredients, providing at systematical consumption positive influence on person's organism in the result of selective stimulation of growth and / or increase of biological activity of normal flora of intestine.

Lentil is characterized with high concentration of the most important microelements [35, 55] and can successfully assist to decide the problem of their deficiency in nutrition which is suffered by nearly two billions of people on the Earth (especially in the countries of eastern Asia, Africa and the Latin America) [54]. That is why it is considered as model object of biofortification – a new trend in traditional selection, connected with increase of nutrient value (including, microelements content) of agricultural crops.

One of the most important microelement is selenium, deficiency of which is felt in the world by 30-100 bln. people. It results in considerable worsening their health [32, 52]. The consumption of sufficient amount of selenium considerably decreases the cancer risks. Selenium possesses antioxidant properties, increases enzyme activity, and positively influences the muscular tissues development. Lentil seeds in this case can serve as an important carrier of this microelement. Different lentil varieties being grown in the North America contain 425-673 mg Se in 1 kg of seeds. Consumption of 100 grams of lentil provides 77-122% of week human need in selenium. But accumulation of Se in the crop seeds greatly depends on its concentration in the soil. Thus in lentil being grown in Syria, Morocco and Turkey on the soils with low selenium content it accumulated only in the amount of 22-47 mg/kg of seeds [54].

No less important is ferrum and zinc content in seeds, because the first microelement is included into the blood enzymes content which realizes oxygen transport, regulates the processes of cell growth and differentiation, the second enzyme has antioxidant properties and is necessary for the DNA replication, protein synthesis, oxidative stress reduction, fulfils brain blastema protective function. Nowadays nearly 60% of the Earth population suffers from ferrum deficiency and 30% - zinc. This situation is typical for developed and developing countries [41, 54, 56].

Lentil contains the considerably amount of these elements [10, 35], that mostly depends on place of crop cultivation and from soil mineral content [54, 55]. The maximum high ferrum content is typical for lentil from Syria (63 mg/kg), Turkey (60 mg/kg), minimum – from Australia (46 mg/kg) and Morocco (42 mg/kg). Maximum zinc amount is contained in lentil seeds, grown in Syria (36 mg/kg), Turkey (32 mg/kg) and the USA (28 mg/kg), minimum amount – in Australia (18 mg/kg) and Morocco (27 mg/kg).

It is stated that consumption of 50 g of lentil seeds produced in the central part of the North America, covers the minimum of 20-50% of week human need in ferrum and 20-30% need in zinc [55]. At the same time, the relatively low content of phytates is defined in lentil. This increases the availability of ferrum and zinc for human organism [53]. Genetic biofortification allows reaching the increase of the mentioned elements content in lentil in different regions by means of finding out and involving into the selection process the genotypes with enhanced capability to their accumulation.

Lentil is a rich source of some other important for nutrition microelements: Mg (911-1087 mg/kg), Mn (10,8-16,4 mg/kg) and Cu (6,9-9,3 mg/kg) [54]. Consumption of 50 g of crop seeds provides 10-58% of the recommended for a person these elements number. High level of genotype variation by their content allows doing dedicated selection for chemical content improvement.

Lentil dominates among leguminous grain crops in taste and nutrient value. It is cooked well and has fine and pleasant taste [21, 55]. Dishes cooked from lentil differ little in taste and nutrient value from meat dishes [24]. In countries of the South-East Asia lentil was called "pauper meat", but now dishes from it are popular in nutrition of different social-economic groups of population [31]. That is why culinary grain evaluation is very important for lentil. Analyzed in competitive variety trial in All-Russian Research Institute of Legumes and Groat Crops regionalized and perspective lentil varieties were characterized with great variety according to cooking period (47-72 min.), the cooking ratio varied in inconsiderable range (2,4-2,7%) [18]. The highest cooking was typical for small seed varieties, that had the best water-uptake ratio for shorter time period: Lana (50 min., K=2,7%) and species Chiflik 7 (47 min., K=2,6%); the worst - large scaled seed varieties: Vekhorskaya 1 (72 min., K=2,4%) and Svetlaya (65 min., K=2,5%). At that all lentil varieties had excellent taste qualities.

It is stated in our research and other authors' works, that being compared with other leguminous crops, lentil seeds are characterized with low activity of inhibitors of trypsin and chymotrypsin [8, 27].

Biochemical lentil seeds content makes it especial valuable in medical, children and vegetarian nutrition. In medical diets it is used to decrease the risk level of cardiovascular diseases, tonsillitis, type II diabetes and hypertension [42, 55].

Unique consumer advantage of lentil seed is the correlation of protein (1/4 part) and carbohydrates with dietary fibers (3/4). This ideal balance defines low glycolic index of lentil (25) and allows regulation of normal level of sugar in blood. Such protein and carbohydrates combination is the most pleasant for sportsmen nutrition, especially skiers, runners, football players. It was stated in the course of special experiments, being done in Canada [55]. In this case lentil is considered as natural energetic.

As a whole these properties and qualities of seed make lentil highly popular crop in the consumer world market. The basic market lentil seed classes in the North America have yellow colour of cotyledons, but at the last time the interest to red seed lentil, especially chipped integrate and cut is increasing [44]. The most popular green lentil varieties are large scaled seed varieties with mass 1000 seeds 50-70 g: Brewer, Laird, CDC Glamis and others. Middle scaled seed Canadian variety Richlea is highly valued for high productivity and excellent quality of seed. Small scaled seed varieties of green lentil with MTC 30-42 g Eston, Viceroy and others are very popular, mainly on the markets of Europe, the Central and North America. Red seed lentil is popular on the world market, especially in India, Bangladesh, Pakistan, Sri Lanka, Egypt, in the countries of the West Asia, these are its main importers. Crimson, CDC Blaze, CDC Redberry, CDC Red Rider are grown from the varieties of such type. Spain brown lentil Pardina is widely cultivated in the USA and is exported, mainly to Spain. French lentil with green strongly spotted colour of seed cover is presented mainly on the Europe markets and is used in an integrate form for salad cooking. The main varieties of this type are Du Puy, Peridot CL и LeMay.

In farm enterprises of the West Asia, the North and East Africa preference is given to different lentil varieties. Thus in Turkey and Syria 80-85% of red seed lentil and 15-20% of green seed lentil are grown; 95% areas are occupied with large scaled green lentil varieties in Iran and Morocco, and in Ethiopia only red seed lentil is cultivated [49]. In Australia also red seed varieties are the most popular [43].

Large scaled seed green (plate) lentil is widely spread in Russia. The varieties with brownless and weak brown seeds, with steady without a design colour are considered to be the most popular [21]. In connection with this lentil selection in All-Russian Research Institute of Legumes and Groat Crops is directed mainly to create varieties of such kind. Seed size of the studied in the competitive variety trial varieties change in the range of from 4,5+5,0 to 7,0+6,5 mm [18]. The largest grain was typical for the following varieties Vekhovskaya 1, Svetlaya, Aida, Л-93, the smallest – Lana and species of Obraztsov Chiflik 7. At this created in All-Russian Research Institute of Legumes and Groat Crops, variety Svetlaya, included into the State Register of selection achievements, eligible for use, at storage does not get brown for a long time and keeps light colour according to its name. The best from the studied by us modern lentil varieties keep the fractionary seed content practically unchanged by years. Their seeds are characterized also with high evenness which varies in the range of

74,7...88,8%. According to seed covers and regionalized and perspective varieties differ insufficiently - 10...10,8%. But it is possible to detect the regularity of increase of cover content with decrease of seed size. Small scaled (MTC < 40 g) varieties Lana and Obraztsov Chiflik 7 have the highest content of covers. It reflects negatively on consumer quality of seed.

It is necessary to stress that in the aspect of technological culture diversification not only the whole grain quality but also the obtained from it groats and flours play the most important role. It is proved that lentil groat is more nutritious than whole grains because its seed covers at processing are taken away [20]. Flour is mostly used in baking industry. Its addition to wheat flour in amount of 15-20% increases protein content in bread by 3–4%. Lentil flour is also used in confectionary and gastronomic industry at production of coffee, cacao, sweets, biscuits, chocolate, sausages [13, 23, 26]. Receipts and technologies of combined foods, close or analogical to taste advantages to drinking dairy and fermented milk products are developed on the basis of lentil [4].

Taking into consideration unique biochemical content in the aspect of consumer diversification deep processing of lentil grain can have wide perspectives. Nowadays there is great number of works on obtaining protein isolates from different raw sources. Never the less industrial production is based on mainly one type of vegetal resources – soybeans, in spite of great efforts directed to raw base extension to obtain vegetal protein products [9]. Lentil is actively investigated in this aspect. The possibility to use lentil for preparation of combined meat and vegetal products is demonstrated. Substitution of meat raw for flour from lentil reduces fat fraction by 1,2...4,4% and increases protein fraction by 1,6...3,1% [19]. High content of separate essential amino acids in lentil protein creates the possibility of obtaining food products with increased biological value in the result of mixing and common consumption of proteins of vegetal and animal origin [5]. Texturization of protein isolates of lentil and development of meat artificial products on their basis is perspective [11].

Vegetative mass of lentil plants plays an important role in the live-stock breeding. It is valuable fodder for agricultural animals [7, 20, 25, 38, 49]. The Haddad и Husein researches demonstrate [40] that lentil grain by its nutrient value surpasses vetch grain and comes to alfalfa grain. Green mass of plants can be used as a green manure [45, 57].

CONCLUSION

Thus, lentil grain biochemical content promotes it as one of the essential dietary products, used in every day ration, medical, children and vegetarian nutrition, and also allows extending biofortification and consumer diversification of the crop. Lentil can play a very important role in providing food safety of the country.

The enumerated advantages of lentil give the reason to consider it high-yield market crop. The Canadian experience demonstrates that it is able to bring significant income to the state as a crop with high export potential. In 2009 when 1,51 bln. tons of lentil grain were produced, 1,25 bln. tons for the sum of 918804 thous. \$ (FAOSTAT) was exported [36]. The second place was occupied by the USA, which export was 184077 tons of grain. This year Russia at total production of 7180 tons delivered to the market only 2389 tons of grain for the sum of 1435 thous. \$.

That is why the lentil crop revival in Russia can be considered as one of the prior directions of national plant science development, selection must be the ground for it from one side and modern technologies of deep processing must be from the other. This completely corresponds to the main requirements of the strategy of The Russian Federation grain farming development – the necessity of technological and consumer diversification of crops, which means the increase of an assortment and the produced food quality [12].

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THE IMPACT OF DESICCANTS AND GROWTH REGULATORS ON THE SOWING QUALITY OF SOYA SEEDS

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ABSTRACT

The text under review deals with the results of studies of the technological parameters of using desiccants Reglon Super and RAP-600 on yield and sowing quality of soya seeds in the Orel region. Additionally the impact of growth stimulating preparations on the stressful situation of desiccants on seed germination and the residual amount of pesticides were determined.

KEY WORDS

Soya; Desiccants; Yield; Moisture; Quality; Seeds.

Soya is practically a new culture for the Orel region. Its crops have been increased rapidly for the last decade thanks to the fruitful work of the local plant breeders, who have bred early-ripening varieties, the seeds yield of which is harvested at the end of August and in the middle of September, using the sum of positive temperatures in the region 1900 - 2300°C. To obtain high yields of high quality seeds soya is harvested in the first days of beans maturation. In the wet years soya matures long and uneven. In this case, a pre-harvesting crop desiccation (drying) with Reglon Super and other preparations is used when seeds moisture is 35-40% [3].

By now the world has accumulated a wide experience of desiccants application on the seed crops of various agricultural crops. However, the analysis of their application leads to the contradictory conclusions. Desiccation is established to accelerate the process of seeds maturing for 10-12 days, to ensure its steady character, to reduce damage and affection by fungal diseases, to increase dramatically the productivity of mechanized harvest [5, 9].

It has practically no influence on seed productivity, biochemical and biological properties of seeds, and in some cases even improves them [8]. There hasn't been enough research of this kind on soya.

METHODOLOGY AND OBJECTS FOR RESEARCH

Laboratory and field experiments are being carried out on the experimental field and in the laboratory for seed studies and primary seed breeding of the All-Russian Research Institute for Leguminous Crops in 2011-2013. The experimental plot has dark gray forest soil. The humus content is 4.5%, P₂O₅ - 12, K₂O - 11 mg/100 g of the soil, pH - 5,2. The power of humus horizon is 30 cm. The object for research is soya variety Lantsetnaya, desiccants are Reglon Super and RAP- 600.

The field experiments are carried out on the test plots of 10 m² in fourfold replication. The location of the test plots is randomized. In 2011 the sowing was done on the 21-st of May and in 2012 - on the 17-th of May with the selective drill SCS - 6-10, the planting distance was 45 cm wide. The seeding rate of the viable soya seeds is 0.6 million seeds per hectare. The background of mineral fertilizers is N₃₀P₄₅K₄₅. The treatment of the crops with desiccants was conducted in 3 periods.

The rate of working solution discharge was determined on the basis of 300 l/ha. The plants were sprayed with pneumatic manual sprayer OP - 1.5 in windless dry weather. In 2011 desiccants started to be used on the 21-st of August when seeds moisture reached

50%. The soya leaves turned yellow and began to fall down at the foot end, beans and seeds began to turn yellow.

In 2012, the first treatment with desiccants started on the 11-th of August when seeds moisture reached 65 % (the beginning of yellowing of the foot leaves of the soya plants), i.e. as soon as the visible sign appeared. The rate of desiccants application is for Reglon - 1,5; 2,0; 2,5 l/ha, for RAP - 600 - 2,0; 2,5; 3,0 l/ha.

THE RESULTS OF THE RESEARCH

It should be noted that the weather conditions in 2011 and 2012 were alike: the first half of the vegetation period had a lack of moisture but excessive heat, the second half - the excessive moisture and moderate heat.

Both years were generally favorable for the growth and development of soya. One of the main research indicators of the impact of desiccants on soya plants was the seeds moisture. The analysis of soya seeds moisture dynamics in 2011 showed that both preparations Reglon and RAP 600 caused the decrease of plants moisture. The effect of Reglon was more efficient due to its different preparative forms (Fig.1).

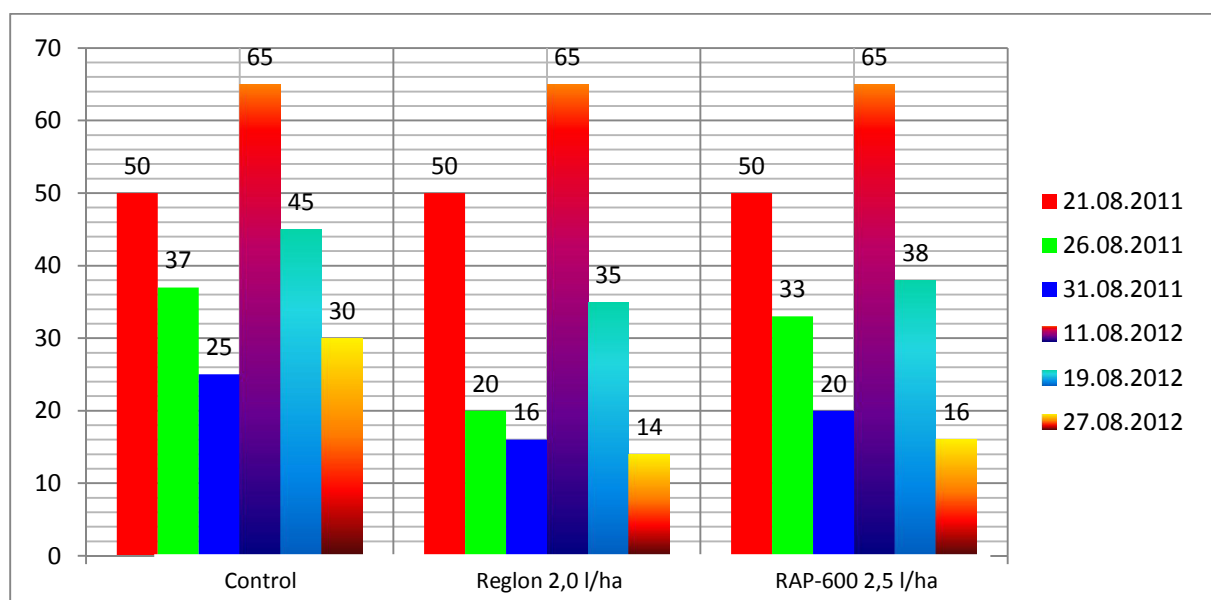


Figure 1 – Soya seeds moisture after treatment with Reglon Super and RAP-600

The desiccants had slight effect on the yield of soya seeds during all periods, even at their early application - in the beginning of yellowing of the foot leaves (Table 1).

The use of desiccants in the first period in 2011 decreased the seed yield by 5 - 10%. This period coincided with the seeds color changing from green to yellow and with leaves turning yellow on the whole plant. Seeds moisture reached 48 - 50%. In the next periods of application desiccants practically did not decrease yields in comparison with the control. The differences in decreasing were more frequent within the experimental error.

It should be noted that in 2012 preparations started to be applied in the earliest period when it only can be visually detected - at the beginning of yellowing of the foot leaves. It didn't make any influence on the soya seeds. It was close to the control. Unlike 2011, soya yield in 2012 was higher when being treated with Reglon by 0.4-1.0 cwt/ha, with RAP - 600 by 1.9 - 2.6 cwt/ha. Thus, our data disprove the generally accepted recommendations that desiccants need to be applied when beans in the foot and middle parts turn brown and soya seeds moisture reaches 45 % [7].

Table 1 – The yield of soya seeds depending on the time and rates of the desiccants application (cwt/ha)

Variants	Time of application						Average h/ha	
	I		II		III		2011	2012
	21.08.11	11.08.12	26.08.11	19.08.12	31.08.11	21.08.12		
Control	21,0	21,6	21,4	22,0	21,4	21,7	21,3	21,8
Reglon Super								
1,5 l/ha	19,8	20,9	21,2	21,4	21,3	21,4	20,8	21,2
2,0 l/ha	19,4	20,4	20,1	20,8	20,0	21,1	19,8	20,8
2,5 l/ha	19,1	20,6	19,2	20,2	20,3	20,7	19,5	20,4
HCP _{0,5}	1,2	0,3	1,1	0,3	0,7	0,8		
RAP - 600								
2,0 l/ha	19,1	21,6	19,4	21,7	20,7	21,4	19,7	21,6
2,5 l/ha	18,7	21,4	18,9	21,5	19,0	21,6	18,9	21,5
3,0 l/ha	18,3	21,2	18,6	21,4	19,0	20,7	18,6	21,1
HCP _{0,5}	0,8	0,5	1,1	0,4	1,6	0,4		

The accumulation of fat and protein in soya seeds, according to many authors [4, 5], goes on until their maturity. The use of desiccants in our research reduced the protein and fat content, especially with the increase of the norms of preparation discharge. But the difference was within the experimental error (Table. 2).

Table 2 – The impact of desiccants on the soya seeds quality

Variants		Time of application					
		21.08.11	11.08.12	26.08.11	19.08.12	31.08.11	21.08.12
		Protein, %					
Control		36,2	40,1	36,1	40,4	36,2	39,8
Reglon Super	1,5 l/ha	36,9	39,6	36,6	40,1	36,1	39,7
	2,0 l/ha	36,6	39,9	36,8	40,5	36,7	39,9
	2,5 l/ha	35,6	38,2	38,2	39,8	37,3	38,4
RAP - 600	2,0 l/ha	35,0	39,8	36,0	40,2	36,0	40,4
	2,5 l/ha	34,3	39,7	35,5	39,9	36,0	40,4
	3,0 l/ha	34,0	38,6	35,0	39,8	35,8	40,2
		Oil, %					
Control		23,3	21,6	23,6	21,9	23,3	22,2
Reglon Super	1,5 l/ha	23,2	20,0	23,5	21,8	23,6	21,9
	2,0 l/ha	23,1	20,7	23,2	20,0	23,4	22,0
	2,5 l/ha	22,9	20,5	22,6	22,0	23,0	21,7
RAP - 600	2,0 l/ha	22,8	21,4	23,2	21,9	23,5	22,0
	2,5 l/ha	22,7	21,2	23,2	21,8	23,1	21,8
	3,0 l/ha	22,5	21,0	22,7	21,8	22,1	21,0

The desiccation when seed moisture is 50 % in the first period of treatment of variety Lantsetnaya in 2011 caused a slight decrease in protein content. When treating with Reglon the reduction of protein content was obtained at the rate of 2.5 l/ha (0.6%). In other variants, there was an increase of protein by 0.3 and 0.6 % in comparison with the control.

The effect of RAP -600 consisted in the considerable reduction of protein content from 1.2 % to 2.2 % when keeping it under control at 36.2%. Its maximum content was obtained with variant Reglon 2.5 l/ha and reached 38.2 %. The oil content in the samples studied ranged from low - 22.6 %, up to medium - 23.2 % depending on the time of treating with desiccants. Its maximum was obtained when plants were treated with Reglon at the rate of 1.5 l/ha in the third period of treating - 23.6 percent.

In 2012 the desiccation carried out in the earlier period practically had no impact on the decrease of protein and oil in the soya seeds. Their indicators were at the same level as the control [2]. In this case, it is necessary to point out the tendency of protein content increase and oil content decrease, in comparison with the year 2011, in variants with Reglon and RAP - 600.

With the physiological ripeness of seeds the laboratory tests for their sowing quality were carried out, as well as for their response to growth-stimulating preparations. The results

of the analyses are shown in Table 3. On average for two years period the germination energy of soya seeds after treatment with desiccation preparations has reached in the variants of experiment 65-73%, when the control was 63%.

Table 3 – The impact of desiccants and growth stimulating preparations on sowing quality of soya seeds

Variants of experiment	2011			2012		
	Aqua Destillata	Binoram ZH	Potassium Humate	Aqua Destillata	Binoram ZH	Potassium Humate
Germination energy, %						
Control	66	93	83	60	71	77
Reglon Super, l/ha	1,5	62	80	76	67	73
	2,0	71	99	81	69	80
	2,5	74	97	80	72	83
RAP- 600, l/ha	2,0	70	86	81	71	87
	2,5	67	83	80	68	90
	3,0	70	88	81	74	87
Germination index, %						
Control	95	97	96	90	92	95
Reglon Super, l/ha	1,5	99	95	97	96	98
	2,0	97	99	95	98	99
	2,5	95	99	97	99	99
RAP- 600, l/ha	2,0	97	98	96	87	90
	2,5	99	99	97	90	92
	3,0	97	98	98	82	91

The desiccation of soya crops has not influenced such an important indicator of quality of seed as laboratory germination. According to the results of two-year old data it can be seen that the laboratory germination of soya seeds in the variants of experience ranged from 90 to 99 % when the control was 93%. The highest values of germination energy and laboratory germination are obtained from Binoram and potassium Humate. These preparations significantly stimulated the indicators analyzed, especially germination energy. When being treated with them, the germination energy increased by 12-17% , the germination of seeds - by 1-5%. The stimulating difference between Binoram and Potassium Humate has not been found out.

According to the environmental requirements the seeds at the permissible content of DDT and HCH can be used either as a seed material or for technical purposes [1]. When the content of these poisons slightly exceeds the maximum permissible limits, the seeds can be mixed with seeds free from them, on condition of bringing the residual amount of the preparation to the permissible quantity [6]. The results of the determination of residual concentrations of desiccants in soya seeds are given in Table 4.

Table 4 – The residual content of pesticides in the soya seeds

Pesticides	Permissible Concentration	Control (without desiccation)	Found			
			Reglon		RAP - 600	
			1,5 l/ha	2,5 l/ha	2,0 l/ha	3,0 l/ha
HCH,mg/kg	Not more than 0,5	Not more than 0,03	Not more than 0,02	Not more than 0,02	Not more than 0,01	Not more than 0,03
DDT mg/kg _s	Not more than 0,05	Not more than 0,004	Not more than 0,001	Not more than 0,003	Not more than 0,002	Not more than 0,002

From the data above we can conclude that after the treatment of soybean with Reglon Super and RAP - 600 the residual content of pesticides, namely α , β , γ isomers of HCH and DDT and its metabolites has not exceeded the rate according to the Government Standard. Therefore the harvest obtained can be used both as a sowing material, and in industry.

CONCLUSION

Our studies have revealed that desiccants can be used much earlier, not when seeds moisture is 45 %, but when it is 65 %. According to the results of two-year studies there was a tendency of slight decrease of the protein content and increase of the oil content in variants with desiccation in 2011, and in 2012 - vice-versa. The preharvest desiccation carried out both in the early and later periods, did not worsen the laboratory germination. This indication ranged, depending on the preparation, from 90 to 99%, which meets the requirements of the Government Standard for original seeds. The residual content of pesticides did not exceed the rate of the Government Standard.

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EFFICIENCY OF COLZA PRODUCTION WITHIN APPLICATION OF THE MARGINAL ANALYSIS

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ABSTRACT

From an economic point of view, economic conditions make rural producers look for different ways of increasing production efficiency and competitiveness of the produced products, but the volatility of the market requires constant consideration of all factors, which ensure the production of colza and the level of its profitability. Production efficiency should be based on an integrated and comprehensive analysis and an integral part of this analysis should be, in our opinion, the margin analysis of the efficiency of crop production.

KEYWORDS

Oil and fat subcomplex; Oilseeds; Agrarian economy; Efficiency; Colza; Marginal analysis; Costs; Economic conditions.

The region's oil and fat subcomplex is an integral part of the agro-industrial complex in the Oryol region, presenting a set of organizations that involve the unity of the process of oilseed production, storage, transportation, refining and marketing of oil and fat products. At the present stage improving the efficiency of oil and fat subcomplex is crucial for the achievement of food security in the country. Due to the high biological value, oil-and-fat production plays an important role in a balanced diet of the population.

Rape remains one of the most demanded oilseed crops both in the domestic and global market. The European industrial countries have already appreciated the advantages of rape production and use as a biodiesel fuel. At present biofuel use by transport is 6% of the traditional, and by 2015 it will have reached 8%. [4]. Rape takes one of the leading positions in the world oilseed production. Countries are more and more interested in the crop due to favorable conditions in the global market of rapeseed and rapeseed oil. Active worldwide consumption of its products, both in food and in technical applications, leads to further use by domestic producers. [5]

All the foregoing words prove the particular relevance and practical value of rape production. In addition, the solution to the problem will significantly reduce the industry's dependence on imports of vegetable oils and other oil-containing foods, as well as promote the growth of food security of the country and the region. In the CIS countries and, above all, in Russia there is a large untapped potential of land resources to grow agricultural products, both for food and for a long-term production of biofuel.

The State Program «Development of agriculture and regulation of markets for agricultural products, raw materials and food for the period 2008-2012» contemplated expansion of sown area of winter and spring oilseed rape in farms of all categories up to 2 million hectares for the period and an increase in gross yield seeds up to 3 million tons. However, increase in acreage, yield and total yield of rapeseed in the farms of various organizational and legal forms of ownership is not fast, as it was planned in the State program. Analyzing the Russian acreage, on which oilseeds are cultivated, we can say that in 2010 they accounted for 9,615.6 thousand hectares, of which 18% (1735.2 thousand ha) is the Central Federal District (CFD). Among 17 areas included in the Central Federal District for the cultivation of oilseeds the Oryol region takes the 6th place (4%, or 67.4 million hectares). The largest share (36%) is occupied by the Voronezh region (1st place), 21% of the area of oilseeds in the CFD is occupied by the Tambov region (2nd place). The Belgorod region takes the 3rd place. Its total area of sowing oilseeds is 246.9 thousand hectares. With a break of 66 hectares the Lipetsk region takes the 4th place. In 2010, the Kursk region took

the 5th place (9%), in 2009 the Kursk region left the Orel region behind, and is moving forward at a solid pace. [7]

In particular, in 2010 it was the first time the area of spring rape cultivation in Russia had reached 638.3 thousand hectares. 34% of the area or 216.3 thousand hectares were cultivated in the Central Federal District. The share of the Oryol region accounted for 17% (36.5 million hectares), and it ranks second after the Lipetsk region according to the size of the area under colza (70 ha). If we consider winter rape, in 2010, crops were grown on 217 thousand hectares, of which only 4% (9.1 million hectares) were in the Central Federal District, 30% of the acreage of winter rape were in the Orel region and 32% - in the Smolensk region. It should be noted that the Lipetsk region was not involved into winter oilseed rape cultivation in 2010. It must be mentioned strongest increase of planted area in 2011 occurred in Western Siberia and the Urals - by 49 and 46%, respectively. In sum, the eastern regions ensured an increase of 95 thousand ha compared to 2010. Of course, the production of any product provides the attachment of certain investments in the sector, which, at the end of the production cycle, must be reimbursed and profitable. Table 1 shows the crop area, yield and total yield of oilseeds in the Oryol region (2010 - 2011). [7]

Table 1 – Production figures of some oilseeds in the Oryol region

Figures	Farms of all categories, 2011	Farms of all categories, 2010	2011 in % to 2010
	Oilseeds-total		
Sown area, ha	93948	67441	139,3
Yield, q from 1 ha	19,9	9,3	2,1 p
Gross yield (weight after processing), t	1629562	479939	3,4 p
Sunflower			
Sown area, ha	28157	9947	2,8 p
Yield, q from 1 ha	23,8	14,2	167,6
Gross yield (weight after processing), t	653072	127955	5,1 p
Soy			
Sown area, ha	14703	15499	94,9
Yield, q from 1 ha	21,7	9,4	2,3 p
Gross yield (weight after processing), t	314203	99113	3,2 p
Rapeseed			
Sown area, ha	48139	39256	122,6
Yield, q from 1 ha	17,0	8,1	2,1 p
Gross yield (weight after processing), t	649904	244978	2,7 p

Therefore, a necessary condition for profit is a certain degree of production development, providing the excess of sales proceeds over costs for its production and marketing. The effectiveness of investments in the production of rapeseeds or any other product depends largely on the price for the goods at the time of its admission to the relevant market, and we should take into account the level of production costs relating them to the possible price level. Besides outputs and colza sales affect production efficiency. Profitability or unprofitability of colza production, therefore, depends on the complex influence, price mobility, costs and outputs. That's why it is very important for Agricultural Organization to determine the precise point. If it passes the point rapeseed production will bring loss. [6]

In the future, when production reaches top results, the financial stability of organizations, will largely depend on the size of its level of profitability and level of payback of the made investments. We consider that the agricultural organizations making colza, and also the state organizations leading agrarian and industrial complex of the region, have to monitor constantly tactical trends in the colza market. Volumes of colza realization made in the Oryol region in 2011 [8] are presented in table 2.

Thus, the analysis of the rapeseed market is influenced by the fact that the operation of the market is carried out in a perfect (pure) competition, where producers cannot influence the price. The manufacturer has to accept the current market price. That's why the organization should, where possible, respond to changing market conditions through appropriate organizational and management decisions aimed at increasing or decreasing volume of sales, maximizing profits or minimizing losses.

Table 2 – Sales volumes of rapeseed produced in the Orel region in 2011

Regions	sold total			including on sales channels		out of the total volume sold	
	quantity, tons	2011 in % to 2010	revenue, thousand rub.	to the processing organizations and the organizations of wholesale trade		outside the territorial subject of the Russian Federation	Including outside the Russian Federation
				quantity, tons	revenue, thousand rub.	quantity, tons	quantity, tons
The Oryol region	29021	124,6	293510	29007	293349	11847	
Trosnyanskij	1576	-	16254	1576	16254	-	-
Kromskoj	2415	126,3	25320	2415	25320	-	-
Orlovskij	2289	4,6p	24291	2275	24131	640	
Zalegoshhenskij	690	77,7	6888	690	6888	-	-
Verkhovskij	1080	-	13240	1080	13240	-	-
Novodereven'kovskij	4924	3,4p	38226	4924	38226	2491	
Livenskij	5889	110,2	53211	5889	53211	3532	
Kolpnyanskij	2992	109,8	27987	2992	27987	2012	
Dolzhanskij	3397	51,2	42841	3397	42841	3172	
Oryol	3768	101,9	45251	3768	45251	-	-

Therefore, the questions of priority directions aimed at increasing rapeseed economic efficiency, forecasting the volume of its production, including the utilization of innovative technologies remain open and require further study. In this regard, we consider it is necessary to conduct a margin analysis of rapeseed effectiveness. This approach to the analysis of the effectiveness will reveal influence of prices, costs and volumes of rapeseed production on profit margin by determining the break-even level of its production and sales [1]. The marginal analysis allows to determine accurately the break-even volume of rapeseed production knowing or supposing price-cost ratio (fixed and variable). Here the determination of the minimum output (sales) colza in an agricultural organization is the benchmark that shows the "threshold" (point), when it is self-sufficient, that is, when the proceeds from the rapeseed sale compensate total costs (Formula 1).

$$P - (AFC + AVC), (1)$$

where P - price, rub. / c; AFC - average fixed costs, rub. / c; AVC - average variable costs, rub. / c; 0 - zero.

The volume of rapeseed production, which provides break-even of its cultivation, is defined as the ratio of fixed costs to the marginal revenue (Formula 2).

$$Q_6 = \frac{TFC}{MD}, (2)$$

where Q_6 - the minimum amount of rapeseed production per 1 ha, c; TFC - the sum of the fixed costs per 1 ha, rub.; MD - profit margins, rub. / c.

$$MD = P - AVC (3).$$

For calculations according to the formulas it is necessary to make the balance of income and expenditure of a total planned production of rapeseed (Formula 4).

$$TFC + TVC = Q_{\Pi} \quad (4)$$

$$TVC = AVC * Q_{\Pi}, \quad (5)$$

where TVC - the sum of the variable costs per 1 ha, rub.; Q_{Π} - planned volume of rapeseed production from 1 ha, c. Taking into account the current market situation of rape, each farm enterprise must determine the minimal limit of its production, when the total costs will be paid off and the desired (target) profit will be achieved. The level of required return is calculated as the ratio of fixed costs (TFC) and the target profit to the marginal revenue (Eq. 6).

$$Q_{\Pi} = \frac{TFC + \Pi}{MD}, \quad (6)$$

where Q_{Π} - the production volume providing receipt of standard (target profit), c; Π – target profit per 1 hectare, rub. For calculation of Q_{Π} it is necessary to make a balance of revenues and expenses (formula 7).

$$TFC + TVC + \Pi = Q_{\Pi}, \quad (7)$$

$$\text{therefore } TVC = AVC * Q_{\Pi}, \quad (8)$$

The marginal analysis allows determining a zone of stability (safety) of colza production that reveals possible reducing volumes of colza production to "threshold" of break-even. Of course, if the volume of rapeseed production, prices, or costs change the «threshold» of break-even, and therefore, the zone of production will change immediately too [2].

Thus, the methodological approaches to analysis of rapeseed production effectiveness in market conditions make it possible for agricultural firms to take organizational and management decisions based on the main components of marginal analysis - price, costs, output and profits. The researches made in one of the agricultural organizations in the Oryol region showed that using marginal efficiency analysis of rapeseed production allows to trace accurately the impact of a number of factors on separate economic indicators of colza production [3].

Fixed costs are usually such costs that remain constant with the change of output (rent, interest on loans, accrued depreciation of fixed assets, certain types of wage). It should be noted that the separation of costs into fixed and variable is arbitrary, because many costs are semi-variant (semi-permanent). The fixed costs for rapeseed production are amortization, salaries, and other costs. Variable costs are costs of seeds, fuel, fertilizer and plant protection products (Table 3).

Table 3 – General and average costs for rapeseed production in agricultural organization

Figures	2011
Area, ha	4281
Yield, t/ha	23,5
Gross production (output), c	100604
Sales volume, c	100410
Amount of fixed costs, thous. rub.	15564
Amount of variable costs, thous. rub.	27512
Gross amount (total) costs, thous. rub.	43076
Average fixed costs of 1c, rub.	1155
Average variable costs of 1c, rub.	1274
Average gross (total) costs of 1c, rub.	2429

In an agriculture organization it is annually cultivated about 4,000 hectares with an average yield of rapeseed 23.5 t / ha (2011). Production volumes and sales volumes in the

economy are practically the same (production is 10.6 million tons, the realization is 10.4 tons), which allows carrying out cost analysis, using data from the calculation of rapeseed production costs. In the farm in the total costs fixed costs are 36.1% and variables ones are 63.9%.

Producing rapeseed the proportion of fixed costs is at the proper level, and since they do not change according to the volume of produced (sold) products, it is, in the case of a significant yield reduction, will not lead to a reduction of the target profit or a loss. For the prevailing balance of price, costs and volumes of production, the critical volume of rapeseed production in the economy is 67,211.7 c. (15.7 c / ha * 4281 ha), which corresponds, at a stable crop area, yield 15, 7 c per 1 hectare of rapeseed (Table 4).

It follows from calculations that the ratio of the actual prices, costs and volumes of rapeseed production is stable enough for the organization. This safety zone is 33.1%. However, not in all agricultural organizations, as rapeseed production is still quite unstable. Sometimes there are large fluctuations in the ratio of sowing and harvesting rapeseed acreage (for example, in 2006, they planted 60 hectares, and harvested 38 ha), and, especially in the yield of rapeseed. Prices in rapeseed market is also not stable enough, and although they are growing, but the rate of increase below the rate of increase in the cost of production.

Table 4 – Calculation of the «threshold» of break-even in rapeseed production

Output, thous. c. Q	Yield, c/ha	Fixed costs per 1 ha, rub. (TFC)	Average variable cost per 1 c, rub. (AVC)	The average total cost per 1 c, rub. (ATC)	Price for 1 c, rub. (P)	Profit from 1c, rub. (Π)
67,2	15,7	3636	1410	1565	1565	0
100,4	23,5	3636	1274	1429	1565	136
57,8	13,5	3636	1476	1631	1631	0
57,8	13,5	3636	1476	1631	1565	-66

It is important to investigate the relationship of factors that impact on the efficiency of rapeseed production. Actual figures are taken for comparison. In this case, the calculations were made on the four options, taking into account firstly - price reduction, secondly - increase in variable costs, - thirdly – increase in fixed costs, finally - on the totality of the above factors (Table 5).

According to the first option we calculated the efficiency of rapeseed production in the case of price reduction at the time of its implementation. It should be noted that the price fluctuation in agricultural market is quite common. Variation in price is fixed at the commodity exchanges (eg, Prices for rapeseed in France and Germany at the end of 2012 were fixed at the following marks EUR 464-475 / t CPT Rouen / Hamburg, EUR 452-462 / t compared to the first half of February, 2012). The gap between the highest and lowest price was about 40%. Seasonal price fluctuations in agricultural products have a direct impact on the organization's profitability.

Table 5 – Efficiency of colza production (the factorial analysis) (area of 4281 hectares)

Figures	Basis	Options taking into account changes of efficiency factors			
		1 (P)	2 (TFC)	3 (FVC)	4 (P, TFC, AVC)
Price 1 c, rub.	1565	1515	1565	1565	1515
Fixed costs per 1 ha, rub.	3636	3636	3709	3636	3709
Variable costs per 1 c, rub.	1274	1274	1274	1493	1493
Break-even level of productivity per 1 hectare), c	15,7	17,4	15,8	16,3	18,5
Profitable production volume (implementations), thousand c	67,2	74,5	67,6	69,8	79,2
Standard (planned) profit per 1 hectare, rub.	3078	3078	3078	3078	3078
The production volume (implementation) providing receipt of target (planned) profit, thousand c	23,1	27,9	23,3	24,9	30,9
The production volume (implementation) providing receipt of target (planned) profit in % to basis, %	100,0	120,8	100,9	107,8	133,8

The second option assumes that variable costs per unit of output will increase due to the steady tendency to rise in the cost of resources used in the cultivation of rapeseed (electricity, fertilizers, fuel, etc.).

On the average during 3 years material costs increased 3 times, which was caused by a sharp increase in rapeseed production and the increase of material costs were 80%. That's why this increase is provided in calculations for this option.

According to the third option it was assumed that the future costs of such expenditure as the repayment of loans, market research, lease payments, skills development, etc. may increase. This situation is also quite natural, but the large increase in fixed costs can not be, unless the activities of the agricultural organizations are radically modernized. According to the calculations, the increase in fixed costs is 2% of the basic version.

Investigating the effect of various factors separately and in their entirety, it is likely to predict the consequences of their changes. So, as a result of lower prices, the critical volume of rapeseed production increases (in our example, from 67.2 thousand c to 74 thousand c), marginal revenue and stability of rapeseed production decrease. Increase of costs also leads to a change in the break-even «threshold» towards its increase, as well as reduce of profitability and sustainability of rape as a whole. To ensure the standard (target) profit for all of the above changes, you will need to increase production through higher yields, at least through the expansion of cultivated area, as well as the adoption of certain decisions (channel search of the rape implementation at a higher price, increasing the shelf life before more favorable market conditions, etc.).

Thus, the variability in determining the effectiveness of rapeseed production through marginal analysis allows taking into account objectively possible consequences of the key factors that directly affect the organization's profitability.

The fourth option includes all the factors taken into account in the calculations of the first three options.

As noted earlier, rape is grown in all soil-climatic zones of the Orel region, its production is concentrated in the south-east zone. The studies show that there is a clear upward trend in the acreage of rape in all soil-climatic zones but it cannot be said about the yield of this crop. During the study years, the yield of rapeseed was different every year.

The instability of the rapeseed market requires continuous monitoring of all the factors that ensure the rapeseed production and its level of profitability. Thus, the development of rapeseed production must be based on an integrated and comprehensive analysis and an integral part of this analysis is to become, in our opinion, the efficiency marginal analysis of crop production, including rapeseed.

Margin analysis of the effectiveness of rapeseed production can determine quite objectively critical level of productivity for certain agricultural organizations that provides break-even production of rapeseed, to define the limits (zone) of sustainability of its production, and also to determine that level of productivity which provides receipt of standard (desirable) profit in case of the average (developed) costs and the price.

However, it should be noted that we determined the fixed and variable costs on the basis of the actual production costs and process maps rapeseed cultivation.

Margin analysis shows that at the existing level of prices, fixed and variable costs, the minimum level of productivity providing break-even rapeseed production is from 10.1 to 14, 0 c/ ha.

Thus, our study confirms that it's necessary to increase the volume of rapeseed production in order to meet population's needs in vegetable (rapeseed) oil and animal's needs in feed. The expansion of rapeseed production will improve the financial position of the enterprise and improve the overall efficiency of the agrarian economy. In this case, the possible changes in the market situation of rape, shifts in the prices of resources or factors of production, affecting costs, are objectively reflected on the economic results. Therefore the marginal analysis of rapeseed production is accessible to us for any agricultural organization.

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BROILER POULTRY OF RUSSIA: ACHIEVEMENTS AND PERSPECTIVES OF DEVELOPMENT IN THE WTO CONDITIONS

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ABSTRACT

The article presents the analysis of the condition of national poultry development and the ways of the main branch problems solution are outlined. It is stressed that according to quality indicators the Russian market is practically provided with poultry meat. The main problem for the nearest future is to create the conditions to provide high quality and safety of production, to take measures to increase its competitive capacity in the WTO conditions. To realize it is necessary to master new resource saving technologies of keeping and feeding, which allow using maximum genetic potential of poultry effectiveness. The authors developed the scheme of profit calculation in broiler production as a relation of income from a production unit (from 1m² of poultry house) to a time unit (for the feeding cycle or for one year).

KEY WORDS

Poultry industry; Innovative development; Competitive capacity; WTO; Production.

Poultry is one of the most important branches of agriculture that has to supply the population with dietary food products: eggs and poultry meat, characterizing with large protein content of animal origin at low calorific capacity. In general amount of protein consumption the poultry meat and eggs protein is more than 27%. The continuously increasing demand in poultry meat and eggs is explained with their consumer properties and low level of consumer costs in comparison with other types of animal production. Poultry products production is concentrated mainly in agricultural enterprises. The portion of farm enterprises and population holdings is 22,0% of eggs production and 9,8% - poultry meat [3,4,7].

Today Russia meat poultry is represented with 180 broiler enterprises, 12 poultry plants on turkey operation, 6 – on geese operation, 4 – duck operation. The Agro Industrial Complex development measures, adopted on the state level, participation of poultry enterprises of meat and egg directions in realization of prior national project « Agro Industrial Complex development», State program of agriculture development and regulation of agricultural production market, raw and food for 2008-2012 (further – State program for 2008-2012), and also target program of “Development of poultry in the Russian Federation for 2010-2012” department provided the attraction of about 250 bln. rubles investments into the branch. It allows putting into exploitation new objects, reconstructing and modernizing more than 400 objects объектов providing the increase in output [10, 11, 20].

For 2006-2011 poultry meat production increased by 1,8 bln. tons in slaughter weight (more than in 2 times), eggs – by 3,9 bln. pieces. (10,5%). Poultry meat import supplies are reduced more than 2,5 times.

The portion of poultry meat in overall meat volume has reached 43 % versus 18 % - in 1990, that corresponds to the world tendencies. More than 2 times in comparison with 1990 average per capita consumption of poultry meat has increased: from 12,5 kg to 25,0 kg at the recommended standard – 30 kg. Eggs consumption corresponds to 273 pieces per year.

3587 thous. tons of poultry meat in slaughter weight and 42,0 bln. pieces of eggs with increase in comparison with the previous year by 383 thous. tons (12,0 %) and 0,9 bln. pieces (2,2 %) (Table 1) were produced in 2012.

At the same time, unfavorable weather conditions in 2010 and 2012, result in considerable feed prices increase and annual increase of prices on consumed resources (electro energy, fuel, petrol) negatively reflect on the finance condition of poultry enterprises. At the same time purchasing capacity of the population does not allow to increase the factory prices for end product – poultry meat and eggs. As the result the industry average earning capacity of the realized production decreases from 17,6 % in 2005 to 11% - in 2011, that is negatively reflected on the investment attraction of the branch.

In the conditions of earning capacity decrease poultry enterprises have to provide credit resources repayment, being attracted in the frame of realization of prior national project of Agro Industrial Complex and State program and State program for 2008-2012.

Table 1 – The main indicators of development of poultry branch in the Russian Federation (by Rosptitsoyus data)

Indicators	2005	2009	2010	2012	2012 in % to 2005	2012 в % to 2009
Poultry meat, thous. tons in slaughter weight	1388	2555	2847	3587	2,58 p.	140,4
Eggs, pieces	37,1	39,4	40,6	42,0	113,2	106,6

From July, 1 2011 The Custom Union of Russia, Belorussia and Kazakhstan functions in full scale. It was formed to create the common custom territory in the frame of which common customs tariff and unified measures of trade with the 3rd countries are used. From January 2012 The International Treaty Frame Work of Common Free Market Zone is put into force. It is supposed that it will be transformed into the Eurasian Union. The Eurasian Economic Commission is organized. It is a supernational body which will be gradually given national authority [8].

In 2012 the Russian Federation joined the World Trade Organization (further – the WTO). Conditions of Russia entering the WTO are functioning customs duties on import meat delivery (within the frame of quota 25% and 80% for extra quota deliveries). But according to the adopted liabilities, tariff quota volume is increased from 330 thous. tons in 2012 to 364 thous. tons (growth 10%). Terminal date of tariff quoting mode at poultry meat import is not defined [14].

The branch program «Poultry Development in the Russia Federation for 2013-2015» (further – the Program) is developed by the Rosptitsoyus specialists (head of composite author is Bobyleva G. A.), and the specialists of scientific research institutes and the leading enterprises of the branch according to the instruction of the Minister of Agriculture of the Russian Federation from August, 6 2012. № НФ-24/199 [3,9]. Realization of the program measures will be done in new conditions. Program is directed to create the conditions providing the food safety of the Russian Federation according to the Russian Federation Presidential Decree from January, 30 2010 №120 «About the affirmance of doctrine of food safety of the Russian Federation» [2].

The Program realization is done in the framework of the State program of agriculture development and regulation of market of agricultural production, raw and food for 2013-2020 affiliated with the Russian Federation Government Resolution from July, 14 2012 № 717 [1].

The Program is directed to achieve by 2015 high level of economical development of poultry branch. The achievement of the preset objective envisages innovative type of development on the basis of rational resource usage improvement, providing competitive capacity of the produced poultry production, complete satisfaction of domestic demand and export access (Table 2).

All this requires formation of complex approach to realize coordinated measures and to solve the following problems: poultry meat production increase on the ground of breeding of high productive and technological poultry crosses; creation of modern selection and genetic centres on the ground of breeding farms; renovation of poultry basis, building of new enterprises, reconstruction and modernization of operating enterprises; increase of the level of competitive ability of the branch production on the ground of production quality increase

and decrease of expenditures connected with its production taking into consideration Russia's annexation into the WTO; product expansion and development of deep processing of poultry meat and eggs accounting the requirements of different consumers groups (children, school, functional, specialized and others nutrition types); provision of implementation of the tracing system of food production to guaranty production quantity and safety and supply possibility for export.

Table 2 – Basic target indicators of the Program [3]

Indicators	2012	2013	2014	2015
Meat poultry production, thous. Tons in slaughter weight	3587	3700	3900	4000
Meat poultry production per capita, kg	25,0	25,8	27,2	27,9
Egg production, bln. pieces.	42,0	42,3	42,5	43,0
Egg production per capita, pieces	273	275	276	279

In the report of proceedings at meeting of Committee of Directors of the Rosptitsoyus from June, 27 2012 is stressed that with Russia's annexation into the WTO the basic objective for the nearest future is the condition development to provide high quality and safety of animal products. In these conditions it is necessary to realize the following measures complex: take steps to increase the production efficiency; at realizing the food industry production processes connected with the requirements of its safety, work out and implement procedures, based on the principles of the HACCP (TP TC 021/2011 «About the food production safety of the Customs Union» from December, 9, 2011); provide implementation of the tracing system of food production to guaranty production quantity and safety, and also the possibilities of production outcome to foreign markets, implement modern resources saving technologies of keeping and feeding animals, and also new equipment; implement the veterinary science and practice achievements into the production.

In the sphere of technology of broiler meat production the perspective directions are: development of progressive operations of broiler growing with differentiated poultry amount of floor space per bird in the starting period of growing to increase the meat production volume and resource saving, creation of modern equipment for this technology; the usage of LED bulbs to grow broilers, replacement chicks, and parent stock of meat hens; usage of different light period duration with different lightning intensity at broilers growing; usage of electroactivated water in the poultry industry at poultry meat processing, disinfection of hatching eggs and equipment.

Academician of the Russian Academy of Agricultural Sciences V. I. Fisinin stresses that today the key notion of any production is efficiency. It is necessary to use actively the achievements of fundamental sciences, but to base on the interaction of practical sectors of animal breeding and related branches [18].

The only leader of branch in the Orel region is JV Factory on poultry meat production JSC of Agro Industrial Complex «Orlovskaya Niva» (Table 3).

The 11 thousand tons poultry farm of broilers meat in live weight in a year is the enterprise with the closed production cycle which structure includes the following shops: parental herd (loud-speaker 2 orders), incubations, two platforms of broilers cultivation, slaughter and processing shop ("Linco" firm equipment, Denmark). Besides, at the factory there are necessary auxiliary areas and services. On poultry farm the modern resource-saving equipment is applied: floor equipment of firms "Big Dutchman" (Germany) and "Facco" (Italy); energy saving systems of providing a microclimate in hen houses - heatgenerators "Jett Master", the GP-70, GP-80, GP-95, GP-120 models; the automated systems of providing a microclimate, the systems of ventilation operated by MC-36A and fx-76 computers; lighting system "Gazolek Orion" (Netherlands).

The priority directions of development of broiler poultry farming in the Orel region in the conditions of the WTO are: formation of effective, competitive production of the poultry-farming production ensuring food safety of the region, and also integration of branch into logistic infrastructure and the food markets; the organization of innovative self-regulating

model of the poultry farming which is based on specialization of participants of the market and development of integration of the branch enterprises, country (farmer) and personal subsidiary farms in the vertically integrated formations; development of line technology of cultivation of broilers with a differentiated amount of floor space per bird of landing during the starting period of cultivation for increase in output of meat and resource-saving; development of new processing methods of production of broilers of different weight categories taking into account requirements of the market; creation of systems of lighting in hen houses on the basis of the LED lighting equipment; development of standard documentation regarding LED lighting; development of energy saving modes of lighting for broilers with a various duration of cultivation; development of new ecologically safe processing methods of cultivation of broilers with BAS (Biological Active Supplements) application (probiotics, prebiotics, enzymes, phytopreparations, natural enterosorbents, zeolites of the Hotynetsky field of the Orel region, etc.) ; development existing and creation of new loud-speakers of the 2nd order for full satisfaction of requirement for incubatory egg at the expense of own producer that will allow to lower economic and an import dependency on branch of poultry farming; strict observance of standards of reproduction of a breeding bird and realization of its genetic potential on the basis of feeding with application of computer programs of drawing up and optimization of diets; to finishing of volumes of processing of meat not less than to 60% with creation on poultry farms and the processing enterprises of modern sites for production of semi-finished products and finished products from fowl; production of new functional food of the treatment-and-prophylactic direction (eggs and the fowl, enriched with selenium, iodine, vitamin E, carotinoids, an omega – 3 fatty acids, folic acid) [6,7,12].

Table 3 – Production and economic indicators of JV Factory on poultry meat production JSC of Agro Industrial Complex “Orlovskaya Niva” 2012.

Indicators	value
Number of hen houses	25
amount of floor space per bird, heads/m ²	19-20
Average monthly livestock, thous. of heads	570
Period of growing, days	38,5
The average live mass of 1 head at the end of fattening, g	2151
Average daily gain, g	54,9
Costs of a forage of 1 kg of a gain, kg	1,76
Safety of broilers, %	96
Live mass in total, t	11473
Slaughter weight in total, t	8438
Slaughter yield, %	73,5
obtained live weight from 1 m ² the hen house areas, kg	40
EFE – European Factor of Efficiency, units.	305

The modern technology tends transfer with cellular on the floor contents. At the same time about 20% of broilers on poultry farms of Russia contain in cellular batteries. In this regard the special attention should be paid to cultivation of broilers as to them the specified system of the contents most often intends. Experience of broiler production in Russia and developed countries of the world testifies that its further development and competitiveness are possible only at large-scale development of the resource-saving technologies allowing as much as possible to use genetic potential of efficiency of a bird. One of reserves of growth of meat production is put in system of meat chickens sagination in cage batteries. It is a return to the past, but it is the innovative direction [5, 13, 16].

It is established that the main zootechnical indicators at broilers growing in cages of different designs are almost identical. However forages costs of 1 kg of a gain of the broilers which have been grown up in cage batteries 2B-3A, are 0,05-0,07 kg lower, than at the broilers fattened in a cage of BKM-3D. It is connected with constructive decisions of feeding supply system and feedings of a bird. Economic efficiency of broilers growing in cage batteries 2B-3A (new option) in comparison with growing in BKM-3D batteries (basic option)

for one technological turn makes 187460 rub. At a manufacturing lead time of 7 turns in a year expected economic effect will make 1312220 rub.

We conducted researches on a comparative assessment of cellular and floor cultivation of broilers. It is established that the highest zootechnical and economic rates were received when using cage KP-8L batteries. General industrial index - the European factor of efficiency was the highest at growing of chickens in cages of KP-8L-285-310 of unit that testifies to rather high level of an intensification of broiler production in cage batteries. KP-8L.

This indicator at floor growing of broilers was slightly lower – 268-280 units. It caused the highest level of profitability of broilers production in KP-8L cages – 14% whereas at the floor keeping it was slightly lower and corresponded 10%.

Now in broiler poultry farming of the world the separate growing of chickens and cockerels from daily age is used. According to our data, forage expenses at separate growing on a floor decrease in comparison with joint growing by 4 - 8%, and live weight increases at cockerels by 2,5 - 7%, and at chickens - by 4 - 12%.

This processing method is especially perspective at the broilers cage keeping. At separate growing on a floor an important question is the definition of optimum terms of slaughter, amount of floor space per bird, and the feeding and watering front. Amount of floor space per bird at broilers growing of cross of "Ross-308" depending on live weight is specified in Table 4.

The analysis of literature allows assuming that the growing systems, especially alternative (not intensive) and organic, are essential part of the modern production technology of broilers meat. They are important factors in management of efficiency characteristics (growth, forage conversion, safety of a bird) and quality of meat (percent of slaughter yield, an output of separate parts of a carcass, organoleptic indicators, and a chemical content of meat). For the last years the growing systems of a bird gained value not only in respect of scientific researches, but also about the purpose of their practical application. Products of the improved quality, welfare of birds and environment protection is the all essential reasons (provided by precepts of law and rules in many countries) to raise interest to innovations in systems of cultivation and to introduction of new systems in real production. Increase of production efficiency of broilers meat is possible only at introduction of the latest energy saving processing methods, one of which, is the rational program of lighting in hen house [15,23,24,25,27].

Table 4 – Standards of amount of floor space per bird for broilers

Alive weight, кг	amount of floor space per bird, heads/m ²
1,0	34
1,4	24-25
1,8	19,0-20
2,0	17-18
2,2	16
2,6	13
3,0	11
3,4	10,0
3,8	9,0

In our researches it is established that application of monochromatic fluorescent lamps of low power of green and blue color for illumination of hen houses promoted decrease in expenses for the electric power in 8,5 times in comparison with traditional lighting by incandescent lamps. Besides, energy of growth, safety of chickens increased, forage conversion improved.

Economic efficiency of growing of broilers in the hen house equipped with system of illumination of "Gasolec ORION", in comparison with usual lighting, for one technological turn was 32684 rub. At a manufacturing lead time of 6,5 turns in a year expected economic effect will be 212446 rub.

At floor growing of broilers of average type with a live weight not less than 2 kg in 42 days during the period from 1st to the 6th day of life it is necessary to use a mode of

continuous lighting (23C:1T), from the 7th to the 35th day – a faltering light mode (5C:1T)*4, from the 36th to the 42nd day – (23C:1T).

Large meat cockerels are recommended to be grown up on a laying before achievement of the live weight of 3,5-3,7 kg at the age of 55 days with application of a faltering light mode: (23C:1T) during the period from the 1st sagination on the 7th day, (18C:6T) from 8 to 14 day, (4C:4T)*3, during the period from the 15th to the 24th day, (18C:6T) from the 25th to the 29th day, (20C:4T) from the 30th to the 52nd day, (23C:1T) from the 53rd to the 55th day of life.

For sagination in the cage batteries of broilers of portion type reaching at 35-day age with a live weight of 1,7-1,8 kg, the applications of a constant mode of lighting (23C:1T) from the 1st to the 6th day of growing, and a faltering mode of illumination (3C:1T)*6 from the 7th to the 28th day of life of and from the 29th to the 35th day – (23C:1T) are most suitable.

Application of the developed programs of lighting at broilers growing in the conditions of poultry farms promoted increase of economic efficiency, increase in profitability of production of poultry by 3,32% (at average type broilers growing), by 2,96% - large meat chickens and by 1,61% - at sagination of chickens of portion type.

Use in poultry feeding biologically active supplements, refusal of fodder antibiotics for receiving ecologically safe production are the most important elements of modern technology of cultivation of broilers [5,12,17,22]. So probiotic use "Laktobifadol" has positive impact on average broilers daily gain (by 3,73% higher, than in control), safety (by 2% higher) and costs of a forage per 1 kg of a gain of live weight (by 3,8% lower, than in control). Economic effect of "Laktobifadol's" use on a livestock of 61100 broilers for one cycle of growing was about 500 thous. rub. At a manufacturing lead time of 6,5 turns in a year expected economic effect will be 3,25 bln. rub.

Inclusion of a probiotic of "Provagen" in technology of broilers growing provided increase of energy of growth, safety of the young growth, significant improvement of conversion of forage. Economic effect of "Provagen's" use on a livestock of 60800 broilers for one cycle of growing corresponds to 371844 rub. At a manufacturing lead time of 6,5 turns in a year expected economic effect will be 2,42 bln. rub.

Introduction in technology of broilers chickens growing of cross "Ross-308" of the complex preparation "Ekofiltrum" in a dose of 0,8 kg per 1 t of combined feed during the whole period of growing allowed to gain the following technical and economic effect: as a result of increase of efficiency and safety of broilers, improvement of conversion of a forage at "Ekofiltrum's" usage, the prime cost of 1 kg of broilers meat in new growing variant was by 4,05 rub or by 6,14% lower, than in basic variant. Profitability of production in new growing variant was 6,7% higher in comparison with the basic variant; economic effect of use of the complex preparation "Ekofiltrum" on a livestock of 3000 broilers for one production cycle of growing was 18561,15 rub (65,94 rub. - 61,89 rub.) x 4583 kg. At a manufacturing lead time of 6,8 turns in a year expected economic effect will be 126215,82 rub (18561,5 rub. x 6,8 turns).

We developed the scheme of profit calculation in broiler production. At profit calculation got by production of meat of broilers, it is necessary to consider the following essentially important positions: technological indicators of efficiency (an average daily gain, forage conversion, a carcass output) that are not profit unit; the accounting of prime cost only on the above indicators of individual efficiency of poultry does not guarantee financial success; structural unit of efficiency in poultry farming is the hen house, instead of a bird itself.

Therefore the profit (P) should be considered as the relation of the income from a unit of production (from 1 m² hen house) to a unit of time (a cycle of sagination or in one year) (fig.). Key production indicators in broiler poultry farming are: live weight (kg/m²) during growing; costs of forage of 1 kg of a gain (kg); European factor of efficiency (units). The main control levers of key production indicators are: amount of floor space per bird; age of a bird at slaughter (days); safety (%); sanitary period (days) European factor of efficiency (units).

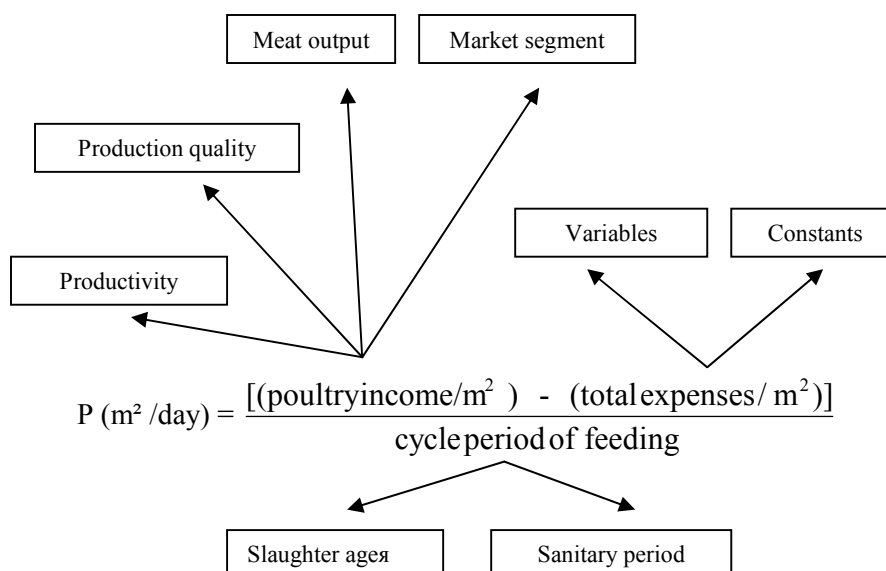


Figure 1 – The scheme of profit calculation in broiler production

European Factor of Efficiency (EFE) is defined by the formula:

$$E\Phi\Theta = \frac{M * C}{K * \Pi} * 100, \quad (1)$$

where M – average live mass of a broiler (kg); C – viability (%); K – fodder expenses per 1 kg of gain (kg); Π – growing period (days).

Despite dynamic development of poultry farming in Russia, branch modernization still far is not complete. The most part of the equipment for poultry farming and poultry processing are morally and physically old fashioned and needs replacement. Annual economic effect of introduction of new the floor or cage equipment can be calculated by a formula:

$$\Theta_r = (B_k - 3_k) - (B_n - 3_n), \quad (2)$$

where B_n and B_k - revenue per unit of production before equipment introduction, rub.; 3_n и 3_k - unit costs before and after equipment introduction, rub.

Modern technologies of poultry farming branch allow in short terms not only quantitatively to increase volumes of national production of poultry meat and eggs, but also to reduce their prime cost. Production of domestic poultry farming will be able to possess not only absolute competitiveness in comparison with import, but also and potential for export to foreign countries.

Besides, necessity of development of poultry farming is caused: existence of raw materials base, in particular the grains, one of which main consumers is the poultry farming branch; existence of land resources for placement of the enterprises taking into account the requirements ensuring veterinary and sanitary safety; existence of rather developed formula-feed industry; existence of fuel and energy resources (considering power consumption of branch); existence of the qualified human resources, etc.

In the conditions of updating of market economy and development of the competitive beginnings those poultry-farming enterprises which constantly work over problems of economy, finding out and uses of production reserves are considered to be the most effective ones. Objectivity of the productivity assessment of functioning of the poultry-farming enterprises is an important condition of their competitiveness.

Table 5 presents data on production of eggs and poultry meat in the Orel region according to the Program "Poultry Farming Development in the Russian Federation on 2013-

2015 Efficiency of the Program implementation is calculated on the basis of dynamics of values of two indicators: productions of poultry meat for slaughter in the live weight (thous. tons), productions of eggs (bln. pieces). Efficiency calculation is done by the following formula:

$$\mathcal{E}_{np} = \frac{A_{1\phi}}{A_1} \times B_1 + \frac{A_{2\phi}}{A_2} \times B_2, \quad (3)$$

where \mathcal{E}_{np} – efficiency ratio of the Program realization; A_1 – target indicators of production gain of poultry meat in the target year to level of 2012; A_2 – target indicators of production gain of eggs in the target year to level of 2012; $A_{1\phi}$, $A_{2\phi}$ – the actual indicators of production gain of poultry meat and eggs in the target year to level of 2012; B_1 , B_2 – weights of production indicators of poultry meat and eggs.

The Program is considered successfully executed at values of efficiency ratio of the Program implementation ranging from 0,9 and above.

The main condition of profitable work of the poultry-farming enterprises is intensive maintaining branch with introduction of resource-saving technologies of the keeping and feeding of poultry, the modern methods of breeding work providing high efficiency, safety and forage conversion, the organization of deep production processing, the most strict saving mode of expenses on all areas of production and skillful marketing.

Researches testify that without providing innovative type of development the economic growth of poultry-farming branch is impossible. Innovations have to become a subject of state regulation of science and practice. It is necessary to increase innovative activity consistently and steadily and it is rational to use investments for mass modernization of branch.

Table 5 – Forecasting of poultry meat and eggs production in the Orel region (all categories of enterprises)

Indicators	2012 (report)	Forecasting			2015 to 2012	
		2013	2014	2015	%	+/-
Production poultry meat of all types, thous.t	18,2	21,3	22,8	25,7	140,8	7,4
Eggs production, bln. pieces	163,1	170,3	170,4	170,4	104,5	7,3

Value of indicators B_1 and B_2 is the following:

Indicators	Weight value of indicators
Production of poultry meat for slaughter in alive weight	0,6
Eggs production	0,4

In this connection on this stage it is important to form a departmental network of research establishments, institutes, laboratories, the centers, for development and implementation of modern methods of the researches conforming to the international requirements, and also for preparation of scientific justifications to adopt the relevant decisions within the WTO.

Only thus it will be possible not only now, but also in the future to solve the difficult complex problems facing the poultry farming branch.

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MAIN APPROACHES TO THE PROCESS OF CORRUPTION RISK ASSESSMENT DURING AUDIT OF BRANCHES OF INDUSTRY AND AGRO INDUSTRIAL COMPLEX

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ABSTRACT

In the article the basic directions of work of the auditors in the field of counteraction of corruption in the course of the audit are examined, emphasis on the special role of auditors in the anti-corruption movement is done. Main stages of assessing the risks of corruption in the process of auditing are differentiated. Within each stage sequentially article describes the main approaches to the study of risks of corruption in the course of the audit. In conclusion the role of auditors in countering corruption offences, the noted shortcomings of modern anti-corruption legislation and made recommendations for its improvement are evaluated.

KEY WORDS

Misconduct; Corruption risks; Audit; Evaluation of risks; Corruption; Counteraction.

Today in our country there are many problems connected with corruption. The bribery, wastes and other types of corruption became the reason of deterioration of an economic and political situation and infliction of harm to society as a whole. Real counteraction of corruption is possible only in case it is considered as the system phenomenon mentioning a wide complex of social, economic, organizational and other problems. As D.A.Medvedev declared in The New York Times interview «Corruption turned into a system problem. And we are obliged to oppose to this system problem the system answer».

Therefore besides criminal and legal measures in fight against corruption the measures of preventive character consisting in improvement of state regulation and control in spheres of action, subject to corruption risks have to play an important role.

As a result so far in the Russia territory the set of various mechanisms according to the prevention and counteraction of corruption both in the public and municipal administration, and in non-state sector is created. One of the most important elements of anti-corruption system in Russia is auditor activity. In anti-corruption movement the special part is assigned to auditors. It is caused by the following. First, auditor activity, being one of elements of system of financial and economic control, widely covers various types of the enterprises – on forms of ownership, branches, organizational and legal forms, the sizes, etc. The main consumers of auditor services are the enterprises and the organizations for which obligatory annual audit (banks is legislatively defined, insurance companies, open joint stock companies, the enterprises, cumulative annual which volume of revenue are exceeded by legislatively established minimum, etc.). Secondly, auditors render full range of services to clients, first of all it is obligatory annual audit according to the legislation requirement in this connection, and they get access to information on financial and economic activity of the client, and, using legislative base, can not only establish the corruption facts, but also take the appropriate measures. Thirdly, the wide network of subjects of auditor activity acts on the market of auditor services of Russia: major, medium-sized and small auditor companies, individual auditors, and also foreign and transcontinental firms like «Big Four» coexist.

December 31, 2011 according to registers of auditors and the audit organizations which conduct the self-regulating organizations of auditors, have the right to carry out auditor activity 6,2 thousand subjects, including 5,2 thousand audit organizations and 1,0 thousand individual auditors [2].

Now in system of standard regulation of auditor activity certain mechanisms of quality control of audit, including for corruption counteraction are put. Rules of quality control of auditor services for counteraction of corruption are established according to the Federal law

«About auditor activity» of 30.12.2008 by No. 307-FL (further – the Law No. 307-FZ), the federal standards of auditor activity approved by orders of the Ministry of Finance of the Russian Federation from May 20, 2010 of N 46n, of August 17, 2010 of N 90n and of August 16, 2011 of N 99n, the federal rules (standards) of auditor activity approved by the resolution of the government of the Russian Federation from September 23, 2002 N 696 (with the subsequent changes), the Code of professional ethics of auditors.

The basis of actions of audit organization (the individual auditor) on corruption counteraction when rendering auditor services is made by Federal Standards of Auditor Activity. First of all on corruption extend. FSAA 5/2010 requirements «Duties of the auditor on consideration of unfair actions during audit» (further - FSAA 5/2010) (corruption can be qualified as deliberate unfair action) and FSAA 6/2010 «Duties of the auditor on consideration of observance by the audited person of requirements of regulations during audit» (further - FSAA 6/2010) (regarding observance by the audited person of the legislation on fight against corruption).

Proceeding from provisions FSAA 6/2010, during audit of accounting reports the auditor is obliged to consider (to consider) observance by the audited person of regulations of the Russian Federation, including the Federal law «About corruption counteraction». Besides, according to FSAA 5/2010 an obligation of audit organization, the individual auditor is consideration during audit of accounting (financial) reports of unfair actions, i.e. the actions made fraudulently by one or several persons from among representatives of the owner, the management, workers of the audited person and (or) other persons for extraction of illegal benefits. Nevertheless, according to FPSAA N 1 «The purpose and the basic principles of audit of financial (accounting) statements» the purpose of audit is not identification of the facts of the organization, preparation and commission from a name or in interests of the audited person of corruption offenses or the offenses creating conditions for commission of such offenses. However during the planning and implementation of audit such auditor procedures which allow obtaining sufficient competent auditor evidences of observance by the audited person of the legislation on corruption counteraction have to be provided and executed.

The auditor considers during audit unfair actions (including corruption character) which were at the bottom of significant distortions of accounting reports, namely: the distortions which have resulted unfair drawing up accounting reports, and the distortions which have resulted assignment of assets. At different stages of an audit inspection various auditor procedures which allow obtaining sufficient competent auditor evidences of observance by the audited person of the legislation on corruption counteraction are applied. The auditor has to receive sufficient confidence that accounting reports of the audited person as a whole do not contain the significant distortions which have resulted unfair actions, including actions of corruption character.

Unfair actions are, as a rule, based on the difficult and carefully organized schemes developed for the purpose of concealment of such actions. In FSAA 5/2010 it is emphasized that the risk of nondetection of the facts of unfair actions of the management is much higher in comparison with risk of nondetection of unfair actions of employees of the audited person or the third parties. It is rather difficult to establish and prove the facts of unfair actions of the management during audit. It is connected with such circumstances, as: complexity of establishment of intention, especially regarding subjective judgments of the guide of the audited person; possibility of concealment of unfair actions, including with application of falsification of documents; circumvention of formally established procedures of control by the management or representatives of the owner of the audited person; possibility of arrangement of persons, representatives of the management, the owner, employees of the audited person or the third parties [4].

For identification and an assessment of risk of corruption manifestations within a main objective of audit – expression of opinion on reliability of accounting (financial) reports of the audited person – auditors need to solve the following main problems: identification of risk of corruption manifestations at acceptance on service of the new client and/or continuation of cooperation with the client; identification of risk of corruption manifestations at acquaintance

with activity of the audited person; reflection of questions and the auditor procedures connected with check of observance by the audited person of the Federal law «About corruption counteraction» and other regulations in the field of corruption counteraction in the plan and the audit program; carrying out auditor procedures for detection of transactions and financial operations which can be connected with corruption; documenting of corruption cases; interaction with the guide of the audited person concerning corruption; informing of representatives of the owner concerning cases of corruption or risk of emergence of corruption; information transfer about the revealed cases of corruption in authorized body; refusal of an auditor task.

Identification of risk of corruption manifestations is the continuous procedure which is carried out by auditors at all stages of audit and rendering by audit organization (the individual auditor) other services.

Process of an audit inspection consists of the following main stages: preparatory (acquisition of preliminary knowledge of activity of the audited person, coordination of conditions of the arrangement on audit); basic (an assessment of auditor risks, studying of system of internal control of the client, audit planning, collecting auditor proofs, including with use of work of the third parties, ensuring performance of conditions of contracts); final (formation of conclusions, registration of the conclusions and reports).

Therefore, assessment stages of risks of corruption in the course of an audit inspection are: assessment of preliminary conditions; direct assessment of risks of corruption; taking measures to reporting of information on the probable facts of corruption.

The self-regulating organizations of auditors, audit organizations (individual auditors) must in the firm standards (internal normative documents) develop a concrete technique of risks assessment of the significant distortion resulting unfair actions, including actions of corruption character.

ASSESSMENT OF PRELIMINARY CONDITIONS

The assessment of preliminary conditions assumes identification and an assessment of factors which promote or can promote corruption, at a stage of collecting data on the potential client and the conclusions of the contract with him. At this stage of an audit inspection the auditor, considering possibilities of rendering auditor services of the organization, must be ready to that the accounting (financial) report of the audited person is subjected to risks of corruption.

According to FSAA 5/2010 the auditor before the conclusion of the contract on carrying out audit at the preliminary acquaintance stage with the economic subject activity can receive information useful to identification of risks of significant distortion, resulting from unfair actions, including actions of corruption character. The stage of preliminary understanding of the client activity represents the analysis of a number of factors, information about which is not closed and is available at a precontractual stage of the relations with the client. At repeating throughout a row of years audit inspections of this economic subject the auditor updates and anew estimates information collected earlier, including data from briefs for previous years. The auditor has to reveal also the considerable changes which were taken place after the financial audit for the previous years. This stage of auditor work is conducted by the head of the organization and/or the persons authorized on implementation of specified actions by the head of audit organization, whose qualification, knowledge and experience allow executing this assignment qualitatively.

Fact-finding process has to begin with the detailed analysis of the current legislation, provisions, rules and standards for the purpose of auditor understanding the activity, mission, the purpose and the main operations of the potential client.

At an assessment of legislative base the special attention is paid to the legislative provisions concerning vulnerable kinds of activity of the potential client. Vulnerable kinds of activity are understood as kinds of the economic subject activity which on the specifics assume the increased risk of corruption. Vulnerable kinds of activity can be as the types concerning the internal organization of the potential client, and the kinds of activity

concerning his functions (external tasks). At a preparatory stage the auditor also can receive information about organizationally-administrative structure of the potential client. The auditor has to understand spheres and the principles of activity of the potential client. Detailed acquaintance with features of structure and functioning of the organization allows estimating degree of corruption risk more precisely. The assessment of organizational structure of the potential client is made on the base of the following criteria: compliance level of organizationally - administrative structure considering tasks, competence, the rights and obligations of the organization; efficiency level of organizationally - administrative structure considering tasks, competence, the rights and obligations of the organization.

Whenever possible it is necessary to estimate reputation of the alleged client in a business community, durability of its financial position and its relationship with the previous auditor firm. Carrying out the specified procedures, the auditor must remain vigilant to existence of potential opportunities for corruption. At identification of factors which promote or can promote corruption, the auditor has to estimate relevancy of threats to observance of the fundamental principles of audit. If the importance of threats is high and it is not possible to reduce them to acceptable level, the auditor firm has to refuse acceptance of the client on service.

At achievement of consent on the conditions of carrying out the audit, the coordinated conditions need to be reflected in the contract on carrying out an audit inspection. Signing the contract, the audit organization has to inform the client that at identification of the facts of non-compliance by the audited person of the requirements established by the legislation on counteraction of corruption, the auditor is obliged to take the measures provided by this legislation, and also FSAA 5/2010 and FSAA 6/2010. In particular, in the cases provided by the legislation, the auditor has to give information on the found facts of the organization, preparation and commission from a name or in interests of the audited person of corruption offenses or the offenses creating conditions for commission of such offenses to authorized government bodies of the power [1].

DIRECT ASSESSMENT OF RISKS OF CORRUPTION

The direct assessment of risks of corruption assumes identification, research and bribery and corruption risk analysis at all stages of audit: when studying system of internal control of the client (SIC), planning audit, collecting and an assessment of auditor proofs, documenting of an audit inspection and preparation of an audit report. Definition of risk indicates certain problem areas where the auditor can face risk of bribery and corruption, and allows it to estimate and reduce this risk better. For this reason in FSAA 5/2010 examples of risk factors of the unfair actions connected with unfair drawing up the reporting and assignment of assets are given. These risk factors are subdivided into three types depending on the reasons which are allegedly in their basis: motive or pressure; available opportunity for commission of unfair action; ability to veil unfair action, finding it logical justification.

Decrease in risks of corruption emergence and fraud in the organizations is promoted by well organized systems of internal control therefore on the basis of an assessment of system effectiveness of internal control, including accounting system, collection of information about real and potential risks of corruption in the organization is made. This is reflected in PSAA N 8 "Understanding of activity of the audited person, the medium in which it is done, and an assessment of risks of significant distortion of audited financial (accounting) statements" So, the standard establishes that the auditor has to study system of internal control in amount, sufficient for identification and an assessment of risks of essential distortion of financial statements as a result of unfair actions.

Practice shows that in the most effective way of identification of unfair actions testing of system of internal control at the enterprise (or risks control system) is represented [5].

When testing control devices the auditor is interested not mostly in search of specific unfair actions, but identification of shortcomings of systems of the account and the control, urged to interfere with their appearance, timely to reveal and to correct them, that as a result will increase efficiency of SIC. Subject of the tests revealing significant distortions in the

result of unfair actions of the audited person can be for example, not observing the measures of internal control by the authorities, the order of drawing up financial statements, risk factors of corruption [5]. In the course of understanding of activity of the audited person and medium in which it is carried out, including system of internal control, when performing auditor procedures of an assessment of risks of bribery and corruption and the related actions the auditor according to FSAA 5/2010 it is necessary to use such well-known measures, as inquiries within the audited person, inquiries to his contractors, supervision and inspection, analytical procedures, discussion in auditor group of susceptibility of the organization to risks of corruption. Within the audited person inquiries can be sent to the address of the directorship of the audited person, officials of the audited person, service of internal audit, representatives of the owner of the audited person, to find out the presence of data: about any actually done or suspected unfair actions; about risk factors of unfair actions.

Supervision and inspection can become a basis for the direction of inquiries and a source of information on activity of the audited person and medium in which it is carried out.

Analytical procedures can help to reveal unusual or unexpected interrelations which can testify to existence of risks of essential distortion as a result of unfair actions. Thus it must be kept in mind that at establishment of susceptibility of accounting reports of the audited person to significant distortion as a result of unfair actions the big role is played by discussion of a course of audit by participants of auditor group. Such discussion gives the chance to reach better understanding of that, as well as in what areas accounting reports are subjected to the significant distortion resulting unfair actions and corruption.

By the plan and the program of audit of financial (accounting) statements, questions and the auditor procedures connected with check of observance by the audited person of the Federal law "About corruption counteraction" and other regulations in the field of corruption counteraction have to be provided. Depending on what assessment reliability of systems of accounting and internal control received, a fraud and corruption risk level, the auditor changes structure and the content of planned auditor procedures. It means that when planning an audit inspection the auditor should define nature of counteractions concerning the estimated risks of significant distortion as a result of unfair actions and corruption. Thus the auditor has to show professional skepticism. Owing to professional skepticism the auditor considers the accounts presented to it and documents original until it does not have bases to hold opposite opinion.

Great help is rendered to the auditor with the list of special auditor procedures which are applied in reply to the estimated risks of significant distortion in case of unfair drawing up accounting (financial) reports and in case of assignment of assets, and also examples of circumstances which indicate possibility of existence of such actions, presented to FSAA 5/2010. According to FSAA 5/2010 the choice of character, a temporary framework and volume of auditor procedures has to be carried out taking into account an element of surprise that promotes decrease in opportunities of workers of the audited person to suppress the fact of unfair drawing up accounting reports.

The auditor can consider an element of surprise, in particular, by means of: performance of check procedures in essence concerning the selected accounts of accounting and preconditions of preparation of accounting reports, instead of their testing owing to their importance or risk; corrections of a temporary framework of auditor procedures performance in comparison with the earlier approved; usage of different methods of selective inspection; performance of auditor procedures in the segments of the audited person having a different site, or without the preliminary prevention [3].

As for selection of registration and corrective records for the subsequent check, the auditor has to analyse: assessment of risks of significant distortion of accounting reports as a result of unfair actions which can help the auditor to choose concrete groups of the same registration and corrective records for the subsequent testing; control devices which were applied to control of registration and corrective records which can reduce the volume of check procedures in essence provided that the auditor tested operational efficiency of such control devices; process of preparation of accounting reports of the audited person and how corrective records are done and what trace they leave; special distinctive features of

misleading registration or corrective records; it is a question of the accounts including accounts of accounting, having no relation to certain economic operations or seldom used; introduction of records by persons which, as a rule, do not do it; introduction of accounts at the end of the reporting period or when closing accounts of accounting after the termination of fiscal year without accurate justification; absence in records of numbers of corresponding accounts of accounting; inclusion in record of the rounded values or existence of a row of the sums terminating on the same figures; character and complexity of accounts of accounting, means the analysis of accounts in which significant estimates and the adjustments which are carried out for the end of the reporting period are reflected; accounts in which in last reporting periods already there were distortions or timely verifications of accounts in which intraeconomic operations are reflected were not carried out; accounts which are somehow connected with the revealed risk of essential distortion of accounting reports as a result of unfair actions; accounts and the other corrections which are carried out at processing of economic operations, not relating to primary activity as concerning non-standard accounts the same control devices, as concerning the accounts brought on a regular basis at reflection of standard economic operations (for example cannot be applied, at reflection of monthly sales, purchases and payments of money) [3].

In case the auditor finds distortion of accounting reports, he has to establish, whether this distortion is a feature of unfair actions, including actions of corruption character. In the presence of such feature the auditor has to receive additional data on such distortion nature and circumstances under which it took place, and also other sufficient information necessary for an assessment of influence of such distortion on accounting reports, the possible financial consequences (sanctions), the compelled termination of activity (license deprivation, suspension of operations) are thus taken into account. Also the auditor has to reconsider an assessment of risk of significant distortion as a result of unfair actions of corruption character and, respectively, reconsider its influence on character, volume and a temporary framework of the auditor procedures which are carried out in reply to estimated risks. At identification of each unfair action, even insignificant, the auditor has to understand that it can be not single one. This circumstance can demand from the auditor of revision of the planned approach to audit, including concerning selection of divisions of the audited person which is subject to more detailed inspection.

The auditor can call into question opportunity to continue carrying out audit if during carrying out auditor procedures it faces the exceptional circumstances indicating significant distortions, resulting from corruption actions. In case of refusal from an auditor task the auditor has to: discuss with the directorship of the audited person and representatives of the owner of the audited person refusal of an auditor task and the reason of this refusal; consider, whether there is a duty to report about refusal of an auditor task and the reasons for his face (faces) which has appointed the auditor, and in the established cases - to authorized government bodies [3].

All information on auditor procedures, their results and the conclusions drawn during audit by consideration of questions, connected with observance of the Federal law «About corruption counteraction» and other regulations in the field of corruption counteraction, the auditor has to reflect in the briefs.

TAKING MEASURES ON REPORTING THE INFORMATION ON THE PROBABLE FACTS OF CORRUPTION

The final stage of an assessment of corruption risks is taking measures on reporting the information on the probable facts of corruption offenses elicited during audit. Duties of the auditor do not include legal qualification whether action of corruption character really took place, as the auditor does not possess the corresponding competence [4]. According to the Criminal code of the Russian Federation corruption is one of types of criminal offenses. In this connection only the court or judicial scrutiny can qualify act as corruption instead of the auditor. Thus the auditor also cannot judge premeditation of distortions. Therefore in FSAA 5/2010 there repeated recommendations to the auditor to address for consultation to the

lawyer. It is important to know that auditors, relying on the professional judgment, can point only to existence of opportunities for corruption, however they should not conduct specially search of the factors indicating existence of signs of corruption offenses. The measures undertaken by the auditor at identification during audit of the probable facts of corruption offenses are provided by FSAA 5/2010. Applying regulations of the specified standard, it should be noted that if the auditor elicits the facts of corruption offenses or receives information indicating their existence, he has to bring this information to the attention of the directorship of the audited person of an appropriate level first of all. The question of what level of the directorship of the audited person has to be informed of such cases, is a subject of professional judgment of the auditor [3].

The auditor has to give also specified information to representatives of the owner of the audited person in case of identification of participation in corruption offenses: persons from the directorship of the audited person; the workers who are carrying out key functions in system of internal control; other persons which activity is capable to have essential impact on accounting reports.

In the presence at the auditor of any bases to believe that transactions or financial operations of the client have corruption character, he has to define, whether he is obliged to report to the party about a case or suspicions, external in relation to the audited person, including authorized government body.

Coming to the conclusion we note that the modern legislation on audit allows auditors to elicit easily the facts of corruption offenses and auditors reveal them. However, if they elicited the specified facts and, especially, they reported to authorized government bodies about the specified facts: first, can not receive payment for the work, and, secondly, can subject itself to real physical and/or property risk. Therefore, in our opinion, cases in which auditors are obliged to report to authorized government bodies about the specified facts have to be accurately stated in the Law on audit, and responsibility for non-execution of this duty is provided.

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**MODERN ASPECTS OF ACCOUNTING POLICIES FORMATION
OF THE CREDIT ORGANIZATION, REFLECTION OF STRATEGIC AND TACTICAL
PROBLEMS OF BANK DEVELOPMENT IN IT**

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ABSTRACT

The basic purpose and the main task of the chosen accounting policies is to reflect activity of the credit organization in the most adequate way, to represent full, objective and reliable information about it. The solution of this task will allow the credit organization, on the basis of the received financial reports, to make right administrative decisions, to estimate a financial position objectively, to put before it the right priorities, allowing increasing efficiency of business. Besides, the credit organization with accurately thought over accounting policies can position itself on international, and in domestic market, as the organization of the international level with a potential of a sustainable development.

KEY WORDS

Accounting policies; Credit organization; Bank; Accounting; Accounting regulation; IFRS, Document flow.

The main objective which is realized by the credit organizations during development and formation of accounting policies is a determination of uniform set of ways of conducting accounting. As a rule, ways of primary supervision and registration of the facts of financial and economic activity, receptions of the organization of document flow are approved, the order of processing of registration information, methods of application of accounts of accounting, ways of generalization of the facts of activity of the organization, methods of group and methods of conducting accounting is organized. The introduction in action of the new normative document — Provisions of Bank of Russia of 16.07.2012 No. 385-P "About rules of conducting accounting in the credit organizations located in the territory of the Russian Federation" (further — Situation No. 385-P) became the main event of 2013 for accountants of the credit organizations. This document replaces earlier operating Regulation of Bank of Russia of the same name of 26.03.2007 No. 302-P (further — Regulation No. 302-P) by which since January, 2008 accounting in banks was regulated. In four years of action of this Regulation fifteen editions, specifying or expanding an order of carrying out and registration of bank operations were accepted. Changes were made generally in connection with a tendency of rapprochement of rules of the Russian accounting and International Financial Reporting Standards. As a result the account in banks became more transparent for analysts and users of financial information, having at the same time expanded possibilities of banks on application of rules of the account in the concrete credit organization.

Therefore the bank accounting policies becomes more and more important internal normative document. In this regard acceptance in 2012 became timely also. The Bank of Russia Regulations from 19.06.2012 No. 383-P "About rules of implementation of money transfer" replaced the Bank of Russia Regulation from 03.10.2002 No. 2-P "About clearing settlements in the Russian Federation".

MATERIALS AND METHODS OF RESEARCH

Goal of research was the studying of the main changes concerning formation of accounting policies of the credit organizations in 2013 in connection with coming into the force of the new normative document — The Bank of Russia Regulations from 16.07.2012

No. 385-P "About rules of conducting accounting in the credit organizations located in the territory of the Russian Federation".

Research objectives are the following:

- studying of the operating normative legal regulation system regulating accounting in the credit organizations;
- development of classification of users of the accounting information provided by the credit organization;
- statement of tactical and strategic problems of development of bank;
- identification of the main changes concerning accounting policies in the credit organizations.

In the course of research domestic and foreign experience of such scientists as Getman G.V., Robin Joyce, V.S. Heendriksen, etc. was generalized. Normative legal acts with use of a monographic method of research are analysed.

RESULTS AND DISCUSSIONS

The main objective of accounting, throughout all history of its existence is a definition of the financial result received as a result of activity of the enterprise. Round any enterprise there is a set of economic interests which want to estimate its profit one way or another, to estimate assets and potential that leads to justification of various methodological and methodical approaches to creation of the account. On the other hand, information represented in financial reports, unambiguously has to be understood and perceived by the trained users, otherwise it is impossible to build partner relationship between the enterprises and the organizations. For the purpose of accounting reduction in the ordered system, the state regulates this sphere of action in a legislative way. The international organizations which develop the international standards, the principles, the provision of maintaining the account, with the purpose to unify methods of maintaining the account and financial statements are created. As a result, accounting needs to be given to uniformity and compliance to the certain established norms and rules. Rapprochement of the national account with world practice of conducting accounting is one of the main conditions of effective occurrence of Russia on the international markets of the capital. As a reference point, for domestic accounting the International Financial Reporting Standards (IFRS) were chosen.

In Russia, for the credit organizations till 1997, approach to conducting accounting was rigidly regulated. Now, the state tries to create the conditions combining rational state regulation and independence of the organizations directed by accounting, in combination with the principles of IFRS. Fixing of set of ways of conducting accounting is regulated by accounting policies of the organization. Therefore, value of accounting policies, now, is not challenged as approaches to conducting registration process changed from the state.

The credit organizations independently form accounting policies on the basis of the legislation of the Russian Federation, being guided by federal and industry standards.

The four-level system of the documents, regulating conducting accounting in the Russian Federation, is based on International Financial Reporting Standards. The similar system can as be applied to regulation of conducting accounting in commercial bank till 2013. Conditionally it could be divided into the following 4 levels:

It was possible to carry the following regulations to the first level: Civil code of the Russian Federation; The federal law "About accounting"; Laws and other acts; Presidential decrees of the Russian Federation; Resolutions of the Government of the Russian Federation.

The normative documents which are carrying out the methodological management of accounting belonged to the second level. These documents were approved at the request of the Government of the Russian Federation by the Ministry of Finance, for all organizations, except for insurance and credit. The methodological management of accounting in the credit organizations was carried out by Central bank of the Russian Federation.

It was possible to refer the methodological recommendations explaining applications of separate provisions and documents of higher level to the third level.

It was possible to refer the internal documents of the credit organization approved by Orders on the credit organization, including accounting policies to the fourth level.

In connection with the introduction in action of the Federal law No. 402-FZ from 06.12.2012r. "About accounting", accounting is regulated by the Legislation of the Russian Federation to which the Law "About Accounting" and other laws belongs. Besides, article 21 of the Law "About Accounting" establishes the following levels of regulation of accounting in the organization: federal standards; industry standards; recommendations in the field of accounting; standards of the economic subject. The systematized levels of conducting accounting in the credit organizations are given in the Table 1.

Table 1 – Levels of regulation of accounting of the credit organizations

n/n	Document type	Approved by	Specific features	Usage in credit organization
1	Federal Laws	The RF President	Extends the actions to all economic subjects, including to Central bank of the Russian Federation. Are considered when forming accounting policies	Obligatory for application
2	Federal standards	Ministry of Finance of the Russian Federation, Central bank of the Russian Federation	Establish special requirements to accounting. Are considered when forming accounting policies.	Obligatory for application
3	Industry standards	Central bank of the Russian Federation	Establishes features of application of federal standards in activity of the credit organizations, including book of accounts and an order of its application.	Obligatory for application
4	Recommendations in the field of accounting	The Ministry of Finance of the Russian Federation, Central bank, Tax inspection, other public authorities, the self-regulating organizations interested in regulation of accounting.	Explain application of federal and industry standards, extend the best practices of the organization of the account, a procedure of internal control.	Are applied on a voluntary basis.
5	Standards of the economic subject.	Head of the subject, Order	Is established by independently credit organization. Accounting policies, regulations, instructions, technological schemes belong to such standard.	Obligatory for application by all divisions of the economic subject, including branches and representations.

The accounting policies of the credit organization allow solving the following tactical problems:

The optimization of fiscal charges providing opportunity, in the years of successful work of the organization to pay the maximum sums of taxes, including on account of next years, and during the difficult periods – minimum. Certainly, thus means, exclusively lawful ways of regulation of fiscal charges;

Minimization of tax risks;

The maximum approach of the account in bank to the MFSO standards, for formation of financial statements within MFSO with the minimum labor expenses;

Choice of ways of maintaining registers of accounting.

Realization of objectives will allow reducing tax burden, tax risks.

Competently made accounting policies will allow to regulate many processes of business, to use the rights provided to business by the government, and as a result, – to save time, forces, money.

The accounting policies have to allow resolving the following issues:

1 . Methodological.

To which it is possible to refer:

- Principles and qualitative characteristics;
- Qualification of assets and obligations;
- Criteria of importance;
- Assessment and calculation;
- Recognition of the income and expenses.

2 . Organizational and technical.

It is possible to refer to them:

- Working book of accounts;
- Order of maintaining the analytical account on a number of accounts;
- Document flow (primary documents, an order and frequency of formation of documents on papers, technology of collecting and information processing, the reporting);
- Order of settlement of mutual debt between branches of the credit organization;
- Organization of registration service;
- Organization of system of internal control;
- Order of carrying out inventory;
- Other decisions necessary for the accounting organization.

In the presence of an ambiguity or a contradiction in acts or normative documents, it is necessary to think over accurately the content of justifications of ways of conducting the accounting, approved as accounting policies of bank. Therefore it is necessary to provide: confirmation of contradictions and ambiguity of provisions of normative documents; impossibility to solve contradictions by permission of collisions and consequently, impossibility of an unambiguous choice of a way from presented in normative documents;

absence of similar norms in IFRS; the description of the developed way, or the chosen way from containing in normative documents on the basis of treatment of the legislation (application of professional judgment); confirmation of compliance of the developed way to managing conditions, branch specifics, the principles of the Russian system of conducting accounting confirmation of compliance of the developed way to managing conditions, branch specifics, the principles of the Russian system of conducting accounting.

With IFRS satisfies information needs of foreign investors, foreign partner banks, and the international payment systems. It is realized by transformation of the Russian accounting reports that is a regrouping of articles of the balance sheet, the profit and loss report and other databases.

The accounting policies of the credit organization fix an order of maintaining the financial account. Within accounting policies, the credit organizations, develop and claim: accounting policies for the taxation of the credit organization; accounting policies on drawing up financial statements according to IFRS.

Conducting management accounting is, as a rule, fixed by separate orders. It is connected with that indicators of management accounting often change, or the main software allowing from the financial account to scoop necessary information for operational management is improved.

Let's consider the main changes in the accounting rules, reflected in accounting policies of the credit organization.

For the analysts comparing editions of Regulation No. 302-P and Regulation No. 385-P, it has to be obvious that at minor changes of terminology the methodology of carrying out and reflection of some bank operations significantly changed. New Regulation No. 385-P does not contain direct references that it is developed on the basis of federal laws from 10.07.2002 No. 86-FZ "About Central bank of the Russian Federation (Bank of Russia)" and from 06.12.2011 No. 402-FZ "About accounting" (further — the Law on accounting).

Thus, Regulation No. 385-P is the independent normative document making own demands to the account in the credit organizations.

So, the Law on the accounting, coming into force since January 1, 2013 and the replacing Federal law of 21.11.1996 No. 129-FL "About accounting", does not contain the obligatory requirement about the signature of the chief accountant on financial records while Regulation No. 385-P specifies that the unsigned chief accountant or the public officials authorized by it settlement and cash documents, the financial and credit liabilities issued by documents, are considered invalid and should not be accepted to execution.

Due to the adoption of Law about accounting in Regulation No. 385-P functions and responsibility of the head and the chief accountant of the credit organization are specified. If earlier for the accounting organization, observance of the legislation of the Russian Federation when performing bank operations responsibility was assigned to the head of bank, according to present edition the head of bank is responsible for the organization of conducting accounting and storage of documents of accounting. The chief accountant bears responsibility for formation of accounting policies, conducting accounting, timely submission of full and authentic accounting reports, provides compliance of carried-out operations to the legislation of the Russian Federation, and also to regulations of Bank of Russia, control of movement of property and implementation of obligations. Functions and responsibility of the chief accountant remained the same.

At the statement of forms of registration documents it must be kept in mind that the credit organization independently develops forms of the primary registration documents applied to registration of operations, except for the forms provided by regulations of Bank of Russia, and the forms containing in albums of unified forms of primary registration documentation.

Requirements which need to be considered when developing normative documents by interfilial calculations are expanded: they have to consider not only a procedure of payments with the branches (structural divisions), but also an order of settlement of mutual debt and the accounting of intra bank requirements and obligations between branches of the credit organization or between head office of the credit organization and branches. Obligatory requirements of the regulator are stated in new characteristics of balance accounts 30301, 30302, 30305, 30306.

The working book of accounts approved by the credit organization has to provide those balance accounts which will be used by it in the account. Since the beginning of 2013 new balance accounts will be entered into Book of accounts and names already operating are changed, other order of reflection of transactions of these or those balance accounts is applied.

So, for example, the name of balance account 30220 "Means of clients on incomplete settlement operations" is changed to "The incomplete money transfers, the clients charged off bank accounts". The characteristic of the account is changed, on the debit of the account the sums of the listed money transfers, including incomplete calculations with operators of services of payment infrastructure, accounts according to the accounting of intra bank requirements and obligations for transfers of clients are reflected. The concept of date of carrying out payment is cancelled.

Changes concerned accounts 30221 (30222) "Incomplete calculations of the credit organization". Now they are called "Incomplete transfers and calculations of the credit organization". The characteristic of accounts is connected taking into account incomplete transfers and calculations for own payments of the credit organization, including for the operations connected with transfers of cash money between the credit organizations.

Besides, these balance accounts were included in the list of pair accounts of the credit organization the balance on which can change on the opposite. Account 30223 "Means of clients on incomplete settlement operations at implementation of calculations through divisions of Bank of Russia" changed the name to "Incomplete transfers and calculations for bank accounts of clients at implementation of calculations through divisions of Bank of Russia". The requirement about existence of means is removed from the characteristic of the account on correspondent account; requirements to the analytical account providing obtaining information on each transfer are changed.

Accounts 30232 (30233) "Incomplete calculations for the operations made with use of payment cards" changed the name to "Incomplete calculations with operators of services of payment infrastructure". In characteristics of accounts there is no reference to Position of Bank of Russia from 24.12.2004 No. 266-P "About cash cards emission and about the operations made with use of payment cards", on the account the sums of incomplete calculations with operators of services of payment infrastructure on the accepted and sent money transfers, including with use of electronic instruments of payment, and to transfers without the bank account opening, the accepted and paid money by calculations by the electronic money, mistakenly enlisted to clients or mistakenly written off from customer accounts are reflected. These balance accounts since January 1, 2013 are entered in the list of pair accounts.

New balance accounts are:

- 30235 "Accounts for cash service of the credit organizations (branches) which is carried out not in a place of opening of correspondent accounts (sub-accounts)" for the accounting of the funds transferred by the credit organization (branch) from correspondent account (sub-account) for receiving cash money if cash service is carried out not in a place of opening of correspondent account (sub-account);

- 30236 "The incomplete transfers which have arrived from payment systems and on correspondent accounts" for the accounting of the sums of the money transfers which are subject to execution on the basis of orders of participants of payment system — payers, and also the amount of transfers credited on correspondent account (except correspondent accounts in Bank of Russia), but not listed (enlisted) in the same day to destination.

Considerable changes happened on balance accounts 30301, 30302, 30305, 30306 which since January 1, 2013 also have other names, reflected operations and requirements to the analytical account. Payments of clients of the credit organization are separated from calculations between divisions of the most credit organization; the order of settlement of mutual debt is specified.

The greatest changes were undergone by balance account 409 "Means in calculations". However with former names and characteristics there were balances accounts 40903, 40906, 40907, 40908. The order of reflection of transactions of other balance accounts of the second order changed radically; there was a new correspondence of accounts.

When writing accounting policies the accountant needs to study and the new correspondence of accounts offered by the regulator in Regulation No. 385-P, including use of again entered balance accounts or changes of names and characteristics already existing.

One of the main questions of accounting policies is the statement of an order of carrying out payments.

The credit organizations approve the internal documents containing: order of drawing up orders; order of performance of procedures of reception to execution, a response, return (cancellation) of orders; order of orders execution.

Along with regulator approved forms in Regulation No. 383-P by documents, banks independently develop and include in the accounting policies forms which can be presented as in electronic form, and on paper. For each form of clearing settlements the existence of a number of the documents being the order on carrying out payment and the settlement document is supposed. The choice is rather wide that the credit organization could take into account level of automation and the organizational features to state a procedure of payments.

CONCLUSIONS

The changes made to rules of accounting by Regulation No. 385-P, generally concern settlement operations. The accounting policies for 2013 have to be made taking into account these changes, and also the requirements in Regulation No. 383-P. Wider use in the accounting of accounts of incomplete calculations, the accounting of requirements and obligations of the credit organization for payments of clients is connected with procedures of

reception and execution of orders of clients, a recoverer of money or the bank itself which are fixed by Regulation No. 383-P.

In comparison with the previous Regulation No. 2-P, the regulator made some essential changes to a procedure of payments

First, the new concept is implemented — the order on carrying out payment. As its originator can act both the client, and the credit organization, and also the recoverer of money providing information on write-off of money directly in bank or the client (for example, the receipt on payment of utilities). Forms of such documents can be different therefore the credit organization has to define forms of documents which will be used as the order when carrying out payments, except those forms of orders which are defined by Regulation No. 383-P.

Payment orders, collection orders, payment requirements, payment warrants, and also other orders (for example, statements, notices, notices, the statements made for collecting money, orders about receiving cash money from the bank account of the legal entity, the order for total amount can reckon with the register made by the credit organization itself) are considered as orders.

Secondly, the bank defines, within what form of clearing settlements these or those orders will be applied:

- calculations by payment orders;
- calculations for the letter of credit;
- calculations by collection orders;
- calculations by checks;
- calculations in the form of money transfer on request of the recipient of means (direct debiting);
- calculations in the form of transfer of electronic money.

Thirdly, the bank defines the settlement (payment) document according to which payment will be made: payment order, collection order, payment requirement, payment warrant, bank warrant. The list and form of these documents on paper are established by Regulation No. 383-P, except the bank warrant which form is approved by the Indication of Bank of Russia from 11.12.2009 No. 2360-U "About the Order of drawing up and application of the bank warrant". In electronic form these documents have to contain necessary information for payment implementation — the obligatory requisites determined by Regulation No. 383-P.

Let's afford the statement that the credit organization is a big accounts department. Practically each employee of the credit organization, except for cleaners, and programmers and top managers, it is possible to carry to registration workers safely. All of them deal with accounts, primary documents and registration registers. Therefore, competently and thoroughly thought over and made accounting policies of the credit organization have huge influence on operability of this organization. Huge value of accounting policies of the credit organization is indisputable.

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OPTIMIZATION OF THE FINANCING STRUCTURE OF IMPLEMENTATION OF REGIONAL SYSTEM OF ENERGY MANAGEMENT RELATING TO THE OREL REGION

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ABSTRACT

The article suggests the model of financing of energy saving measures with usage of the regional energy servicing company in the structure of general management system of the regional heat supply. The existing structures of the financing resources are considered and the analysis of models of energy service mechanisms application is carried out.

KEY WORDS

Energy management; Energy service; Finance; Energy savings; Performance; Contracts; Public-Private partnership; Management.

The article examines two the most vital nowadays aspects: sources of financing and participants of financing of implementing the early suggested by us the improved energy management system [1].

From the variety of the well-known finance structures we selected three the most large and vital structures. Figure 1 presents the first structure [2].

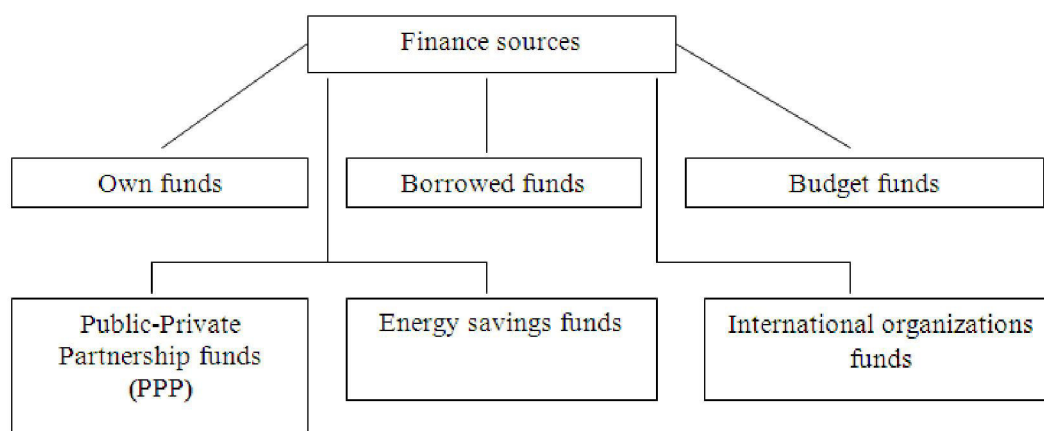


Figure 1 – Structure of financing of energy saving projects

Figure 1 shows nearly all possible sources of finance. The use of such structure on the regional level is problematic because some of the mentioned finance sources are out of access, the use some of them is connected with unreasonably great risks. In the Orel region the regional strategy of energy saving [3] was developed. Large portion of budget financing (nearly 30%) the authors suggest to take extra-budgeting. But it is not so easy to realize in practice.

In the survey published in 2012 on the question of energy saving finance [4] the authors developed the third structure presented in Figure 2.

Analyzing the classification in connection with heat supply branch, taking into account its strategic and social importance, the budget funds will suffer from heavy load. To extend the negative leverage in the conditions of weak motivation of energy saving and development energy saving technologies is necessary to use the legislative initiatives.

This becomes very urgent in modern conditions, when heat supplying branch practices the lease of management functions to private companies more often.

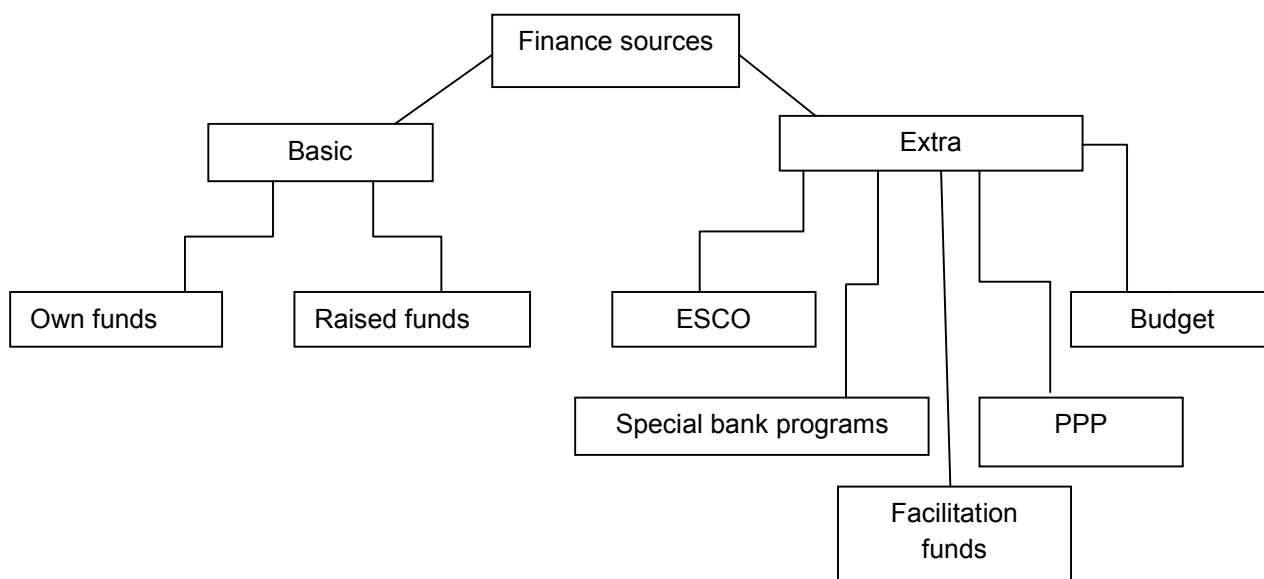


Figure 2 – Classification of finance sources

As a rule, they reach an agreement in Energy Saving Contracts. Today three basic models of Energy Service Contracts are developed [7]:

1. The model of savings assurance, its main participants are a customer, Energy Saving Company and Creditor-Company. In this model Energy Saving Company and Creditor-Company (ESCO) in actual fact is a contracting organization realizing the project on all its stages from designing to implementation. Financing is done at a customer's cost that gets the borrowings from a creditor.

2. The model of split savings is organized in a different way: funds are raised by Energy Service Company and in a fact all the range of works is done also by ESCO. As far as project and payments from a customer are being realized ownerships on the objects of implementation of energy saving measures are transferred [5].

3. The model of interest accountancy suggests an extra participant that provides all liabilities accomplishment. In case of this model usage ESCO gets the definite profits in terms of reduction of risks. But the procedure time increases in connection with appearing of one more participant. The customer in this model is dependent from the rest of the participants; the bank gets some extra costs on Guarantee Company but risks reduce. Energy Service Company interacts with the bank in this model indirectly but through an agent.

The number of drawbacks in these models is mentioned in some works [6]. They are the following: inequality of participation in the project in risks and responsibilities allocation. More than that, the overestimated dependence of one project participant from another is obvious. Some extra finance expenses for debt holdings handling or extra project participants are also marked.

Further in this paper the author [6] suggests improved finance model with engaging of the organized national company integrating the guarantor functions and allocating functions and local ESCO of different levels.

It is obvious that even with the developed mechanisms of energy inspection and energy service this model does not give the answer to the question "how is the heat supply system managed?" Energy audit allows differentiating the possibilities for potential saving and prescribing the list of the necessary actions; energy service helps in energy saving measures implementation by means of tooling of energy saving companies and performance contracts. Nevertheless having realized measures check list is necessary to have clear tooling on non-admission hereafter of different deviations from energy efficient functioning of

heat supply system and business mechanism of this system management in general. These very problems are solved with energy management system.

Estimating the condition of energy service companies and actual situation in the market is possible to stress practical absence of the examples of efficient cooperation with ESCO. Finance mechanism as a rule is investment credit which is given in much overestimated conditions. To put it in another words, in the conditions of extremely high risks of energy saving projects implementation, often it is difficult to find finance sources.

In most cases the claimed firm activity is not realized in practice. As a rule energy inspection is done because the organization according to the Federal Law № 261 [8] must make energy passport where the whole measures complex is presented. After this theoretically energy service mechanism must start. But in practice the inspected organizations refuse to make performance contracts because of different reasons among which is the absence of motivational constituent.

From our point of view the finance tooling via energy service company (ESCO) on the basis of energy service contract formulated in the Federal Law [8] is the most vital and demanded. «Energy service agreement (contract) is an agreement (contract) the object of which is the realization of actions by the executive which are directed to energy saving and energy efficiency increase of energy resources usage by the customer» [5]. From the wording of the contract and provisions described in the corresponding Law article it runs that energy service is a kind of activity when one of the organizations takes the responsibility for execution of energy saving measures, fulfils them at the expense of own finance sources or raised under own responsibility.

The necessity to use energy service mechanisms is conditioned with high project risks to which we can refer low level of capitalization of the being created energy service and engineering companies; falseness of economic effect fixation in the conditions of continuously changing prices and rates; the absence of regulations of investor access organization to finance flows at the realization of energy saving projects; the absence of guaranties of right protection of investor and customer; high finance risks [4].

The main function of energy service companies is guaranties of energy saving measures realization and their finance support.

In this connection to realize energy saving measures we suggest to recognize on the legislative level the necessity of investments into modernization, improvement and focusing on energy saving. It is recommended to work out the addenda to the Regulation containing investment rate depending on measures recorded in energy passports. Among the tooling of attracting investments the mechanisms of public-private partnership are recommended to be used more widely.

Public-private partnership is based on mutually beneficial cooperation of state and individual in declared objectives. [5] In connection with the heat supply sphere the objectives are integrated with other legislative acts. The main one is attraction of private investments into strategically important branch for its development and rationalization.

Realization of Public-Private Partnership (PPP) is heat supply will promote: the development of business constituent of energy saving; risk split; attraction of professional investment staff to energy saving projects, involvement of private investors interested in efficiency increase into management process; decrease of load on the budget at the expense of fundraising for budget objects modernization.

There is a lot of co-financing programs depending on the formed energy politics, the project objectives and targets. In the frame of realization of the project of management system improvement and energy management organization it is necessary to use some of them.

In the developed model of energy management [1] the key chain of command is the Coordination Council that includes qualified representatives of private companies, municipal and regional authorities. It is suggested to organize the Regional Energy Service Company (RESC) on the ground of the Coordination Council. Its specialization will be complex participation in all processes connected with energy service attendance. The basic functions are the following: finance flow coordination, finance resources integration (all accessible sources) on own base, full participation in implementation at all project stages.

The relations between RESC and the enterprises are formed on the ground of public-private partnership, the form of interrelation is chosen depending on established energy policy and is defined according to targets, objectives and the project scope. The works on the project implementation are done by RESC independently or attracting the contracting organizations. Enterprises included into the model have the number of possibilities of investment (according to the suggested legislative initiative this perspective is embedded into the implications of possibility to include private enterprises into the heat supply branch, in fact it is the necessary condition for partnership). Financing sources are found by private enterprise independently, including the attraction of local energy service companies using the above described models. But the key moment is the interaction of ESCO and RESC; finance resources obtained in ESCO come into RESC; and local ESCO will be subcontracting organizations. The developed model possesses the following advantages: complex approach; systematic approach; guaranties from local authorities; high level of participants qualification; risks decrease; balance of interests; actualization on the regional level; fragmentation of financing structure.

CONCLUSIONS

The paper analyzes the present structures of financing and participants of financing of implementation energy saving projects and management systems with heat supply on the basis of which the model of financing with attraction of the regional energy service company applied to the Orel region. It is shown that with regard to the modern condition of systems of heat supply branch management it is reasonable to use energy service mechanisms, particularly, by means of public-private partnership being legislated. It is stated that with the aim of successful realization of the improved model of energy management it is necessary to organize the Coordination Council including the representatives of the municipal, regional authorities and private companies.

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UDC 534.8

THE USE OF ULTRASONIC METHODS FOR VISCOSITY CONTROL OF SOLUTIONS IN THE PECTIN PRODUCTION

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ABSTRACT

The construction of the ultrasonic viscometer for the viscosity continuous control of a liquid in a stream is developed. Perspective of the application of ultrasonic methods of control of the viscosity in the production of pectin substances from plant raw materials is showed.

KEY WORDS

Viscosity; Ultrasonic vibrations; Pectin; Vegetal raw materials; Rheology.

It is necessary to create new equipment and new technologies to solve the tasks of food and processing industry for the coming years. Development of rational structures and choice of optimum modes of processing of food materials may be provided only on the basis of careful study of production processes, with the view of physical-mechanical properties of the processed mass.

Processing of various food materials is accompanied by complex physical-chemical, biological and mechanical processes, the study of which allows you to organize effective and objective control of the quality and management of the technological production cycle. Most of the processes in the food industry is related to the processing of disperse systems, suspensions and colloidal solutions, various elastic-viscous materials. Rheological studies help to understand better the physics of the phenomena occurring in the processing of food materials.

Knowledge of the physical and mechanical properties is used in the calculation of processes that must be carried out to create new machine design and alterations to existing machines, as well as to select the optimum operation of the equipment and the optimum technological scheme of production. Rheological properties of materials can be used as control parameters for creating automated machine control systems, aggregates, industrial sites, for automated control of product quality. Rheology can control the structure and quality of products by making additions, changes in modes and methods of mechanical and technological processing.

Ultrasonics is one the promising lines in control of different rheological parameters [1,2,3]. This is due to its capabilities, the birth of advanced electronics, innovations in touch technology, the availability of computer equipment, techniques of signal and image processing. In addition, ultrasonic methods are methods of nondestructive monitoring, and if a significant number of processes are continuous, it is essential to create full-time devices that determine the viscosity of the material in the flow.

At present in the sphere of ultrasonics they use modern automated computer methods based on the traditional methods of measurement. However, the creation of automated systems, embedded directly in the production chain, can significantly increase the speed and accuracy. Also on the basis of these systems, you can create computer systems to collect and display information that is especially important in studying rheological properties of different materials.

MATERIALS AND RESEARCH METHODS

During the process of extraction of pectin substances from plant raw materials the viscosity is one of the most important factors influencing the content of extractive agent in the solution. You can evaluate amount of the extractive agent by its magnitude that transferred to a solution, that is, monitor continuously the technological process of extraction itself.

An ultrasonic fluidity meter was developed to control the viscosity of the solution containing pectin. Its operating principle is to measure the changes of sound wave amplitude when it passes through the medium.

Figure 1 shows a structure flowchart of the installation.

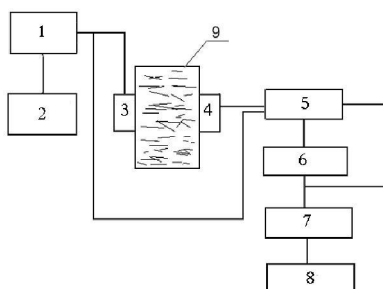


Figure 1 – a structure flowchart of the experimental assembly: 1 - oscillation generator; 2 - control device; 3- ultrasonic acoustic transmitter; 4 – radiation receiver; 5 – preamplifier; 6 – detector; 7 – L-CARD; 8 – a computer; 9 - a vessel with the liquid.

The device consists of a power unit, an oscillation generator, radiator ultrasonic vibrations, an ultrasonic acoustic transmitter, a radiation receiver, a preamplifier, a detector and a system of information processing. The ultrasonic acoustic transmitter and the radiation receiver are installed on the vessel, containing the investigated liquid.

The device operates in the following way. The power supply unit generates continuously an electrical current to the oscillations generator, which generates high-frequency electrical signal and sends it to the radiation source, converting the electrical signal to ultrasonic vibrations. When passing through the investigated medium fluctuations are picked up by the radiation receiver and are converted into an electrical signal. The signal is amplified by the preamplifier, converted by the detector and processed by the system of information processing. Simultaneously, the impulse is delivered to ultrasonic radiator and current fed into the preamplifier increases and falls in the data processing unit. The received signals are processed by the information processing system, the amplitude of input and output signals are determined, and they determine the viscosity of the investigated liquid judging by the difference of the amplitudes. The function of the detector is to convert alternating current into direct current that allows you to monitor continuously the viscosity of the fluid through any time intervals.

RESULTS AND DISCUSSION

Comparative tests of a standard viscometer were conducted. We used a viscometer with a sliding ball. Figure 2 shows a dependency diagram of the dynamic viscosity η of pectin solution and temperature.

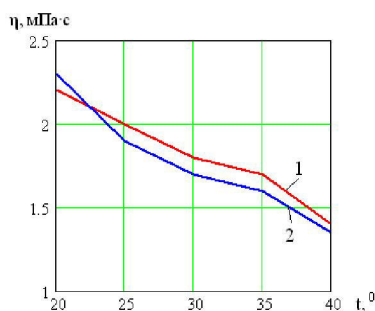


Figure 2 – Dynamic viscosity-temperature relationship:
1 - a standard viscometer; 2 – engineering sample

As it is seen in Figure 2, the conducted experimental studies have shown quite good convergence compared to traditional methods for measurement of viscosity, and let greatly increase the speed of the device, as the method applies to non-destructive testing.

CONCLUSION

We can make a conclusion about the prospects of the use of methods of ultrasonic diagnostics in the production of pectin substances. On the basis of conducted researches a pilot model of ultrasonic viscometer was developed [4] which will be used in developing an automated complex for obtaining pectin substances from beet press by the method of vibration extraction.

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DEVELOPMENT DUAL-FUEL DIESEL INJECTION SYSTEM FOR TRACTORS CLASS 14 KN AUTOMATIC ADJUSTMENT OF THE MIXED FUEL

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ABSTRACT

Described several options for the design development of dual-fuel diesel injection system of the tractor MTZ-80 and proposed a system with automatic control of drop-in fuels, providing the work on the mineral and vegetable and mineral fuels.

KEY WORDS

Diesel; Oil; Fuel; Performance; Mixer; Power supply system; Metering; Diaphragm mechanism.

The main consumer of motor fuels derived from petroleum is automotive engineering. Moreover, the proportion of such mobile equipment fitted with a piston diesel engine in the overall structure of automobile and tractor fleet is increasing every year. [1]

In the energy strategy of the Russian Federation for the period up to 2020 a lot of attention paid to the need for renewable energy sources and, in particular, the sources extracted from plant biomass for the production of environmentally friendly motor fuel. GOST R 52808-2007 [2] refers to such diesel fuel mixed fuel - a binary mixture of mineral oil and vegetable oil. As the biological component of the blend fuels the department staff "tractors, cars, and combined heat and power" of Penza State Agricultural Academy explored lesser known vegetable oils, prepared by cold-pressed from the seeds of white mustard, camelina seed, colza, oilseed radish, softlora, soya, linseed. Due to differences of physical, chemical and performance properties (viscosity, density, flowability, lubricity, etc.) such biofuels from mineral diesel fuel (DF) required structural adaptation commercially available automotive vehicles, preferably without upgrading regular components and assemblies. Practical results obtained by adapting tractors class 14 kN [3, 4, 5, 6] by setting the factory system for the supply of diesel oil tank. Mixing mineral oil and vegetable oil, switch, fuel heater. The main disadvantage of these systems is their lack of control components that provide the desired composition DST depending on changes in load-speed mode of the diesel engine.

MATERIALS AND METHODS OF RESEARCH

Known dual-fuel diesel injection system [7, 8, 9], which allows the feeding of fuel through a common nozzle using a high pressure fuel pump (fuel pump) traditional performance. This fuel system to provide correction of the mixture in the feed.

Circuit supplying the combustion of biofuels in a diesel engine shown in Fig. 1. It includes 8 injectors (one per cylinder diesel engine), fuel pump 13 to supply to the nozzle of mineral diesel fuel from the tank 14, and the equipment for the storage type of alternative fuel supply. The latter, in its simplest form comprises cylinders 3 and 1 for bio-fuels and inert gas, the battery 4, fuel, the check valve 7.

The inert gas provides a predetermined pressure in the cylinder 3 and the battery, which is regulated gear 2 and the pressure gauge registers 5. An alternative fuel supply system supplies diesel fuel only a complete loss of biofuels mixer 6.

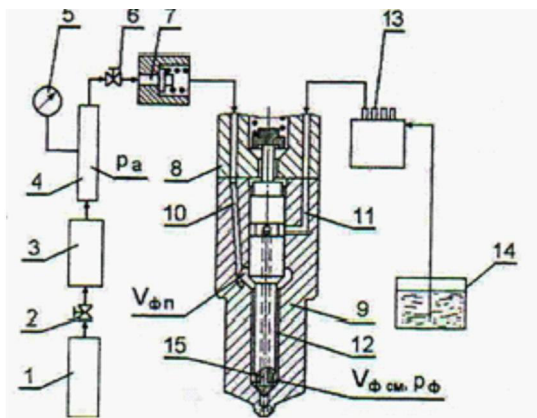


Image 1 – Flow diagram of alternative fuels

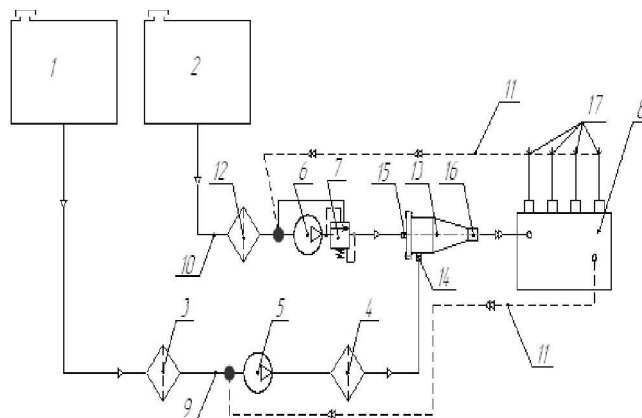


Image 2 – The scheme of dual-fuel diesel injection system

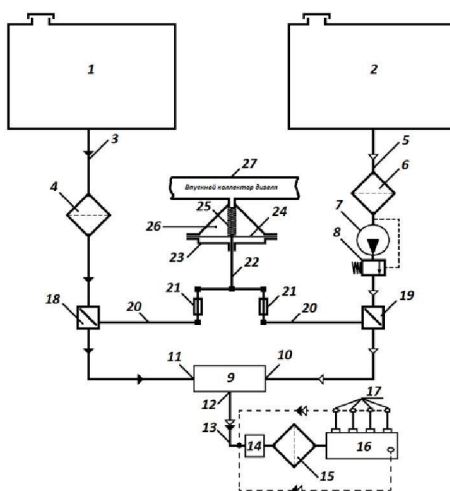


Image 3 – Dual-fuel diesel injection system with automatic regulation of mixed fuel

Known dual-fuel diesel injection system [10] containing mineral fuel tank 1 (Fig. 2), 2 tank of biofuel, fuel filters 3, 4, 5 fuel pump, electric pump 6, the fuel injection pump 7, 8 injectors, fuel lines 9 and a mixer 10 having one input and two output channels.

The purpose and objectives of the study: to analyze well-known models of dual-fuel diesel injection systems, to identify their shortcomings. To develop a new dual-fuel power system with automatic control of the DST.

RESULTS AND DISCUSSION

To ensure reliable operation of the tractor diesel dual fuel (diesel fuel and mineral DST) developed dual-fuel diesel injection system with automatic control of drop-in fuels, which provides the required percentage of mineral and biological components in a mixture, depending on the load and speed modes of diesel, and the fact thus improving the cardinality, fuel-economic and environmental performance of diesel engines under operating conditions [11].

Fig. 3 shows the dual-fuel diesel injection system with automatic regulation of mixed fuel, which contains mineral fuel tank 1, 2 fuel tank of the biological, mineral fuels fence line 3, which consists of a coarse filter 4, the line of the fence biofuel 5, consisting of coarse filter cleaning 6 and 7 of the electric control valve 8, 9 mixer biological and mineral fuels, which has two inputs 10 and 11 and one outlet channel 12, the supply line of diesel mixed fuel 13, consisting of a fuel feed pump 14, the fine filter 15, fuel injection pump pressure nozzles 16 and 17, while in lines 3 and 5, mineral intake and biological fuel to the inlet ports 10 and 11 of

the mixer 9 are mounted dispensers 18 and 19, kinematically connected to and controlled by control rods 20 and 21 with the diaphragm rod 22 of the actuator 23, the other end of the rod 22 is connected with the membrane 24, a loaded spring 25, the cavity 26 of the actuator 23 disposed therein with a spring 25 in communication with inlet manifold 27 diesel.

Works dual-fuel diesel injection system with automatic control of drop-in fuels as follows. The diesel engine and warm it is carried out on mineral fuels. This mineral fuel dispenser 18 is fully open and the biological fuel dispenser 19 is fully closed. Mineral fuel tank 1, having strainer 4, through the dispenser 18 enters the mixer 9 and further fuel pump 14 through the fine filter 15 is supplied to the high pressure fuel pump 16 and the injectors 17 is injected into the cylinders of diesel.

CONCLUSIONS

Changing the load-speed mode value changes diesel vacuum in the intake manifold 27 diesel engine that drives the diaphragm actuator 23, the rod 22 which, through kinematically associated control 20 and the adjustable rod 21 changes the position of dispensers 18 and 19, changing wherein the ratio of mineral and biological fuels entering the mixer 9. This achieves the automatic regulation of the drop-in diesel fuel directly into the process of the diesel engine.

After heating on a mineral diesel fuel include an electric pump 7 that supplies biological fuel tank 2 through the fuel filter 6, and the dispenser 19 to the mixer 9. Mineral fuels thus fed to the mixer 9 is similar to the mode of operation of the engine start and warm. The mixer 9 both fuels are mixed, and the resulting drop-in top Livo diesel fuel pump 14 is fed through a fine filter 15 in the high pressure fuel pump 16 and a further 17 jets injected into the cylinders of a diesel engine.

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