INNOVATION PROCESSES IN ICSTI COMMUNITY

Agro-industry: challenges and innovative solutions

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Dear readers!

In accordance with the decision of the 63rd sitting of the Committee of Plenipotentiary Representatives of ICSTI member states, ICSTI headquarters with assistance of members of ICSTI community are pleased to present the 6th issue of the series «Innovation Processes in ICSTI Community» - the international information and analytical collection «Agro-industry: challenges and innovative solutions».

The collection is focused on issues and presents developments of a theoretical and practical nature in agro-industry in ICSTI community.

The relevancy of discussed topics is obvious, since last decades are characterized by significant growth of population and corresponding increase of foodstuff consumption, and at the same time by aggravation of the negative impact of global climate changes on agriculture in different world regions.

It is also necessary to pay serious attention to environmental problems of agriculture, caused by development of agro-industry, namely, to issues of field-husbandry, animal husbandry, poultry farming, etc. and to potential directions of problem-solving. Solution of agro-industry problems requires innovative approaches and methods.

Modern agro-industry is called to provide sustainable development of countries and the society on the whole through introduction of high-efficiency, intensive, environmentally-friendly and energy saving technologies, production of foodstuff, improvement of reliability of used equipment, expansion of raw-materials base.

Successful scientific, engineering and innovative development of national economies is closely connected with agro-industry improvements, since a sufficient level of agro-industry development is one of the indicators confirming membership of a particular country in a club of world technology powers.

This collection contains materials from Azerbaijan, Belarus, Georgia, Czech Republic, India, Kazakhstan, Moldova, Mongolia, Russia, Romania and Ukraine.

Results of research and corresponding developments from scientific, educational and other organizations within the innovative sphere are represented. The collection is divided into sections by ICSTI member and partner countries. All parts contain theoretical, conceptual, information and reference sections. Materials are illustrated by pictures, photos, diagrams and tables.

REPUBLIC OF AZERBAIJAN

Organization of work of specialized farms in the sphere of crop production

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One of the main directions of agrarian policy of the Republic of Azerbaijan is improvement of structure of lands of agricultural purpose and growth of number of small-scale farms in this sector of economy, and also creation on their basis of middle-size and large agricultural enterprises. Therefore, today the most actual task is integration of small farms and determination of their economically optimum size.

In the Government Program for 2008-2015 on reliable provision of population of the Republic of Azerbaijan with food products it is noticed that main tasks are the following: plant growing development, determination of optimum structure of sown areas, increase of crop production.

The optimum size of an enterprise in agriculture is such its size, when at small enough used agricultural lands, small production assets and manpower the best crop production results are provided. It is important to mark out that the typical feature of modern development of the country is integration of different areas of agriculture.

According to the ordinance of the Cabinet of Ministers of the Republic of Azerbaijan from December 18, 2009 «Criteria of determination of limits of subjects of small business by types of economic activity», small enterprises in agriculture – companies with staff of not less then 25 workers, annual turnover of 250 ths. manat. And, by the way, farms, producing agricultural products, have been recognized as an important part of subjects of small business.

For farms, specializing in the area of plant growing, total areas of more than 1000 hectares are required. At the same time, according to statistic analysis of 2009, in grain farming small private enterprises have (on the average) about 10 hectares, and specialized agricultural enterprises - about 46 hectares (Table 1).

From the Table 2 it is obvious that for heavy crop it is necessary to increase a number of agricultural enterprises. It is also necessary to notice that after Republic independence attaining significant quantitative changes in functioning of state agricultural and private enterprises take place.

In 2009 (in comparison with 2003) grain production has increased by 45.2%. More over, the area under crops in the above-mentioned years has been increased by 45%. Thus, growth of crop production has been provided basically due to increase of area under crops.

In 2010 (in comparison with 2009), taking into account a seasonal factor, plant growing production has decreased by 8.3%.

The main reason - sharp change of climatic conditions: long and continuous pouring rains have hampered the process of wheat flowering and forming of ovaries. Thus, because of hard rains a natural process of pollination has been broken, number of grains in ears reduced and their weight decreased by 25-30%. In this connection grain crop capacity has decreased to 19.9 centner/hectare.

According to the government program of reliable provision of population with food products for 2008-2015, till 2015 demand of Azerbaijan in grain, estimated at a level of three million tons per year, will be completely satisfied

due to internal crop production. The main task – crop capacity growth up to 35 centner/hectare. Such tasks can be performed not only due to increase of lands under cultivation, but due to growth of performance through implementation and introduction of new technologies, increase of lands fertility and other measures.

Table 1: Areas of agricultural enterprises lands, required for turnover of 250 ths. manat

Products	*Crop capacity, centner/ha*	*Cost of 1 centner.*	*Capital, received on 1 ha of planted area*	*Planted areas for 250 ths. manat turnover*	*Planted areas for 500 ths. manat turnover*
Cotton-wool (raw)	15.5	36.16	560.5	446	892
Tea (green)	5.7	85.28	486.0	514.4	1028.8
Fruit	71.9	46.28	3327.5	75.1	150.2
Vegetables	140.0	17.98	2517.2	99.3	198.6
Grapes	74.7	29.80	222.6	112.3	224.6
Wheat	26.6	16.71	444.5	562.4	1124.8
Tobacco	21.7	96.80	2100.5	119.0	238
Sugar beet	251	4.74	1189.7	210.1	420.2

Taking into account these problems, the President of Azerbaijan Ilham Aliyev at the meeting of the Cabinet of Ministers, devoted to results of social and economic development in 2010 and tasks for 2011, has marked out importance of taking additional measures on increase of grain production. It has been noticed that though in 2010 crop capacity decrease was obvious, in 2011 it was necessary to reach the level of 2009. According to this task, on January 17, 2011 the Cabinet of Ministers has held a special session and discussed possibilities of mass scale sowing on state lands, and corresponding resolutions have been adopted.

At the conference devoted to results of the second year of implementation of the «Government program of social and economic development of regions of the Republic of Azerbaijan for 2009-2013», the head of the state has noticed that active creation of large farmer complexes takes place in the country. In all regions of the Republic arable lands are engaged for this program, and their total area is more then 203 ths. hectares.

Analysis demonstrates that economic growth in the sphere of grain farming does not satisfy existing demand from the side of population. While in the world in the sphere of grain farming many farmers have 50-60 centners of crop from one hectare, in Azerbaijan this index (on the average) does not reach 30 centners from one hectare, and that results in necessity of provision of dynamic growth in grain farming due to intensive (instead of extensive) factors.

For this purpose it is reasonable to analyze sown areas and their productivity in different economic regions.

Thus, while grain crop capacity on the average in the Republic is equal to 26.6 centner/hectare, in three leading economic regions this index is equal to 30.9 centner/hectare, 30.4 centner/hectare and 28.5 centner/hectare, correspondingly. Average grain crop capacity in these economic regions is close to a target, set by the state (35 centner/hectare).

However, one of the basic conditions for corresponding goals achievement - availability of adequate land resources in these regions. For this purpose it is necessary to consider area of arable lands of agricultural enterprises in different regions for the last years.

On lands with low grain crop capacity it is more reasonable to stimulate production of other agricultural products. For example, grain crop capacity in 2009 in Guba-Hachmazsky economic region was equal to 21.3 centner/hectare, from a pure economic point of view this is not a successful result. However, while, on the average, harvest of tomatoes in the Republic is about 154 centner/ha, in the above mentioned region it is 215 centner/ha. Thus, cultivation of tomatoes or similar crops in

Table 2: Characteristics of private grain farming enterprises and specialized agricultural enterprises

№	*Characteristics*	*Private enterprises*	*Specialized agricultural enterprises*
1	Number	2571	2392
2	Total area of lands, (ha)	27137	111.100
3	Size of an average plot, (ha)	10.55	46.45

this economic region would be more actual. Such situation is observed also in other regions. For growth of grain crop capacity in the Republic by 2020 it is necessary to take all measures for achievement of average crop capacity at the level of 50 centner/ha, and in grain farming it is important to stimulate ecological and high quality production (Tables 3, 4).

Table 3: Grain crop capacity, centner/hectare

Economic regions	*Years*					
	2000	*2005*	*2006*	*2007*	*2008*	*2009*
Absheron	12,0	14,1	13,4	14,1	14,0	15,1
Gyandzha-Gasahsky	24,2	29,8	29,5	31,3	32,8	30,9
Sheki-Zagatal'sky	18,1	21,4	20,5	24,0	29,6	25,3
Lenkoransky	22,7	24,2	24,6	24,9	23,3	20,5
Guba-Hachmazsky	23,5	21,6	23,5	23,8	21,3	21,3
Aransky	26,7	29,5	30,2	30,1	30,7	30,4
Verhne-Karabahsky	24,4	27,3	27,9	28,0	28,5	25.2
Kel'badzhar-Lachinsky	11,6	27,2	29,1	29,1	30,2	30,6
Mountian Shirvan	20,8	24,2	21,8	21,2	22,7	21,2
Nahichevansky	35,6	38,7	35,5	30,9	25,1	28,5
On the average in the Republic	23,8	26,5	26,5	27,1	27,9	26,6

Cotton-growing. The important place in agriculture is occupied by cotton-growing, which is one of the most labor-consuming branches of economy. The Aransky economic region is considered as a specializing in this sphere. Unfortunately, cotton production for years of independence began to reduce. It is obvious from data in the Table 5.

The area under cotton crops in 1985 in the Republic was equal to 295.5 ths. hectares, and value of production has reached 787.9 ths. tons. Every year these indices (Table 5) decreased and in 1990 they were only 263.9 ths. tons and 542.9 ths. hectares, correspondingly, in 1995 - 210.4 ths. tons and 274.1 ths. hectares, in 2010 – 38.2 ths. tons and 30.2 ths. hectares.

Statistical data demonstrate that development of cotton-growing, one of the most important branches of agriculture in Azerbajan, crop capacity improvement, increase of production volumes and growth of quality must be priority directions of the state agrarian policy. Area under cotton crops in 1980s was equal to 300 ths. hectares, value of production - 800 ths. tons, and crop capacity (on the average) - 26 centner/hectare. Sale of 70-75% of produced cotton of the first grade significantly increased profit of enterprises and wellbeing of population during that period.

Viticulture. In 1985 viticulture in Azerbaijan was at the highest level. In 1970 total area of vineyards was equal to 212.6 ths. hectares, value of production has reached 351.7 ths. tons, crop capacity – 46.9 centner/hectare. As a result of effective work in 1984 area of vineyards have been increased in 2.3 times, production has been increased in 6 times, crop capacity has grown in 2 times. That time Azerbaijan was at the first place in the sphere of production of grapes among all countries of the former Soviet Union.

In spite of the fact that the law of the Azerbaijan Republic «About viticulture and wine-making» was adopted yet on October 19, 2001, no serious changes occurred in this sphere (see Tables 6, 7). And only the decree of the President of Azerbaijan I. Aliev from October 13, 2011 made some changes, concerning a credit period and total volume of investments (maximum credit period -10 years, maximum volume of investments - 10 mln. manat) from the National Fund of Help to Entrepreneurs.

Table 4: Total sown area of agricultural lands, hectare

Economic regions	*Years*					
	2000	*2005*	*2006*	*2007*	*2008*	*2009*
Baku	133	574	746	457	441	499
Absheron	3 544	4 510	4 829	3 972	4 038	3 706
Gyandzha-Gasahsky	116 389	164 651	160 473	168 690	180 546	208 402
Sheki-Zagatal'sky	126 950	155 496	145 929	140 336	183 665	221 672
Lenkoransky	102666	102430	102 395	94 931	111 206	117 203
Guba-Hachmazsky	57 804	105 812	97 127	85 557	95 913	116 094
Aransky	470 270	592 145	597 887	607 421	645 544	705 738
Verhne-Karabahsky	39 800	60 679	64 768	68 687	103 379	139 578
Kel'badzhar-Lachinsky	2 198	2 065	2 243	3 741	5 192	6 473
Mountian Shirvan	84 671	90 750	100 617	100 673	111 047	126 886
Nahichevansky	37 117	48 810	49 275	49 397	58 910	59 200
On the average in the Republic	1 041 542	1 327 922	1 326 289	1 323 862	1 499 881	1 705 449

Vineyards, in comparison with other agricultural objects, can be located on low-fertile, high-relief and different by content soils (accept of salty and marshy lands). At vineyard making first of all it is necessary to choose those

plots, where it is possible to gain high-quality crop.

Table 5: Area under crops, value of production and crop capacity, regarding cotton-growing in the Republic (All categories of agricultural enterprises)

Years	Area under crops, ths. ha	Value of production, ths. t	Crop capacity, c/ha
1990	263.9	542.9	20.6
1995	210.4	274.1	13.0
2000	101.2	91.5	9.1
2005	112.4	196.6	17.5
2006	102.8	130.1	13.0
2007	75.6	100.1	13.4
2008	48.5	55.4	11.5
2009	21.1	31.9	15.5
2010	30.2	38.2	12.7

According to Goskomstat (State Statistics Committee) information, area of vineyards in 2010 in Azerbaijan was equal to 15.4 ths. hectares, production volume - 129.5 ths. tons, import of fresh and dried grapes - 5.5 ths. tons, and export was at the level of 24.1 ths. tons. In 2010 wine production was equal to 1070.7 ths. decaliters, from which 21% (or 224 ths. deciliters) has been exported.

More over, in this year about 187 ths. decaliters of wine material were imported into the Republic for processing. It is clear that without significant investments into agriculture no serious changes will take place.

Tobacco cultivation is one of the most profitable agricultural branches. In 1990s volume of tobacco production sharply decreased, and currently the primary goal of this branch is growth of tobacco production up to a level of 50-60 ton/ha (like in 70-80s years of the previous century).

In spite of provision of macroeconomic stability and implementation of agrarian reforms in a series of agricultural branches, such as cotton-growing, viniculture, tobacco cultivation, tea growing, sericulture, decrease of production in these spheres is obvious.

The mentioned agricultural branches underwent a long-term crisis, production has decreased to a critical level (especially in tobacco cultivation) and even was completely terminated (sericulture).

From such analysis it is possible to draw a conclusion that in plant growing the optimum size of farm depends on geographic conditions, structure of landscape, climate, water resources, soil fertility, area of arable lands, structure of a concrete agricultural branch, location (in suburbs or developed regions), state of roads, technical progress, development of communication facilities, electrification, fertilizing, etc.

According to international experience, a farmer wishing to have high crop capacity should have (Table 8) 500 hectares for grain, 250 hectares for cotton-growing, and 200 hectares of arable lands under vegetables. It is possible due to consolidation of small farms.

For January 1, 2010 the number of farms in grain production in the Republic is not enough. After corresponding reforms co-operative farms, answering to the mentioned criteria, can be created again. In whole, agricultural cooperatives with area under crops a minimum of 200-300 hectares, crop capacity of 35 centner/hectare and general crop of 800-1000 tons can be considered as optimum agricultural enterprises.

Table 6: Viticulture indices in Azerbaijan

Business entities	1985				2010			
	Area of vineyards, ths.ha	Productive area (from the mentioned), ths.ha	Total yield, ths.t	Crop capacity, c/ha	Area of vineyards, ths.ha	Productive area (from the mentioned), ths.ha	Total yield, ths.t	Crop capacity, c/ha
In whole in the Republic	267.8	218.8	1789.6	81	15.4	11.2	129.5	74.7
Special agricultural enterprises and other organizations	254.2	206.5	1642.4	78.7	3.7	2.7	14.1	51.9
Individual entrepreneurs, small farmers, householders	13.6	12.3	147.2	119.5	11.7	8.5	115.4	81.8

In gardening cooperatives optimum number of workers is equal to 18, such enterprise should have 20 hectares of fertile arable lands with crop capacity of 120 centner/ha, yield of 240 tons of products, 146 ths. manat of fixed

capital and 100 ths. manat of current assets.

Agricultural cooperatives, specializing in potato cultivation, should have arable lands with area of 35-50 hectares with crop capacity of 200 centner/ha and total volume of production of 700-1000 tons.

20 hectares of area under crops, 15 workers, 350 centner/ha, total yield of 700 tons – indices of successful vegetable-growing cooperatives.

Correct organization of agricultural cooperatives, proper execution of their functions, protection of their rights and observance of corresponding obligations promotes growth of production, increases efficiency of work and creates favorable conditions.

Table 7: Viticulture in economic regions of Azerbaijan

Economic regions	*2000*				*2010*			
	Area of vineyards, ha	*Productive area (from the mentioned), ha*	*Total yield, t*	*Crop capacity, c/ha*	*Area of vineyards, ha*	*Productive area (from the mentioned), ha*	*Total yield, t*	*Crop capacity, c/ha*
Absheron	2406	2382	2615	45.5	1686	1574	1509	17.9
Gyandzha-Gasahsky	2245	2245	15852	48.6	4071	2723	45458	103.6
Sheki-Zagatal'sky	1081	985	4004	36.2	1247	1108	8861	68.9
Lenkoran-Astarsky	387	387	1266	3.2	1732	1029	5395	46.7
Guba-Hachmazsky	2407	2407	11827	17.2	685	440	6235	116.5
Aransky	1370	1158	16667	57.8	2489	2047	24653	71.2
Nagorny Karabah	1232	1232	1143	5.3	121	13	1290	81.4
Mountian Shirvan	1571	1571	9536	45.0	2373	1261	8722	44.4
Nahichevansky	1519	1512	14026	92.7	1031	972	13912	141.2
Total	14212	13879	76933	35.8	15436	11166	129536	74.7

Conclusions

Development of an agricultural sector of economy and provision of food safety is positively influenced by stimulation of goods production in this branch of economy, as one of the basic branches of national economy, competitiveness growth, subsidizing of agricultural enterprises for the purpose of export increase, provision of stable demand (from the side of population) on products of local companies, application of tax incentives, expansion of leasing service, other complex measures of state support.

In comparison with 1993 in 2010 agriculture gross output has increased by 58.1%. Significant progress is obvious in production of the following agricultural products: grains, potato, watermelons, melons and gourds, and also in gardening. In 2010 farmers has gathered about 2 mln. tons of grain, 954 ths. tons of potato, 1190 ths. tons of vegetables, 434 ths. tons of watermelons, melons and gourds, 730 ths. tons of fruit and 130 ths. tons of grapes. In comparison with 1993, in 2010 production of the following products has been increased: grains - in 1.7 times, potato - in 6.3 times, vegetables - in 2.4 times, watermelons, melons and gourds - in 9.2 times, fruit and berries - in 2.1 times.

The same tendency is typical also for 2011. According to Goskomstat information (for December 1, 2011) yield includes 2,457,900 tons of grain (including corn), 938,500 tons of potato, 1,196,500 tons of vegetables, 58.0 ths. tons of cotton, 761,200 tons of fruit and berries, 477,900 tons of watermelons, melons and gourds, 135.0 ths. tons of grapes, 235,300 tons of sugar beet, 3.6 ths. tons of tobacco, 513.6 tons of green tea.

In the Government Program on social and economic development of regions for 2009-2013 great attention is paid to development of agriculture and modernization of an agrarian sector. Analysis shows that agrarian modernization in Azerbaijan, based on high specialization of agriculture and food production and also on significant experience, creates favorable conditions for achievement of the best results.

It is necessary to take into account that household farms, producing up to 95% of agricultural products, own (on the average) 2 hectares of lands. Such small area does not allow application of advanced techniques and technologies, crop rotation, full-fledged use of production factors.

For organization of specialized middle- and large-scale

Table 8: Criteria of grain farming enterprises

№	*Criteria*	*Value*
1.	Crop capacity per 1 ha (in centners)	26.6
2.	Value from 1 ha (manat)	16.71
3.	Profit from 1 ha (manat)	444.5
4.	Area under crops (ha), necessary for turnover of 250 000 manat	562.4

agricultural enterprises the following measures are required:

1. Determination of priority directions in structure of agricultural lands according to corresponding economic regions, i.e. in each region it is necessary to provide complex measures for cultivation of plants satisfying corresponding demands. For this purpose it is necessary to take into account local demands in corresponding economic regions, where farms are located;

2. Farms specialization according to their location in corresponding natural-environment conditions and production of specific types of products. It is necessary to facilitate conditions of long-term (preferential) crediting, taking into account favorable natural-environment conditions of corresponding economic regions, also for the purpose of increase of areas of orchards, vineyards, tea plantations;

3. Replacement of extensive agricultural techniques by intensive for the purpose of growth of production of agricultural products. Special economic methods must be used for increase of crop capacity (on the same lands) up to acceptable levels;

4. One of the basic conditions of forming of a competitive agricultural sector is increase of a level of living of population in rural places, namely, creation of favorable market conditions, and also smart regulation of internal market prices for agricultural products, improvement of conditions for all agricultural companies and farmers to help them to appear in corresponding markets. Systems of preferences and growth of possibilities of export for all entrepreneurs in an agriculture sector are also must be encouraged in every way.

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Automated system of low-intensive irrigation (ASLII) for mountain and foothill regions of Azerbaijan

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Azerbaijan is in severe climatic conditions. Precipitation in Republic territory is non-uniform, and in a series of mountain regions it is not enough for crops during their vegetation period. Thus, in these regions severe water shortage is obvious.

The most part of suitable for agriculture lands is in mountain and foothill regions, so they require a special approach to irrigation techniques, since at use of ordinary techniques soil washout, surface water runoff and erosion take place. One of ways of this problem solution is use of low-intensive irrigation with moderate water supply according to needs of corresponding plants during the period of their vegetation. It is necessary to mark out that at maintaining of correct parameters of the process of low-intensive irrigation it allows to reduce sharply water discharge and to provide necessary microclimate for plants, and also supply of water and fertilizers in required amount directly to a root zone, thus promoting earlier maturing of plants and their fruiting.

However, low-intensive irrigation (in comparison with traditional surface agricultural methods) is more sophisticated (in technological terms) and in wild places, far from settlements, qualified service is quite complicated, and for provision of efficiency of work of such systems complex automation of technological processes of irrigation is required.

In this paper creation of a typical automated system of low-intensive irrigation for mountain and foothill regions of the Republic is considered. The system is created on the basis of special equipment for distant measurement of corresponding parameters with data interchange through the Internet. Parameters define

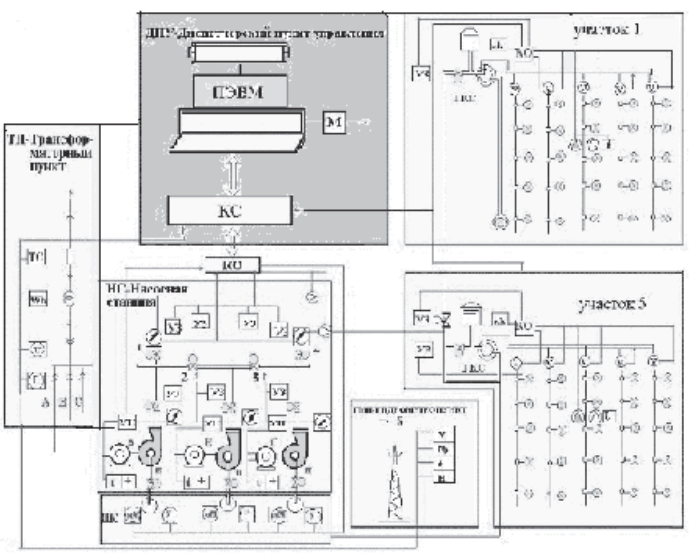

Fig. 1. The scheme of the ASLII for mountain agriculture

technological processes of equipment work, form a scheme and intensity of soil watering, monitor qualitative state of soil at different sites and crops development (Fig. 1).

Taking into account heterogeneity of reclamation works at cultivation of crops at different agricultural sites (economic units) and significant variety of climatic-geographic conditions, typical for mountain and foothill regions, at ASLII creation it is necessary to use decentralized automated system, corresponding (by operation-technological modes) to local agricultural sites (economic units), and also centralized control of work of local systems through Internet channels. [2,3].

Monitoring and control of modes of agro-technical processes is carried out on the basis of data of instrumental measurement of different parameters, characterizing content and a current state of soil, atmosphere, phases of plant development and corresponding agro-technical measures, recorded on-line into a data-bank (DB). [7]. The DB includes the following subdivisions:

a) Normative-reference - includes a series of parameters, which are used for agricultural sites comparison and matching with different variations of characteristics of fields, meeting in practice: types of their soil-ecological conditions, types of cultivated crops, types and modifications of agricultural equipment. This information is always in computer memory.

b) Seasonal conditional-constant - contains a series of parameters, which are used for taking into account characteristics of each separate field, typically not changing during a vegetation period: area, relief, type, water-physical properties of soils, depth and mineralization of ground waters, type and variety of cultivated crops, forbidden techniques. This information is recorded into the mentioned DB and can be corrected.

c) Operative - for operational planning of different technological operations, taking into account a current state of fields.

All used data can be divided into two groups: independent of a farmer parameters and feedback parameters, concerning performance of scheduled works. The first from the mentioned include: temperature, air humidity, precipitation, actual time of phases of plants development, appearance of plants pests and other. Feedback parameters – terms, norms of watering, results of control measurement of soil moisture, terms, forms and doses of fertilization, results of control sampling.

Creation of the DB and work with it is carried out via programs, developed with use of corresponding programming languages.

Information is recorded by users into the DB, representing itself a certain file structure, or the DB is formed in an automatic mode on-line at sampling and measurements. The DB can also be modified according to a specified schedule or requests.

The main purpose of irrigation automation - maintenance of necessary soil moisture and provision of maximum crop capacity in specific natural and agro-physical conditions at minimum irrigation water consumption and minimization of negative influence of accompanying factors on land fertility and environment. It is provided due to solution of the following complex of tasks:

1. information-reference tasks
2. operative-information tasks
3. operative-managing tasks
4. applied agro-technical tasks
5. preparation of reports on irrigation and its results

Information-reference, operative-information, applied agro-technical tasks, preparation of information reports is carried out with use of special software; operative-management tasks and applied agro-technical and agro-reclamation tasks are set and analyzed individually, with use of specially developed programs, and preparation of reports on irrigation and its results - with use of C programming language (and its modifications).

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Automated integrated low-intensive system of irrigation for mountain agriculture in Azerbaijan

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At joint work of the automated system of low-intensive irrigation with other control systems for distant control of the process of irrigation and used equipment, diagnosis and decision-making regarding change of its operating conditions by agricultural specialists from any site of the serviced agricultural region and from the top control level, for example, from the Agricultural Ministry or the Irrigation Control Center, it is necessary to create the Data Distribution Network (DDN).

This network must provide the following functions:

- useful data acquisition at middle and upper levels, and output of this information on users requests;
- transfer of this information from the system into the Network according to set rules;
- telemetry from automated agricultural objects regarding the current state of the process of irrigation and technological equipment, corresponding information recording;
- displaying of useful information on monitors of portable or desktop computers from the system on users requests;
- acquisition from the Network and displaying (on monitors of the control system) of data regarding the current state of distributed water resources between agricultural fields, for example, hydro-weather-parameters, used for solution of functional tasks, concerning definition of watering rate and period;
- provision of restricted access to the information (only for authorized users), thus maintaining information protection from illegal access.

For execution of the specified functions the DDN must include generally at each control level the following features:

(a) computer-server with software, providing integration of information about automated objects of irrigation, connected to this server, output of necessary information on request from a desktop or portable computer with the corresponding software. Server power is determined by a number of connected to it automated irrigation control systems;

(b) personal computer for data acquisition from receivers-transmitters, for transmission of information to server for recording; and also for processing and output of necessary information, for analysis pertaining to the corresponding level of control;

(c) low-power portable or desktop users computers, equipped with software and drivers, providing satellite communication or communication through TV-channels (Internet, Ethernet or other channels) with the mentioned computer-server from any office or site of serviced region;

(d) communication channels: radio stations, providing data reception-transmission through satellite communication channels, wire communication channels (Internet, Ethernet, etc.), controllers, providing coordination of communication channels, for example, according to regulations and scaling, and other parameters.

At the lower level there is a telemechanic system of control of technological objects, including the following features:

(a) primary measuring transducers, signaling devices, blocks of control and regulation;

(b) controllers, providing data acquisition, processing and transmission into a personal computer;

(c) personal computers, providing data acquisition from controllers, solution of functional tasks regarding definition of rates and periods of irrigation, control over irrigation processes, control signals regarding pumps and valves, other mechanisms according to corresponding programs, printing results of analysis, output documents, concerning the current state of technological equipment, the state of irrigated sites (humidity and temperature of soil), watering (time of watering and water discharge), other documents; provision of necessary information on requests of the upper level.

At the administrative level of the corresponding agricultural region it is necessary to implement an integration station, including a computer-server, personal computer, receiver-transmitter radio station and the Internet communication controller (or, for example, the Ethernet-controller), controller of communication with the «Telemetry» channel.

Through the «Telemetry» communication controller information is captured from telemechanic control systems and systems of control of automated irrigation systems of the corresponding agricultural regions. The mentioned controller allows to provide communication of the top control level through telephone lines using Internet channels.

Top level communication can be maintained also through satellite channels and send-receive radio stations.

At the top level (the Agricultural Ministry or the Irrigation Control Center) this Network is represented by a computer-server, personal computer, send-receive radio station and Internet communication controller. Information interchange between region irrigation control sites (middle control level) and the Irrigation Control Center or the Ministry (top level) is carried out through Internet and satellite channels.

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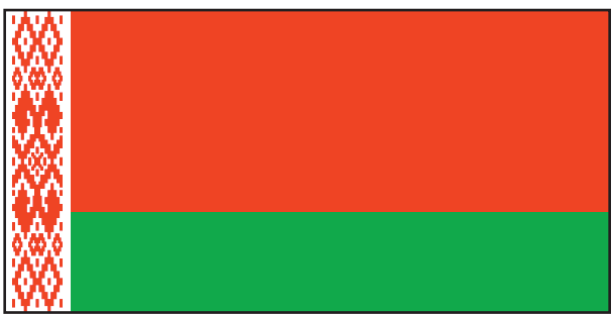
REPUBLIC OF BELARUS



Innovative development of agro-industrial complex (AIC) of Belarus

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Current state of AIC of Belarus (Republic of Belarus, RB) substantially defines a level of economic development of the country and social stability of a society, provides food safety and stability of industrial functioning of almost all branches of national economy.

Statistics confirms that in AIC of the RB stable dynamics of strengthening of industrial potential and intensification of technological processes is provided, innovative and scientific-technical components of economic branches are extended, growth of gross income and efficiency is obvious. Success in AIC is reached substantially due to introduction of innovation techniques, modern equipment, and, of course, due to efficient domestic and foreign developments and innovations.

In industrial strategy of development of each branch of AIC requirements of development and introduction of innovations, creation of import-substituting and export-oriented products are strictly fulfilled. For acceleration of social and economic development, strengthening of an innovative component of an agrarian sector of economy the Government of the RB, Ministry of Agriculture and Food Production, Republic Regional Executive Committees in close cooperation with agrarian sciences implement engineering-technological measures, organizational and structural solutions, provide budgetary, off-budget financial and material security of reforming and development of corresponding branches of economy.

The following tasks are put into the basis of development of AIC.

In 2011-2015 on the basis of engineering and technological re-equipment, introduction of the best achievements of science and engineering, active expansion of a sphere and volumes of use of innovations it is planned to provide growth of profitability of agricultural production (on the average) up to 30%. Increase of productivity in an agricultural sector of economy is to be maintained at a level of 30-35%. Revenue and profit - indices of stability and economic efficiency of production – are currently at the first place in a series of criteria of estimation of work of agricultural organizations (taking into account growth of total volumes of production). Profitability, economic efficiency of sales of products, dynamic recoupment of capital investments, import-substitution, growth of export become priorities and basis of efficiency of economic activity of organizations and branches of economy.

It is expected that in 2015 growth of export potential of agricultural production and foodstuff will provide positive balance of foreign trade in amount of 5 bln. US dollars. For this purpose by 2015 is planned to increase grain production up to 9-10 mln. tons, production of sugar beet – up to 6 mln. tons. New strategic targets: to produce 7.5-8.5 mln. tons of milk, 1-2 mln. tons of meat (live weight). Production of fish (in salable condition) by this time is to be increased up to 22.7 ths. tons, including pond and lake-river – up to 20.2 ths. tons. Taking into account growth of demand for salmon, sturgeon and silurus kinds of fish, their production in the Republic will be increased up to 2.5 ths. tons. At the same time decrease of import of fish products will make 7.9 ths. tons per year, and reduction of outflow of hard currency from economy will reach 41.8 mln. US dollars per year.

External and internal conditions, laws of functioning of world markets of raw materials and food set specific tasks in the sphere of perfection of organizational structure of AIC, creation of dynamically developing integration systems at branch, inter-branch, regional, republican and interstate levels. The basis of development and growth of efficiency of agricultural branches and processing industries includes:

- optimization of resource provision of production;
- creation of a mechanism of provision of quality of initial raw materials and final products;
- accelerated development of techniques and production of import-substituting and especially export-oriented products;
- optimum combination of domestic and foreign innovations in agro-industrial production, in the form of modern, high-potential and new cultivars, breeds of animal, agricultural machines and equipment, other organizational components of production processes;
- maximum engagement of local sources and raw materials, power sources in industrial activity.

Solution of tasks, set before domestic AIC, and perspectives of its development are stimulated with expansion of economic and political targets of the United State, formation and strengthening of the United Economic Space, growth of their influence on international arena.

The basis of export of AIC includes:

- products of processing branches of economy;
- agricultural machines and equipment;
- varieties of agricultural, vegetable and technical crops;
- veterinary preparations;
- innovative engineering processes.

It is necessary to mark out that in an expert segment of food products alongside with traditionally asked-for in foreign markets milk, dairy and meat products, sugar expansion of export sales of rape oil, products of a flax growing and processing branch is expected. Directions of application of such products are wide enough - foodstuff, fodder preparations, production for technical needs, bio-fuel production. For example, it is supposed that by 2015 rape oil export will be at a level of 180 ths. tons at 194 ths. tons of internal consumption.

In implementation of such projects a significant part must represents itself developments and innovations in the form of high-yielding domestic varieties of rape, including food «canola» type, effective techniques of seeds harvesting in short periods at reduction of crop losses, techniques of a prolonged storage of oil with maximum preservation of quality of raw materials.

Reserves of expansion of cooperation of science and production exist also in a sugar beet processing branch. Science must be engaged not only in solution of problems of optimization of raw materials regions, but also in issues of preservation of sugar beet root crops at their processing, growth of sugar content of root crops, expansion of a final product range (with use of sugar), increase of general efficiency of production and sugar beet processing. Such approach is very important, since in the Republic production of marketable sugar from 1 ha under sugar beet makes about 5.3-6.0 tons, in Germany and France - 12 tons.

In this area it is reasonable to engage innovative techniques and special biological preparations, improving preservation conditions of raw products, maintaining high sugar content of root crops and reducing losses at sugar beet storage (protecting it from pile rotting).

The level of achievements and innovations, created by domestic selectionists and used in a foreign agrarian sector, can be estimated on the basis of the following information. Outside of the Republic of Belarus farmers sow more then 70 varieties, selected in Scientific-Practical Agricultural Center (SPAC) of the National Academy of Sciences (NAS) of Belarus, including the following: in the European Union countries - 4 varieties, in Russia - 29 varieties (from them 16 varieties of grain crops), in Ukraine - 13, in Lithuania, Latvia, Kyrgyzstan - 8-9 varieties.

Currently agricultural organizations of the Republic and foreign companies widely use perspective varieties and hybrids, created by the SPAC of the NAS of Belarus, the Scientific-Practical Center (SPC) of the NAS of Belarus on potato growing and fruit and vegetable growing - winter rye and soft wheat, winter rape, potato, white cabbage, cucumbers, onion, beans. In particular, promising varieties of winter soft wheat with potential of crop capacity of 90-100 centner/hectare («Suite», «Ode», «Elegy», «Uzdym»), selected in 2011-2012, are cultivated on 185 ths. hectares of lands. Value of received bread-grain is estimated at a level of more than 199 mln. US dollars. In 2013 wheat of such varieties is to be sown on 150-200 ths. hectares of arable lands. In total 93 varieties of grain, leguminous, fodder and industrial crops are successfully used in agriculture of the Republic, different techniques of their cultivation, developed by specialists of the SPAC of the NAS of Belarus, are widely implemented. The area under such crops makes 650 ths. hectares.

In dairy and beef cattle husbandry contribution of science into growth of production is to be based on potential milk yield at the level of more than 8 ths. kg per year. Daily average weight gain of horned cattle must grow up to 950-1000 g, pigs – up to 650-700 g.

For this purpose with scientific help of the SPC of the NAS of Belarus on animal husbandry highly productive herds with milk yield of 8-9 ths. kg of milk from cows of intra-pedigree dairy type and the Holstein population with genetic potential of 10-11 ths. kg of milk per lactation on the basis of Belarusian black-motley breed are created, perspective selection herds of pigs of new types of Belarus meat breed (Belarus black-motley, large white) are developed, their livestock extends.

Special attention is paid to technical re-equipment and modernization of AIC. Significant acceleration of terms of creation of modern equipment and improvement of quality of serial machines and equipment of domestic production to the level of the best foreign analogues is required. One of the main tasks in this matter – to introduce (in industrial volumes) competitive complexes and systems of machines in all basic directions of agricultural production. For solution of the specified problem the SPC of the NAN of Belarus on farm mechanization develops systems of machines for implementation of innovative production technologies in agricultural sectors.

Alongside with such measures in domestic agricultural machine industry the term «modernization» in work of designer and industrial companies must be privileged, that factor will allow to reduce terms and expenditures for renewal of models of machines and equipment of agricultural organizations, processing and trade companies.

In this matter priority tasks - creation of an efficient system of agro-industrial products sale, maintenance of corresponding infrastructure of promotion and positioning of domestic products in foreign markets, allowing to provide export of goods and services at the level of 6-7 bln. US dollars.

In the system of the world food market processing industry of the Republic must become hi-tech, waste-free and competitive. To a certain degree it plays a role of a locomotive of AIC, with help of which the Republic attracts significant capital and other resources. The brand «Made in Belarus» must be attractive and well-know at any regional market. International standards, quality management systems ISO 9000 and systems of analysis of risk of critical points (HACCP) must become norms of daily work of companies.

Scientific support of solution of tasks, set by the President of Belarus and the Government of the Republic, concerning strengthening and development of AIC of the Republic, is provided by different organizations within frameworks of the following government programs:

- «Agropromkompleks (AIC) - sustainable development»,
- «Mechanization of growing and processing of basic crops»,
- «Industrial biotechnologies».

Within frameworks of the following sections of government programs:

- «Potato growing and fruit and vegetable growing development»,
- «Developments of production of veterinary preparations»,
- «Innovative biotechnologies».

Branch scientific-engineering programs:

- «Import-substituting products»,
- «Scientific support of development of branches of food-processing industry»,
- «Scientific support of development of a flax growing and processing branch»,
- «Oil-yielding flax».

Analysis of results convincingly testifies that the most efficient form of R&D in the sphere of developments and scientific support of development of AIC are the state scientific and technical programs. Commercial introduction, serial production and implementation of developments in AIC is transparent and traced in branch plans during the period of not less than three years after R&D ending. It is proved that the most perspective innovations are created within frameworks of the state scientific-engineering programs in an interface area or in a complex of mutually supplementing scientific directions.

It is necessary to mark out that the cycle of the state scientific-engineering programs:

- «Agropromkompleks (AIC) – village revival and development» (2005-2010),
- «Agropromkompleks (AIC) - sustainable development» (2011-2015).

It is a successful example of participation of domestic agrarian science in organization of complex approach and continuity at scientific support and solution of corresponding AIC tasks, and also in formation of the state scientific and technical policy in this sphere. In the mentioned programs specificity and a current level of development of branches of an agrarian sector is taken into account. Development of organizational-economic solutions, innovative techniques, new products, their introduction in production is implemented according to the following directions:

- «AIC economy»,
- «Crop-growing agriculture»,
- «Animal husbandry and veterinary medicine»,
- «Mechanization and power engineering»,
- «Processing, foodstuff».

System work at the state level for the purpose of introduction of breakthrough innovations and functioning of national economy in the mode of intensive innovative development takes place within frameworks of the Government program of innovative development of the Republic of Belarus (RB) for 2011-2015, according to which more than 80% of implemented innovations are based on domestic developments.

Existing at all levels of state administration and scientific support system work for development and modernization of AIC, perfection and increase of efficiency of scientific-engineering support of development of its branches and even separate organizations gives tangible results, allowing domestic AIC to be competitive not only in Post-Soviet economic space, but also far abroad. Created scientific-engineering production is actively enough introduced in domestic agricultural production, successfully competes in foreign markets.

For example, in 2011 within frameworks of the branch plan many scientific-engineering developments, created at solution of 193 problems of the State Scientific-Engineering Program (SSEP) «Agropromkompleks (AIC) – village revival and development», have been implemented. Value of produced goods has made 1,113,436.6 ths. US dollars, and for 9 months of 2012 new products (175 items) are manufactured with total value of 1,368,085.0 ths. US dollars. Growth of money equivalent is equal to 23%.

The State program of innovative development of the RB for 2011-2015 includes 38 items, according to which created within frameworks of tasks of the SSEP «AIC – village revival and development» innovative products are to be introduced in 2012-2015 with creation of new production facilities. According to 28 of the mentioned tasks corresponding production will be continued in 2013, according to 10 of them - in 2014, and according to 9 of them - in 2015. For the first half of 2012 value of produced goods (according to corresponding items of the program) has made 108,725.4 ths. US dollars.

In whole productivity of the SSEP «AIC - sustainable development» for 2011-2015 on creation and introduction of scientific developments in AIC is estimated positively. It is obvious, that at implementation

of this program the following items will be developed and introduced: 80 names of new machines and equipment, more than 150 techniques and technological processes of production of agricultural products and foodstuff, more than 165 varieties and hybrids of agricultural plants, about 50 pedigree groups and selection breed herds of agricultural animals. It is planned in 2011-2015 to reach a level of new products sales of more than 1 bln. US dollars. Total value of export-oriented and import-substituting products must be equal (approximately) to 700 mln. US dollars.

In further development of AIC the main attention is to be paid to implementation of programs on equipment of agricultural machines with systems of automation for introduction of techniques of precise agriculture, results of lands remote sensing from space, other directions of domestic and foreign scientific-engineering and innovative activity.

Special attention is paid to expansion of scientific and innovative cooperation within frameworks of joint programs of the United State and the Eurasian Economic Space.

In the current five-year period a series of joint programs with the Russian Federation on scientific support of AIC is successfully implemented. Among the most perspective it is necessary to mark out the following:

- «Growth of efficiency of food production due to waste processing on the basis of progressive techniques and equipment (topic «Wastes»)»,
- «Development of perspective resource-saving, ecological technologies of production of biologically high-grade mixed fodders».

Programs on other directions of scientific-engineering cooperation are also developed and coordinated.

The example of successful cooperation in this matter - the Interstate Target Program of the Eurasian Economic Community «Innovative technologies» for 2011-2015, implemented by joint efforts of scientists of Belarus, the Russian Federation, Kazakhstan, Tajikistan, Kyrgyzstan. The program is intended for creation of modern production of competitive biotechnological products, increase of efficiency of agricultural production, improvement of quality of raw materials and foodstuff, growth of ecological safety of production and, at last, expansion of range of products and operative introduction in countries of the Eurasian Economic Community (EEC) of biotechnological products of import-substituting and export-oriented types.

In particular, at the international scientific-practical conference «Innovative biotechnologies in countries of the EEC (EvrAzES)», held more than a year ago, it has been marked out, that «biotechnology becomes a powerful factor of development of economy of separate countries and the world economy in whole. It successfully solves such vital problems, as food security, creation of efficient biological preparations of agricultural assignment, medicaments, bio-fuel on the basis of renewable natural resources, ecological equilibrium maintenance, preservation of bio-resources of the Earth. At development of this branch of economy essentially new perspectives are discovered. Participants of the conference have agreed that implementation of the program of the EEC «Innovative technologies» will render powerful consolidating influence on development of hi-tech and agrarian sectors of economy of countries-participants.

Conclusion

It is necessary to underline, that (in whole) it is important to accelerate processes of creation and commercialization of innovations in the sphere of republican AIC on the basis of new perspective knowledge and techniques - results of R&D of domestic and foreign specialists. Formation and expansion (in science and economy) of a role of organizations, activity of which is directed to adaptation and modification of technological, engineering and information developments, is obviously required. Such companies must provide (in the long term) operative growth of economy up to an acceptable level of competitiveness in domestic market and in a significant segment of the foreign market. At strengthening of positions of these companies in corresponding markets, at accumulation of scientific and industrial potential, they are capable to enter into struggle for long-term leadership at zonal and global levels of the world market of agricultural products and foodstuff.

In this segment use of international standards, supporting corresponding specifications of production of goods for the world market and corresponding requirements, pertaining to quality, ecological compatibility, health and safety of consumers, will allow to accelerate technological modernization of traditional production, appearance of new directions in branches of economy, creation of new production facilities.

It is time for domestic economic and agricultural sciences to pass from creation of «fundamentals of innovative development of AIC» and scientific support to participation in creation of developments in the sphere of scientific-engineering and innovative support of activity of complex companies, holdings and implementation on their base of programs of transfer of domestic agricultural production to international markets, and also integration of these organizations into the world agrarian and food systems.

In the mentioned strategy of strengthening of influence of science and acceleration of introduction of corresponding scientific research it is necessary to expand and transform a role of Scientific-Practical Centers (SPCs) of the NAN of Belarus in the area of support of development of AIC. On the agenda - active formation of domestic holdings and international companies within frameworks of the United Economic Space.

Tactics and policy of the state strategy of innovative development of domestic AIC can be defined conditionally by the following directions:

- creation of innovative techniques;
- production of import-export products;
- active expansion of products and companies in foreign markets;
- strengthening of positions of companies in these markets, including at their association into international holdings and unions;
- transformation of agrarian sectors of economy into «innovation-oriented».

At the same time the State Administration of the Republic, a scientific sector of economy understands that in AIC of the country still there is a wide range of problems. In particular, there are some financial-economic issues. However, people in Belarus believe that such difficulties are surmountable, and all set tasks will be fulfilled.

Developments of the Republic of Belarus

Food-processing industry

BLR-01

Chemically modified oxidized starch

Purpose

Principally new product for food-processing industry and technical purposes with an optimum ratio «price-quality».

Area of application

Food-processing industry and technical purposes.

Description

Starch oxidized represents itself a homogeneous powder of white color, produced by oxidation of potato or corn starch with or without application of catalysts.

Advantages

Mass content of moisture - no more than 20%, ash - no more than 0.3-1.0%. Acidity - no more than 20 ml of (0.1-n) NaOH solution for neutralization of 100 g of dry substance. Conditional viscosity of water paste with mass concentration of 9% at 60°C - no more than 35 s. Starch-sugar jelly strength - 800-1000 g.

Development stage

The following documents are developed:

- package of Technical Normative Legal Acts (TNPA) (Technical Specifications TU BY 190239501.780-2010 «Starch oxidized»;
- technological Instruction TI BY 190239501.10.054-2010 «Technological instruction on production of chemically modified oxidized starch».

The technology is completely developed and introduced on the base of the Open Joint Stock Company (OJSC) Starch Factory «New Drut'».

Cooperation proposals

Introduction of the developed technology can be implemented on facilities of starch-syrup production factories, which have a special reactor for chemical modification of substances.

Provision with corresponding documentation.

Rendering of scientific and technical help.

Contact information

Republican Unitary Enterprise (RUE) «Scientific-Practical Center of the National Academy of Sciences of Belarus on Foodstuff».

220037, Minsk, Kozlova street, 29

Tel.: 294-09-96, fax: 285-39-71, URL: http://belproduct.com, e-mail: info@belproduct.com

Food-processing industry

BLR-02

Production of calvados and calvados alcohols

Purpose

Supply of alcohol markets with principally new products.

Area of application

Wine-making

Description

Young and fortified calvados alcohols and calvados, previously not produced in the Republic. They represent themselves a group of high-quality alcoholic beverages.

Developed products differ by unique organoleptic characteristics due to use of local varieties of apples for production of calvados vine-materials. It is import-substituting and by quality corresponds to world analogues.

Advantages

Calvados production has huge potential for creation of elite brand products. It allows to create assortment of products with a wide price range - depending on duration of aging calvados can be ordinary (aging during a period from 6 months to 3 years) and vintage (more than 10 years of aging).

Stage of development

The following documents are developed:

- state standards on calvados alcohols and calvados;
- branch technological instructions;
- technological instructions on production of two brands of calvados;

At the Unitary Enterprise «Ilovskoe» (Minsk region) experimental batches of calvados «Le calvados inspiration» and «Le calvados mystère» in amount of 500 decaliters are produced.

Cooperation proposals

Introduction of the technology can be organized on the basis of existing wine-making enterprises, additionally equipped with a special plant for fractional distillation and tanks for aging of calvados alcohols.

Long time aging of calvados alcohols will allow to launch production of vintage calvados and to create national brands, meeting the highest expectations of consumers.

Food-processing industry

BLR-03

Prophylactic baby food on the basis of fruit and vegetables

Purpose

Production of sealed jars with baby food, containing functional ingredients, allowing to create balanced products of a new generation with required physiological effects.

Area of application

Fruit-and-vegetable processing branch of food-processing industry.

Description

Preserved baby food of a prophylactic type is represented by an assortment group of 5 products: on fruit and vegetable basis; with sugar or without it; with special food additives and with an optimum set of nutrients due to use of natural food ingredients.

The technology allows to produce products with a harmonic organoleptic profile and a guaranteed complex of qualitative characteristics, beneficially influencing a growing organism of a child.

Advantages

It is proved that this preserved baby food due to its specially developed nutrient formula promotes compensation of deficiency of corresponding macroelements (Mg, Ca) and normalization of phosphor-calcium-magnesium metabolism.

This food is recommended to children from 8 months to 3 years as a diet component for normalization of sleep, lowering of a level of anxiety, improvement of attentiveness and increase of activity during games.

The technology and formulation allow to expand assortment of baby food products and to bring the powerful contribution into improvement of children health by means of lowering of risk of diseases.

Stage of development

Engineering and technological standard documentation is developed.

Cooperation proposals

Technology can be implemented at factories, specializing in baby food production.

Food-processing industry

BLR-04

Low-protein confectionery for people, suffering from phenylketonuria, and gluten-free products for celiac disease patients

Purpose

Provision of a specific diet for people, suffering from phenylketonuria and celiac disease. (Phenylketonuria is a hereditary disease, caused by metabolic disorder (regarding phenylalanine) and characterized by progressing dementia. Celiac disease is a disease of a gastrointestinal tract, characterized by malabsorption, as a result of cereals gluten protein intolerance, leading to general debiliation).

Area of application

Confectionery and food concentrates production.

Description

Technologies of production and formulation of pastry of low-protein (cookies and spice-cakes) and food concentrates (cold cereals) and mixtures for cakes, cookies baking in house conditions and also gluten-free concentrates (cold cereals and porridges) are developed.

Advantages

Products have no domestic analogues; import-substituting products of functional purposes.

Stage of development

Technologies are introduced at enterprises of Belarus, producing confectionery and food concentrates: Open Joint Stock Society (OJSS) «Confectionery factory Slodych», OJSS «Confa», KUP Vitebsk confectionery plant «Vit'ba».

Cooperation proposals

Introduction of the developed technology can be organized on the basis of functioning confectionary companies.

Requirements to production - preliminary careful cleaning of processing equipment for provision of a low level of protein in products.

Special additional equipment is not required.

Provision with corresponding documentation.

Rendering of scientific and technical help.

Food-processing industry

BLR-05

«Bellakt BL» – dairy dry lactose-free product for baby food

Purpose

Baby food from first days of life to one year and further at symptoms of lactase deficiency.

Area of application

Dairy dry lactose-free mixture is a special product for babies, it is prescribed by doctors at presence of specific symptoms. The product is intended for nutrition of children from first days of life to one year and further at symptoms of lactase deficiency.

Description

The dry lactose-free dairy product for baby food «Bellakt BL» contains milk proteins, vegetable oils, maltodextrin, mineral substances (calcium, phosphorus, potassium, sodium, magnesium, copper, manganese, iron, zinc, iodine, selenium, chlorides), vitamins (A, D, E, K, B1, B2, B6, B12, BC, C), taurine, carnitine, nucleotides, polyunsaturated fatty acids (linoleic and α-linolenic acids). In «Bellakt BL» there is no lactose, and that defines belonging of the designed product to special baby food.

Advantages

The product «Bellakt BL» is close by content to human milk, and that provides full-fledged growth and development of a child. Nucleotides stimulate maturing of an immune system, improve growth and development of cells of mucous coat of bowels. Linoleic and α-linolenic fatty acids are necessary for full-fledged development of immunity, brain and organs of sight of a child. Maltodextrin promotes improvement of digestion and consumption of nutrients. The complex of immune-nutrients (zinc, iodine, selenium) and antioxidants is necessary for optimum growth and development of a child.

Stage of development

Technical Normative Legal Acts (TNPA) (TU BY 100377914.574-2010) and Technical Documentation (TD) for the dairy dry product for nutrition of children with lactase deficiency, RC BY 100377914.625-2010 «Dairy dry lactose-free product for baby food», are developed and approved.

Cooperation proposals

Provision with corresponding documentation.

Rendering of scientific and technical help.

Food-processing industry

BLR-06

«Bellact GA» – dairy dry special product for baby food

Purpose

Nutrition of children from one year at deficiency or absence of human milk; solution of problems of food allergy.

Area of application

The modern domestic technology of production of dry dairy products on the basis of hydrolyzates of milk proteins for nutrition of children with symptoms of food allergy.

Description

It is produced by drying of a condensed mixture with use of special spraying drying equipment. The mixture consists of partial hydrolyzate of serum proteins, vegetable oils, low-saccharified syrup and-or maltodextrin, dairy sugar, mineral salts, vitamins, carnitine, taurine, biotin, inositol. Protein of cow milk in this mixture is partially decomposed, due to this factor allergenic potential of mixture is reduced. The carbohydrate component is represented only by maltodextrin and thus does not contain lactose. The fatty component is optimum.

Advantages

Domestic dairy dry product «Bellakt-GA» is a special product for health treatment and prophylactic nutrition of children. Content of vitamins, microelements corresponds to needs of children of the first year of life.

Stage of development

The change report #2, pertaining to TU BY 100377914.549-2008 «Dairy dry special product for baby food «Bellakt-GA»», and RC BY 100098867.1650-2009 «Dairy dry special product for baby food «Bellakt-GA» are developed.

Cooperation proposals

Provision with corresponding documentation.
Rendering of scientific and technical help.

Contact information

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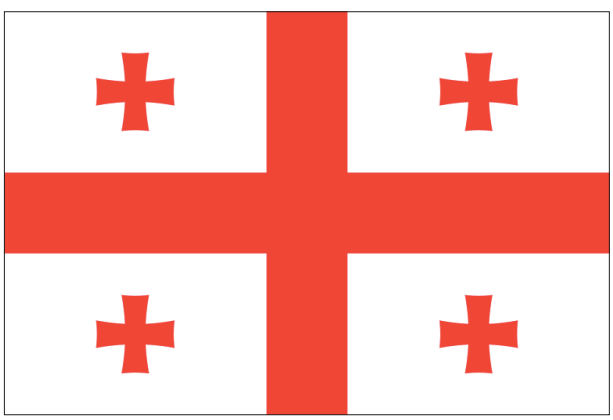
GEORGIA



Developments of Georgia

Agriculture

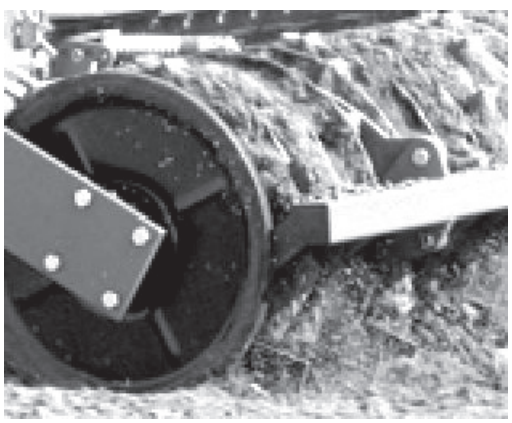
GEO-01

Roller Furrower

Application

Agriculture, protection of nature.

Description



In the Institute of Water Management was developed a new furrower making furrows by cutting and tamping. The new furrower is suspended on T-40 or similar modification of tractor with hydro-suspension facility. The forrower comprises three connected frames. In each frame two by conic type roller furrowers are placed, which by its own weigt, pressure of the hydro-system and additional weight goes deep into soil. By moving of the tractor it leaves behind six furrows of triangle form. The furrow by cutting and tamping is formed without splitting of walls and bottom, ensuring: lenght of the furrow, stability, exclude flooding of water at the beginning of the furrow, free of water and excludes water erosion. In the furrow cut by the above technology filtration prevention screen is not formed, irrigation and damping is going on normally.

For cutting forrows in the vineyard, as it was mentioned above, the furrower comprises three frames and in each frame two cutting wheets are inserdet, the side frames can removed and in each frame one main frame with two wheels enabling to cut the irrigation furrows between the vine rows. The irrigation furrow cut under the said technology enables to irrigate the area several times. Construstion of the furrower is simple, higly effecient, stabile during the work, has high economic indicies.

Technical Capabilities

- Width of engagement, m:
  - For plowing cultures, m: 6.6
  - For perennial cultures, m: 2.2
  - Diameter of the cutting wheel, m: 0.2
  - Width, m: 0.2
- Dimensions of furrow:
  - Depth, m: 0.2
  - Width, m: 0.2
- Speed of movement, km/h: 5

Innovation aspects

It is used on national level.

Advantages
The roller furrow makes the furrows by tamping and cutting. It ensures the length of operation of furrow, its stability and reduction of soil erosion.

Development stage
The development is available for demonstration.

Intellectual property
Patent of Georgia is granted.

Cooperation proposals
Financial support.
Information exchange.

Contact information
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Agriculture

GEO-02

Bio-energy activator "Biorag"

Application
Agriculture, healthcare.

Description
The purpose of this technology is the developement of a production biologically safe product without polluting the environment.

The application of this method will make it possible:
- to raise yield with minimum expenses;
- to produce an ecologically safe product with effective use of land, which is of particular imprtance for agricultura, land-poor countries;
- to increase resistance of plants to duseases and unfavourable climatic conditions;
- to significantly decrease toxicity and mitagenicity of fertilizers and pesticed being currently applied in agroculture;
- to essentialy raise vitality of plants.

Innovation aspects
The development can be used on different levels.

Advantages

Biorag represents a bio-energy activator that facilitates maximum activation of reserve mechanisms of living organisms and building-up of their potential.

It ensures an incrsase in crop capacity without application of fertilizers and genetic engineering.

The proposed bio-organic method promotes production of edible and ecologically safe quality agricultural products and human health protection.

Development stage

Available for demonstration on the market.

Cooperation proposal

Financial support.
Joint research.
Technical cooperation.
Joint venture agreement.
Marketing support.

Contact information

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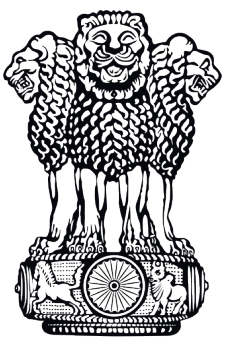

सत्यमेव जयते

Traditional wisdom for sustainable agri and livestock production. An opportunity for better animal, human and environment health

M.J. Saxena, Managing Director Ayurvet Limited, Delhi

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Animal production is poised to make a generous leap in the years to come because of the multiplicity of the related events that are taking place around the globe. Increased demand of the livestock products, ease of market accessibility, and opportunity of global trade, increased cash flow in urban & rural societies, application of science & application of new technologies in production, feeding & processing may be some of the key factors responsible for the anticipated increase in livestock production. However, at the same time it is high time that we address some areas of quality assurance of feed & food of animal origin, maintaining the production inspite of scarcity of land, water & imminent climate change In nutshell it is high time we integrate Animal health & Agriculture sector for better sustainability of farming community y & simultaneously addressing the national food security .Needless to mention, education of rural masses for adopting new techniques will play a significant role in entire process of livelihood generation of farming community.

Introduction

The traditional wisdom of ancient India existed in integration of "5F", which meant Food, Feed, Fodder, Fuel & Fertilizer security. In the current era, Ayurvet with help of modern science has worked on the above model using technological tools for addressing the needs of Animal, Human & Environment Health.

India has different climatic zones, natural resources, socio economic strata which is what makes feeding of ruminant different in various parts of the country. This is in contrast to the western part of the world. In fact in our country livestock plays a key role in the natural resources based livelihood, which is mostly confined to rural areas. In fact livestock rearing in our country is quite different for subsistence farmers, where risk management is more important than the developed market driven systems. Apart from unfriendly climate, we have

problem of large human & animal population, pressure on land, scarcity of pasture land, shortage of feed & fodder, resulting in comparatively low productivity & consequently the low economic returns.

Inspite of the above, we should all be proud that livestock sector is showing better promise (growth of 4-5%) than the agriculture sector (growth of -1 to 1%). The key point to be observed here is that our majority of the ruminants are reared under suboptimal conditions, as the small livestock holders and landless together hold around 70% of our country livestock. However, planning and involving the stake holders for holistic interactions with plants and soil, involving TRM (Total Resources Management), which means optimum utilization of the available resources including the available biomass, through its recycling would help in improving the overall Animal & Human Health & Food Solution.

Food: Our current challenge for its security & safety

Food apart from air is the most important thing for the living being survival. This is true globally. India looking into the concern our Government has set up National Food Security Mission. In view of the stagnating food grain production and an increasing consumption need of the growing population, Government of India has launched this Centrally Sponsored Scheme, 'National Food Security Mission' in August 2007.

The major objective of this scheme is to increase production and productivity of wheat, rice and pulses on a sustainable basis so as to ensure food security of the country. The approach is to bridge the yield gap in respect of these crops through dissemination of improved technologies and farm management practices. The implementation of the NFSM would result in increasing the production of rice by 10 million tones, wheat by 8 million tones and pulses by 2 million tones by 2011-12. It would also create additional employment opportunities.

In this mission Livestock is also expected to jointly play an important role. Livestock play an important role in our lives. Apart from providing livelihood to the people in the rural & semi urban areas, they from are vital link for the food security. They provide us milk, meat which is essential source of protein & energy. Moreover, agriculture income may come to farmer three to four times in a year where as the income from milk is on daily basis.

Feed: To help the biocoverter for producing food

Scenario of Feed Resources

The inadequate feed resource is the major constraint in the productivity of livestock. Since feed is the only raw material required for the production of foods of animal origin, improved supply of nutrients can bring out the full potential of the animal to the fore. Feed is also the main input factor for milk and meat production from livestock constituting 60-70% of the cost of livestock products. Inadequate feed supply is coupled with the availability of low quality fibrous feeds forming the major roughage source. The cost of feed ingredients is spiraling higher and higher with each passing day. In India, another reason for the high cost of good quality feeds is the sudden spurt in the export of these ingredients during the last few years. It is really beyond the means of resource poor animal keepers to buy good quality feeds, as they even don't get the remunerative price for their produce, making a vicious circle which eventually results in sub-optimal performance from their animals. There is still not a good market for good quality feed.

NIANP Bangalore has shown that the present deficit with regard to dry fodder, green fodder and concentrate has been shown to be to the tune of 11, 28 and 35% respectively.

In livestock farming, it becomes very important for us to feed our livestock with proper balanced feed. The basic principle of GIGO applies here. If you feed them right, they will remain healthy & more productive during their lifespan.

As a matter of fact in our country our farmers mostly complain of less milk production & % of fat in the milk, but, often they do not realize that production is part of reproduction. In our country, we have immense problem of tackling the issue of infertility in animals or we may refer it as decline in the reproductive efficiency in animals. One of the most common factors affecting this is improper nutrition or animals being not fed the nutritionally balanced compound feed.

Value added compound Feed

Though there is improvement in usage of cattle feed amongst farmers, however the quality of this feed is a big question mark.

Off late certain value added feeds which are nutritionally balanced and also possess the herbs for improving immunity digestion, stress, production etc.

These feed may cost little higher but are known to deliver the results. Ayurvet Uttam is one such brand in India

Another concern is safety is the high content of the chemical fertilizer & pesticides in the milk & meat which the animals produce. This comes from Agriculture by products which are used for animal feeding. These are ultimately passed on to the human beings. This has lead to higher incidence of cancer. It is not only common in people who consume these crops/grains but also amongst the farmers who use these pesticides to produce these crops.

Improving genetic variability in nutritional quality of straws

Straw quality differs with crops. This variation could be as high as 10-15 units, which has been studied in most of the cereal crop residues viz. rice, wheat, barley, sorghum and millets. In the crop-livestock sustainable production system, better quality of straw can result in 10% increase in productivity of ruminants. Cereal breeders have often overlooked this point. It his high time that the cereal breeders plan their breeding programmes in collaboration with animal nutritionists, and thus, helps in improving the economic lot of resource poor farmers.

Biotech Feed

The new upcoming research claims that the straw when treated with a special fungus breaks the lignin bonds & releases energy. This may even help in replacing the grain portion from the feed.

Use of trace mineral supplements

There is an urgent need for the extension agencies in the country to educate the farmers about the benefits of feeding mineral mixture/ chealated minerals to their livestock, so that their livestock can perform at optimum level with respect to production as well as reproduction.

Fodders: Nutritionally enriched green feed for Animal health

Fodder is important part of Livestock feeding & can never be under estimated. The fodders are rich in Omega 3 Fatty acid which is essential for maintaining a healthy heart, flexible joints, healthy growth and strong bones and teeth. Another constituent of importance is Conjugated Linoleic acid (CLA), which is believed to boost immune function and reduce the growth of tumors.

Enhancing green herbage

In India, the area under fodder cultivation has remained static for the last three decades at 4.5% of the total cultivable land, due to pressure of human population. The only way to increase fodder production is through intensive fodder production, especially using high yielding varieties of fodder crops. But it is important that the farmers are supplied seeds of high yielding fodder varieties, as its non availability is yet another bottleneck in enhancing fodder production. Intercropping of cereal and a forage legume can serve the dual purpose of increased grain yield (wheat) and provide good grazing. Integration of forage legumes improves soil fertility and soil structure and controls soil erosion and thus, helps in the sustainable development of agriculture (Reddy, 2008).

In our country we do not get the green fodder round the year which affects the health of the animals & the quality of the milk which they produce.

Hydroponics: A novel initiative for green feed

The word hydroponics has been derived from the Greek word where 'Hydro' means water and 'Ponic' means working, i.e. Water working. Plants require 3 things to flourish- water, nutrients & sunlight; Hydroponics is a straightforward way of providing all these nutrients without the need of soil under controlled environment conditions to optimize the growth of plants. It is referred as feed because when compared to conventional fodder, Protein content is about three times higher and Energy values are about double in Hydroponics feed. The conventionally harvested green fodder consists only of cut grass but the Hydroponics feed consists of grass, along with grain and root. This method of producing green feed has many advantages for the farmer, the ecology and the environment.

Advantages of Hydroponics

Saving of water: It takes 2 to 3 liters of water to produce 1 Kg of green feed as compared with 80-90 liters/ day required in conventional system. Therefore, it uses minimal water for maximum fodder production. Water that is not used by the growing fodder is not wasted, as it can be recycled & reused again.

Marginal land usage: Fodder production in our hydroponics machine provides huge ecological & economical advantages, as the production of lush green feed requires minimal land usage as compared to field grown grasses & fodder (only 135 sq. feet for 240 Kg fodder production against 2178 sq. feet in conventional system) This reduction in the amount of land required for maximum fodder production is an asset for both regions where agriculture is difficult & in densely populated regions that lack sufficient growing space.

Constant feed supply: Hydroponics technology will remove the need for long- term storage of feeds. With our hydroponics machine, a consistent supply of green fodder is guaranteed 358 days (365-7) of the year irrespective of rain, storm, sunshine or snow. Therefore, the farmer knows exactly what feed they have available every day of the year regardless of the seasonal conditions as it takes an initial investment of just 7 days to produce up to 240 kg of fresh green feed per day and a minimum of 75-84 tons of fodder per year.

Reduction in growth time: The growing time of hydroponics plants takes as little as 7 days from seed germination to a fully-grown plant at a height of 25-30 cm, ready for harvest. Also, the biomass conversion ratio is as high as 6-8 times. Thus, for every 1 Kg of seed 6-10 kg of green feed is produced.

Nutrient	Grain Barley	Conventional Fodder	Hydroponics Fodder
Protein, %	10.1	11.5	31.99
Fibre, %	6.80	31.8	24.75
Energy, kcal/kg	3900	2600	4727
Ash, %	2.79	11.4	5.70

Table 1. Comparison of Hydroponics fodder with conventional fodder (Barley)

However, to grow the same amount of fodder in a conventional situation, if there was sufficient water for irrigation, would take up to 12 weeks from seed germination until ready to feed out to livestock.

Reduced labor requirement: This process of growing cattle feed requires minimal man- hour ratio per day. It is as little as 2 to 3 hours per day, needed to maintain & produce hydroponics fodder, as compared to the many hours of intense labour required for growing the same amount of feed as a pasture crop.

Enhancement of Nutritional value: Hydroponics fodder is a highly effective particularly nutritious feed, which produces 3 times more protein as compared to conventional fodder. It has high energy content and very high moisture content. Feeding livestock hydroponically produced feed may increase considerably the fertility rates of cattle. Hydroponics fodder can also help improve the quality & quantity of milk production.

Completely natural: An important factor about growing green feed in Ayurvet's hydroponics machine is that it is completely natural product. Therefore, there are no pesticides or fungicides used that could alternatively contaminate the milk or meat that are being produced.

Fuel: For our daily domestic & community needs

Energy is a necessary concomitant of human existence. Although many sources of energy exist in nature, it is coal, electricity and fossil oil which have been commercially exploited for many useful purposes. This century has witnessed the phenomenal growth of various industries based on these energy sources. They have application in agricultural farms and have domestic use in one form or other. Fossil oil, in particular has played the most significant role in the growth of industry and agriculture, which would be recorded in the history of progress of human race in golden words. By now, it has penetrated so deep into the mechanism of human living that man is not prepared to accept the fact that this useful source of energy is not going to last very long. But that is the fact of life. Earlier fossil oil was available easily and at lower prices irrespective of its origin of supply. It has now been scarce and costly. The immediate effect of this is that the world is in a grip of inflation and rising prices. Today, energy crisis has mainly emerged from the fear that the boons of fossil oil may turn into a bane as the disappearance of fossil oil would compel the habits and practices of living of the society to change. That is the crisis and that is the compulsion for search alternate sources of energy.

Bio-Gas as one of the Alternate Renewable Sources of Energy

It is evident that no single source of energy would be capable of replacing fossil oil completely which has diverse applications. On the other hand, dependence on fossil oil would have to be reduced at a faster pace so as to stretch its use for longer period and in critical sectors till some appropriate alternative energy sources preferably renewable ones are made available. Presently, the country is spending a fortune in importing fossil oil which can hardly be afforded for long on the face of developmental needs. Methane gas and more popularly known as bio-gas is one such alternate sources of energy which has been identified as a useful hydro-carbon with combustible qualities as that of other hydrocarbons. Though its calorific value is not high as some products of fossil oil and other energy sources, it can meet some needs of household and farms.

Major Benefits of Installing Bio-Gas Plants

It is estimated that alternative sources of energy like bio-gas plants, wind mills etc. may reduce the dependence on conventional sources of energy by about 20% by the turn of the century. Presently, the cooking media in rural areas consist of burning dung cake, fire-wood and to some extent kerosene where it is

Commonly used fuels	Calorific values in Kilo calories	Thermal efficiency
Bio-gas	4713/M³	60%
Dung cake	2093/Kg	11%
Firewood	4978/Kg	17.3%
Diesel (HSD)	10550/Kg	66%
Kerosene	10850/Kg	50%

Table 2. Comparative heat values and thermal efficiency of commonly used fuels

available easily. The installation of bio-gas plants would directly replace the use of above three and in saving them, following gains would be made:

- Nearly 30% of available dung which is burnt and wasted would be recovered as bio-gas plants conserve the dung while producing bio-gas.
- The dung after digestion in gas plant preserves more of NPK in the dung solids and cellulose which otherwise gets lost if heaped in the open..
- Rural people would gradually stop felling trees. Tree felling bas been identified as one of the major causes of soil erosion and worsening flood situation.
- Bio-gas plants would be helpful in correcting this situation.
- In rural areas kerosene is used for lighting lantern and cooking in a limited way wherever kerosene supply has been made possible. Whatever quantity is used can be replaced by bio-gas as it can be used for lighting and cooking. This would reduce the dependence on fossil oil directly and in saving foreign exchange.
- Lastly, the most important social benefit would be that the dung being digested in the digester, there would be no open heap of dung to attract flies, insects and infections. The slurry from digesters can be transported to the farm for application in the soil, thus keeping the environment clean for inhabitation. Also, gas cooking would remove all the health hazards of dung cake or fire wood cooking and would keep the woman folk free from respiratory and eye diseases which are prevalent in the villages.

Fertilizer: For enriching the soil & its recharge

The government recent decision on deregulation of the chemical fertilizer is indicative that it is not possible to for the government to foot the subsidy bill. As a matter of fact the use of synthetic fertilizer is reducing the soil fertility & affecting the food production, said a joint study by Non profit Green Peace & West Bengals'Visva Bharti University. The data quoted that in 1960 there was a 25 kg increase in grain production with each kg increase of fertilizer. In early 1990s this came down to 19 & late 1990s it was at 8 kg.

One of the report further mentions that micro nutrients of the soil are lost with over use of nitrogen fertilizer, urea. The fertilizer subsidy is now at Rs.1, 20000crore against Rs.60crore in 1976-77.

Another study states that if these subsidies are gradually phased out in next 5 years, India will be able to save Rs.12, 000 billion. Biogas can be effectively promoted by using some these saving in our country. This would help in gradual shift to organic nitrogen fertilization of the soil.

- The average NPK content of Farm Yard Manure (FYM) is about 0.5, 0.2 and 0.5 percent respectively and it may be observed that biogas slurry is rich in NPK by more than four times than ordinary dung when converted into FYM.
- When the country is faced with shortage of fertilizers and has to spend enormous amounts for its import, the application of bio-gas slurry can replace the chemical fertilizers to a large extent.
- Bio-gas slurry or FYM not only adds NPK but it proves the soil porosity and texture

	N	P_2O_5	K_2O
Bio-gas slurry	1.4	1.0	0.8
Farm Yard Manure (FYM)	0.5	0.2	0.5
Town Compost	1.5	1.0	1.5

Table 3. Percent NPK & its comparison

Conclusion

In our country feed shortage, especially the shortage of quality feeds is a serious problem.

For increasing the supply of green herbage, the strategies needed are: conservation of degraded pasturelands and development of wastelands.

Feeding strategies for ruminants in tropics should also include environmental protection, through reduced methane emission, apart from increasing the productivity of ruminant stock. Improving the utilization of the straw is a big opportunity & scientists are confident about the breakthrough. Similarly Green Feed from Hydroponics system is the new way of animal feeding for improving animal reproductive health.

This would help in saving save the water & land as the precious resource.

It is high time we integrate these initiatives to bring prosperity to our country.

This would only happen if we effectively integrate Agriculture & Livestock sectors.

This will not only help us in succeeding in National Food Security mission but would help in bringing back the soil fertility & improved crop production.

This may not happen overnight, but then there is always a possibility to begin at some point.

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REPUBLIC OF KAZAKHSTAN

Development of productive horse breeding in Kazakhstan

I. Nechaev, Academician, NAS RK, SRI of Animal husbandry and food production

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The Program on development of the Agrarian and Industrial Complex (AIC) of Kazakhstan for 2010-2014 sets the task to create the competitive AIC, providing food safety and growth of export of production.

And more than 80% of the internal market of food commodities must be covered by domestic foodstuff.

Thus, great attention must be paid to development of productive horse breeding.

Many centuries a horse served to a human as the closest and most favorite animal. For Kazakhs a horse was and is of special value.

With development of engineering and scientific-technical progress the role of a horse, as a draft animal, becomes minor, and, on the contrary, its role as a sports animal gradually becomes major. In Kazakhstan in 1960-1970s due to successful work of famous horse breeding scientists (J.N. Barmintsev, I.N. Nechaev, K.I. Dujsenbaev, M.N. Borisov, A.E. Zhumagulov and other) a new agricultural direction - productive herd horse-breeding - has been founded.

Further followers of the scientific school of the academician I.N. Nechaev - N.A. Kikebaev, G.V. Sizonov, S.S. Rzabaev, A.R. Akimbekov, M. Nurushev have strengthened theoretical foundations and practical methods of such horse-breeding in Kazakhstan.

Currently uneclipsed horse breeds (as a product of herd horse-breeding) are created in the Republic, they optimally use vast natural pastures.

Kazakh breed

Adaevskoe sub-breed

The Adaevskoe sub-breed of the Kazakh horse is bred in Aral-Caspian desert region. The Adaevskaya horse is a ride type horse. It was bred on the basis of the Akhal-Teke, Yomud and Karabair breeds. It is characterized as an excellent workhorse, irreplaceable in animal husbandry. More over, in desert conditions of Mangystau Oblast, where relative humidity drops down to 7%, this horse grows and maturates well, it is used as a draft animal, and also in meat and dairy husbandry [1].

According to [2], daily average gain of live weight of the Adaevsky colt - 626.6 g for a yearling, and 541.5 g for a two-year-old animal. Real autumn fattening of six-month-old, 1.5- and 2.5-year-old colts has demonstrated good results. So, for example, while initial (stand) colt weight was equal to 180.6, 260.5 and 342.3 kg, accordingly, finish live weight after fattening was equal to 226.9; 297.7 and 377.4 kg, accordingly, and general gain of live weight was equal to 46.3; 37.2 and 35.1 kg.

For 60 days of fattening gain of live weight on the average per one colt for one-year-old animals was equal to 45.8 kg, or 19.7% of initial (stand) weight, and for two-year-old colts these index was equal to 41.6 kg and 15.2%, accordingly. The most detailed description of the Adaevskaya horse contains information, underlining that this breed, bred during many centuries in conditions of sharply continental climate in herds, has got a series of specific biological adaptive qualities, characterizing this animal as highly-adapted to severe climate [3]. This breed distinguishes, first of all, by fast fattening, high milk producing ability, optimum delivery terms. This is exclusively efficient and hardy horse, capable to cover in mount condition about 300 km per day. Exterior of this horse characterizes it as a medium-size animal with a harmonious body type and strong constitution. Live weight of stallions of the Adaevskaya line on the average is equal to 442 kg, of mares – 412.7 kg, the index of mass is equal to 146.6 and 142.9, accordingly.

The problem of preservation of the Adaevskoe sub-breed is studied well enough [4]. The sequence of change of chemical content of colostrum and milk of mares is analyzed: colostrum right after delivery contains fat – 1.25%, protein – 16.25%, sugar – 3.6%. In 12 hours after delivery sugar content increases in 1.3, and fat - in 2 times. Content of the basic source of protection of young animals from infectious diseases - protein – decreases in 3.1 times.

In the Western Kazakhstan specialists have launched 3 special stud farm lines of outstanding stallions - studs of the Adaevsky ecotype of horses. At the age of 6 months colts reach 60-65% of live weight, 80% of height at the shoulder and 90% of height of forefeet of mares-mothers [5].

On the basis of revealed biological laws at pasture herd breeding of the Adaevskaya horse scientists give a series of practical advices on perfection of technologies of such horse ranching. For the purpose of increase of production of horse meat, improvement of its quality, production of koumiss and high-quality tanning raw material it is recommended to all enterprises (of all forms of ownership) of the Aral-Caspian zone to introduce widely breeding of the Adaevskaya horse.

The recommended method of their ranching – year-round, pasturable. The breeding method - thoroughbred, the coupling method - herd. For the purpose of growth of production, improvement of quality and decrease of cost price for horse meat, and also for increase of gain of live weight coupling is expedient in April-May, for subsequent delivery in March-April [6].

Naimanskoe sub-breed

This sub-breed is bred in mountains of Dzungarian Alatau. By a phenotype it is close to the Mongolian horse. The Naimanskaya line of the Kazakh horses is ranched during many centuries in territory between lakes Alakol and Zaysan, including the Tarbagatai Mountains [7]. This unique under-

sized mountain horse remained in its pure state in Agricultural Product Cooperative «Tok-Zhailau» of Alakulsky region, Almaty Oblast. For estimation of corresponding meat productivity specialists slaughter horses of the Kazakh and Don-Kazakh crosses, Don-Verhovo-Kazakh crosses of the Naimanskaya line, Mugalzhar crosses and crosses of unknown origin [8]. Results of slaughter have demonstrated that the Kazakh horses after two months of spring fattening had maximum absolute gain of weight (59 kg), average daily gain of weight (980 g) and slaughter weight percentage – 55.4%.

The Kazakh horses of the Naimanskoe sub-breed have slightly lower indices, and other crosses have significantly lower indices.

The worst parameters of fattening are typical for Don-Verhovo-Kazakh crosses, their absolute weight gain is equal to 40.0 kg, daily average gain of weight - 660 g, slaughter weight percentage – 51.85%. Thus, crossbreeding must be carried out according to specific plans (systematically) at correct combining of breeding and productive qualities in the course of creation of a horse of a desirable type. Proceeding from specific crossing tasks, it is necessary to pay special attention to breeding of a thoroughbred local Kazakh horse, as an irreplaceable mare basis.

Kazakh horse of the Jabe type

It is well known that for production of horse meat the Kazakh horses of the Jabe type are of great value, since they distinguish by exclusively strong, often even horny constitution, magnificent fitness to semi-desert and steppe pastures [1]. They have rather rugged head, not a long meaty neck, a wide and deep-set trunk, a wide back, brawny croup, bony legs, a mane and a tail of this horse are thick, long, legs have short fetlocks. Their skin is thick enough and dense. This breed is characterized by hardly visible hypodermic blood vessels and legs tendons.

In structure of breeds, used for meat production, Jabe type horses occupy 34.5% of total specific weight, and that characterizes their high meat productivity [9]. Authors conduct research on perfection of breeding and productive qualities of horses in farms «Altai Karpyk» (Pavlodar Oblast), «Tajlak» (East Kazakhstan Oblast) and «Zhaksylyk» (Almaty Oblast).

Horses of the Sary-Arkinsky type of the Mugalzharskaya breed and the Jabe type are characterized by maximum flesh index equal to 74.4% and 74.2%, accordingly, thickness of kazy is equal to 3.5-3.1 cm, that exceeds value of the similar index of the Don-Kazakh and Trotter-Kazakh crosses [10].

In the «Zhailau» farm of Sozaksky Region (South Kazakhstan Oblast) efficiency of production of horse meat with use of horses of the Jabe type is scientifically proved. For example, sales of meat of yearlings yielded 31,733 tenge of net income, and that has provided growth of profitability up to 128.5%. The pre-slaughter live weight of 6-month-old colts of the Jabe type was equal to 190.5 kg, of one-year-old – 260.0 kg, of 1.5-year-old – 314.0 kg [11].

In the Open Joint Stock Company «Jenis» and Joint-Stock Company «Kulandy» selection work for the purpose of increase of number of horses of the Jabe type takes place. It is noticed that live weight of Jabe mares on the average is equal to 466.7 kg, of the Kulandinsky intra-breeding type – 455.0 kg, and yield of milk is equal to 537.7 and 493.2 liter, accordingly [12]. The basic attention will be paid to perfection of horses of the Mugalzharskaya breed (the Jabe type), Adaevsky, Kushumsky and Kazakh local breeds.

Scientists revealed inverse relationship between milk yield of mares and volume of milk, consumed by a foal before milking, the scale of estimation of suitability

Table 1. Growth of volume of meat for the Kazakh horses of the Jabe type

Age of horses, months	*Pre-slaughter live weight, kg*	*Weight of carcass (with fat), kg*	*Useful weight (meat+fat), %*	*Fat weight*		*Bones weight*	
				kg	*%*	*kg*	*%*
6	190	106	55.8	2.7	2.64	14.55	13.7
18	333	179	53.8	6.45	3.6	26.5	14.8
24	330	175	53.0	8.5	4.86	26.10	14.9
30	371	201	54.6	16.4	8.16	27.9	13.9
36	430	245	57.0	33.75	13.76	35.5	14.5

of these mares to mechanical milking during the period of maximum physiological activity of their udder [13] is scientifically proved. Thus, authors have demonstrated possibility of application of the constant 0.2 depending on frequency rate of milking.

Fattening (regarding volume of meat) at horses ranching in conditions of pasture-snowfields conditions at Betpak-Dalinsky experimental station of animal husbandry is studied [1]. In these experiments specialists used the Kazakh horses of the Jabe type.

For control of increase of volume of meat workers slaughter most typical horses from different sex-age groups. Fatness of slaughtered horses was above the average (Tab. 1).

From the Table 1 it is obvious that with age main meat parameters of horses (useful weight and bones weight) change weakly, but fat percentage increases significantly enough - from 2.64% for 6-month-old colts to 8.16% for 30-month-old animals.

It is underlined that in the East Kazakhstan, Pavlodar and Almaty Oblast special cattle breeding enterprises are founded for breeding of the Kazakh horses of the Jabe type [14].

Horses of this breed occupy in structure of breeds, used for meat production, about 34.5% of the total number of horses of the Republic. At pasture ranching at the age of 2.5 years Jabe horses reach live weight of 350-370 kg, and that factor does such animal husbandry for the purpose of horse meat production highly profitable.

Kushumskaya breed

Hard work of scientists-selectors of Kazakhstan is marked by approbation of a new breed group of horses, named the Kushumskaya breed. Authors of this breed - J. N. Barmintsev, M. N. Borisov, S. S. Rzabaev, B. Gubashev, M. Nurgaliev. This is the first-ever breed of horses, which main characteristics are not draft, but meat and dairy. The new breed is created in farm enterprises of the Ural and Aktyubinsk Oblast. This is a breed of meat-and-milk direction of productivity, created by the method of complex reproductive crossing of the Kazakh mares with stallions of the Trotter, Don, thoroughbred riding breeds and specific desirable type horse breeding. The Kushumskaya horses distinguish by solid constitution and a riding-draft constitution type. Mares are prolific, have high milking capacity, give 80-85 foals per 100 mares. Breed is non-uniform by content. There are three intra-breed types: riding, main and solid. For meat horse breeding the most interesting type – the solid type of the Kushumskaya horses [1].

The science-based selection-breeding work for perfection of the Kushumskaya breed of horses takes place in the Limited Liability Partnership «TS-AGRO» (Aktubinskaya Oblast). Horses of a selection group have high live weight and large enough exterior. It is noticed that on the average live weight of adult stallions exceeds the same of standard animals of an elite class by 53.3 kg or 10.3%, and for adult mares - by 36.0 kg and 7.5%,

accordingly [15]. It is necessary to underline that main results of such selection work - a new line of stallions («Samocvet») and development of a target standard of the line.

Genetic potential of the Kushumskaya breed by live weight reaches for mares - 577 kg, for stallions – 640 kg. Currently the maximum number of stallions, used in base farm enterprises, is represented by animals from the specially created stud farm line «Krepysh» - 11 horses (57.9%), and also from the line «Grom» - 5 horses (26.3%) and the line «Samocvet» - 3 horses (15.8%). Stallions of the line «Krepysh» have good height (159.2 cm), elongated oblique length of a trunk (165.4 cm), large chest girth (197.2 cm) and metacarpus girth (21.5 cm), high live weight (582.2 kg).

These stallions by their live weight exceed the standard of a breed of animals of an elite class by 62.2 kg or by 12.0%, and stallions and mares of the line «Grom» exceed these indices by 45.0 and 32.9 kg or by 8.6 and 6.8%, accordingly. Thus, stud farm lines of «Krepysh» 33-64 and «Grom» 98-58 by quantitative and qualitative indices of productivity meet requirements of approbation of new stud farm lines.

The complex of exterior-productive research of the most widespread genotypes of herd horses of Kazakhstan, including the Kushumskaya breed, is represented in [17]. For Kushumskaya horse the following features are typical: a proportional head, a middle length neck, a deep-set compact trunk, a well developed croup, strong lean feet. By fertility and adaptation to herd-snowfields ranching the Kushumskya horse practically does not differ from the Kazakh horse. It is resistant to blood-parasitic diseases and necrobacilli.

Genealogical structure of the Kushumskaya breed of the West Kazakhstan Oblast is revealed. In breeding work with the Kushumskaya breed in conditions of the Western Kazakhstan the most efficient method – line breeding. In structure of the Kushumskaya breed of horses 10 genealogical groups are formed. Analysis of meat productivity and exterior of the Kushumskaya horses of different intra-breed types has demonstrated that the best indices of constitution are typical for horses of a productive direction [18, 19].

Authors underline that a well developed and well-fad foal of a mare of the Kushumskaya breed is the main sign of high milking capacity of the mare [20, 21]. The milking capacity of mares was determined by analysis of basic dimensions of foals and their live weight for the 3rd day after their birth and also at the age of 1 month. At their birth live weight of foals was equal to 48.4 kg or 8.9% of weight of their mothers. At the age of 1 month live weight of foals on the average was equal to 79.5 kg at farms of the Limited Liability Partnership (LLP) «Kushum» and 87.7 kg at farms of Horse Breeding Enterprise (HBE) named after I. Sergaziev. It is revealed that 51.5% of mares of the LLP «Kushum» and 66.9% of mares of HBE named after I. Sergaziev can be treated as elite and the first class horses. It testifies to high milking capacity and high potential of mares of the Kushumskaya breed in the mentioned enterprises of the West Kazakhstan Oblast. Authors assert that the most important role at selection of horses is played by exact definition of live weight on the basis of body measurements. So, for example, professor K. I. Dujsenbaev has suggested to define live weight by harmonious constitution of a horse with use of a 10-point scale of estimation, the so-called method «Ipprognoz KZ 57», the essence of which - variability of chest girth (CG) at the level of ~1 cm: for the Jabe type of horses - 5 kg, for the Kushumskaya horses - 7 kg.

Kushumskaya stallions - good improvers of local horses in conditions of year-round herd ranching. Live weight of stallions - 400-410 kg, of mares - 350-360 kg. Use of the Kushumsky stallions allows to increase live weight of offspring from local mares already in the first generation on the average by 30-40 kg. Index of fertility - 78-85 foals per 100 mares, milking capacity of mares at the 2nd-3rd month of lactation - 14-22 liter/day. [22].

At analysis of business yield of foals of the mentioned enterprises (LLP «Kushum» and HBE, named after I. Sergaziev) specialists made a conclusion that for breeding of healthy offspring, reduction of idle young (3-4 years old) and old (15-16 years old) horse-mares is important to observe age structure of mares and stallions, to form specific herds, taking into account a physiological state, fertility, heredity and adaptive qualities to specific pasture ranching [23]. Specific weight of mares of each age in herd structure, according to opinions of authors, should be equal to 6-8%. 7-12-years-old stallions should be fixed to young mares. Stallions, coupling for the first time, should have 8-10 corresponding mares, and adult stallions - 10-15 mares. In the mentioned enterprises optimum period for delivery - April-June.

Mugalzharskaya breed

This breed has exclusive value for animal husbandry at year-round pasture-snowfield ranching [1]. The breed is created on the basis of perfection of the Kazakh horses of the Jabe type and simple reproductive crossing of local mares of various regions with Jabe stallions and breeding of horses, meeting requirements of desirable types.

Specialists underline that this is the first-ever breed of a meat-and-milk direction of productivity, created on the basis of an unspecialized intra-breed type (Jabe) without addition of blood of stud farm breeds [17].

At the same time authors of this breed managed to increase live weight of stallions in comparison with initial horses by 100-120 kg, and mares by 80-100 kg without essential change of technologies of breeding, and a level of selection-breeding work has been raised to stud farm positions.

Analysis of exterior features of herd horses has demonstrated that they have high enough indices of massiveness – 142.6-158.5, that characterizes them as meat animals.

The breed structure consists of three intra-breed types - Embinsky, Kulandinsky, Sary-Arkinsky (and also since 2009 - Kozhamberdinsky), six lines and 55 families. Live weight of stallions - up to 560 kg, mares - up to 520 kg, useful weight - 55-60%, successful fertility - 80-90%, milking capacity of mares reaches 2000 liters.

Scientists have studied more than semi-centennial history of creation of the Mugalzharskaya breed [24]. They underline that methods of its creation in different regions basically had no distinctions.

Due to such work breeders provided quite sufficient genetic variety of the whole line of the breed. It is approbated in 1998 as a breed of horses of a meat-and-milk direction. Stallions of the Mugalzharskaya breed have proved themselves as improvers of local herd horses of a productive direction in the most various environment (from Priaral deserts to high mountains of the Eastern Kazakhstan, from Astrakhan Oblast to Sakha-Yakutia of the north of Russia).

Embinsky intra-breed type

The Embinsky intra-breed type of horses is created in Aktyubinskaya Oblast, where there are some base enterprises, breeding it [25]. It is marked out that by results of bonitation of horses in 2007 all 45 thoroughbred stallions of the Embinsky intra-breed type pertain to an elite class. Mares population of this type is represented by 624 mares, from them 477 mares (76.5%) pertain to an elite class, 97 mares (15.5%) - to the first class and 50 mares (8.0%) - to the second class.

These figures visually testify to a high enough level of selection-breeding work with the Embinsky intra-breed type of horses of the Mugalzharskaya breed. As a result of science-based selection-breeding work a highly productive selection group of horses is created, it includes 4 approved stud farm lines and one specially created line with valuable constitution-productive qualities, necessary for further selection work for perfection of this breed.

In the Joint Stock Company (JSC) «Pervomaysky» of Mahambetsky region and in the JSC «Zhana-Tan» of Zhylojsky region of Atyrauskaya Oblast in conditions of desert and semi-desert zones on the basis of studying of various variants of crossing of local mares with stallions of the Embinsky type of the Mugalzharskaya breed specialists revealed difference in live weight at horse birth – 1.7-3.5 kg, of 3-month-old horses - 9-18.8 kg, 6-month-old horses - 1-30 kg, 12-month-old horses - 40-43 kg, 24 and 34-month-old horses - 58-69 kg in comparison with horses from stallions of the local Kazakh breed [26].

Kulandinsky intra-breed type

At the Kulandinsky horse farm of Aral region of Kyzyl-Orda Oblast specialists developed methods of breeding of the Kulandinsky intra-breed type of the Mugalzharskaya breed [27].

This type was extended in severe conditions of the Priaralskaya desert and is characterized by diversity of types, since in crossing with local mares along with Jabe stallions breeders used stallions of the Don and Budenovskaya breeds, and also stallions of the Adaevskaya subtype. Local mares of the mentioned horse farm have height in a crest - 139.2 cm, oblique length of a trunk - 142.3 cm, chest girth - 166.3 cm, metacarpus girth - 18.1 cm, and improved contemporaries – 147.7 cm, 150.2 cm, 174.1 cm and 19.0 cm, accordingly.

Use of the most desirable type (Jabe) has allowed to increase live weight of adult mares from 350 to 430 kg and stallions - from 390 to 480 kg. Annual sales of breeding colts and fillies will be at the level of (approximately) 100-120 heads. For this purpose number of breeding thoroughbred mares of the Kulandinsky intra-breed type of the Mugalzharskaya breed should be increased up to 750 heads.

Specialists conducted experiments, studying live weight of young animals of the Kazakh breed in conditions of Priaral deserts [28]. It is proved that optimum period for engagement of mares in reproduction - April-May. Live weight of March and April newborn foals is higher in comparison with the same of their May contemporaries by 3.5-1.4% (colts) and by 2.9-1.4% (fillies), and in comparison with the same of their June contemporaries by 4.8-2.7% and 4.4-2.9%, accordingly.

Higher rates of growth of foals of earlier months of birth can be explained by favorable fodder and weather conditions of the first 6 months of their life and better adaptation to corresponding conditions.

Possessing high enough milking capacity, population of horses of the Kulandinsky intra-breed type represents itself great value for population of Priaralsky region.

Heritability coefficients are analyzed, meat and dairy productivity of such horses in comparison with local Kazakh breeds is also studied. The highest milking capacity of mares of the Kulandinsky intra-breed type was registered in May-June and has made 550.8 and 517.0 liters vs. 392.4 and 390.6 liters for local Kazakh mares [29].

Specialists carried out zoo-engineering analysis of the Kulandinsky intra-breed type of the Mugalzharskaya horse. Studying seasonal dynamics of live weight, they revealed that at the age of 30 months colts of this type by live weight and basic dimensions corresponded to an elite class, and colts of the local Kazakh horse – to the 1st class [30].

Sary-Arkinsky intra-breed type

The base enterprise, creating and breeding the Sary-Arkinsky stud farm type of horses, is known as the Pedigree Sheep Growing State Farm (PSGSF), named after Mynbaev, on the basis of which specialist founded Betpakdalinskaya experimental animal husbandry station. The basic features, methods of creation, perfection and application of the Sary-Arkinsky stud farm type of the Mugalzharskaya breed, as a new genotype of horses with significant prospects of cultivation in enterprises of various patterns of ownership, are described in details [31].

Breeders used stallions both from the stud farm «Emba» (currently - Mugalzharsky stud farm of Aktyubinsk Oblast) and local horses. A certain part of mares also has been taken from the stud farm «Emba», and the other part - was represented by mares of the Kazakh breed of the lost origin. However, by type, exterior and

Table 2. **Meat** ***productivity of Jabe mares (mothers) and their great-granddaughters***

Group	*n*	*Pre-slaughter live weight, kg*	*Carcass weight, kg*	*Useful weight, %*	*Bones weight*		*Flesh weight*	
					kg	*%*	*kg*	*%*
Mothers	3	341	179.02	52.5	36.34	20.3	142.7	79.7
Great-granddaughters	3	368	195.40	53.1	38.29	19.6	157.1	80.4

Table 3: Grain crop capacity, centner/hectare

Economic regions	*Years*					
	2000	*2005*	*2006*	*2007*	*2008*	*2009*
Absheron	12,0	14,1	13,4	14,1	14,0	15,1
Gyandzha-Gasahsky	24,2	29,8	29,5	31,3	32,8	30,9
Sheki-Zagatal'sky	18,1	21,4	20,5	24,0	29,6	25,3
Lenkoransky	22,7	24,2	24,6	24,9	23,3	20,5
Guba-Hachmazsky	23,5	21,6	23,5	23,8	21,3	21,3
Aransky	26,7	29,5	30,2	30,1	30,7	30,4
Verhne-Karabahsky	24,4	27,3	27,9	28,0	28,5	25.2
Kel'badzhar-Lachinsky	11,6	27,2	29,1	29,1	30,2	30,6
Mountian Shirvan	20,8	24,2	21,8	21,2	22,7	21,2
Nahichevansky	35,6	38,7	35,5	30,9	25,1	28,5
On the average in the Republic	23,8	26,5	26,5	27,1	27,9	26,6

dimensions they did not differ from thoroughbred Jabe mares. Meat productivity of Jabe mares is represented in the Table 2.

Results of slaughter have demonstrated that difference in live weight and carcass weight was in favor of great-granddaughters. Their carcass weight is 16.4 kg higher. It is necessary to mark out that daughters of experimental mares at the age of 5.5 years surpassed their mothers both by dimensions and live weight, and mares of the second generation surpassed initial mares (by live weight) by 33 kg with high degree of reliability of measurements, and mares of the third generation - by 56 kg. By dimensions and live weight all figures are statistically authentic. Thus, genetic progress at thoroughbred breeding of Jabe horses in comparison with mares of the initial group has made by live weight of daughters - 20 kg, grand daughters - 33 kg, great-granddaughters - 56 kg.

At perfection of the Jabe type on the basis of mares of the 2nd class specialists used stallions of the 1st class, and on the basis of mares of the 1st class and an elite class - only elite stallions with high live weight. It is necessary to notice that the special feature in such process of creation of a productive type of the Jabe horse – breeders did not take into account draft capacity of horses. On the contrary, they gave preference to animals with well developed muscles and hypodermic fatty tissues, that is, they bred horse with brightly expressed meat productivity. As a result of long-term selection work breeders has created new (the Sary-Arkinsky stud farm) type of horses - large enough animals with good height, an elongated trunk, well developed chest and high enough live weight (Tab. 3).

Horses of the Sary-Arkinsky type have outstanding adaptation qualities to severe conditions of year-round pasture-snowfield ranching. They are resistant to blood-parasitic diseases, necrobacillosis, piroplasmosis, outbreaks of which cause significant damage to horses of stud farm breeds.

The Sary-Arkinsky type of the Mugalzharskaya breed is well adapted for corresponding climatic conditions of breeding [32]. These horses have exclusively valuable meat qualities and early growth capacity, they quickly fatten. And even on the basis of pasture forage their live weight already at the age of 2.5 years is equal to 370 kg, adult stallion weight - 560 kg, mare weight - 520 kg, milking capacity - up to 2000 liters, fertility - 85 foals per 100 mares. Their breeding for meat production is highly profitable. As a result of joint efforts of breeders, zoo-veterinary specialists and horse herd wranglers, the most valuable Sary-Arkinsky type of the Mugalzharskaya breed of horses has been preserved. The genetic potential (by live weight) of stallions has reached 580 kg, mares - 530 kg.

Conclusion

This information-analytical work, demonstrating the reached level of the Kazakhstan scientists-breeders in the area of perfection of existing and creation of new highly productive breeds, types and lines of herd horse-breeding, testifies to the fact, that productive breeds of horses in the best way correspond to innovative

development of different branches of agrarian and industrial complex (AIC), in particular, animal husbandry of Kazakhstan.

Innovation potential of scientific and technical developments of breeders is underlined by creation of special meat breeds, distinguishing by high enough fertility (number of foals per 100 mares) of the Kazakh breed – 86.5%, of the Mugalzharskaya breed - 89%, high meat gain coefficient – 5.5. Herd horses fatten well enough in conditions of pasture-snowfield ranching. Horse meat production per 1 mare of Kushumskaya breed - 331 kg, Mugalzharskaya breed - 310 kg, Kushum-Kazakh breed - 313 kg and Kazakh breed – 269.8 kg. These high enough indices of productivity at ranching of herd horses have allowed to prove and develop scientifically practical recommendations, concerning expediency of their pedigree zoning in 5 regions of Kazakhstan. Horse meat production at the stud farm «Sholak Espe» differs by a high level of profitability - 200%, and production of marketable horse meat - 85-90%. Genetic potential (by live weight) of stallions of the Sary-Arkinsky stud farm type has reached 580 kg, and mares - 540 kg.

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REPUBLIC OF MOLDOVA

Agro-industrial complex (AIC) in the Republic of Moldova. Problems of innovative development

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One of the main tasks of modern economy - development and growth of an agrarian sector for creation of conditions of sustainable social-economic development. For today this sector of Moldova economy in fact has exhausted classical resources and further it can develop only at transition to innovative and synergetic channels. However, for this purpose it is necessary to create a complex of the following components: legislative, financial, organizational, administrative and others. That will allow to create favorable and efficient innovative environment.

The Republic of Moldova is the country, where AIC is one of leading branches of economy (8-10% of GDP) and one of main spheres of employment. At the same time AIC of Moldova currently experienced some economic problems. Problems of innovative development are pushed to sidelines, and general innovative activity in AIC has been reduced significantly at all levels (animal husbandry, plant growing, etc.). The price mechanism, functioning in these spheres, has led to deeper insusceptibility to innovations in agriculture in comparison with a pre-reform period, and agrarian science is on the brink of collapse.

Primary units of AIC of the Republic, forming its basis, are cooperatives, agro-industrial unions, agro-companies, farm enterprises. These enterprises with branch and multi-branch structure in aggregate are territorial complexes.

Regarding to AIC of Moldova, innovation represent themselves successful results in the form of new varieties of plants; animal breeds and species and bird hybrids; new or improved foodstuff; materials, technologies in plant growing, animal husbandry and processing industry; fertilizers and plant and animals protection products; methods of prophylaxis and treatment of animals and bird; forms of organization and management of various spheres of economy; approaches to social service.

By a subject and an area of application in AIC there are four types of innovations, which can be adapted to local conditions of Moldova [4]:

- selection-genetic;
- engineering-technological and industrial;
- organizational-administrative and economic;
- social-ecological.

Selection-genetic - a specific type of innovations, inherent only to an agrarian sphere. It includes fundamental and applied research. Selection-genetic innovations are the following:

a) new varieties and hybrids of agricultural plants;

b) new breeds, types of animals and bird hybrids;

c) growing of plants and animals, resistant to diseases and pests, unfavorable factors of environment.

Industrial-technological – innovations, which, being results of scientific (including selection-genetic) developments, are practically applied in production of new types of agricultural and food products or provide substantial improvement of quality of traditional products. This type of innovations includes principally new techniques of agricultural works; application of new methods of cattle breeding; technologies of storage and processing of agricultural raw products, providing increase and preservation of biologically valuable qualities of products; modern industrial technologies in animal husbandry; advanced plant protection means; new resource-saving technologies of foodstuff production and storage.

Organizational-administrative innovations include institutional innovations at formation of principally new organizational-legal structures of integrated types (agro-holdings, agro-companies, techno-parks), creation of information-consulting systems. This type of innovations also includes:

a) development of cooperation and formation of integral structures in AIC;
b) new forms of engineering service and resource support of AIC;
c) modern forms of labor motivation;
d) new forms of organization and control in AIC;
e) marketing of innovations;
f) creation of innovative-consulting systems in the sphere of scientific-engineering and innovative activity.

Economic-social-ecological - innovations in systems of economic and social relations, in production and market regulation, in complex development of villages, formation of a system of manpower for scientific-engineering support of AIC, improvement of labor conditions, solution of problems of public health service, education and culture of agricultural workers, introduction of modern management, including synergetic, new methods of solution of environmental problems. All the mentioned innovations have concrete forms of embodiment. These are results of fundamental and applied research, patents for inventions, certificates, trade marks, technological documentation, projects, national, regional and branch innovative programs.

In Moldova applied technological research in AIC is developed in the following directions [1]:

- agriculture, land reclamation, water economy and forestry;
- plant growing and protection;
- zootechnics and veterinary medicine;
- mechanization, electrification and automation of production;
- storage and processing of agricultural products.

With reference to different branches and spheres of economy essence of innovative activity is principally the same, however, a character and directions of this process can have some distinctions. In particular, an innovative process in AIC has its specificity, caused by special features of agro-industrial production (in particular, of agricultural production, included into it).

Such features are the following:

- plurality of kinds of agricultural products and products of their processing, difference of technologies of their cultivation and production;
- high degree of territorial dissociation of agricultural production and differentiation of separate regions by corresponding conditions;
- significant difference of production periods duration for separate types of agricultural products and products of their processing;
- significant dependence of production technologies in agriculture on natural and weather conditions;
- absence of a science-based organizational-economic mechanism of transfer of scientific achievements to agricultural producers and, as a consequence, significant backlog of this branch of economy in innovations mastering.

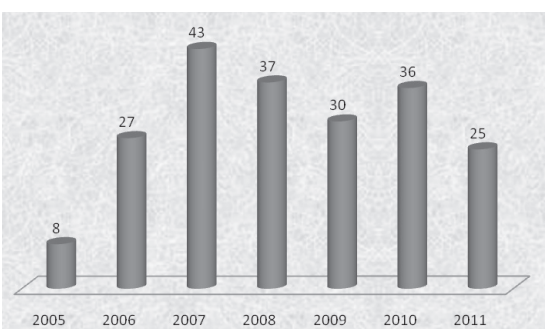


Fig. 1. Projects on technological transfer, financed in 2005-2011

Table1. Dynamics of financing of projects on technological transfer for 2006-2011

Year	State budget		Co-financing		Total
	ths. leu	%	ths. leu	%	
2006	2986.6	43.5	3885.0	56.5	6871.6
2007	8310.8	59.7	5600.0	40.3	13910.8
2008	8205.5	59.1	5667.4	40.9	13872.9
2009	6652.0	47.9	7249.6	52.1	13901.6
2010	9789.8	51.4	9533.5	48.6	19623.3
2011	7350.0	48.5	7819.0	51.5	15169.0

For the purpose of stimulation and introduction of mechanisms of activity in the area of innovations and technological transfer in 2004 the Agency on Innovations and Technological Transfer (AITT) has been created as a division of the Academy of Sciences of Moldova (ASM). This Agency plays a role of a center, uniting scientists, representatives of state organizations and business. It is leading innovative structure on introduction of innovations and the newest technologies into an industrial sector of the Republic [2].

Analysis of activity of the AITT shows that within 7 years it has been implemented about 206 projects (Fig. 1), financed by the state budget and private sectors of economy [1].

In 2011 state financing of selected on a competitive basis projects on technological transfer was at the level of 7350.0 ths. leu (48.5% of a total sum of investments). Co-financing of projects was executed from off-budget sources (7819.0 ths. leu, 51.5% of a total sum of investments). Dynamics of financing of projects in 2006-2011 from the state budget and off-budget sources is represented in Table 1.

Analysis shows increase (without taking into account inflation) of financings of projects on technological transfer, both from the state budget, and from off-budget sources in 2010. For example, while in 2006 the sum of 2986.6 ths. leu was assigned from the state budget, in 2010 this sum has reached 9789.8 ths. leu, and that is in 3.3 times more. But in 2011 financing of projects from the state budget has decreased to 7350.0 ths. leu.

The important role in implementation of projects on technological transfer is played by co-financing. This sum in 2011 has made 7819.0 ths. leu, and that is in 2.0 times more than in 2006.

The state policy in the area of science and innovations implies concentration of corresponding resources on strategic lines of activity in this sphere, and they are defined taking into account existing tendencies at the international level, national potential and necessities of social-economic development of the country.

Strategic lines of activity in Moldova in the area of science and innovations are the following:

- creation of a lawful state and mastering of cultural and historical values of Moldova in a context of European integration;
- use of human, natural and informational resources for sustainable development of national economy;
- biomedicine, pharmaceutics, maintenance and improvement of health;
- agricultural biotechnologies, fertility of soils and food safety;
- nanotechnologies, industrial engineering, new products and materials;
- growth of efficiency of a power-generating complex and provision of power safety, including due to use of renewable resources [3].

The majority of projects on technological transfer is developed in the following directions:

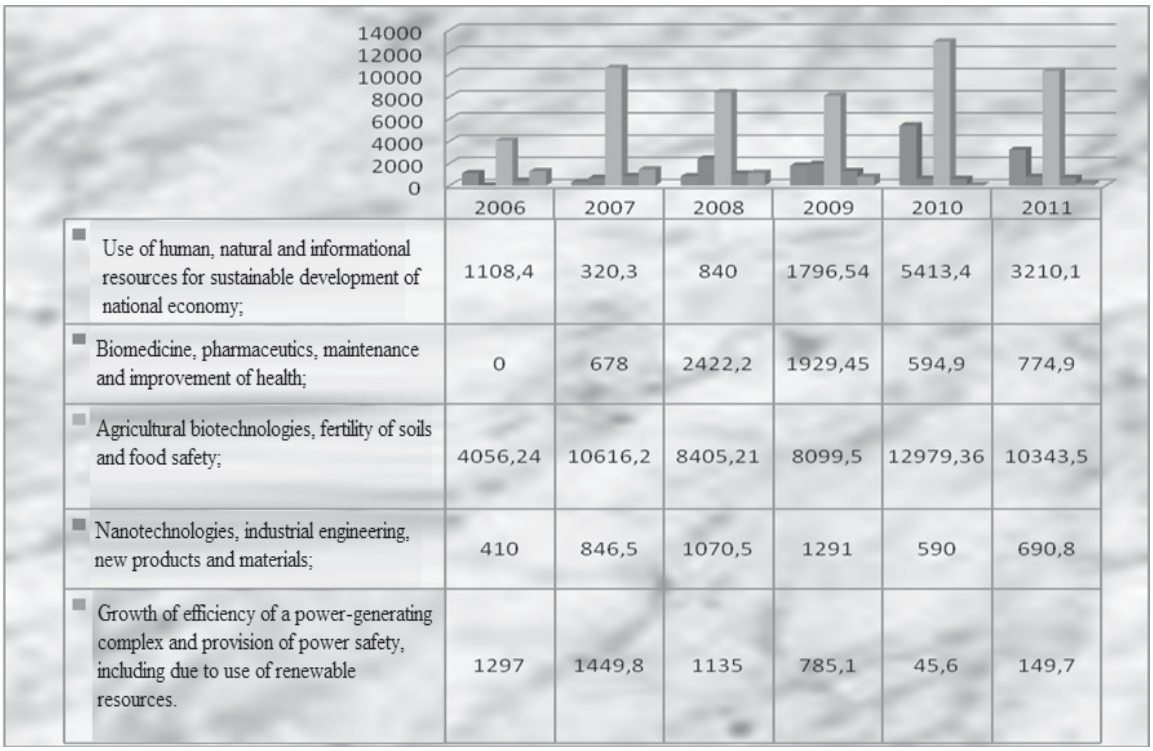
- «Agricultural biotechnologies, fertility of soils and food safety»,
- «Nanotehnologies, industrial engineering, new products and materials».

Distribution of financial assets in strategic directions in 2006-2011 shows a high enough level in the direction «Agricultural biotechnology, fertility of soils and food safety» - 10343.5 ths. leu (2011), from which 5016.6 ths. leu - from the state budget, and 5326.9 ths. leu – co-financing (Fig. 2).

The basic share in financing of projects of technological transfer is connected with the direction «Agricultural biotechnologies, fertility of soils and food safety» (Fig. 3).

For Moldova it means:

- improvement of agricultural products;
- selection and application of intensive techniques in animal husbandry and plant growing;
- growing of plants, resistant to low or to high temperatures, drought;
- selection of animals and birds for meat production, milk, eggs and wool.



	2006	2007	2008	2009	2010	2011
Use of human, natural and informational resources for sustainable development of national economy;	1108,4	320,3	840	1796,54	5413,4	3210,1
Biomedicine, pharmaceutics, maintenance and improvement of health;	0	678	2422,2	1929,45	594,9	774,9
Agricultural biotechnologies, fertility of soils and food safety;	4056,24	10616,2	8405,21	8099,5	12979,36	10343,5
Nanotechnologies, industrial engineering, new products and materials;	410	846,5	1070,5	1291	590	690,8
Growth of efficiency of a power-generating complex and provision of power safety, including due to use of renewable resources.	1297	1449,8	1135	785,1	45,6	149,7

Fig. 2. Financing of projects on technological transfer for 2006-2010

In 2011 10343.5 ths. leu has been invested into the mentioned measures, from which 5016.6 ths. leu (48.5%) - from the state budget and 5326.9 ths. leu (51.5%) - co-financing. Huge enough sum has been assigned for plant growing – 35.9% (3713.3 ths. leu), mechanization and electrification – 17.9% (1851.5 ths. leu), power engineering with use of biomass – 16.5% (1706.7 ths. leu).

Fig. 4 represents dynamics of a number of companies-residents of scientific-technological parks of Moldova.

For transfer of technologies of AIC of Moldova in 2008 Scientific-Technological Park (STP) «INAGRO» has been created. Its production capacity can be characterized by the following parameters:

- complex of buildings is located on 15 hectares of lands;
- area of agricultural lands – 92.5 hectares;
- there is a branch of a scientific-industrial complex (Kagulsky region).

Innovation projects in the area of agriculture and food-processing industry are implemented by 14 residents of STP «INAGRO». The main directions of activity of the techno-park:

- organic fertilizers farming;
- biotechnologies in agriculture;
- processing of products;
- application and distribution of new technologies in agriculture;
- technological innovations in greenhouses;
- techniques of storage and freezing of vegetables and fruit;
- techniques of preservation, drying and sublimation;
- new forms and methods of modern marketing and sales of agricultural products in markets.

Examples of basic innovative techniques, represented in AITT and implemented [1]:

- Innovative preparation «FOLIAR PLUS» for viticulture with a stimulating effect. Provides growth of crop capacity, increases it by 15-20%.

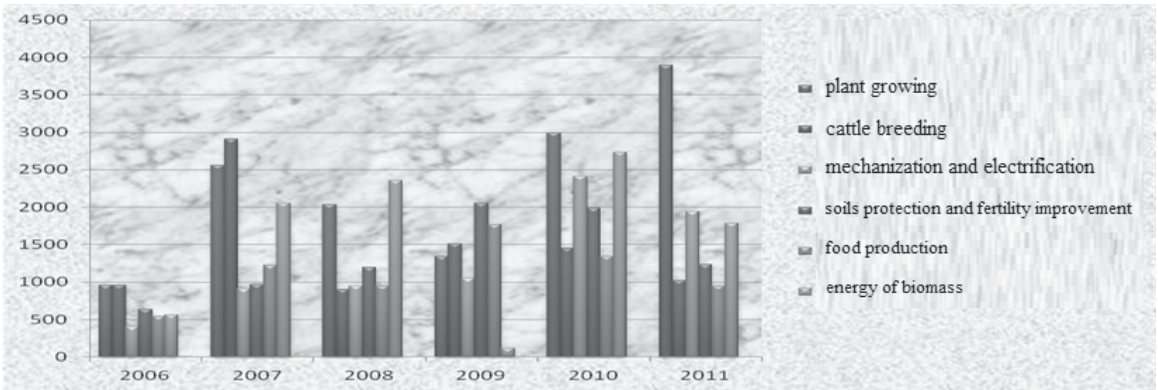


Fig. 3. Financing of projects on technological transfer according to the direction «Agricultural biotechnologies, fertility of soils and food safety» for 2006-2911

- Innovative techniques of reproduction and cultivation of sorghum with an edible grain - „SORIZ". Reproduction and planting of new seeds of sorghum - SORIZ. This product by properties can successfully substitute common rice.
- Corn hybrids «waxyl» and «owx1», more resistant to various diseases, pests and climate change. It is also has higher crop capacity and drought-resistant.
- Seeds of onion, pepper and cabbage of the highest categories and varieties. Introduction of new technological elements at cultivation of onion, sweet pepper, white cabbage. Such seeds provide high crop capacity, are resistant to climatic conditions in Moldova, and also to diseases and pests.
- Technology of production of pork of high categories and palatability. These ecological technologies of pork production at use of mixed fodder and rational feed of technological groups of animals provide excellent palatability of meat. These technologies will allow to increase annual volume of meat production for local and international markets.
- Seedlings of fruit trees of high quality «virus free» (cultivation of cheaper high-quality seedlings of a «virus free» type will promote growth of competitive strength of domestic products).
- New variety of seedlings of fruit trees „Migdal". These are new varieties of local almond trees (implying simultaneous creation of corresponding gardens) will provide quantitative and qualitative increase of production and high competitiveness in markets.
- Innovative technologies of cultivation of mushrooms with use of vegetative waste. This is a technology of cultivation of mushrooms with use of the newest methods and minimum expenditures for production. It provides high yield and great palatability. Such technology use vegetative waste.
- New breed of fish - „Pelingas". It helps ecologically to improve fish ponds, has high rate of development in ponds with fresh water.
- New hybrids of corn, adapted to different climatic zones of Moldova: Porumbeni - 176 MRf and FAO 170 (early hybrids of corn, resistant and

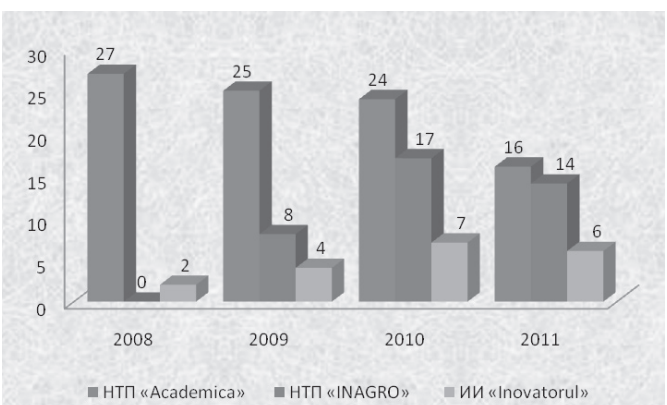


Fig. 4. Dynamics of a number of companies-residents of scientific-technological parks of Moldova in 2008-2011

adapted to conditions of northern regions of Moldova. Crop capacity of these hybrids is more than 30% higher in comparison with the similar, created in Belarus).

Analysis of introduction of innovations into AIC testifies to presence of a large number of barriers, which must be overcome in the nearest future.

First of all, this is:

- absence of the state policy, connected with consumption of products, produced in Moldova, and stimulation of innovations in AIC;
- absence of qualified manpower in AIC in the area of innovations and knowledge, concerning business and business-administration.
- low level of innovative management. The significant part of managers makes decisions without their complex consideration, and that quite often is the reason of seasonal losses or even stoppage and closing of production;
- low competitiveness of national products in home market, there are much more expensive than import products;
- unsuccessful current financial-economic state of AIC. Absence of positive tendencies in social development of villages;
- weak ties between science and business;
- high investment risks in the area of innovations in an agrarian sector of economy;
- insufficient technical equipment, underdevelopment of enterprise infrastructure.

For solution of the mentioned problems it is necessary:

- develop the concept of public administration of technological development, in which it is necessary to state basic priority directions in agro-industrial production, stages of technological development of AIC of the country, and also corresponding mechanisms;
- develop the state and regional target programs on support and implementation of a series of key innovative projects in AIC;
- improve the system of stimulation of innovative activity: definition of criteria of estimation of results, instruments of support of innovations from the beginning of research and up to their implementation in domestic and foreign markets;

- free from taxation profit, used for introduction of innovations, including financing of R&D;
- upgrade professional skills of manpower by means of specialized tutoring, provision of extensive consultations, distribution of information about advanced innovative techniques;
- use manpower more efficiently due to growth of intensity of agricultural production; increases of a number of small enterprises; development of spheres of service, farms;
- form and introduce new structures (innovation centers, techno-parks);
- strengthen public administration in creation of conditions for intensive development of innovative infrastructure in AIC of Moldova, including creation of regional and national innovative clusters, agrarian corporations and other corporate structures;
- creation of conditions for stimulation of interaction between economic subjects for the purpose of their participation in synergetic development, at which results of co-operative interaction more than individual results of separate elements of AIC, transformation of the whole system into its essentially new state;
- stimulation and creation of conditions for essential acceleration of innovative cycles.

Conclusions

1. Currently AIC of the Republic of Moldova owing to specific features and restricted organizational-economic and technical possibilities cannot effectively function without help of the state. Stabilization of the state of AIC, successful struggle with crisis is possible at substantial increase of innovative activity at all stages of the process and corresponding control levels: from the national level to the level of separate agricultural producers.

2. Major factors of innovative activity in AIC are the following:

- acceleration of new developments, meeting corresponding requirements of agricultural production;
- knowledge of agricultural producers from all spheres of AIC of scientific developments, recommended for mastering;
- right selection of priority directions at mastering of scientific developments in agro-industrial production.

3. Innovative activity in AIC must be developed both top-down, and bottom-up. In the upper echelon of the innovation flow (national and regional levels) it must correspond to real needs of production. This is quite possible at perfection of production management at all levels and at development of stimulus of growth of innovative activity.

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Developments of the Republic of Moldova

Food-processing Industry

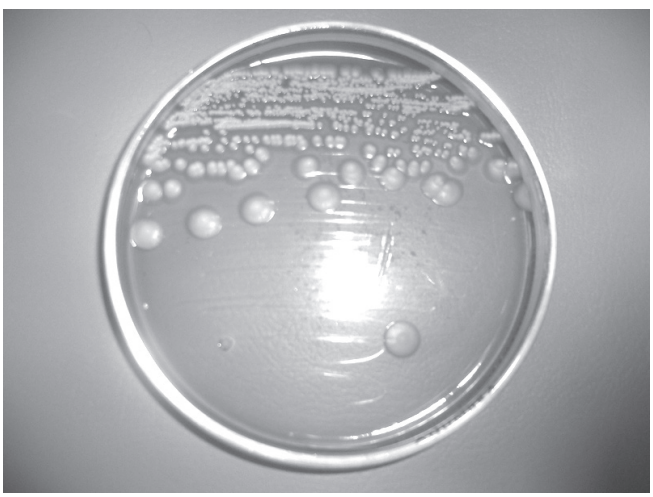
MOL-01

BILEV – the food additive on the basis of brewer's yeasts

Propose

The source of dietary fiber is recommended for normalization of metabolic processes.

Preparation with antianaemic, antitoxic, vitaminizing, immunostimulating action. In cosmetology – preparation with regenerative, antioxidant, protective activity.



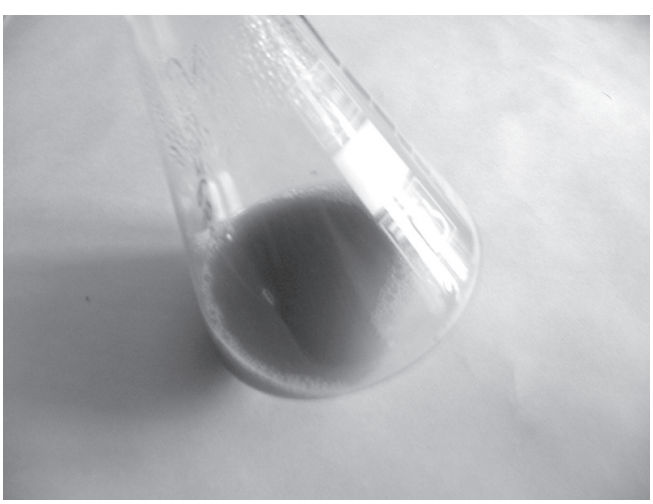
Description

Preparation consists of autolysate brewer's yeasts (Saccharomyces carlsbergensis).

Contains irreplaceable amino acids, ergosterol – provitamin D, microelements, polysaccharides (glucans and mannans), vitamins of group of B.

Novelty

The modernized technology, highly productive strain, the optimized nutritive medium.



Advantages

Improves health.

Safe preparations.

Development stage

Patents MD 3538, BOPI No. 3, 2008; MD 4044, BOPI No. 5, 2010.

The experimental model of preparation is obtained.

Cooperation proposal

Technical documentation.

Coproduction.

Food-processing Industry

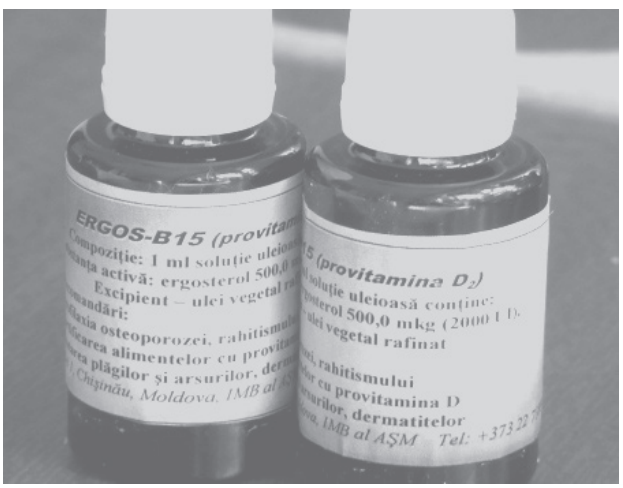
MOL-02

ERGOS-15 (provitamin D) – yeast extract

Propose

It is recommended for avitaminoses, osteoporosis prevention.

Regulates calcium and phosphorous metabolism. it is proposed as product with the regenerative and protective activity.



Description

Active substance of preparation- ergosterol from brewer's yeasts (Saccharomyces carlsbergensis).

Bioproduct ERGOS-15U – (500 UI or 2000 UI) – 1 ml of oil solution contains 12.5 mkg or 50.0 mkg of active substance ergosterol and vegetable oil. It is offered for enrichment of food by provitamin D (breadmaking, manufacture of cottage cheese, margarine, vegetable oils).

Bioproduct ERGOS-15A - alcoholic solution (500 UI or 2000 UI) - ethanol solution contains 12.5 or 50.0 mkg of the active substance - ergosterol and 40% ethyl alcohol. Is intended for treating of wounds, burns, dermatitis.

Innovational element

The modernized technology, highly productive strain producer, the optimized nutritive medium, the improved procedure of ergosterol extraction.

Advantages

Improves health.

Safe preparations.

Development stage

Patents MD 3538, BOPI No. 3, 2008; MD 3570, BOPI No. 4, 2008; Patent MD 4044, BOPI No. 5, 2010.

The experimental models of preparation are obtained.

Cooperation proposals

Technical documentation. Coproduction.

Contact information

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Food-processing Industry

MOL-03

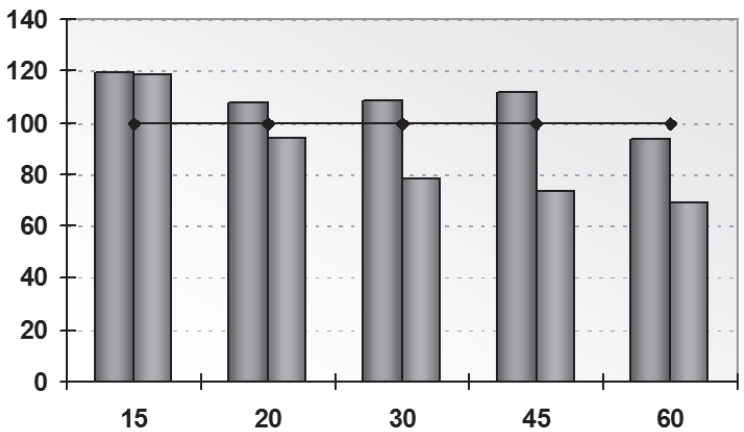
The procedure of enzymatic activity increasing of fungal strains – producer of hydrolases with use of electromagnetic irradiation in millimeter diapason

Propose

Obtaining of enzyme preparations with hydrolytic action (pectinases, amylases, cellulases) with high technological properties for application in food, juice industry, winemaking, beer, alcohol, molasses obtaining, medicine, household for elaboration of new, high effective, modern biotechnology.

Description

The essence of inventions consists in proposing of submerged cultivation procedures of fungal strains from genus Penicillium and Aspergillus - producers of hydrolytic enzymes, that includes action on inoculum or/and fungi culture, that is in logarithmic phase of growth, with millimetre waves (with λ=5.6 mm, 7.1 mm) in periodic/or continuum regime of irradiation.



Influence of MM-waves with low intensity on the pectolytic activity of fungal strain Penicillium viride

Innovation element

The use as producers of hydrolytic enzymes of new strains from mycelial fungi Penicillium viride CNMN FD 04 P – pectinases producer, Penicillium expansum CNMN FD 05 C – cellulases producer, Aspergillus niger CNMN FD 02 and Aspergillus niger CNMN FD 06 – amylases producers. New methods of submerged cultivation of strains – enzyme producers that include action on inoculum or/and fungi culture, that is in logarithmic phase of growth, with millimetre waves with low intensity.

Advantages

Increasing of hydrolytic enzyme biosynthesis with 28.0-43.0%; reducing of cultivation duration of producer strains with 24-48 hours.

Development stage

Patents MD 3255, MD 3301, MD 3943, MD 2363, MD2613, MD2588.

Scientific-technical documentation of realization technologies for obtaining of enzyme preparations with amylolytic action in directed synthesis condition of enzymes is elaborated:

- regulation Technology Laboratory;
- the scheme of technological process;
- the technical conditions of enzyme preparation.

Cooperation proposal

Joint research of technologies implementation.
To microbiological, food, pharmaceutical industry with biotechnological characteristic.

Contact information

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Food-processing Industry

MOL-04

Development of canning technology of grape leaves

Propose

Canning industry and especially for small business companies

Description

Canning technology of grape leaves. Canning industry and especially for small business companies. Studies on canning of grape leaf for industrial production.

For research were used grape leaves of plant varieties zoned in Moldova: Aligote, Rkatseteli, Kobasna, Chasselas, Hibernau GM, Romulus.

Development of canning technology was carried out by four methods, namely: draing (by air); preservation in 10% solution of salt; preservation by method of fermentation, by method of freezing

Novelty

Grape leaves - a new raw material for the food industry

For development of canning technology of grape leaves ware investigated: physico-chemical and microbiological parameters in fresh and preserved leaves: mass fraction of moisture - 67.7%; carbohydrates - 0.62%, including: xylose 0.09, fructose - 0.16, glucose - 0.24, sucrose - 0.13.

Advantages

Advantages are in developing a new types of canned food; the extension of the off-season business.

Development stage

Was developed normative and technical documentation.
Application for a patent.

Contact information

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E-mail: vierul_isphta@mail.ru
www.agriculture.md

Food-processing Industry

MOL-05

New compositions for tobacco flavoring

Purpose

Improving the organoleptic properties of tobacco in the tobacco industry.

Description

Developed original recipes aromatic composition functions that improve the organoleptic properties of smoking tobacco.

For flavoring tobacco mixture used gamma various natural and synthetic components, but a large role to play derived labdane diterpenoids sclareol drimanovoy series or compounds that alter the flavor of tobacco smoke and soften the taste.

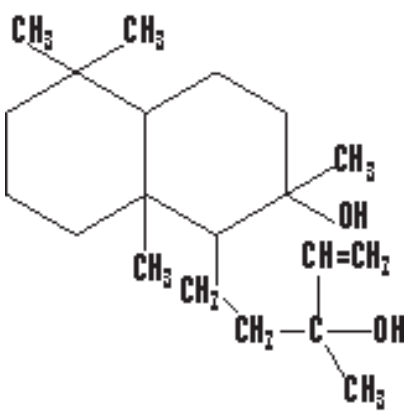
Advantages

Sclareol - the base compound for many fragrances is made of the waste processing clary - local, natural, renewable raw material.

Development stage

The developed compositions are patented in Russia: №№ 2031608, 2033739, 2052970, 2053260 and in Moldova: №№ 217, 2253, 2348, 2349, 2350.

Production of flavored cigarettes such as «Zimbru» and «MT» with the use of these compositions performed at the Chisinau enterprise «SA TUTUN - CTC».



Cooperation Proposals

Organization of consolidated companies producing components aromatizantov themselves compositions.

Contact Information

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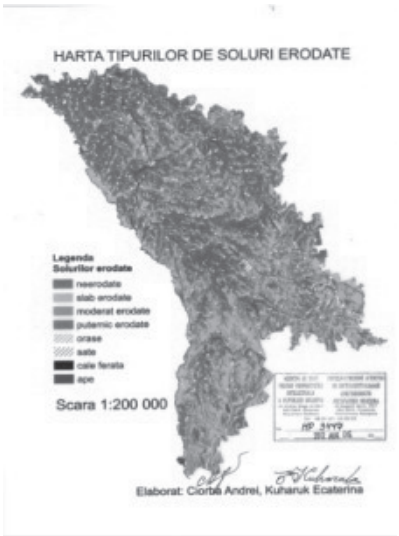
E-mail: lupascut@gmail.com; ichem@asm.md

http://www.chem.asm.md

Agriculture

MOL-06

Soil erosion risk map of the Republic of Moldova (1:200000)



Propose

An overview of the phenomena of erosion throughout the country; the planning of agricultural production; design and placement of erosion control measures within the individual farms.

Application

Investigation of soil erosion, soil science, ecology, agro-ecology, forestry, for universities.

Description

Digital map information in scale 1:200 000 includes data on the three degrees of erosion of soils: weak-moderate-strong and none eroded soils. At the basis of maps were used 16 sheets of the polls eroded soil maps of Moldova (M: 1:200000), made for the "General scheme of erosion control measures for the period 1991-2005» (Author E. Kuharuk). In the developed map are used the new methods of cartography: GIS Database, Orthophoto, Arc GIS.

Novelty

Map includes new information on the soil cover of the Republic of Moldova, which was used the approved classification of soils - highlighted eroded soils in level of soil erosion degrees.

Advantages

With the approved classification of soils map provides a complete, modern and objective characterization of soil of the republic. In the development of digital maps used new methods of cartography.

Development stage

Obtained:

- "Certificat de înregistrare a obiectelor dreptului conexe" Seria HP Nr. 3447 din 06.08.2012;
- The Certificate of the State Agency on Intellectual Property of the Republic of Moldova, a series of HP, N 3447, on 06.08.2012.

Cooperation proposal

- The Agency for Land Relations and Cadastre;
- Ministry of Agriculture and Food, the Ministry of Environmental Protection;
- Agency ,,Moldsilva»;
- High schools, where studied the production of agriculture and land cover;
- Organizations using digital maps on the local level and foreign.

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Biotechnologies

MOL-07

«BioR-plus» - preparation for increasing the efficiency of artificial insemination on domestic animals

Propose

For use in spermatogenesis correction, increasing the stability of sperm material in conditions of cryoconservation, and for increasing the efficiency of artificial insemination on domestic animals.

Application areas

Animal Husbandry and Veterinary.

Description

Complex biological product containing selenium produced by the original technology from the biomass of blue-green algae Spirulina platensis.

Novelty

The new active substance in preparation is selenium, which is actively involved in the metabolic processes in the cell. Selenium-dependent enzymes are involved in the detoxification, regulating fatty acid oxidation, affecting hormones metabolism and synthesis, regulating cellular and humoral immunity. Selenium is involved in key stages of the antioxidant defense system, as at the primary phase of biochemical protection (oxidation of organic compounds with the formation of oxides and peroxides), and at the next phase - the binding and removal of active metabolites. It is involved in the regulation of metabolism of vitamins A and E, preventing their destruction.

Advantages

Preparation is derived from the primary vegetal matirial, which does not pollute the environment. Has a number of economic benefits, the entire process is non-toxic, provides expansion of the range of preparations and nutraceuticals for pharmacy and medicine.

Development stage

Pilot development.

Cooperation proposal

Commercialization of the end product. Commercialization of technology.

Contact information

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E-mail: microbioteh@yahoo.com

Agriculture

MOL-08

The process of sugar beet cultivation

Propose

Treatment of seeds before sowing and plants during the growing season.

Description

Treatment of seeds before sowing and plants during the growing season with aqueous solution of active substance $[Co(DH)_2(PP)_2][BF4]\cdot 2H_2O$ (cobamid) at a concentration of 0.001% by weight, at a rate of 200-250 L/ha.

Novelty

Utilization of cobamid for the treatment of seeds before sowing and plants during the growing season is increasing the root yield and sugar production.

Advantages

Plants are distinguished by increased content of assimilation pigments compared to plants treated with the nearest analogues, especially with chlorophyll a – higher by 22.72% and chlorophyll b – by 28.79%, carotenoids - by 45.44%. Utilization of cobamid preparation has increased yield by 11.6% and sugar by 18.4% compared to the control plants.

Development stage

Patent of the RM has been obtained.

Cooperation proposal

A preparation consisting of cobamid solution (in a concentration of 0.001% at a consumption of 200-250 L/ha) during the growing season to increase the root yield and total sugar production per unit area is offered is proposed to Farmers Societies and agricultural producers.

Contact information

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MONGOLIA

Legal regulations of land ownership in Mongolia

T. Balzhinnyam, Agrobiological Institute

Ch. Baasanzhargal, Agrobiological Institute

Introduction

The land is not only a main source of human vital activity, but also is an important factor of economic relations in the state. In this context, legal regulation of responsibility for land plays an important role. The new constitution of 1992 radically transformed public relations and showed ways for reorganization of national land relations. In particular, it includes the following positions:

- all lands, except of those assigned to citizens of Mongolia in ownership, belong to the state;
- citizens of Mongolia can get in ownership any lands except those assigned for pastures, general purpose and, especially, protected areas;
- citizens of Mongolia are forbidden to sell, grant and convey lands provided them in ownership to foreign citizens, and also to convey lands to other persons without permission of relevant state bodies;
- land owner has certain obligations against the state. In case of state necessity the land can be withdrawn with replacement by an equivalent territory or monetary compensation of damage;
- the state can provide lands to foreign citizens and economic entities for a certain term and with relevant tax payments, and also in view of other conditions and norms established by legislation;
- citizens of Mongolia have the right to live in ecologically safe conditions, ask for protection against negative consequences of environment disruption;
- citizens of Mongolia are obliged to protect environment.

In 2002 the code «About land ownership of Mongolia's citizens» was adopted. According to it, Mongolia's citizens have possibility to get once free-of-charge the ground with size of 0.07 ha in ownership in cities for family needs, 0.35 ha in aimaks and 0.5 ha in somons.

Main activity on transformation of the land policy in Mongolia begins with adoption of this code. Enough time elapsed since its occurrence for effective putting the law into life. Many works are under way, but citizens passively participate in such land transformations.

For this reason the study of main factors of passive participation of Mongolia's citizens in purchase of ground in ownership became a vital necessity.

Investigation method

Methods of comparison, a historical approach and zoning were used for investigation. Data of the Bureau for Urban Development, Land Relations, Geodesies and Cartography of Mongolia through 2008 - 2010 were attracted for this work.

Work results

In 2009 were 553,179 ha of the ground were in landed property with 22,997 ha in ownership and 101,659 ha in rent.

In 2009 in comparison with 2008 the area of the ground in landed property and land tenure increased by 486,697 ha. In 2010 a number of land owners was 504,907 citizens, in comparison with the previous year their number increased by 51,889, 203,043 men received 22,997.15 ha of the ground free-of-charge.

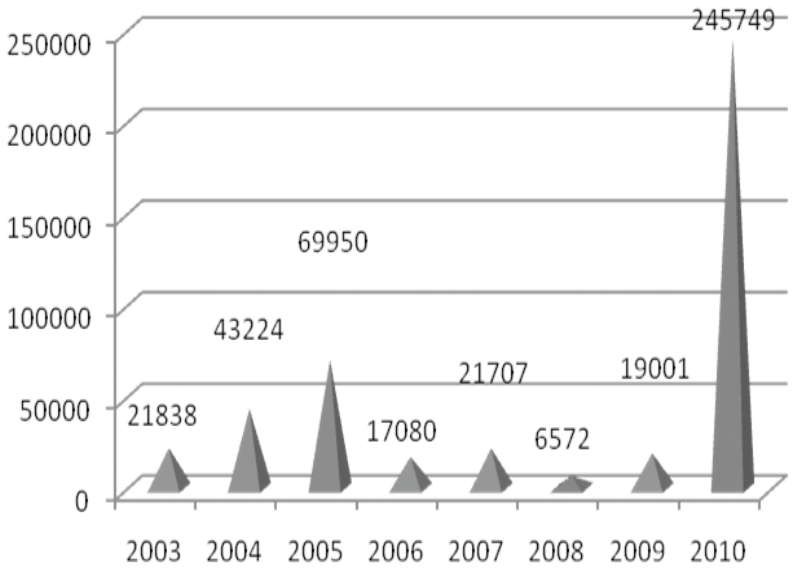

Fig. 1. Comparison of a number of land holders by years

Of them 128,269 men got 18,926.86 ha ground in ownership in aimaks, 74,774 citizens received 4,070.29 ha ground in the capital. (Fig. 1, 2).

As a result of land turnover over the past three years 16,982 Mongolia's citizens got mortgage bank support. Only in 2009 land holders received 18.1 mln tugriks.

Having got the possibility to become a landholder, Mongolia's citizens use various financing sources. Herewith, there is a new state source of income due to the land tax.

The state received the land tax in a volume of 156.3 mln tugriks.

Meanwhile, the existing legal regulation conditions on transfer of ground in ownership to Mongolia's citizens are unsatisfactory. It can be explained, on the one hand, by that they received free-of-charge the ground in ownership on the base of the accepted law, and, on the other hand, by the following impact factors:

- Inaccessibility of information on landed property;
- Insufficient formation of market conditions and limited possibility for economic ground turnover, as well as weak potential possibility for capital investment in the ground;
- Separate registration of landed property and other real estate complicates the economic ground turnover;
- Weak connection between a base price used at calculation of ground taxation and indemnification and market prices. A wide range of market prices for the ground depending on its location area;
- According to the law «About land ownership of Mongolia's citizens», each citizen of the country has the right for such property. However, actually there was the onetime compensatory-free transfer of grounds for family needs, and then for all citizens. In result, transfer of grounds in ownership was slowed down;
- Necessity for transfer of grounds in ownership through landed property slows down the process of proprietors occurrence;
- The long duration of the process for transfer of grounds in ownership;
- Inconvenient location of some grounds assigned for transfer in ownership.

The USA, Canada, the European states possess 200-300-year experience on transfer of grounds in ownership.

This process was realized in the most severe struggle, as these actions were carried out without the legislative bases [6].

Experts mark that the most important is overcoming of the arising obstacles related to land and search for a correct solution of the arising situation.

Many consider that this issue can be solved with the help of economic instruments.

For example, it is possible to establish a higher tax for the ground with a more favorable location.

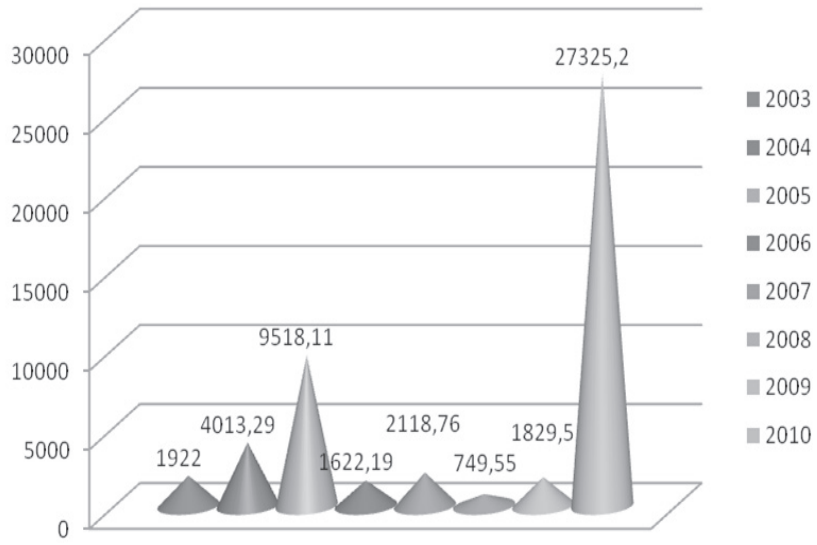

Fig. 2. Hideland sizes assigned in ownership by years.

In result, purchase in ownership of such ground will not depend on the will of a government official, and only on purchasing power of a Mongolia's concrete citizen.

Conclusions

As a whole, it is necessary to state once again that, meanwhile, legal regulations of landed property in Mongolia are unsatisfactory. It can be explained by:

- Realization of land-related laws is at an inadequate level;
- Propagation and agitation of the law «About land ownership of Mongolia's citizens» is carried out insufficiently dynamic;
- There is no uniform system of ground registration, citizens and ground right.

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8. Отчеты столичного земельного управления (2007, 2008, 2009 гг.)

Results of tomatoes crossing in protected ground

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Introduction

Heterosis is a powerful development of hybrids of a first generation significantly exceeding in sizes, fruitfulness, precocity and other properties of a parent. Using heterosis seeds, productivity of many vegetable cultures increases by 20-50% and more in comparison with the initial grades, products quality improves, resistance to adverse environment conditions improves.

Over the past years great importance is paid abroad to creation of hybrids with the use of male functional sterility, whereby expenses for production of hybrid seeds are considerably reduced. In this connection it is expedient to use it in research to create hybrids with productive yield.

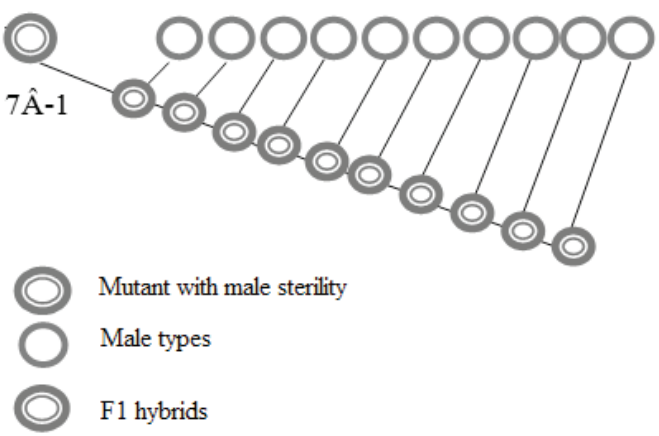
With intensive development of hothouse facilities in Mongolia, absence of own hybrid seeds throws into sharp relief. In result, grades and hybrids from the CIS countries are used in such facilities.

The purpose of research is estimation and breeding of the most promising strains possessing a complex of valuable attributes. To achieve this purpose biology of flowering of sterile types and growth of hybrid seeds for the protected ground were studied.

Materials and methods

Ten initial types of tomato and 7B-1 mutant with the male sterility developed by a mutation method in Canada served as research material. Hybridization was carried out by a topcross method.

Research was conducted in accordance with methodical recommendations and over results of study of the vegetable cultures collection (All-Russia Research Institute of Plant Industry) in the protected

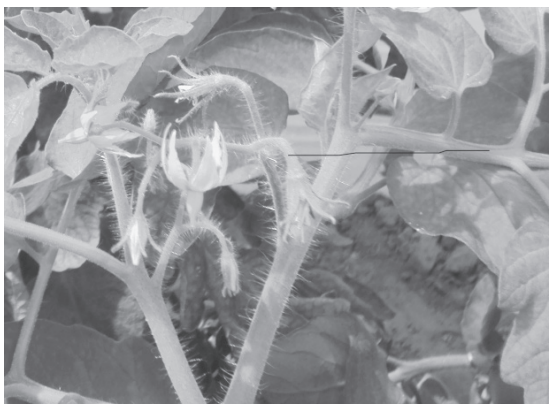


Pic. 1. Topcross scheme

ground. Phenological investigation was carried out. Productivity, ripening dynamics, disease resistance and fruits quality were taken into account.

7B-1 mutant's flowers are heterosterile, a pestle is put forward against anthers. There is no meiosis in anthers. The 7B-1 mutant is also capable of enduring abiotic stresses and low temperature.

Research was carried out in film nonheated greenhouses. Sowing seedlings was conducted on 20 May. There were 4 female types for 10 male ones; the growing space was 70 x 40 cm.



Research results

Research shows that the best results at crossing can be achieved, when pollination of tripped flowers in a yellow – green buds phase takes place. Crossings in the first and in the second inflorescence were carried out, when flowers had yellow - green color (during the period since 28 June till 7 July). Pollen was taken from female flowers on a pollination day. Four flowers in each combination were pollinated since 7 till 11 o'clock for one and two clusters on a sunny day. Fruit inception occurred on the 7 till 9 day after flowers pollination.

While pollinating female flowers by male pollen, the fruit inception percent varies in a range of 41.7 – 88.9%. 7B-1 vs. De-Barao Red combination has the highest level of fruit inception (88.9%), and 7B-1 vs. Gelb Giant combination - the lowest one (41.7%) (Table 1).

144 fruits were incepted out of pollinated 190 flowers. Measurements were made and seeds were taken after fruits ripening (Table 2). Over the results of topcross crossing, 1880 pieces of seeds were taken for the 7B-1 vs. Naama combination; it is more than for other combinations. 110 pieces of seeds were taken for one fruit for the 7B-1 vs. Ventura combination. A number of seeds for one fruit is the lowest for 7B-1 vs. Ventura

Table 1. Pollination of 7B-1 mutant flowers by male types (2010)

Combinations	*Pollination*			*Fruit inception, %*
	Flowers pollinated, pcs.	*Of them*		
		Aborted flowers, pcs.	*Incepted flowers, pcs.*	
7B-1 vs. Carlson	24	4	20	83.3
7B-1 vs. Ventura	16	3	13	81.3
7B-1 vs. Efimiya	14	4	10	71.4
7B-1 vs. Orange	16	2	14	87.5
7B-1 vs. Gelb Giant	12	7	5	41.7
7B-1 vs. July	24	10	14	58.3
7B-1 vs. Pepper-like	18	4	14	77.8
7B-1 vs. Ravid	24	6	18	75.0
7B-1 vs. Naama	24	4	20	83.3
7B-1 vs. De-Barao Red	18	2	16	88.9

Table 2. A number of taken hybrids seeds

Combinations	*A number of fruits on a plant, pcs.*	*A total number of seeds, pcs.*	*A number of seeds from one fruit, pcs.*	*Weight of 1000 seeds, g*
7B-1 vs. Carlson	16	687	43	4.07
7B-1 vs. Ventura	9	310	34	3.95
7B-1 vs. Efimiya	9	990	110	3.43
7B-1 vs. Orange	13	1077	82	3.68
7B-1 vs. Gelb Giant	3	137	46	3.53
7B-1 vs. July	13	791	60	3.70
7B-1 vs. Pepper-like	14	492	35	3.29
7B-1 vs. Ravid	13	1051	81	3.75
7B-1 vs. Naama	30	1800	60	3.84
7B-1 vs. De-Barao Red	15	1178	78	3.71
Total	*144*	*8513*		

and 7B-1 vs. Pepper-like combinations. It is associated with Ventura and Pepper-like male types with fruits having a dense and low-chamber pulp and a lower number of seeds that proves their dominance.

The table 2 shows that a grade parameter is of great importance by a number of seeds in one tomato fruit. A number of seeds for one fruit in 7B-1 vs. Efimiya, 7B-1 vs. Orange and 7B-1 vs. Ravid combinations is 81 – 110 pcs. It is more than in other combinations. While measuring weight of 1000 seeds, it varies in a range of 3.29 – 4.07 g, the 7B-1 vs. Carlson combination has the highest parameter – 4.07 g.

Conclusions

- While pollinating female flowers by male pollen, the fruit inception percent varies in a range of 41.7 – 88.9%. 7B-1 vs. De-Barao Red combination has the highest level of fruit inception (88.9%).
- 8513 seeds were taken from all tomato combinations that allows to carry out further selection works and estimate combination abilities of initial tomato types.

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Influence of xylase on in situ decomposition of 106 and 141 Darhan varieties wheat straw

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Introduction

Grain crop straw is one of the important components of coarse fodder. However, because of its poor digestion and a low nutritional value it is necessary to process it using mechanical, chemical and biological methods (Chesson, 1984; Tan et al., 1995). Recently a ferment processing of straw is widely used in livestock farming, which accelerates microorganisms growth in a farding bag (Martin et al., 1989; Callaway and Martin, 1997), improves digestion (Henderson et al., 1982; Nakashima and Orskov, 1989; Sheperd, Kung, 1996; Colombatto et al., 2003), influences on fattenig of beaf cattle (Bolsen et al., 1980) and milk yield of dairy cattle (Stokes, 1992; Chen et al., 1994, Williams et al., 1991; Piva et al., 1993; Kung et al., 1997).

Ch.Tungalag /1993/, H. Altantsetseg /1995-1997/, D. Lhagvazhav /1996/ conducted research on breeding of cellulose-fermenting bacteria strains, lignin-fermenting higher and lower fungi and their tests; worked on a task to improve straw digestion and nutritional value using higher fungi micelles.

The research task consisted in determination of optimum xylase enzyme dozes to improve straw digestion and nutritional value.

Research materials and method

Straw of 106 and 141 Darhan varieties spring wheat obtained in 2011 in Research Institute of Plant Industry and Agriculture has been used for investigation. Xylase enzyme for straw treatment was produced by American company «Dyadic International».

The chemical composition of straw was determined by methods approved by International Association of Official Analytical Chemists and decomposition of dry substance was studied in situ using a nylon bag.

To determine influence of the enzyme on decomposition of some substances in straw, 0.5, 1.0, 1.5, 2.0 mcl/g of xylase were added to a sample in the nylon bag and kept their during 16 hours at room temperature, that was a simulation of incubation process in the farding bag.

Research results

Research results were processed using the SAS, S-N-K programs (1985, Steel and Torrie).

Table 1. Chemical composition of wheat straw (%, in dry substance)

№	Sample	Raw protein	Raw fat	Raw cellulose	Free-nitrogen extracts	Raw ash
1	106 Darhan variety wheat straw	4.12	0.53	33.02	41.17	5.02
2	141 Darhan variety wheat straw	4.03	0.43	34.35	39.78	4.89

Table 2. Structure of wheat straw cell membrane (%, in dry substance)

№	Sample	NDF	ADF	Lignin	Hemicellulose	Cellulose
1	106 Darhan variety wheat straw	76.80	46.16	14.25	28.11	27.99
2	141 Darhan variety wheat straw	77.20	45.90	15.58	29.61	27.80

Chemical composition and structure of the cell membrane of wheat straw investigated are presented in tables 1 and 2.

Tables show that the chemical composition of these two kinds of straw is approximately equal, but 141 Darhan variety wheat straw contains more raw cellulose, neutral detergent fiber, lignin and hemicellulose.

In situ wheat straw decomposition

In situ decomposition of 106 and 141 Darhan varieties wheat straw is shown in Table 3.

The term increase of straw stay in the farding bag has influence on its decomposition. After 48 hours of treatment a dry substance share changes to 30.05-32.15%.

Decomposition of 106 Darhan variety wheat straw is more intensive. Decomposition of the neutral detergent fiber was similar for the both varieties.

Its decomposition during 48 hours was approximately 22%.

However, in situ decomposition of the acid detergent fiber was more intensive for 106 Darhan variety wheat straw ($P < 0.05 \sim P < 0.009$).

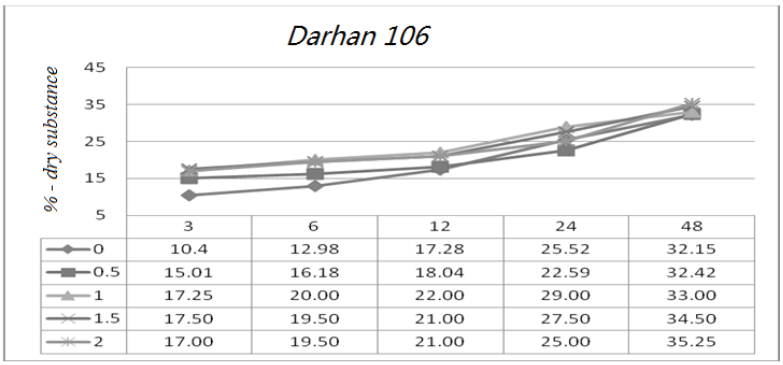
Table 3. In situ decomposition of 106 and 141 Darhan varieties wheat straw

Parameters	Stay term	106	141	SEM
Dry substance	3	10.4	11.96	0.373
	6	12.98	13.28	0.830
	12	17.28	13.91	2.258
	24	25.52	19.47	0.881
	48	32.15	30.05	0.386
NDF	3	3.96	3.06	0.373
	6	4.20	4.02	1.117
	12	6.20	6.93	1.937
	24	15.67	12.26	1.321
	48	22.76	22.87	0.930
ADF	3	10.28	5.05	1.784
	6	9.38	7.28	6.173
	12	12.80	10.38	6.056
	24	16.80	12.07	0.842
	48	27.49	24.85	1.668

Influence of xylase enzyme on in situ decomposition of the dry substance in 106 and 141 Darhan varieties wheat straw is presented in fig. 1 and 2, respectively.

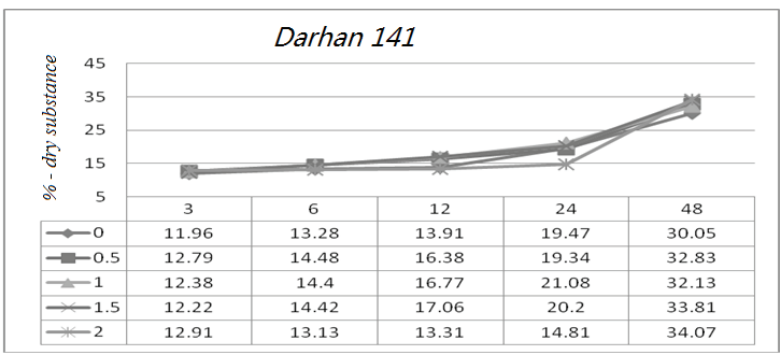
Enzyme action increases by 3.1 – 4.2% dry substance decomposition after 48 hours.

The xylase in amount of 1 mcl/g had more influence on 106 Darhan variety wheat straw, and the xylase in amount of 1.5 mcl/g – on 141 Darhan variety wheat straw.



	3	6	12	24	48
0	10.4	12.98	17.28	25.52	32.15
0.5	15.01	16.18	18.04	22.59	32.42
1	17.25	20.00	22.00	29.00	33.00
1.5	17.50	19.50	21.00	27.50	34.50
2	17.00	19.50	21.00	25.00	35.25

Fig. 1. Influence of xylase on in situ decomposition of 106 Darhan variety wheat straw



	3	6	12	24	48
0	11.96	13.28	13.91	19.47	30.05
0.5	12.79	14.48	16.38	19.34	32.83
1	12.38	14.4	16.77	21.08	32.13
1.5	12.22	14.42	17.06	20.2	33.81
2	12.91	13.13	13.31	14.81	34.07

Fig. 2. Influence of xylase on in situ decomposition of 141 Darhan variety wheat straw

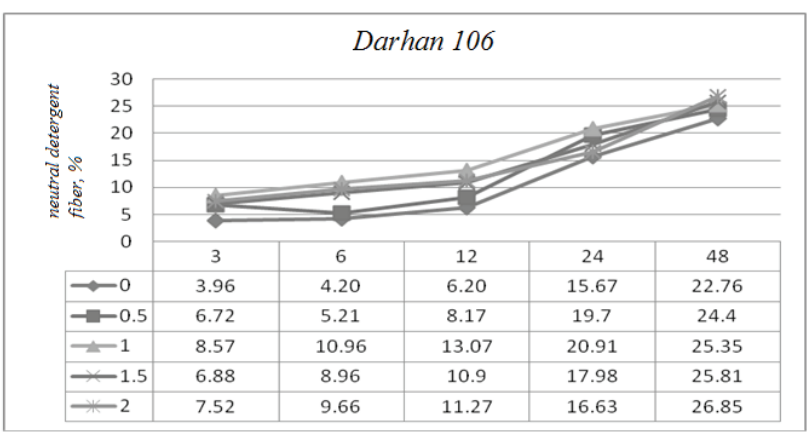
Influence of the xylase on in situ decomposition of the neutral detergent fiber

Influence of the xylase on in situ decomposition of the neutral detergent fiber for 106 and 141 Darhan varieties wheat straw is presented in fig. 3 and 4, respectively.

The xylase increases by 4.1 – 4.4% neutral detergent fiber decomposition for 106 Darhan variety wheat straw after 48 hours incubation.

For 106 Darhan variety wheat straw, the increase was in 6 and 12 hours.

The effective doses for 106 and 141 Darhan varieties wheat were 1 mcl/g and 1.5 mcl/g, respectively.



	3	6	12	24	48
0	3.96	4.20	6.20	15.67	22.76
0.5	6.72	5.21	8.17	19.7	24.4
1	8.57	10.96	13.07	20.91	25.35
1.5	6.88	8.96	10.9	17.98	25.81
2	7.52	9.66	11.27	16.63	26.85

Fig. 3. Influence of the xylase on in situ decomposition of the neutral detergent fiber for 106 Darhan variety wheat straw

Influence of the xylase on in situ decomposition of the acid detergent fiber

Influence of the xylase on in situ decomposition of the acid detergent fiber for 106 and 141 Darhan varieties wheat straw is presented in fig. 5 and 6, respectively.

During experiment, acid detergent fiber decomposition were increasing gradually and reached a level of 2.4 – 5.1% after 48 hours, but 1.5 mcl/g concentration enzyme influence was more effective

for 106 and 141 Darhan varieties wheat.

Conclusions

- 1 mcl/g xylase is more effective for dry substance decomposition of 106 Darhan variety wheat straw, and 1.5 mcl/g – 141 one.
- 1 mcl/g enzyme is more effective for neutral detergent fiber decomposition of 106 Darhan variety wheat straw, and 1.5 mcl/g – 141 one.
- Enzyme in amount of 1.5 mcl/g has equal influence on acid detergent fiber decomposition of 106 and 141 Darhan varieties wheat straw.

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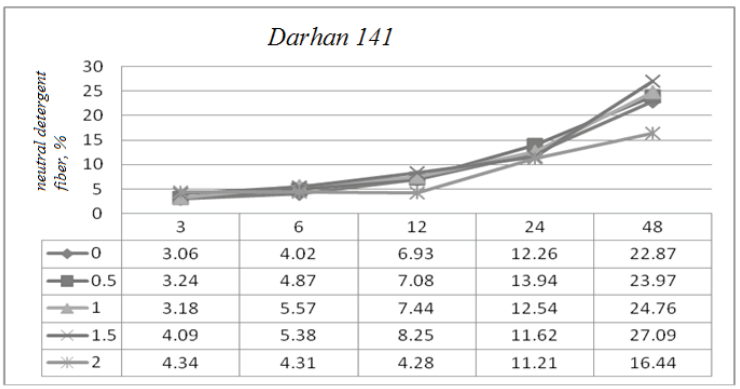
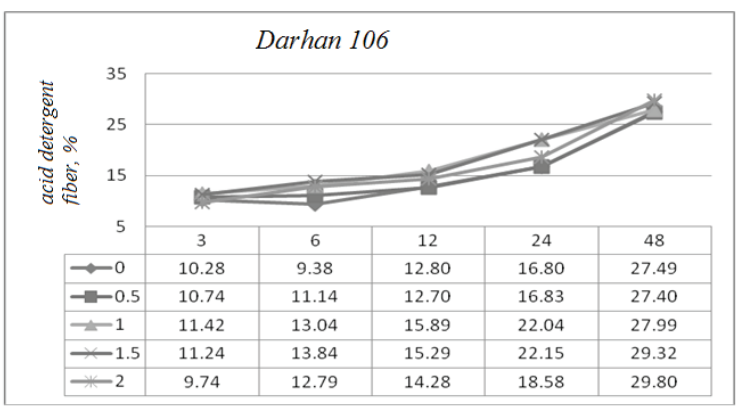


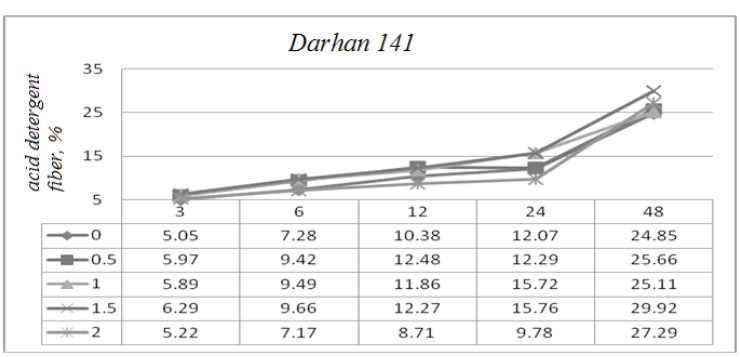
	3	6	12	24	48
0	3.06	4.02	6.93	12.26	22.87
0.5	3.24	4.87	7.08	13.94	23.97
1	3.18	5.57	7.44	12.54	24.76
1.5	4.09	5.38	8.25	11.62	27.09
2	4.34	4.31	4.28	11.21	16.44

Fig. 4 Influence of the xylase on in situ decomposition of the neutral detergent fiber for 141 Darhan variety wheat straw



	3	6	12	24	48
0	10.28	9.38	12.80	16.80	27.49
0.5	10.74	11.14	12.70	16.83	27.40
1	11.42	13.04	15.89	22.04	27.99
1.5	11.24	13.84	15.29	22.15	29.32
2	9.74	12.79	14.28	18.58	29.80

Fig. 5. Influence of the xylase on in situ decomposition of the acid detergent fiber for 106 Darhan variety wheat straw



	3	6	12	24	48
0	5.05	7.28	10.38	12.07	24.85
0.5	5.97	9.42	12.48	12.29	25.66
1	5.89	9.49	11.86	15.72	25.11
1.5	6.29	9.66	12.27	15.76	29.92
2	5.22	7.17	8.71	9.78	27.29

Fig. 6. Influence of the xylase on in situ decomposition of the acid detergent fiber for 141 Darhan variety wheat straw

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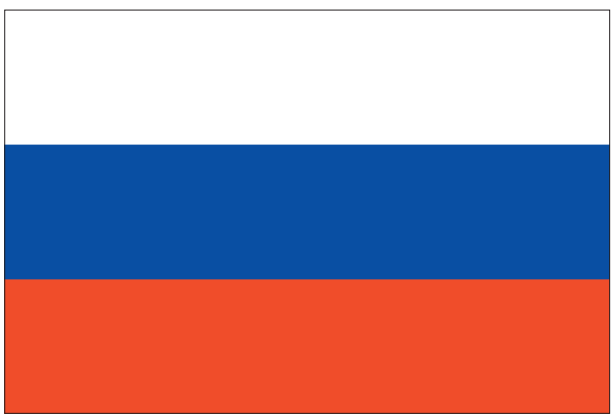

Nanobiotechnologies. The basic directions of development

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In the modern world rates of development of scientific investigations shorten periods from a scientific discovery to its practical application. Specialists underline that nanotechnologies themselves are the beginning of the Third Scientific and Engineering Revolution (SER-3) - appearance of a new reality, changing the world of the 21st century. It implies research of the world of objects and corresponding structures with sizes from parts to hundreds of nanometers. «Nano-» means one billionth of meter (1 nm). The lower boundary is determined by classical radius of an atom (about 0.1 nm), while the upper - by dimensions up to 0.1 um (100 nm size of bio-molecules, when specificity of behavior and properties of nanoparticles is lost). The term «nanotechnology» has been used for the first time by Japanese scientist N. Taniguchi in 1974 at the conference of the Japanese Society of Precision Engineering [1]. This term has been popularized by E. Dreksler in 1986 in his book «Engines of Creation: The Coming Era of Nanotechnology» [2]. Previously value of small-scale objects has been marked out in 1959 by the Nobel Prize Winner, theoretical physicist R. Feynman in his lecture «There's Plenty of Room at the Bottom: invitation into the new world». He has underlined urgency of works in this area, marking out that laws of physics do not prohibit construction at an atom-molecular level. Transition from macro- to nano-scales leads to appearance of qualitative changes of properties of various compounds and production of specific nanosystems on their basis. Nanotechnology promises to get into all spheres of human activity, to change cardinally industries, economy and life in whole. Modern rates of scientific research practically erase barriers between discoveries of new phenomena and their practical application. Research in the area of nanotechnology is focused on solution of practical problems, and applied use of nanobiotechnologies is impossible without fundamental scientific research. Appearance and development of nanoscience corresponds to modern development of natural sciences.

The basic priorities of nanobioengineering and nanomedicine are determined by the following directions [1, 3-8, 14-17]: biological nanochips for diagnostics of somatic and infectious diseases (identification of agents of dangerous infections and toxins); medical nanorobots, capable to remedy defects of diseased human organs by controlled nano-surgical intervention; molecular detectors for DNA sequencing on the basis of inorganic nanopores; self-replicating genomes, applicable in the area of biotechnology and medicine for the purpose of drugs production, pharmacological screening and modeling of pathological processes; biocompatible nanomaterials for a wide spectrum of application.

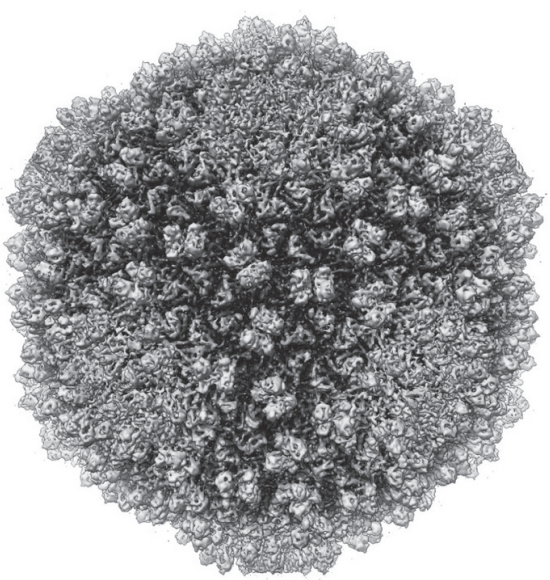
The major task of nanobiotechnology - creation of carriers of therapeutic drugs for certain cells. In fact they can be medical products of a new generation, and also containers for address delivery of drugs to cells-targets. In particular, it is interesting to create methods of introduction of DNA and RNA into cells for further development of expanding gene therapy. New approaches to DNA and RNA delivery are developed currently. To stimulate binding of nucleic acids with cells it is suggested to form special complexes from them,

representing themselves nanoscale particles, created due to noncovalent interactions of nucleic acids among themselves and also with cationic polymers. Such particles effectively bind with a cellular surface, and that promotes their absorption by a cell. This research discovers new advantages of gene therapy.

Nanobiotechnology is an area of creation of new methods of study of biological systems on the basis of construction of nanoscale structures. Transition from a macro- to nanoscale world leads to qualitative changes of physical-chemical properties of compounds and creation of specific nanosystems on their basis.

Nanobiotechnologies can be applied not only for creation of new materials. On the basis of biomolecules it is possible to produce so-called «biomachines», various devices and sensors. Scientists actively conduct research in the area of molecular machines: it is possible to create moving nanostructures, «mobile robots» from DNA molecules. With use of supplied to them energy they can move in a certain direction along DNA molecules. Such discoveries are especially important for development of new methods of biodiagnostics - application of nanoparticles for specific detectors. Also scientists have created silver nanoparticles with antibacterial properties. They can be used in the form of paints in medicine for suppression of staphylococci, as chlorine-free agents for disinfection, bandaging materials, varnishes for catheters coating. Clothes from such material can be worn for a long time without washing. These materials are used in agriculture, for example, in milking machines, they allow to solve problems of clogging of filters of any conditioners. Specialists also develop new materials for cellular technologies, including biocompatible polymers, synthetic, for example, polyethylene terephthalate (PET), polytetrafluoroethylene (PTFE), or biodegradable polymers - chitosan, cellulose acetate, and materials of bacterial origin. For example, when PTFE undergoes ion-plasma treatment by ions of CF 4 and on its surface specific relief with specified roughness is created, such polymer gains absolutely new properties. It means that it is possible to provide reduction of concentration of pathogenic bacteria and fungi in different mediums at their contact with films, treated by the above mentioned methods. Russian scientists already have received important scientific-practical results with use of nanomaterials for restoration of mechanical properties of tooth enamel [6]. Currently researches develop technologies of nanoscale deposition of different materials for creation of antibacterial coatings.

The other innovative direction is connected with creation of multifunctional materials at integration of synthetic and natural nanostructured polymers, for example, chitosan and fullerene 60 (C60). Chitosan is a biodegradable or soluble (in biological environment) polymer. Fullerenes are nanomaterials, representing themselves an allotropic form of carbon. The special attention is paid to a possibility of its application in biological and medical chemistry. Diversity of fullerene (and its derivatives) production technologies allows to widespread application of nanoparticles as drugs. Creation of models for prediction of biological activity, formulation of corresponding requirements to industrial technologies and production of nanoparticles with specified medical properties – all these works are quite innovative.



Integration of two above mentioned nanobiomaterials allows to widespread their application by means of creation of agents of address delivery of medical substances. For example, fullerene 60 by means of a chemical reaction is bound with porphyrin (applied for photodynamic chemotherapy), then nanostructured polymers (for example, chitosan) are coated with the dyad «fullerene-porphyrin» and with use of laparoscopic techniques are introduced directly

into tumor areas. After laser emission porphyrin decays with formation of radicals, destroying cancer cells, and chitosan is dissolved in a human organism. This nanocomposite biomaterial also has antibacterial and immunomodulatory properties.

The other direction of research is connected with creation of bioceramic matrices from mixture of chitosan and ceramics. Specialists currently work in the area of definition of parameters of a surface for optimization of growth rate of cells on the matrices, and also study parameters of a surface of chitosan films, created at corresponding ion-plasma treatment.

New pharmaceuticals, based on nanochemistry and biotechnologies, will allow to create neurostimulators and highly efficient aerosols.

Molecular detectors on the basis of nanopores are also created by scientists. This category of molecular detectors is quite useful for detection of separate genomes. Registration of transition of molecules through nanopores is provided due to change of electric characteristics of penetrated surfaces or appearance of specific signals on special nanoelectrodes. At use of the last method of registration such detection is quite enough to distinguish different nucleotides in a DNA chain. And such reading of a sequence of nucleotides goes hundred thousand times faster, than at use of standard methods of DNA sequencing.

Works in the area of nanosensors are also intensive enough. They will be applied in molecular diagnostics. Currently there are many medical diagnostic systems, based on oligonucleotides, self-assembling into a complex on analyzed DNA, patents for such systems and corresponding DNA-chips are received yet.

Specific nanoscale inorganic structures («quantum drops») are also developed. They (due to quantum effects) are painted into various colors and can be used as spectral markers for diagnostic systems.

Phospholipid nanosystems are applied for introduction of vaccines. Pharmaceuticals of a new generation are provided with special systems of their prolonged delivery to corresponding human organs. The phospholipid nanosystem with a diameter of nanoparticles of 20-50 nm is developed and certified. Focused transportation of drugs to centers of pathological process allows to raise efficiency of already existing methods of medical therapy. The world sales of pharmaceuticals, accompanied by modified systems of their delivery, make 20% of the total volume of a pharmaceutics market.

R.F. Feynman's dreams come true - humankind can design surrounding material environment according to own intentions, joining and disjoining atoms like bolts and nuts in mechanical engineering, automobile industry, aircraft engineering, and the same is in medicine [9]. By means of such technologies scientists create super strong and thin materials, which cannot be produced in usual conditions. Already in 1982 a patent for a scanning tunnel microscope (STM) was registered, and now specialists can observe atoms and even manipulate them.

The most developed spheres of nanobiotechnology - sequencing of DNA of various organisms; genetic engineering - change of genetic properties due to substitution of separate genes and nucleotides in DNA molecule; use of organic molecules in chips for electronics; intracellular manipulations.

The most safe, practically important directions in the area of nanobiotechnologies - development of new methods of sequencing and revealing of polymorphism of genomes [4]. It allows to discover proteins-markers of pathological conditions, to develop technologies of improvement of concentration sensitivity of molecular diagnostics. Nanobiotechnologies bring significant contribution into development of methods of assessment of bio-safety of genetically modified products (GMP), into creation of new generations of pharmaceuticals, and also into optimization of methods of gene therapy.

One of well developed directions of nanotechnologies - biochips or DNA-micromatrices, without which biology and medicine cannot exist any more. It is of great importance for sequencing and studying of polymorphism of genomes. DNA-chips application is a modern nanotechnology of analysis of genetic material, allowing to screen mixtures of nucleic acids. This is an industry of high technologies, based on modern discoveries in chemistry, biology, physics, microelectronics, computer science. Biochips represent themselves plates, carrying on their surface a set of various probes - fragments of nucleic acids or oligonucleotides, placed in a certain order. By means of such chips it is possible to observe structure and functioning of genes in a human body. Simplified variants of these chips are necessary for medical purposes: to detect different viruses and pathogenic microorganisms.

DNA micromatrices - outstanding technical achievements in a series of nanobiotechnology methods, using principal property of DNA duplex - complementarity of sequences of two chains. One of developers of micromatrices - A.D. Mirzabekov [10].

Micromatrices (microchips), containing thousand of immobilized fragments of nucleic acids, are the basis of development of a new area of molecular genetics - genomics, science about genome.

Foundations of this science: definition of primary sequences of DNA, their physical order in genomes, extent and laws of polymorphism, rate of evolution.

Development of methods of use of micromatrices allows to create DNA-diagnosticums to reveal mutations in genes, corresponding to various diseases, and also genetic material of pathogenic agents, integrated into genomes of animals. At study of a segment of a human genome with length of 2.3x10e bp scientists revealed 2,000 sites of polymorphism at a level of nucleotide substitutions, and that allows to understand scales of genetic variability of a human being. In 2006 researchers created the map of human chromosomes with zones of polymorphism according to duplications of DNA sites [1, 11]. Such segments occupy almost 12% of the whole genome. They contain hundreds of genes, regulatory sequences. Significant amount (~5%) of extended DNA blocks, having in various segments of a genome almost identical replicas, is revealed.

The technology of DNA microchips allows to implement monitoring of expression of huge number of genes and to study profiles of gene expression of various cell populations at different stages of their development. For genes with known sequences of nucleotides special micromatrices of cDNA segments with length of 0.5-1.0 kbp are created. From analyzed samples scientists select total mRNA and by means of reverse transcription convert it into cDNA, mark it by fluorescent paints and use for competitive hybridization with fragments of known genes, placed on a micromatrix. Intensity of fluorescence of separate elements of a micromatrix after formation of hybrids allows to characterize differences in levels of expression of separate genes in analyzed samples. For example, absence of competition for formation of hybrids from the side of cDNA of normal tissues can speak about transcription of new genes in a tumor, not expressing in normal cells.

Use of DNA-micromatrices allows to monitor simultaneously nucleotide sequences of a significant number of genes, to evaluate activity of their transcription, and that is especially important for searching of genes, transcription of which brings significant contribution into formation of useful economically valuable signs, and also pathological phenotypes at series of diseases of livestock.

Analysis of profiles of gene expression in various organs allows to reveal genes and controlled by them metabolic fates, change in work of which can be connected with formation of various phenotypic characteristics. To type reliably work of such «critical» genes for different phenotypes, it is necessary to create a database of inter-organ features of profiles of gene expression of animals, conditionally treated as a physiological norm. Such base can serve as a means of initial control.

Thereupon scientists have analyzed profiles of gene expression of pigs (for two organs - liver and kidney, having certain affinity of early stages of histogenesis and bringing significant contribution into control of biochemical homeostasis of multicellular organisms).

In spite of widespread use of DNA-micromatrices for analysis of profiles of gene expression, this method has a series of disadvantages, which can lead to erroneous results. Sources of errors still remain insufficiently studied. One of them, widely discussed - cross hybridization. In research [16] with use of DNA-micromatrices scientists analyzed expression of a series of genes in a liver and a kidney of pigs. Differences between gene expression in cells of kidneys and the same in a liver of pigs correspond to inter-organ functional and histological differences.

Summarized analysis of differences in intensity of expression of genes in a liver and kidneys, differing more than by 20,000 standard units of fluorescence, has allowed to reveal 40 genes, expression of which significantly higher in cells of kidneys in comparison with cells of a liver. And more than half from them – genes, products of which are proteins-receptors or transporters. These compounds are included into plasmatic or mitochondrial membranes, representing themselves a signal system of a cell and directly participating in ion exchange between extra-cellular environment and cytoplasma, and also between cytoplasma and internal mitochondrial matrix.

The obtained data prove possibility of use of DNA-micromatrices for research of laws of formation of cellular and organ phenotypes. It allows to reveal genetic-biochemical foundations of formation of organo-specific

phenotypes, genes bringing crucial contribution into their specificity, to develop approaches to control and regulation of cellular, organ phenotypes. It is also important to take into account potential sources of errors at estimation of expression of genes, belonging to gene super-families, caused by «cross» hybridization of one sample with different cDNA transcripts [16].

Study of changes of profiles of gene expression is used for detection of gene ensembles, transcription of which changes in response to regulatory influence. Besides known genes scientists sometimes monitor casual clones of cDNA, that allows to identify new genes, expression of which is associated with pathological conditions of organs and tissues.

Other authors compared expression of 20,000 genes of prostate tumor and corresponding normal epithelium. 40 genes (0.2%), expression of which essentially differed from norm, were revealed. Among these genes there were already known, participating in carcinogenesis and other tumors [10]. Only few diseases are results of damage of separate genes. In most cases it is necessary to talk about certain predisposition to disease, in connection with presence of a concrete gene mutation. Comparison of genetic information, received at use of DNA-micromatrices, with results of statistical analysis of origin, process and outcome of diseases, can give corresponding keys to interpretation of genetic screening of genomes. Possibility of simultaneous monitoring of change of expression of a great number of genes in strictly controlled conditions opens wide perspectives for functional analysis of a genome as a single whole.

The basic problems at use of these methods - limitations of sensitivity at detection of hybridization signals and specificity of hybridization, difficulties at quantitative estimation of signals and sophisticated data processing for the purpose of interpretation, high cost of DNA-microchips.

Creation of genetic details is already a serial process. The leading center of production of different structures from DNA - E. Winfree's laboratory [12]. The first level is purely mechanical. BioBricks can be created and stored separately, then they can be assembled together and form larger DNA segments. The second level is functional. Each element of this level can send and receive biochemical signals. It allows to change behavior of such construction, simply by substitution of its separate details. Interchangeable components of devices are widely applied at usual assembling.

Analysis of spectra of products of amplification of segments of genome DNA, flanked by inverted repetitions of nucleotide sequences (AG)9C and (GA)9C, is performed for representatives of Bovinae (horned cattle, bisons) and Caprinae (house sheep, bighorn) species [15]. Results revealed in studied genomes presence of DNA-segments, highly-conservative by their length not only within one sub-family, but also between representatives of Bovinae and Caprinae species. This fact testifies to nonrandom positioning of inverted repetitions of short dinucleotide purines of the specified species. Scientists also analyzed polymorphism of fragments of DNA, flanked by terminal segments of retrotransposon similar elements of R173 family, of a series of varieties of rice and wheat. Results testify to absence of equiprobable distribution of different retrotransposon similar elements, belonging to R173 family, along genomes. Polymorphic polylocus spectra, useful for solution of a series of applied problems in gene pool research of cultural plants, can be received

with use of markers, based on estimation of polymorphism of segments of DNA, connected with clusters of different retrotransposon similar elements.

Last years specialists gathered information, confirming the hypothesis about relationship between molecular structure of material of heredity and morphology of chromosomes. Analysis of genome polymorphisms must be performed, taking into account belonging of molecular-genetic markers to families of various genome elements with nonrandom distribution by length of chromosomes, structurally-functional arrangement, and also laws of conservatism/polymorphism and evolution. Use (for research) of certain molecular-genetic markers can lead to essential distortion of results at extrapolation of received data to genome variability.

It is supposed that the volume of the market of nanotechnologies in 10-12 years will be equal to the same of the market of information technology. Nanotechnologies are recognized driving force of science and engineering of the 21st century. According to estimates, by 2015 the world market of nanotechnological products will make trillion dollars, and labor demand in this sphere will grow up to two million people. It is important to mark out one more special feature, connected with development of nanoscience, namely, its interdisciplinary character. Here many approaches and methods of research of physics, chemistry, biology and material science are closely interlaced. Successful development of nanoscience in conditions of diversity implies cooperation of scientists from different areas of research. Interdisciplinary approaches require perfection of education and training of specialists for work in this sphere. And the good example in this matter – database, containing information about 160 projects of use of nanotechnologies in agriculture under the aegis of the FAO [13]. The majority of them is connected with food-processing industry, use of nanomaterials for food packaging or for revealing and, in some cases, even for neutralization of dangerous toxins, allergens or pathogens. Specialists develop projects on production and improvement of food additives. For example, production of vegetable oil with nano-additives results in clustering of fat acids and hinders cholesterol accumulation in blood. Special additives make chocolate fine-dispersed. The other group of projects is focused on development of efficient agro-techniques. Scientists also develop different projects with use of nanomaterials for safe delivery of pesticides and fertilizers to corresponding targets. In animal husbandry they study methods of application of nano-additives for reduction of doses of growth mixes and hormonal preparations, neutralization of pathogens at early stages of their contact with animals.

In such projects they engage:

- transport processes - nanomaterials as agents of transport of chemical compounds, molecules;
- bioselecting surfaces - nanomaterials with increased or decreased ability of binding with specified molecules or organisms;
- bioseparation - nanomaterials or nanoprocesses, inducing separation of molecules, biomolecules or organisms;
- microelectromechanical systems (MEMS) allow to study channels and surfaces, flows of substances through them;
- nanobioprocessing - use of nanotechnologies or biotechnological processes for creation of substances with desirable properties. Bioengineering of nucleic acids - use of DNA as blocks for creation of nanoparticles or nanoparticles themselves for genetic engineering.
- address delivery of substances - use of nanomaterials for delivery of substances to cells-targets of animals;
- modeling - use of nanotechnologies for construction of models of nanomaterials and their applications in complex systems.

By directions of research the following projects can be mentioned:

- Biosensors - use of nanotechnologies for control of biological processes or biomolecules.
- Environment protection («green» engineering) – use of nanotechnologies for analysis of a current state of environment, removal of pollutants, remediation or recycling of waste.
- Use of nanotechnologies for reduction of agricultural influence on environment, potable water, production with use of power efficient methods.
- Use of nanotechnologies for revealing of pathogens in environment, in organisms of animals, plants, forage, final agricultural products.

- Plant growing / animal husbandry - use of nanotechnologies for improvement of reproduction and for selection work, including methods of transgenesis or cloning; improvement of resistance of plants to weeds and pests, herbicides and insecticides, different temperatures, drought, other unfavorable factors of environment, and also for use of plants for bio-fuel production.
- Low-temperature drying with decontamination of seeds/yield.
- Veterinary medicine - use of nanotechnologies for improvement of health of animals, safety of cattle-breeding production, specific microclimate creation.
- Food bioprocessing - use of nanotechnologies for increase of nutritive value, improvement of technologies of food processing and growth of food quality, production of dietary food, and also for development of methods of ultra-filtration, allowing to control color, aroma and other specific properties of products.
- Nano-bioindustrial products - use of nanotechnologies for production of products, necessary for engineering industries (from agricultural cultures/species, products or waste).
- Agricultural machinery – nanopowder materials, increasing lifetime of machines; hardening of cutting tools; nanoadditives to tires, oils; reduction of harmful emissions.
- Nanoelectrobioengineering – use of nanoparticles for modification of biological and physiological processes at a level of cells due to influence of electrons, protons, ions, photons; optical irradiation of agricultural objects.
- Nanomembranes and nanofilms - light-converting films, membranes for air and water treatment, desalination of sea water; films with silver nanoparticles for bactericidal filters, including equipment for milk industry, and also as packing materials; use of silatranes, silicon-organic biostimulators; development of self-cleaning membranes.

Fundamental research must be focused on solution of practical problems. Concrete applied implementation is impossible without deep scientific analysis. Appearance of nanoscience corresponds to modern development of natural sciences.

The volume of annual investments into the SER-3 is estimated at the level of 20-50 bln. dollars. It is expected that use of its advances will form a basis for sustainable development, declared at the World Summit, held under the aegis of the United Nations in Johannesburg (South Africa) from 26 August to 4 September 2002. The corresponding Declaration of heads of the states, accepted at the summit, is finished by the following words: «From the African continent, the cradle of humankind, we solemnly pledge to the peoples of the world and the generations that will surely inherit this Earth that we are determined to ensure that our collective hope for sustainable development is realized.» [7].

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Influence of nanostructured agents on corn crop capacity in the Lower Povolzhye (Volga Region)

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Increase of productivity and improvement of stability of agroecosystems requires development of high-tech management of agricultural cultures growing [1, 4, 6]. Use of regulators of growth and various microelements is perspective enough, since they help to solve problems of regulation of natural processes in plants and to implement their genetic potential by maximum [1-4].

To supply plants with required to them elements it is reasonable to use nontraditional agrochemical raw materials and corresponding local resources. In this matter bischofite (deposits of which are located in Volgograd oblast) belongs to a series of the most useful natural minerals [5]. This is a mix of 70 macro- and microelements. The basis of bischofite (up to 96%) - magnesium chloride. Exactly magnesium controls intake of nutrients in plants, it is in ferments, inducing synthesis of protein, carbohydrates, lipids, some other substances.

Results of research allow to draw a conclusion about a promising character of this natural salt (bischofite) as a source of microelements. Bischofite in small doses stimulates development of plants, promotes increase of their resistance to harmful organisms and maximum yield, differs by low toxicity, high technological effectiveness [2, 4].

Use of an electrochemically nanostructured agent on the basis of a bischofite water solution (ENBS), produced by electrochemical treatment of a water solution of this mineral with use of a copper anode, became a new trend in this area of agriculture. As a result, scientists create colloidal (nanoscale) structures, containing hypochlorite and hypobromite-ions of magnesium and copper, assembled into micelles with size of 20-90 microns with hydroxide dispersions on the basis of magnesium and copper. They are very active in interaction with plants. Corresponding ENBS-ions of such agents participate in the process of regulation of transition of nutrients and vital activity products through cellular membranes.

To reveal the most efficient nanostructured solutions for preseeding treatment of seeds in the CF «Olejnikov Nikolay Nikolaevich» researchers have performed experiments on light-brown soils

Variety	Variant	Phenology				Crop characteristics		
							Crop quality	
		Shoots (October)	Tillering (September)	Heading (May)	Wax ripeness (June)	Crop capacity, t/h	Grain-unit, g/l	Mass of 1000 grains
Donskoy surpriz	1	12	25	11	21	0.398	802	39.2
	2	10	24	11	21	0.393	804	39.2
	3	8	22	10	20	0.367	801	38.8
Tanais	1	16	25	11	21	0.392	921	37.2
	2	14	25	12	21	0.397	822	37.3
	3	9	25	12	20	0.398	819	37.1
Don-95	1	9	24	12	21	0.340	809	41.6
	2	10	24	13	21	0.372	812	43.0
	3	9	23	12	20	0.387	813	42.6
Don-93	1	10	23	15	22	0.350	818	41.3
	2	8	23	15	22	0.366	817	41.7
	3	9	23	16	21	0.361	819	43.1
Garant	1	12	26	18	27	0.399	786	36.4
	2	11	26	18	27	0.389	788	36.9
	3	10	25	17	26	0.391	790	36.2
Donskaya unbearded	1	17	27	22	23	0.352	798	43.8
	2	16	27	22	27	0.358	804	41.3
	3	16	26	22	27	0.348	803	41.6
HCP095						1.6		
Accuracy						2.3		

Table 1. Influence of preseeding ENBS-treatment of seeds on phenology and crop capacity of winter wheat.
Note: 1 - Premis, 1.2 kg/hectare; 2 - 10.6 kg/hectare of Premis + 1/2 ENBS, 5%; 3 - ENBS, 10%.

of Kalachevsky region (Volgograd oblast). Objects of the research - winter and summer wheat. The control sample – a field, sowed with seeds, treated by common water. The area under experimental plants - 10 hectares. Treatment of seeds was carried out one day prior to seeding.

Treated seeds were wet by touch, but already 30-40 min later the solution was completely absorbed. Use of ENBS excludes necessity of introduction of special glues into working fluid. The agent differs by good adhesiveness. The working solution completely envelops seeds, penetrates into seeds and reliably protects cracks and microdefects of a germ from a pathogenic microflora, ground mites and rotting. For this compound high hygroscopicity is typical. It provides good moistening of seeds, not interfering their germination.

Application of high norm of consumption of the working solution (up to 15 l/t) is inexpedient, since this results in seeds sticking, complicating seeding. The most efficient formulation - 10 l/t.

ENBS provides appearance of amicable and leveled corn shoots, germination grows by 1.3-5.6%. Use of such solutions for treatment of poor quality seeds leads to increase of germination by 8.0-13.7%. High enough results of stimulating influence of an electrochemically nanostructured solution of bischofite can be explained by intensification of biological processes due to use of additional energy and nutrients.

The high effect is registered at use of ENBS solution for preseeding treatment of seeds of winter wheat. Shoots occur 1-5 days earlier in comparison with standard samples (Tab. 1). The tillering phase also takes place in 1-2 days. At later stages, defining efficiency of crops (heading and wax ripeness), solution action is less expressed. It is necessary to mark out that the period of vegetation of winter wheat under the influence of ENBS is shorter and more intensive. It is important for arid regions, since influences associativity of development of pests of winter wheat, leading to weakening of biocoenotic relations between them.

Treatment of seeds by ENBS promotes development of large number of caulises, including productive, and crop capacity increase for separate varieties reaches 0.6-4.7 centner/hectare.

The gain of crop after treatment of seeds with such nanostimulator and its mix with Premis is received due to larger amount of plants, remained in good conditions to time of harvesting, better tilling capacity and a larger number of grains in an ear. By mass of 1000 grains and grain-unit there are no significant distinctions between standard and experimental variants.

At analysis researchers also marked out different responsiveness of varieties of winter wheat to ENBS-treatment. More expressed influence of the nanostimulator is registered for Donskoy surpriz, Tanais and Garant. Varieties Don-95 and Don-93 have shown significantly smaller responsiveness.

In these experiments scientists also estimated efficiency of ENBS-spraying of grain crops at a tillering stage in comparison with spraying by a special stimulating solution, containing, alongside with microelements, biologically active components. Experiments have shown that use of the nanostimulator promoted decrease of phytophages populations on crops (in 1.9-7.89 times) and suppression of vital activity of infection agents: Septoria, Ascochyta, Puccinia, Sphaceolotheca cruenta (in 1.2-4.3 times). Only leafhoppers equally reacted to application of the specified sprays. ENBS solution to a greater extent stimulated attraction of indifferent, parasitic and predatory insects to crops. Their concentration for this variant was, accordingly, by 24.1 and 26.0% higher, than at use of ENBS.

Thus, growth of phytosanitary efficiency of ENBS and high economic effect are provided due to application of the innovative nanostimulator in a mix with pesticides.

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Application of seleno-organic feed supplement DAFS-25к in animal husbandry and poultry farming in Russia

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Closed Joint-Stock Company (CJSC) «Sulfat» is created in 1992 for R&D in the area of seleno-organic feed supplements production.

The purpose of functioning of the CJSC «Sulfat» - organization of industrial production of artificial and synthetic feed supplements, veterinary preparations on the basis of seleno-organic feed additive DAFS-25к.

During more than 15 years specialists of this organization work in the sphere of introduction of food additive DAFS-25к in veterinary science and medicine, create industrial technologies of DAFS-25к synthesis. The result of this research – development of scientific foundations and regulations of DAFS-25к synthesis. Scientists have developed special equipment, in which high-scale transfer with ratio 1:100 is implemented, that allows to launch industrial synthesis of DAFS-25к. DAFS-25k production technology is protected by a series of Russian patents.

CJSC «Sulfat» is ready to produce DAFS-25к for corresponding consumers: cattle-breeding and poultry-farming companies, producers of mixed fodders, premixes and protein-mineral vitamin additives (PMVA), pharmaceutical enterprises.

Introduction

Growth of production of high-quality animal husbandry and poultry farming products in conditions of membership of Russia in the WTO is one of the most important and challenging tasks of Russian agriculture.

One of main preconditions of increase of cattle and poultry productivity - well-balanced, high-grade feeding, provided due to improving of quality of feed, optimum ratio of different nutrients and enrichment of feed with corresponding supplements, biologically active additives (BAAs) at minimization of expenses.

The special attention at cattle and poultry feeding is paid to use of ecologically safe, biologically active additives with favorable impact on metabolism and growth of productivity. In practice it is used more than 150 various substances, promoting more economical feed consumption at significant growth of cattle and poultry productivity.

Nowadays interest of researchers to selenium (microelement, required for normal vital activity of organisms) continuously grows. Selenium is widely used in various industries, pharmacology and agriculture. It is a very important ultra-microelement for all organisms and it is a structural component of major ferments,

participating in oxidation processes of organisms of animals and a human. Its deficiency inevitably invokes functional disorders of cattle and poultry. The important biological role of selenium requires its presence in cattle and poultry feed.

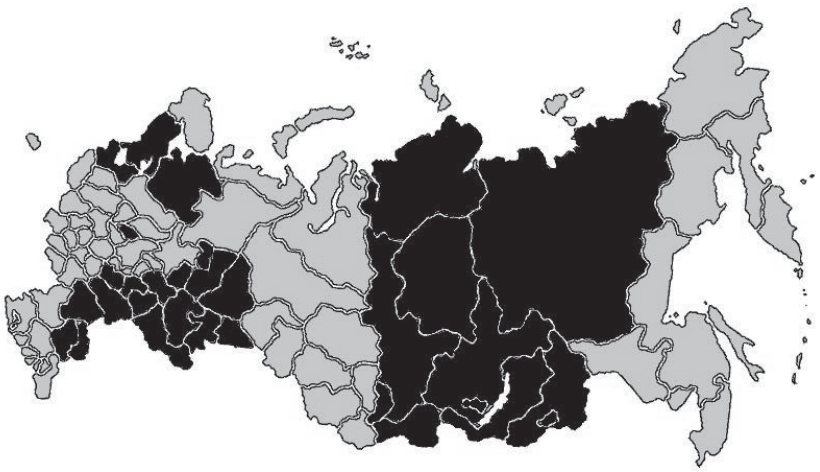

Fig. 1. Selenium-deficient regions of Russia

Selenium participates in processes of tissue respiration and oxidative phosphorylation, plays a role of a regulator of enzymatic reactions, improves immunity, hampers peroxide oxidation of fatty acids and accumulation of toxic substances. Thereby it normalizes metabolism in organisms of domestic animals. Selenium is efficient enough for prophylaxis and treatment of over 20 animal diseases, including some kinds of muscular dystrophy, known by its bactericidal and anthelmintic activity.

Ability of small doses of selenium to accelerate metabolic processes allows to use it as a specific means for increase of productivity of domestic animals and improvement of quality of corresponding agricultural products.

Results of numerous experiments testify to interrelation between vitamin E and selenium in organisms of domestic animals. In small doses supplements on the basis of selenium act like vitamin E. They participate in tissue respiration and oxidative phosphorylation, perform antioxidation and antitoxic functions in synergistic interaction with vitamin E.

Availability of selenium depends on nature of a concrete composition. Inorganic forms of selenium are more toxic, than organic. The level of safe consumption of inorganic selenium is significantly lower in comparison with the same of its organic forms. Therefore for prophylaxis of selenium-deficient diseases it is better to use organic forms of this element.

According to information of the Institute of Nutrition of the Russian Academy of Medical Sciences (Moscow) and results of clinical research, practically all regions of Russia suffer from deficiency of selenium. The most selenium-deficient zones - Arkhangelsk, Leningrad, Murmansk, Sverdlovsk, Perm, Chelyabinsk, Tyumen, Omsk, Novosibirsk, Irkutsk, Chita, Kemerovo, Magadan, Amur oblasts, Krasnoyarsky, Khabarovsky, Primorsky Krais, Bashkirskaya, Tatarskaya, Sakha-Yakutia, Komi, Mariyskaya republics. In many regions of Russia deficiency of natural selenium is aggravated by low content of this element in soils. In the Fig. 1 selenium-deficiency regions of Russia are marked by black color.

In the world there are many selenium-deficiency regions, including Asia (especially China), the USA, Canada, Germany, a series of other countries.

Estimate of annual demand for selenium in veterinary medicine is represented in the Table 1.

In a series of countries national programs of elimination of selenium deficiency are successfully implemented. For example, in Finland since 1981 selenium is an obligatory component of fertilizers, used for growing of cereal and feed crops. In the USA, England, France, Holland, other countries selenium is applied as a supplement for cattle and poultry feeding. Agricultural companies mainly use for this purpose selenium-containing feed additives.

There are two types of such additives for animal husbandry and poultry farming:

- on the basis of sodium selenite;
- on the basis of selenium-containing compounds (selenomethionine, selenocysteine, etc., for example: DAFS-25к, Sel-Plex of the «Alltech» (USA).

1. Feed supplements on the basis of sodium selenite

For provision of required content of selenium in cattle and poultry feed Russian farmers widely use sodium selenite and corresponding additives on its basis with anticoagulation and antitoxic properties. Sodium selenite, as a strong antioxidant, inhibits formation of peroxide compounds, hampers reoxidation of fatty acids and accumulation of toxic reoxides, thereby it normalizes metabolism. It is also an immunomodulator.

Main disadvantages of such additive - its high toxicity (the 1st class of danger) and bad assimilability of selenium (30%) by organisms. More over, being an oxidant, it can react with some feed components (fats, vitamins), and that worsens nutritional value of this product.

The number of sodium selenite producers in the Russian market is small enough. They offer basically import products of European companies, so distributors significantly raise prices for such products.

Country	Consumption of elementary selenium, kg	Demand for selenium (in terms of DAFS-25 volumes), kg
USA	47 500	190 000
Canada	2 000	8 000
South America	1 500	6 000
Belgium	1 000	4 000
Denmark	900	3 600
Germany	2 500	10 000
Italy	900	3 600
Holland	1 000	4 000
Portugal	325	1 300
Spain	800	3 200
Sweden	450	1 800
Great Britain	1 575	6 300
Eastern Europe	3 500	14 000
Australia	1 400	5 600
China	42 000	168 000
New Zealand	600	2 400
Other	1 950	7 800
TOTAL	109 900	439 600

Table 1. Annual world demand for selenium. Source: Noranda Sales Corporation, Ltd.

Other selenium-containing additives are also represented in our country, for example: Neoselenium, Selenium Alga Plus, Selenium VEL, Aqua Selenium, BioSelenium, Life Selenium Plus, etc., in their basis there is sodium selenite (as an active substance).

There is a series of supplements (basically produced in the Great Britain), widespread in Europe, but a little known in the Russian market: Permasel C Seleium pellets (Copper Animal Health Ltd), Selendale (Arnolds Veterinary Products), Dystosel (Intervet UK Limited), Vitesel (Norbrook Laboratories (GB) Limited), (Rycovet Limited), Seleen (Sanofi Animal Health Ltd), Rycovet Deposel, Rycovet Widespec Drench, Rycovet Duospec Drench (Rycovet Limited), in which the main active substance - inorganic compounds of selenium.

2. Feed additives on the basis of selenium-containing compounds

Supplements on the basis of selenium-containing compounds are much more efficient in comparison with feed additives on the basis of sodium selenite, however they differ (all over the world) by high prices, explained by technological complexity of production of such additives.

2.1 Supplement DAFS-25k of the Russian company CJSC «Sulfat»

Seleno-organic supplement DAFS-25k represents itself a special substance for production of veterinary preparations and pharmaceuticals, and also feed and food additives on its basis (Fig. 2).

DAFS-25k (diacetophenonylselenide - bis(benzoylmethyl)selenide) is a fat-soluble supplement, developed for compensation of deficiency of selenium in nutrition of cattle and poultry, providing increase of their productivity and improvement of health. It serves for treatment and prophylaxis of diseases, induced by insufficiency of selenium in organisms of cattle and poultry, promotes digestion of some vitamins (especially

vitamin E), is a medical product for prophylaxis of white muscle disease, toxic dystrophy of a liver of lambs, pigs, calves, poultry, exudative diathesis of chickens.

More over, DAFS-25k can be used for treatment and prophylaxis of some infectious diseases and poisoning. It has antifungal activity to molds (Aspergillus, Penicillium), at the same time it does not suppress gut microflora. It has immunostimulating and general health-improving action, and that renders a positive effect at diseases, poisoning of other etiology. DAFS-25k has strongly pronounced antioxidant properties.

DAFS-25k represents itself a free-flowing powder (from white to light yellow color) with slight specific odor, it is not water-soluble. Time of its full dissolution in olive oil at 70°C - 8-10 min. In the Fig. 2 there is a chemical formula of DAFS-25k.

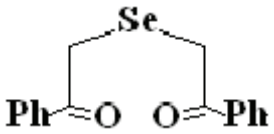

Fig. 2. Chemical formula of DAFS-25k. Mass concentration of bis(benzoylmethyl)selenide - not less than 95%. Mass concentration of selenium in bis(benzoylmethyl) selenide - 25%. Melting point - 68-72°C.

Application of DAFS-25k in medicine is also possible, it can be used as a drug for treatment of diseases of a thyroid gland, gynecologic, cardiologic, oncologic and other health problems. For medical purposes pharmaceuticals can be produced with content of the main substance of 98-99%.

The Ministry of Agriculture and Foodstuff has approved Technical specifications and Regulations on application of DAFS-25k as a feed supplement.

Pharmacological properties of DAFS-25k

Supplement DAFS-25k participates in tissue respiration and oxidative phosphorylation, has antitoxic properties, hampers formation of peroxidates, accumulation of toxic substances in an organism, promotes increase of activity of ferments of glutathione peroxidase (GPx).

As a feed additive DAFS-25k performs the following functions:

- compensates for deficiency of selenium in feed;
- normalizes protein, carbohydrate, lipidic and mineral metabolism;
- enhances metabolic processes in organisms of cattle and poultry;
- increases content of immunoglobulin in blood;
- improves resistance of an organism to infectious diseases;
- display high antioxidant activity;
- has strongly pronounced antitoxic reaction to mycotoxins and heavy metals compounds;
- indifferent to components of feed admixtures.

According to classification of Hodge&Sterner the drug belongs to the 3rd class of dangerous substances (moderately toxic substances).

It can be treated as a substance with slightly expressed cumulative properties (4th class according to L. I. Medved and co-authors classification, 1968).

Assimilability of selenium from DAFS-25k is at the level of 76-100%. The preparation significantly improves poultry immunity. For example, histological research has demonstrated that poultry, receiving DAFS-25k since the first day and to 110-day age (dosage of 1.6 mg/kg of feed), have volume of lymphatic follicles, exceeding the same of control chicken in 2-3 times. It testifies to activation of corresponding immunological centers - lymphatic follicles and promotes growth of resistance to various agents of infection.

The drug with the specified dosage does not accumulate in organisms of animals and has high biological activity, therefore it can be applied from the beginning and till the end of a production cycle with dosage of 1.6 g per 1 t of feed.

To provide uniform distribution of DAFS-25k in feed, it must be added step by step or in a vegetable oil solution, mixed to feed.

Production of DAFS-25k

DAFS-25k production technology is developed by specialists of the CJSC «Sulfat». In its basis - a method of synthesis of 1,5-diphenyl-3-selenopentadion-1,5-dions with good output on the basis of interaction of an initial ketone with H_2SeO_3 with subsequent reduction of a selenium-containing dichloride.

Optimum conditions are experimentally discovered: corresponding temperature conditions, parameters of a reactionary medium, ratio of reagents and reaction time. It allows at maximum simplicity of the process to produce dichloride of a selenium-containing diketon with output up to 90% and purity, sufficient for its reduction into a final diketon without additional purification.

The technological process of DAFS-25k production consists of the following basic stages:

- raw material receiving and feeding;
- production of di-(acetophenonyl) selenide dichloride (DAFSDH);
- production of raw DAFS;
- crystallization of DAFS from a solution;
- pressing of DAFS suspension;
- DAFS drying and powdering;
- finished product packing;
- wastes collection and recycling;
- isopropyl alcohol regeneration.

The special feature of the developed technology - simplicity of production and applied substances, high output of the product, high coefficient of usage of raw materials and low power consumption of the technological process (fine organic synthesis).

Influence of DAFS-25k on exchange processes

At DAFS-25k dosage at the level of 1.6 mg per 1 kg of feed, antioxidant status of cattle and poultry significantly grows. For example, activity of ferments of glutathione peroxidase, catalase, superoxide dismutase in blood of broilers chicken increases in 1.5-2 times, at the same time content of superoxide-anion-radical in blood also increases, and that implies activization of exchange processes in an organism.

Correlation of intensity of exchange processes with a level of free-radical processes is represented in the Fig. 3.

The interval of free radical concentration AB is a «zone of activation» of exchange processes. In this zone a level of free-radical particles does not influence significantly architecture of bio-membranes and, correspondingly, does not change their permeability for building and power materials, and also activity of membrane-linked ferments.

The role of DAFS-25k in this matter - increase of a degree of reliability of bio-membranes at attacks of many free-radical particles. It is provided due to activation of glutathione peroxidase, catalase and superoxide dismutase, maintenance of functioning of molecular «liporoscopes» - vitamins E and A.

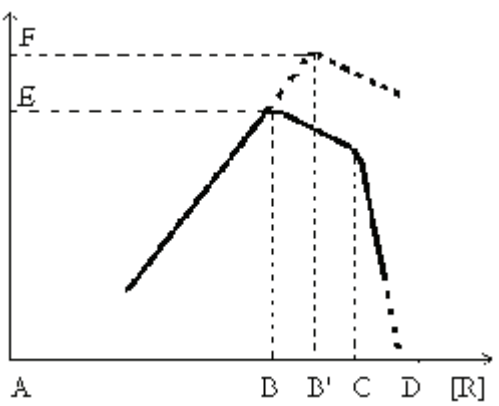

Fig. 3. Correlation of intensity of exchange processes and concentration of free radicals.

Improvement of reliability of membranes under the influence of DAFS-25k allows to extent the «zone of activation» by the interval BB', and that leads to shift of intensity of exchange processes from the level E to the higher level F.

Stimulating effect of DAFS-25k is implemented due to increase of a degree of «insensibility» of bio-membranes to damaging influence of free radicals. This is a basic difference of DAFS-25k from other endogenous and exogenous antioxidants: vitamin C, thiols, ionol, santochinum, ethoxyquin, which can only intercept active free radicals, suppress them due to transfer of an electron or an atom of hydrogen and transform them into their low-active radical forms.

The interval of positive influence of DAFS-25k on metabolism is an «inhibition zone» (BC) or a «pathogenic zone» (CD), where a level of concentration of free-radical particles grows up to such extent, that it can induce inhibiting influence on metabolism or block it due to oxidative decomposition of bio-membranes.

The character of stimulating influence of DAFS-25k (activation of reserve potential of an organism) predetermines expediency of its use as a growth-promoting agent. It is necessary to underline that provision of a metabolism activation process with selenium can be implemented only under conditions of supply of an organism with required nutrients and at presence of reserve potential of animals. Probably for this reason a growth-promoting effect of DAFS-25k can be traced most clearly at its application for young animals. Use of DAFS-25k for mature animals with exhausted resource potential is justified only for veterinary purposes or when it is required to extent their productive periods due to specific gerontological features of DAFS-25k.

DAFS-25k is not recommended for application together with antioxidants.

Joint application of DAFS-25k and antioxidants leads to decrease of cattle and poultry productivity.

This drug, as an antioxidant, protects membranes of cells from devastating influence of free radicals, while usual antioxidants intercept free radicals and suppress them.

Joint application of sodium selenite and DAFS-25k is prohibited. Sodium selenite, being an oxidant, oxidizes DAFS-25k in a stomach. As a result, elementary selenium, not assimilated by an organism, and a series of products of destruction are formed, their influence on an organism can not be predicted.

Correct assessment of DAFS-25k, as a growth-stimulator of animals, is extremely important. It is obvious that the maximum effect of stimulation of an organism by DAFS-25k for normal feeding and content of selenium is provided at concentration of DAFS-25k at the level of 1.6 mg per 1 kg of feed. Prescription to increase DAFS-25k dosage is reasonable at any stressful situation of cattle and poultry.

Efficiency of DAFS-25k use in animal husbandry and poultry farming

Influence of DAFS-25k on reproductive functions of cows.

Introduction of 9 mg of DAFS-25k per day during 60 days before calving into ration of cows yields the following results:

- number of cases of placenta retention after birth decreases;
- endometritis cases after calving met rarely;
- service-period reduces.

Intramuscular introduction of oil solution of DAFS-25k 3 times (dosage 90 mg per a cow) 60, 30 and 15 days prior to expected calving displays the following results:

- placenta retention after birth is prevented;
- endometritis cases after calving met rarely;
- number of days of infertility decreases;
- mastitis cases after calving met rarely;
- metrorrhagia is prevented.

Efficiency of DAFS-25k application in swine breeding.

Growing of young pigs:

- growth acceleration;
- more efficient feed digestion and assimilation;
- reduction of murrain in the course of fattening;
- more uniform development of animals;
- reduction of susceptibility to stress and growth of resistance to infectious diseases.

Pigs fattening:

- acceleration of pigs growth;
- more efficient feed digestion and assimilation;
- reduction of murrain in the course of fattening;
- reduction of susceptibility to stress and growth of resistance to infectious diseases;
- improvement of amino-acid composition of meat;
- increase of slaughter weight.

Efficiency of DAFS-25k application in poultry farming.

Broilers:

- increase of slaughter weight;
- improvement of general well-being;
- reduction of susceptibility to stress and growth of resistance to infectious diseases;
- more efficient feed assimilation and, as consequence, their saving;
- improvement of amino-acid composition of meat.

Hens-layers:

- growth of egg production;
- feed saving;
- reduction of susceptibility to stress;
- increase of a number of hatching chickens from incubatory eggs;
- improvement of vitamin composition of incubatory eggs;
- improvement of categories and quality of eggs.

2.2 Other seleno-organic additives

Sel-Plex of the American company «Alltech, Inc.»

Supplement Sel-Plex of the company «Alltech» (USA) can be considered as a competing preparation for DAFS-25k. This additive is produced by a microbiologic method – it is extracted from yeast cells at processing of sodium selenite and selenate by microorganisms.

It contains selenium mainly as a structural part of amino acids of selenomethionin (50%) and selenocysteine (25%), and also as a structural part of other organic compounds. General content of selenium in Sel-Plex - 1000 mg/kg. It raises antioxidant status of an organism and viability of young animals, increases productivity at presence of mycotoxins in feed, improves plumage of poultry.

The main disadvantage of Sel-Plex - its high toxicity (1st class of toxicity) and bad removal of such selenium from an organism. Price for Sel-Plex - 8.64 US dollars for 1 kg. Thus, price of one ton of mixed fodder is increased by 2.6 US dollars, i.e. it is in 3.7 times more expensive, than with DAFS-25k.

Selenium 1000; Selenium 2000 of the company CENZONE, the USA

Natural feed additive for agricultural animals which composition, including organic selenium and living yeast (analogue of Sel-Plex). It promotes removal of toxicants from an organism, raises immunity, enhances processes of self-regulation of an organism, provides high productivity.

Composition:

- Yeast: Saccharomyces cerevisiae;
- Organic selenium - 1000 and 2000 mg/kg;
- dried up extract of yeast, cultivated in the medium, containing corn, molasses and sugarcane.

3. Comparison of DAFS-25k and other selenium-containing additives

Efficiency of DAFS-25k is higher than the same of sodium selenite and Sel-Plex due to the best assimilability and lower toxicity. (In the case of sodium selenite and Sel-Plex at increase of dosage (up to levels higher then recommended) toxic effects prevail over positive).

DAFS-25k contains selenium in its bivalent state and practically has no an oxidation level. Sodium selenite and other selenium-containing inorganic compounds contain this element in its oxidized (four- or hexavalent) form, and that lengthens its assimilation chain and leads to its very high toxicity. According to one of theories, sodium selenite in a stomach reduces with formation of hydrogen selenide (substance more toxic than hydrocyanic acid), and then bivalent selenium is assimilated from hydrogen selenide.

According to information from scientific literature, sodium selenite has antitoxic properties, but larger dosage of sodium selenite is lethal.

DAFS-25k favorably differs from sodium selenite by its significantly smaller toxicity (more than in 20 times in terms of elementary selenium) and inertness to components of fodder mixes, that allows to extend a therapeutic range and to achieve the best results. More over, in DAFS-25k selenium is in its organic (i.e. more useful to an organism) form. Tests3 have demonstrated that the positive effect from application of DAFS-25k surpasses effect from application of sodium selenite.

According to information of VNITIP introduction of DAFS-25k into diet of broilers with recommended dosage of 1.6 g per ton of mixed feed decreases cost price of 1 kg weight gain by 1.5%, and at dosage of 3.2 g per ton of mixed feed - by 4%.

At estimation of efficiency of preparations it is proved that DAFS-25k dosage of 1.6 mg per 1 kg of chickens-broilers feed leads to increase of live weight (at age of 49 days) by 4.2%, and use of sodium selenite with dosage of 0.4 mg per 1 kg of feed - to increase of live weight only by 3.2%.

More over, under the influence of analyzed supplements dimensions of internals of chickens, including their gastrointestinal tract (length and mass of bowels), increased. This increase at application of DAFS-25k made up to 37%, and at use of sodium selenite - up to 20%.

At DAFS-25k addition into diet of parental chickens with dosage of 1.2-1.6 mg per 1 kg of feed and sodium selenite addition (for the same group of hens) with dosage of 0.4 mg per 1 kg of feed improvement of egg production of hens-layers has been clearly traced.

At analysis of efficiency of application of studied selenium-containing drugs it is necessary to notice that production price at use of DAFS-25k and sodium selenite was below the medium price by enterprises. The supplement DAFS-25k, application of which has been started in poultry farming recently enough, by its influence on productivity indices, assimilation of nutrients and hematological parameters of incubation has some advantages versus sodium selenite.

Research of FGOU VPO «S.-Petersburg State Academy of Veterinary Medicine» in the area of comparison of supplements DAFS-25k and Sel-Plex has shown that these additives have the similar effect on an immune system of poultry, enhance mechanisms of immunity of hens-layers at purposeful and efficient struggle with selenium deficiency.

Taking into account that application of DAFS-25k in poultry farming and animal husbandry is efficient enough, and removal of antioxidants and adsorbents from feed mixes leads to additional lowering of feed price, such circumstances make DAFS-25k even more attractive.

Potential demand for DAFS-25k from the side of the Russian animal husbandry and poultry farming is estimated at the level of 106 tons per year, and probable consumption – 15.56 ton.

Practice of promotion of DAFS-25k in markets shows that enterprises, which have started to use DAFS-25k, have refused to apply sodium selenite and Sel-Plex.

Novelty and competitiveness of DAFS-25k and corresponding technologies of its production provide high export potential of products of CJSC «Sulfat».

Conclusion

CJSC «Sulfat» consistently promotes its product DAFS-25k in the Russian veterinary market as a seleno-organic feed supplement. This preparation distribution has been started from poultry farms of the Saratov oblast. Now DAFS-25к is applied by agricultural enterprises of seven oblasts of Russia.

Tests of selenium-containing drugs have demonstrated all advantages of DAFS-25k, which is an efficient antioxidant at a cell. It is efficient at mycotoxicosis of cattle and poultry. Enterprises, which apply DAFS-25k, remove antioxidants and adsorbents from an animal diet (adsorbents are introduced for adsorption of mycotoxins), and that reduces the price of each ton of mixed feed by 8-10 US dollars. Thus, at application of DAFS-25k not only a selenium-containing additive, but at the same time an efficient enough antioxidant and an antidote (neutralizing action of mycotoxins), is introduced. (Diets with application of sodium selenite and Sel-Plex do not show such effects).

Currently analysis of biological potential of DAFS-25k is carried out in the Branch of VIZH (Tambov), Saratov Agricultural Academy, Saratov Medical University, Scientific Research Institute of Cattle Breeding (Mytischi), Izhevskaya Agricultural Academy, Penzenskaya Agricultural Academy, Krasnodarsky Scientific Research Institute of Veterinary Science, GU Volgogradsky NITI of Milk-Meat Cattle Breeding, VNITIP (Sergiev Posad).

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ROMANIA

Pregnancy diagnosis and identification of fetal structures in domestic buffaloes by ultrasonography

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Introduction

Buffalo farming represents an old rural tradition in Romania, the total number of individuals being around 60,000, with the most significant herds found mostly in Transylvanian counties (Velea and Zanc, 2010). Buffalo milk production is approximately 1700 liters per lactation (Noakes et al., 2009), with 132 kg of pure fat and fat percentage of 7.49% (Rosati and Van Vleck, 2002).

The traditional concept about this species is that they have low reproductive indexes, due to late maturity, poor expression of estrus with variable duration, and prolonged calving interval (Kanai and Shimiazu, 1983; Madam and Raina, 1984; Baruselli et al., 1994; Madam, 1998; Singh et al., 2000 cited by Chaikhuna et al., 2010).

Nevertheless, if managed properly and well fed, buffalos can have acceptable fertility rates (Chaikhuna et al., 2010). Although artificial insemination is practiced quite often, it's drawback is represented by difficult estrus detection (Drost, 2007).

Management of pregnant domestic buffalo females is generally inadequate because of natural mating and extensive farming systems. This leads to low fertility rates and poor reproductive indexes, materialized in low productions. (Groza and Muntean, 2002). Ultrasonography represents a modern tool that allows practitioners to rigorously examine multiple fetal parameters during gestation (Ali and Fahmy, 2008).

Ultrasounds help in early pregnancy diagnosis and identification of twins, assessment of ovarian and uterine disorders, and fetal sexing (Fricke, 2002). The early diagnosis of pregnancy allows a shortening of the service-period, with direct implications on production and

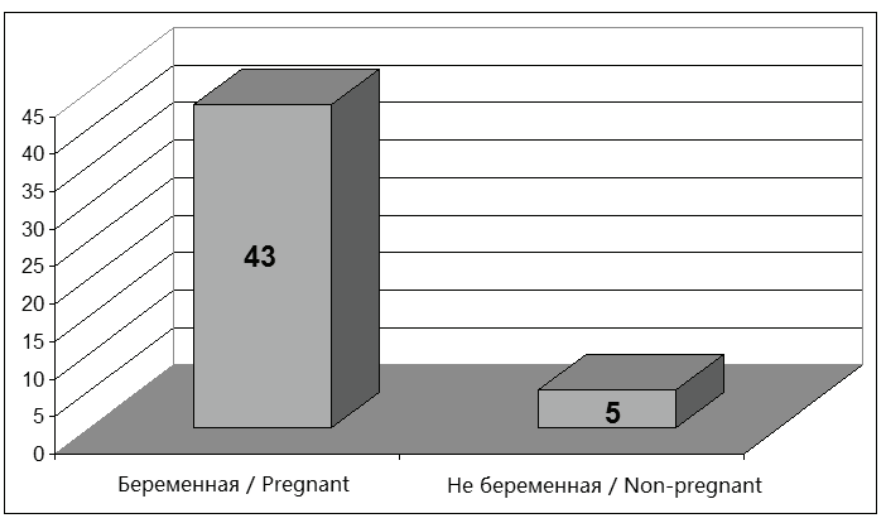

Chart 1. Results of the ultrasound pregnancy diagnosis

reproduction in buffaloes (Groza et al., 2006, Tomai, 2012). The purpose of our research was to implement ultrasonography for early pregnancy diagnosis in domestic buffalos and to provide an ultrasonographic guide to fetal buffalo anatomic structures in different stages of pregnancy (Fig. 1).

Materials and methods

A total of 48 domestic buffalo females, 3 to 5 years of age, were artificially inseminated 12 and 24 hours after the onset of standing heats.

Pregnancy diagnosis was carried out beginning with the 25th day post-insemination using a portable ultrasound scanner (Mindray DP 2200 Vet) equipped with an endorectal linear transducer.

The females in which positive pregnancy diagnosis was established were regularly examined until day 90 of pregnancy, in order to observe fetal development, perform measurements and identify the main organs and other anatomic structures.

Ultrasonographic examination of the genital tract in female buffalos was performed per rectum, using an endorectal linear transducer that provided excellent quality images of anatomical structures situated below it.

Thus, the examiner's intention was to place the transducer as close as possible to the organs of the pelvic cavity, ensuring a thorough and detailed examination of the structures of interest.

One of the most important and challenging steps in the examination was represented by the proper restraint of the females, taking into consideration the native aggressiveness of this species and considering the safety of the examiner as extremely important.

After emptying the rectal ampoule and manual palpation of the genital organs, the transducer was placed above the genital tract.

The cervix, uterus and ovaries were scanned and longitudinal as well as transverse images were obtained.

The main goal was to find obvious signs of pregnancy (a corpus luteum on one of the ovaries together with a gestational sack and fetus inside one of the uterine horns).

After assessment of pregnancy status, subsequent examinations focused on the pregnant uterus and the identification of various fetal structures, as follows: fetal position in the uterus, fetal annexes and liquids, umbilical cord, placentomes, major fetal organs and

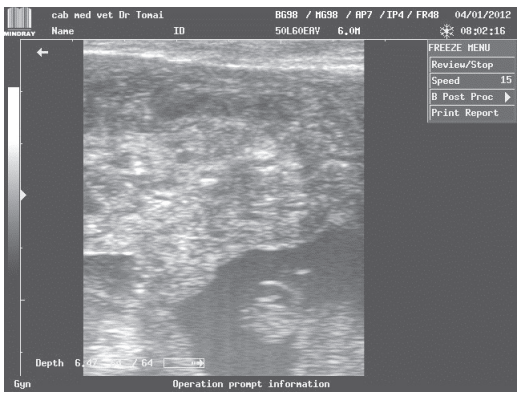

Fig. 1. Pregnancy in domestic buffalo (ultrasound 25 days)

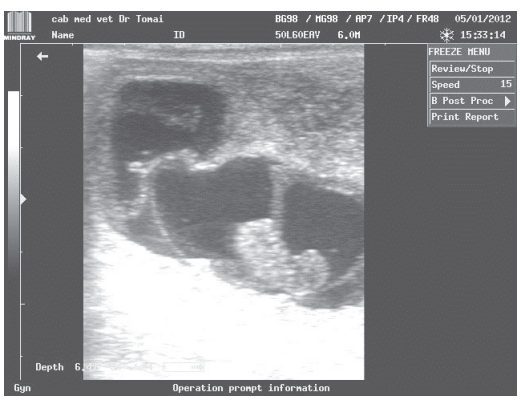

Fig. 2. Pregnancy in domestic buffalo (ultrasound 31 days)

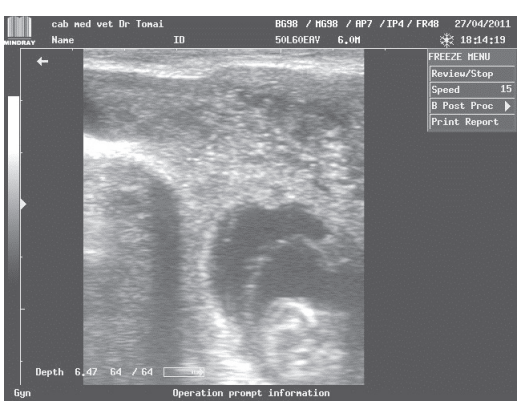

Fig. 3. Domestic buffalo fetus 40 days old

anatomic structures (abdominal cavity, limbs, head, gastric vesicle, ribs, heart, liver and gull bladder.

Adequate measurements were performed, while the moment when a certain organ or structure was first identified was carefully recorded.

Results and discussions

Following artificial insemination, the pregnancy diagnosis was positive in 43 of the 48 females (89.58%), the earliest diagnosis being made on day 25 and the latest on day 31.

The structures identified on these occasions are shown in figure 1 and 2. Five of the females were diagnosed as non-pregnant (10.42%), showing a dominant follicle on one of the ovaries, as well as empty uterine horns (Chart 1).

The 25 days old fetus (fig.1) was observed as an echogenic structure surrounded by anechogenic fetal fluids and part of the fetal membranes.

The 31 days old fetus was identified in lateral section having an average echogenicity, with uniform structure and undefined cephalic extremity.

The limb buds were also difficult to point out, while the fetal membranes and umbilical chord were easily identified.

The subsequent ultrasound examinations of pregnancies allowed a detailed classification and characterization of fetal development, revealing the most important developmental events that occur during the first trimester of pregnancy in domestic buffalos.

Between day 40 and 90 after insemination, the evolution of pregnancies was carefully monitored, trying to visualize the main fetal structures and organs:

On day 40 after insemination, the fetuses were approximately 5 cm long, with average echogenicity, surrounded by fetal fluids (anechogenic) and fetal membranes (hyperechogenic) as shown in figure 3.

Some images showed the cephalic extremity and ear lobes with the former having a lower echogenicity. The cervical region is also visible, but the vertebrae cannot be visualized yet.

This shows that skull bones and vertebrae are not ossified yet (fig. 4).

Fetal sexing is also possible at this stage by observing the abdominal wall and recording the dynamic relative position of the genital tubercle.

It is migrating towards the umbilical chord in males and towards the tail in females.

Fig. 4. Cephalic extremity of domestic buffalo fetus 40 days old

Fig. 5. Day 55 female buffalo fetus (genital tubercle near tail)

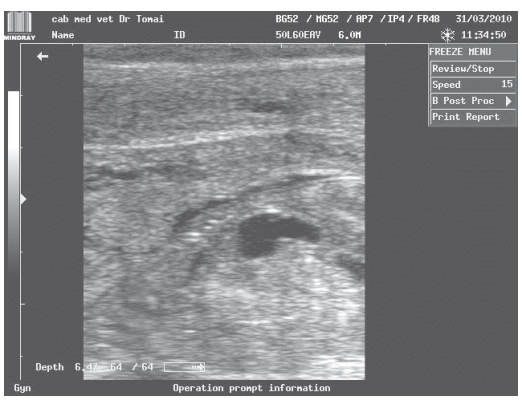

Fig. 6. Day 60 domestic buffalo fetus

The median raphe is also visible in female fetuses as a hyperechogenic line between the two hind legs (fig. 5).

On day 60, the fetal size had increased to about 12 cm, the abdominal cavity showing a very well-defined gastric vesicle (fig. 6).

The longitudinal section at thoracic level showed the ribs, together with the vertebrae and sternebrae.

The heart, heart cavities and heart beat could also be noticed, representing a valuable tool in evaluating the viability of the fetus.

The liver occupied most of the abdominal cavity, appearing as a large and medium echogenic area. Sometimes, the gall bladder could also be noticed, as a small, anechogenic area on the surface of the liver (fig. 7);

On day 75, the abdominal cavity of the fetus was easily distinguishable, showing mainly the liver and stomach. The caudal region, (including tail) was also visible (Fig. 8).

The anatomical structures of the fetal heart were very obvious, the atria, ventricles and inter-ventricular septum being easily evaluated (fig. 9).

An interesting capture showed the detailed anatomy of one limb extremity, showing the entire acropodium, with the already cornified hyperechogenic hooves. The uterine wall, as well as caruncles were also shown (fig. 10).

On day 80, the fetuses were about 15 cm long, most of the abdominal cavity being occupied by the liver.

The gall bladder was clearly visible as an anechogenic spot; the gastric vesicle was large and well defined, while the ribs and sternebrae were also visible (fig. 11);

On day 90, the stomach of the fetus was very well developed, filled with liquids as a result of swallowing the amniotic fluid (fig. 12); the cross section performed at the level of the umbilical chord entry shows a portion of the latter, with the blood vessels inside (fig. 13).

The evolution of fetal size (cm) during the first part of gestation in buffalos can be seen in chart no.2, while the development of the main fetal organs and structures to be monitored during ultrasound examination, according to age of gestation, is shown in Chart 2.

Our data and images represent a useful guide for veterinarians that work in the field of domestic buffalo theriogenology and wish to improve their performance by applying ultrasonography for pregnancy diagnosis and assessment of fetal development in this species.

Fig. 7. Ribcage of day 60 domestic buffalo fetus

Fig. 8. Abdominal cavity of a 75 days old domestic buffalo fetus

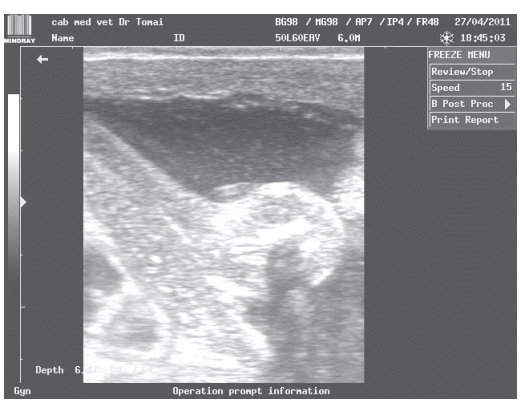

Fig. 9. Heart of a 75 days old domestic buffalo fetus

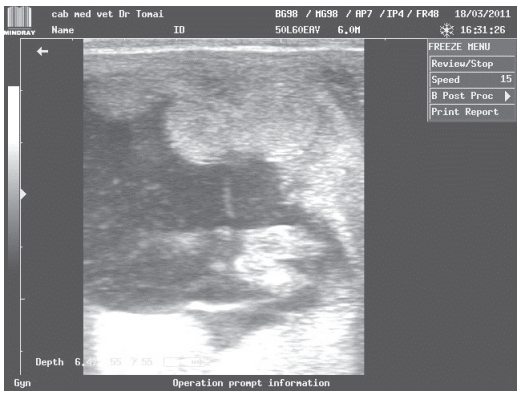

Fig. 10. Limb extremity of a 75 days old domestic buffalo fetus

Fig. 11. Abdominal cavity and ribcage of day 80 domestic buffalo fetus

The data can also be used for pregnancy age estimation when natural mating has occurred without knowledge of the owner (usually when adult females and males are pastured together during the warm season), therefore enabling a good estimation of the probable due date.

Ultrasound scanning of the genital tract for pregnancy diagnosis and other fetal measurements has been performed by other researchers as well.

The work of Ali and Fahmy (2008) has focused on ultrasonographic fetometry and fetal sex determination in buffalos.

According to this study, gestational age and various fetal parameters can be correlated as follows: the crown-rump length (CRL) and amniotic vesicle diameter (AVD) is a great indicator of fetal age during early gestation; the biparietal diameter (BPD) during mid-gestation; and the eyeball diameter (EBD) during the mid and late-gestation.

Pawshe et al. 1994, performed a study that aimed for pregnancy diagnosis and monitoring of early conceptus in buffalos using real time B-mode ultrasonography, between days 18 and 62 of gestation.

Other tests, like PAG-RIA (pregnancy-associated glycoprotein radioimmunoassay) were also used for pregnancy diagnosis and were compared to transrectal ultrasonography in terms of accuracy and precocity (Karen et al., 2007).

Fig. 12. Abdominal cavity of a 90 days old domestic buffalo fetus

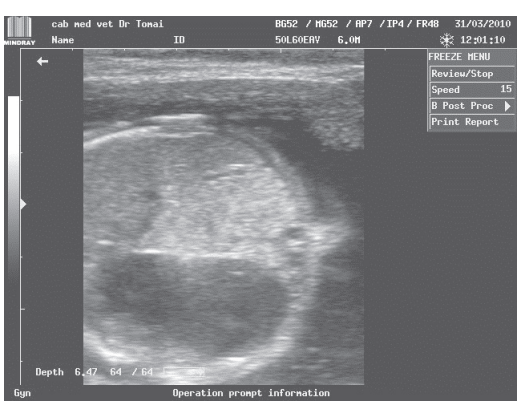

Fig. 13. Cross section on the abdominal cavity of a 90 days old buffalo fetus

Table 1. Development of the main fetal organs and structures in buffalo fetuses according to age

Pregnancy age	Fetal membranes	Cephalic extremity	Genital tubercle	Gastric vesicle	Ribs, vertebrae, sternebrae	Heart, heartbeat	Liver, gall bladder	Cornified hooves
Day 40								
Day 55								
Day 60								
Day 75								
Day 80								
Day 90								

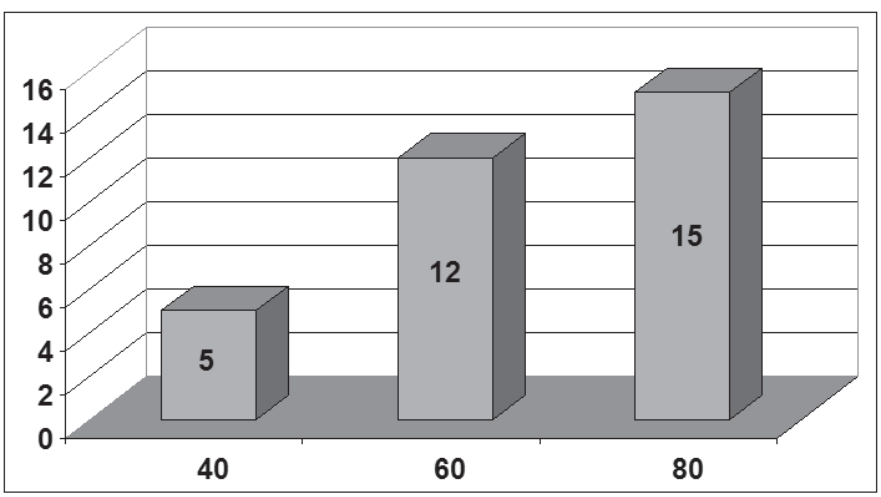

Chart 2. The evolution of fetal size (cm) during the first part of gestation in buffalos

No significant difference was found and both were recommended as highly accurate from day 31 after mating onwards.

Conclusion

Ultrasound scanning for early pregnancy diagnosis in buffaloes is a suitable tool, enabling an accurate pregnancy diagnosis beginning with the 25th day after mating.

As pregnancy duration is about 30 days longer in buffalos than in cattle, this advantage becomes even more interesting and useful.

Ultrasonography can also easily identify twin fetuses at a very early age, although the present study has not found any such situation.

Fetal structures ca easily be identified after the 40th day of gestation, enabling the examiner to assess normal fetal development, establish the age of pregnancy (if unknown) and determine the viability of the conceptus.

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Agriculture in a changing world: the impact of green biotechnology

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In modern times the high input agriculture is criticized for its negative effects on the environment, for the reliance on agrochemical suppliers and for the social consequences in creating the dependence of farmers on inputs from private industry. Biotechnology can help to overcome these issues by providing crop varieties better adapted to tolerate biotic and abiotic stresses, thus offering environmentally compatible means of enhancing agricultural production on a long-term basis. Agriculture biotechnology encompasses a complex group of related technologies, most of them less controversial than genetic engineering, that together are parts of the biotech-driven revolution in agriculture. Biotechnology provides unique opportunities for success and failure, therefore there is a large demand for good quality, science based, unbiased information regarding agricultural biotechnology.

Providing the necessary food for the population relies primarily on crop production. Plants are the key of life on earth as they stay at the very basis of the food chains, providing protection and sustenance for organisms ranging from bacteria to large mammals. The relaying on plants as the most important resources for food and feed and other important biomaterials goes along with the history of mankind. The cultivation of plants more than 10,000 years ago marked the beginning of the modern civilization and behind all the important achievements of mankind stays the silent world of plants. Since the beginning of agriculture humans used plants that nature provided and modified them through selective breeding, applied empirically for a long time, to confer special qualities of plants and agricultural products, such as improved taste, enhanced yields or disease and pest resistance.

Changing the characteristics of the major crops for maximizing their productivity and profitability has concerned countless generations of farmers, and as a result agriculture has become a major agent of environmental changes, given that large areas of natural ecosystems have been converted into agricultural systems.

After the rediscovery of Mendel's laws plant breeding developed on scientific bases and Green Revolution led, since 1960, to creating varieties with improved traits, of major practical interest. Nevertheless it should be noted that the high productivity of these varieties was due not only to breeding, but also to the widespread use of pesticides, fertilizers, irrigation and mechanization. The performances of the intensive agriculture have

generated a high level of enthusiasm among experts, who hoped that the main economic and social issues will be solved at the global level (A.M.Mannion, 1998).

Unfortunately, analyzes performed at the end of the 20th century highlighted some important limitations of conventional agriculture (P.B.R.Hazell, 2002):

- as a result of continuous endeavor for the expansion of cultivated areas and for improving agricultural production by applying chemicals, irrigation and mechanization, agriculture became a major agent of negative impact on the environment;
- the spectacular progress of the scientific creativity in agricultural productivity has not resulted in a world free from the threat of hunger and malnutrition, so that Malthus's theory had to be reconsidered.

Analyses on development prospects of civilization in the new millennium revealed without exception that in terms of a population estimated at 8.3 billion by 2030 and to over 9 billion by 2050, food production will need to be tripled from the current levels. The growing demand for food products must be resolved while the available land cannot be significantly expanded, while about one third of the agricultural production is lost due to pests and diseases and while the widespread use of agro-chemicals cause serious pollution of soil and water . Global warming also affects ecosystems and human activities; it is estimated that only 1°C warming will significantly reduce the amount of available water and therefore will determine the extent of drought and the reduction of agricultural production. Consequently, an increased food production can be achieved only by increasing productivity on currently cultivated areas, but with less water and in more severe environmental conditions (I.K.Vasil, 2003; D.Sawaya, 2009).

Due to the global concern about these perspectives, the concept of sustainable development has been imposed in order to reduce the negative economic consequences caused by mismanagement of natural and agricultural ecosystems. The sustainable agriculture advances a new paradigm of agricultural practices that includes, together with the conventional breeding, the modern biotechnology methods.

It is now generally accepted that beside the advanced technologies with long-term effects on the development of global societies, biotechnology offers a key to efficient use of resources required for sustainable development. Consequently the modern biotechnologies already gained a wide use in many vital areas such as agriculture, health, nutrition, industry, waste management, energy production, etc. No doubt that a major role to be played by plant biotechnology, also called «green biotechnology» is both inevitable and desirable, having in view the advantages it offers:

- decrease in pesticides use and reducing the level of their residues in the environment;
- improving the efficiency of traditional breeding programs;
- increases in production;
- savings in production costs;
- less pollution, reduced erosion of topsoil;
- better conservation of natural habitats.

Plant biotechnology, consisting of a complex group of technologies such as molecular markers, cell and tissue cultures, genetic engineering, genomics, proteomics, metabolomics and bioinformatics, has demonstrated its full potential especially in recent decades, causing a new revolution in agriculture, the so-called «gene revolution» (FAO Biotechnology Forum, 2009). The transfer and stable integration of foreign genes into the genome of cultured cells «in vitro» and regeneration of fertile plants from the transformed cells led to the commercial establishment of the first transgenic crops, an achievement of biotechnology which enjoyed the widest publicity.

That is why currently available biotechnologies in the crop sector are:

Molecular markers - identifiable DNA sequences found at specific locations of the genome, that can be used for: marker – assisted selection (making the selection more efficient by using markers to track the presence of valuable characters in large segregating populations); marker – assisted introgression (introducing genes from wild relatives into modern plant varieties); studies of genetic diversity and the taxonomic relationships; studies of the genetic mechanisms behind physiological traits;

Genetic engineering – obtaining genetically modified crops (transgenic plants or biotech plants) by the application of rDNA technology, where a foreign gene (a transgene) is incorporated into the plant genome, by: „wide transfer" (genes are transferred from organisms of other kingdoms into plants) ;"close transfer"

(genes are transferred from one species of plant to another);"tweaking" (genes already present in the plant genome are manipulated to change the level or pattern of expression);

Tissue culture techniques - in vitro culture of plant cells, tissues and organs under sterile conditions, include: micropropagation, embryo cultures, androgenesis and gynogenesis, somatic hybridization, in vitro slow growth storage and cryopreservation;

Genomics, proteomics and metabolomics - studying the DNA and the protein sequences and establishing the gene expression catalogues.

The first genetically modified plants whose fruits were sold in 1994 were FlavrSavr tomatoes, transformed by the suppression of polygalacturonase enzyme production, in order to prolong the storage life. The tomato paste obtained from the fruit of plants transformed by a similar technology was introduced to the market in 1996, but as in the previous case did not enjoy a commercial success.

The first generation of transgenic plants were endowed with qualities of resistance to herbicides (soybean, canola), to insects (cotton, corn) and to viruses (papaya, squash). By eliminating or by significantly reducing the losses caused by weeds, pests and diseases, the transgenic crops were remarked by higher productions, helping in the same time to conserve soil, water, energy and other resources.

The areas planted with transgenic plants increased significantly, from 2 million ha in 1996 to 80 million ha in 2003, and the total market of transgenic seeds exceeded $ 3 billion. Plant biotechnology proved that is not an abstract science, which offers only promises and potential, but a strong agricultural technology, resulting in productivity increase, with positive impact on human health, on the environment and on the conservation of biodiversity, arable land, water and energy resources.

In 2005, worldwide, 8.5 million farmers in 21 countries planted «biotech plants», and the U.S., followed by Argentina, Brazil, Canada and China were in the top; soy been took the first place among cultivated biotech species, followed by maize, cotton and rapeseed and the herbicide tolerance continued to be the dominant trait in transformation.

Many useful genes were introduced into the next stage in the genomes of plant species grown for food or fibers, in order to improve the quality, the nutritional value and the resistance to various abiotic and biotic stresses. Over 50 such transgenic plant species have been approved for commercial scale cultivation and another 100 species were being tested in the field. This second generation of transgenic plants was expected to be introduced for commercial production during 2005-2015.

Summarizing the data it can be said that the second generation of transgenic plants in 2005 – 2015:

- resistant to herbicides, pests and pathogens;
- tolerant to drought, salt, heavy metals and extreme temperatures;
- improved nutritional quality (protein, oils, vitamins, minerals);
- improved shelf life of fruits and vegetables;
- improved flavors and fragrances;
- elimination of allergens;
- production of vaccines, human therapeutic proteins, pharmaceutical compounds;
- phytoremediation

Molecular farming or the controlled production of biopharmaceutical compounds in plants is one of the most promising areas of research using transgenic plants to produce vaccines, prophylactic and therapeutic proteins and other important biopharmaceutical compounds, such as those to treat cystic fibrosis, hepatitis B, non-Hodgkin's lymphoma, diarrhea, cholera, diabetes and other diseases. In most of cases these drugs and vaccines are produced in corn, tobacco, potatoes, tomatoes or bananas and are in various stages of clinical trials.

The accelerated progress in sequencing plant genomes and in elucidating the structure, function and gene regulation have greatly contributed to understanding the molecular basis of plant growth and development. After completing the Arabidopsis thaliana and rice genome sequencing, the researches focused on species such as Lotus, Brassica, Medicago, maize, barley, wheat, tomato, potato, soybean, poplar and pine.

Most crops have already reached physiological limits of productivity and cannot be significantly increased by conventional breeding methods. Consequently, the third generation of transgenic plants, more productive and better adapted to abiotic and biotic stresses, is awaited with interest (table 3). Also, transgenic food

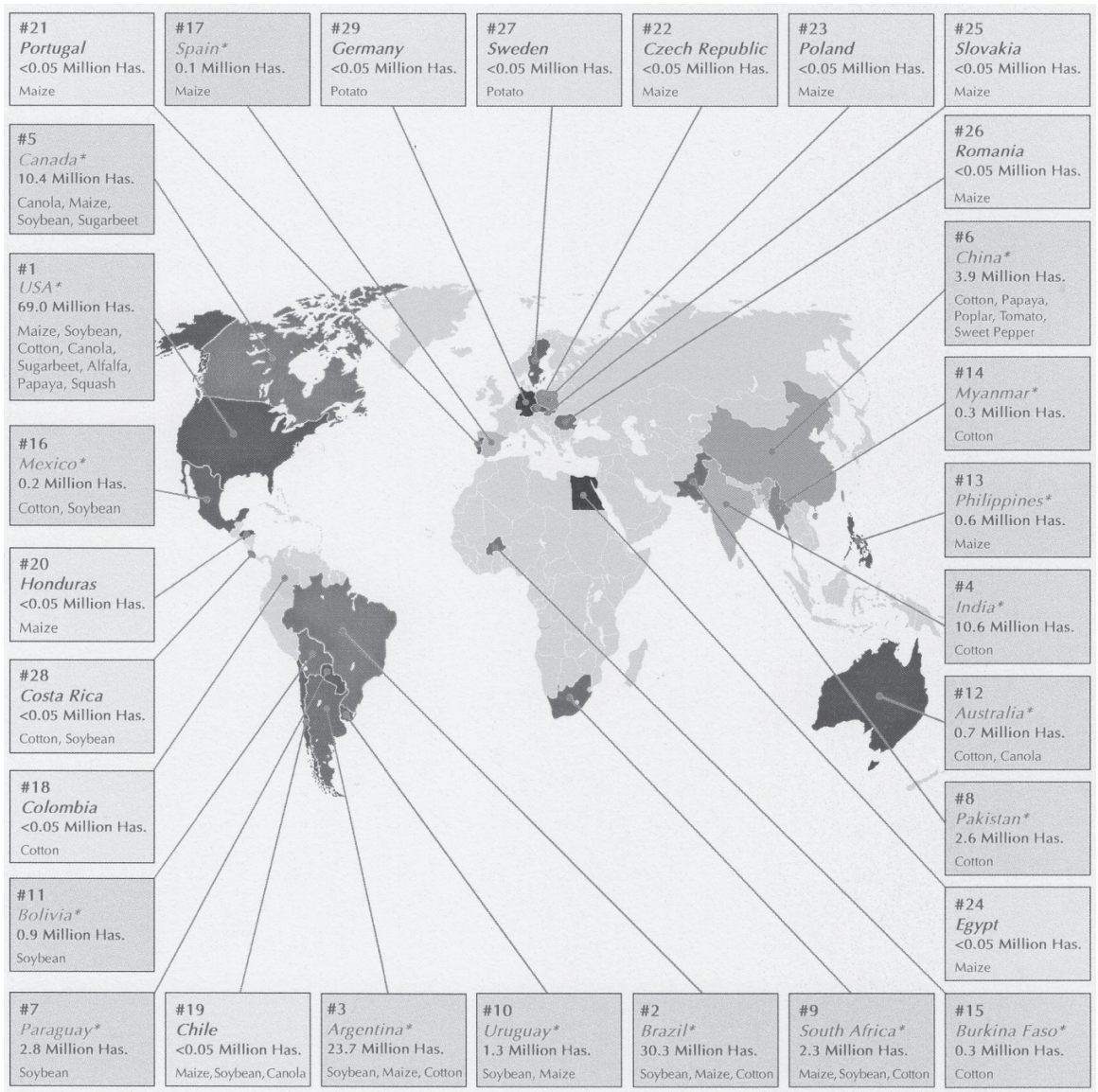


Fig. 1. Global map of biotech crop countries and mega-countries (*) in 2011

products are expected to be more nutritious and healthier, and a wide range of pharmaceutical compounds will be available after 2015 for use in human and veterinary therapeutics (I.K. Vasil, 2003).

The third generation of transgenic plants includes:

- altered plant architecture;
- manipulation of flowering time;
- manipulation of fruit and seed quality, size and number;
- improved photosynthetic efficiency;
- improved nutrient assimilation;
- exploiting and manipulating heterosis and apomixes/

Generally, scientists consider transgenesis as precise, predictable and safe. Transgenic plants are among the most exhaustively tested, characterized and regulated products in the history of breeding, aiming to demonstrate that they and their products are at least as safe for humans and the environment as plants

obtained by conventional breeding. In fact, according to some opinions, crossing and selection practiced over the centuries, led to pronounced changes of the genetic structure of plants, so that almost all species of cultivated plants should be considered «genetically modified». Caution is however necessary to eliminate the risk proclaimed by the opponents of the transgenic technology of the «unintended effects» on other organisms and on the environment.

The development of transgenics has generated heated controversies in which were committed scientists, politicians, businessmen, journalists, non-governmental organizations and the general public. Unlike the conventional improvement, the biotechnological methods allow the transfer of genes between species which cannot be hybridized due to the natural barriers of sexual incompatibility, this being the main argument of the opponents of genetic engineering, perceiving the genetic engineering tools as «unnatural». There is fear that this unnatural interference in the genetic constitution of species may have undesired consequences for human health. At present the consumers do not automatically accept that any scientific progress is necessarily beneficial for humanity.

Much concern is generated by the gene drift from transgenic plants to the untransformed ones, by the emergence of insects tolerant to the proteins with insecticide effect synthesized by transgenic plants, by the emergence of microorganisms tolerant to the resistance mechanisms of plants transformed with single genes for resistance, and by the narrowing the genetic base of crops by reducing the number of commercial varieties. The ideal transgenic technology must be commercially feasible, environmentally benign and easy to use in different agriecosystems.

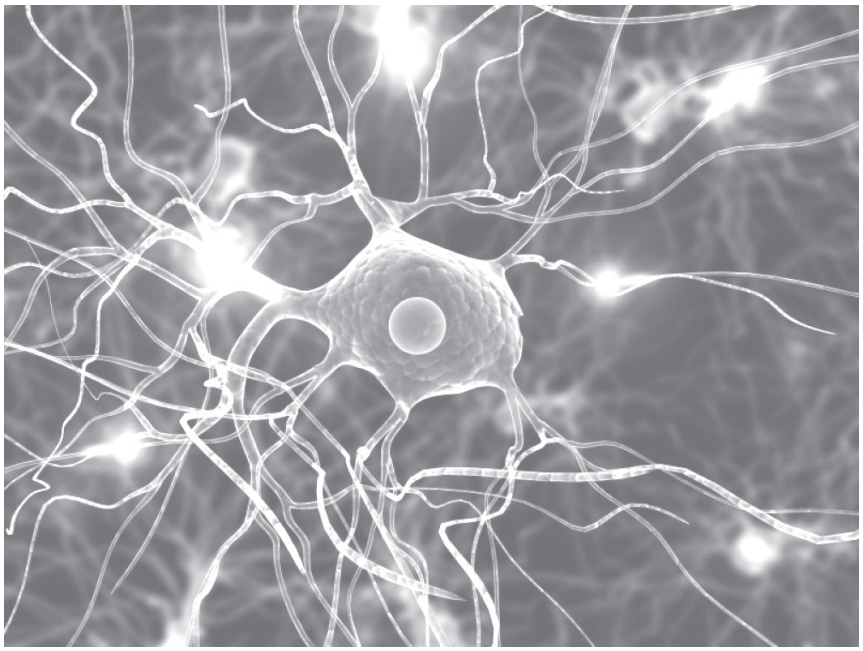
Obviously, people no longer accept that any scientific development is necessarily beneficial and the consumer acceptance and perceptions of biotech products became critical to the future success of the science. The efforts of scientists to find a way out in the bitter debate about GMOs resulted in outlining of several means:

- refining GM crops by further research for minimizing their environmental impact;
- spatial separation of GM and non-GM populations;
- remove foreign trait genes from pollen or render the pollen infertile;
- exclude all excess DNA;
- localizing the expression of foreign genes products are needed;
- sequester foreign trait genes in plastids for the enhancement of their containment;
- apply the technique of stacked traits;
- GURTs (Genetic Use Restriction Technologies) – molecular switches that can be inserted into plants to control seed fertility;
- strict rules for labeling and tracebility of GMOs.

An analysis of the situation of biotech plants (GM) at global level performed at Cornell University, USA, (C. James, 2010), showed that the consistent and substantial economic and social benefits offered by biotech plants, made millions of farmers in developing countries to continue cultivation of additional areas with biotech plants during 2008, which is the thirteenth year of their marketing. Besides increasing the cultivated areas, is also mentioned an increased number of countries and farmers that have adopted the cultivation of biotech crops, because of their contribution to solving the major challenges faced globally by societies, such as food security, high food prices, sustainability, alleviation of poverty and hunger, as well as challenges associated with global warming. The number of countries that have adopted biotech crop cultivation increased from 6 in 1996, the first year of their marketing, to 18 in 2003 and 25 in 2008 (10 industrialized and 15 developing countries) so that the total area globally cultivated with these plants was of 125 million hectares. Beside the 7 species tested in 1996 (soybeans, corn, tobacco, cotton, canola, tomatoes and potatoes) new species have been added, such as, squash, papaya, alfalfa, carnations, poplar, petunia, pepper and sugar beet.

U.S. ranks first, with 62.5 million hectares planted with soybeans, corn, cotton, canola (rapeseed), pumpkin, papaya, potato, alfalfa and sugar beet, followed by Argentina (21 million hectares planted with soybean, corn and cotton, Brazil (15.8 million ha of soybean, cotton and corn), Canada (7.6 million ha of canola, corn, soybean, and sugar beet), India (7.6 million ha with cotton) and China (3.8 million ha of cotton, tomato, poplar, petunia, papaya and peppers). The transgenic traits with the widest incidence were tolerance to herbicides (glyphosate) in soybean, maize and sugar beet, followed by insect resistance in maize and cotton. Other transgenic

characters of interest include virus resistance, male sterility and oil quality (Q. Que et al., 2010).



According to C.James (2010), the continuous and rapid adoption of biotech plant by many countries is due to the substantial and consistent benefits both for large farms in the industrialized countries and for the small subsistence farms in Africa, considered as the continent with the most urgent need of the benefits of biotechnology. In perspective, the main pursued objectives aim at introducing the trait of drought tolerance in rice and marketing in the U.S. in 2012 and in the African sub-Saharan zone of drought-tolerant biotech corn.

Not minimizing the advantages offered by biotech plants (GM), A.Sonnino, FAO representative at REDBIO Conference held in Mexico in November 2010, stressed that, for developing countries, the technologies of productivity growth and of conservation of natural resources must be accessible, appropriate and tailored to the needs of small farmers, imposing an substantial increase of their own investments in the agricultural research and development of the public sector. Farmers must have a wide range of technology options, including agricultural biotechnology, which is not reduced to GMOs or transgenic, as it emerged from the extensive documentation previously prepared (March 2010), during the FAO international technical conference regarding agrobiotechnologies in developing countries (ABDC-10). It was pointed out that too much emphasis was put on GMOs, overlooking the potential merits and benefits of other non-transgenic biotechnologies, which can have a positive role for food security and sustainable development in developing countries. FAO believes that currently enough food is produced globally to feed the existing population of around 7 billion, yet one in six people in developing countries suffers from chronic hunger, and this phenomenon is due to disparities in the distribution and access to food.

Future food security is guaranteed only by increasing the agricultural productivity, coupled with conservation of natural resources, using the tools provided by science and technology, including agricultural biotechnology, for the benefit of farmers, producers and consumers. It was also stressed that governments need to develop their own vision and national policy on the role of biotechnology, and that it was spent too much time and money for the fierce controversies on GMOs at the expense of non-transgenic biotechnologies with unexploited potential in developing countries (mutagenesis, interspecific hybridization, embryocultures, selection based on molecular markers, micropropagation, etc).

At European level it was expressed for a long time a hostile position against genetically modified crops. Genetic engineering has been labeled as «unethical, unnecessary, unsound and unsafe» and in 1998 a moratorium was imposed on the approval of GMOs, for a period of 10 years. The European Union has adopted the principle of prudence (the precautionary principle), providing that the experiment can only take place if there is a guarantee that the result will not be harmful. However in 2004 P.Bousquin, European commissioner for research, presented a program on plant genomics and biotechnology development by the year 2025, as Technology Platform «Plants for the future». It was stated on this occasion that Europe cannot risk losing

competitive positions in the biotech sector, and therefore more attention will be given to genomic research and biotechnology. Plant genetic modification technology is not the only modern plant biotechnology in perspective and should not reduce the whole area of plant biotechnology to genetic engineering only.

In the document subsequently developed under the EU General Directorate for Research and Innovation in Biotechnology, Agriculture and Food, entitled: «A decade of EU-Funded GMO Research (2001-2010)» is highlighted the importance of biotechnologies, including genetically modified organisms, for increasing the agricultural production and for environmental sustainability. As with other new technologies, the potential risks of biotechnologies have been identified and quantified by launching research programs that have the purpose, based on the prudence principle, to assess the risks and benefits that GMOs pose to public health, to animals and to the environment. As regards the environmental impact of GMOs, many research projects have addressed issues such as resistance to pathogens (fungi, viruses, nematodes), efficiency of nitrogen use, the use of transgenic organisms as biofertilizers and biosensors for monitoring bioremediation, gene drift, horizontal gene transfer, soil ecology, and so on, concluding that GMOs are not more harmful to the environment than other cultivated plants. In matters of food safety, research has helped to identify and characterize the potential risks associated with the agricultural products derived from GMOs. Sensitive and accurate methods were developed for highlighting the traces of GMOs in food and feed. Other researches focused on the production of human biotherapeutic compounds in plants, production of biofuels and of alternatives for the insufficient natural resources.

The global status of commercialized biotech/GM crops in 2011 presented by C. James in behalf of the International Service for the Acquisition of Agri-biotech Applications (ISAAA) mentions a record of 160 million hectares planted with biotech crops, which means a sustained global increase of 8% or 12 million hectares over 2010, thus making biotech crops the fastest adopted crop technology (Fig. 1).

The US continued to be the lead producer of biotech crops globally with 69.0 million hectares, with particularly strong growth in maize and cotton in 2011 and the resumption of the planting of biotech alfalfa. The 5 lead biotech developing countries (China, India, Brazil, Argentina and South Africa) which have ~ 40% of world population grew 44% of global biotech crops. Biotech soybean continued to be the principal biotech crop in 2011, followed by biotech maize, biotech cotton and biotech canola, while herbicide tolerance remains

the dominant trait. Stacked traits (biotech crops with two or more traits) are an important feature of biotech crops in 2011.

Six EU countries (Spain, Portugal, Czech Republic, Poland, Slovakia and Romania) planted a record 114,490 hectares of biotech Bt maize, with Spain growing 85% of the total in the EU (Fig.1).

While 29 countries planted commercialized biotech crops in 2010, an additional 31 countries, totaling 60, have granted regulatory approvals for import of biotech crops for food and feed use and for release into the environment since 1996. Of the 60 countries that have granted approvals for biotech crops, USA tops the list followed by Japan, Canada, Mexico, South Korea, Australia, the Philippines, New Zeeland, the European Union and Taiwan. Maize has the most events approved, followed by cotton, canola, potato and soybean.

As future prospects 2012 to 2015, the ISAAA Brief 43 is cautiously optimistic, admitting that the adoption of biotech crops will be dependent on three factors: first, the timely implementation of appropriate, responsible and cost/time-effective regulatory systems; second, strong political will and enabling financial and material support; third, a continuing wave of improved biotech crops that will meet the priorities of industrial countries and developing countries in Asia, Latin America and Africa. Anyhow, biotech crops, whilst not a panacea, have the potential to make a substantial contribution to the 2015 goal of cutting poverty in half, by optimizing crop productivity. It is worth to mention that in October 2011, 41 leading Swedish biological scientists, endorsed by UK scientists, addressed an open letter to politicians and environmentalists, about the need to revise European legislation to allow society to benefit from GM crops using science-based assessments of the technology.

In conclusion, without ignoring the social and ethical implications of gene manipulation, by treating these implications in an open, scientific and responsible manner, it is estimated that in the near future biotechnology will become everywhere a routine component of agricultural systems, and what we call «gene revolution» will become the core of sustainable development.

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UKRAINE

Issues of the Ukranian agribusiness industry and ways of their solution

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Economy of Urkaine, including the agribusiness industry (ABI), influenced by negative structural and inter-industry distortions is in a deep crisis. The crisis is sharpened by out-of-balance conditions in a finance and credit system, inadequacy of current administrative structures to needs of economic development. With the extraordinary high monopolization of the economy branches of the ABI processing industry are very sensitive to abrupt changes of social and economic situation in Ukraine [1].

Agriculture of Ukraine significantly determines its social and economic development, living standard of population, its provision with foodstuff, and industry with raw materials. By volume production it ranks fourth after industry, trade and communication. In whole, a share of agriculture in a total volume of gross added value of the economy is 8%. Expor of its products and food industry is 19% of the total cost of Ukranian export. 15% of economic active population are working in agriculture. A cultivated land occupies 69% of Ukraine`s territory. Ploughing-up of the land is 56%. In Ukraine, as in many other countries, agriculture development features an extensive character. The volume of its production is significantly behind of neighboring countries with similar geographic and climatic conditions, and in 1991–2010 reduction of gross output took place in comparison with the base 1991. Gross output development rates are given over the statistic collection «Gross production of Ukranian agriculture», which contains results of recalculation of its volumes since 1990 to 2010 in fixed prices of 2010 approved by № 362 order of the Ukranian State Statistics Committee dated 22.12.2011 «About approvement of Fixed prices of 2010 for agriculture products to calculate agriculture output volume index» (Table 1).

Over the past years a shortage of some foodstuffs comes into being, whereupon significant increase of prices or limitation in quantity of such products takes place. Such situation is unallowable and confirms that state regulation of the agricultural sector is unsatisfactory and inefficient. In this regard it can be said that it is insufficient production creats a non-providing risk for food security of Ukraine, as well as it is a main obstackle for development of agriculture products export [2].

The system of national foodstuff security is based on the following principles: self-sufficiency, independence, availability, quality. They should be taken into account when formation of the state policy in this field takes place. They have to ensure such areas, as efficient development of the ABI, foreign-economic activity, population`s incomes formation, ensuring balanced and quality consumption [3].

A part of means spent by population of each country for foodstuffs is, usually, reduced, as the income level per capita increases. It changes from 60% in countries with the lowest income level to 15% in countries with the high income level. Data on food balances of each country exert a strong influence on choise of priority

foodstuffs. It is expedient to note that income increase per capita predetermine increase in amount of food calories, which are provided by livestock products, vegetable oils, sugar, fruits and vegetables. Population dietary intake in countries with the low income level is focused on grain crops (55%), potatoes and root vegatables (11%). Only 3% are the share of meat, 6% - beans, 5% - sugar. That is why, low-income population of developing countries suffers from undernutrition because of unavailability of diverse and well-balanced in terms of diet products.

Table 1. Agriculture gross output development (all categories), %

Year	Gross output	Including	
		Plant growing	Livestock farming
1990 = 100			
1991	86.8	83.3	90.5
1992	79.6	83.4	75.6
1993	80.8	92.1	68.8
1994	67.5	71.2	63.5
1995	65.0	73.1	56.5
1996	58.9	66.5	50.7
1997	57.8	70.4	44.4
1998	52.2	58.5	45.7
1999	48.6	52.6	44.5
2000	53.4	63.8	42.4
2001	58.9	71.7	45.3
2002	59.6	70.6	47.8
2003	53.0	60.7	44.9
2004	63.5	80.7	45.1
2005	63.5	78.7	47.4
2006	65.1	80.1	49.2
2007	60.9	72.8	48.2
2008	71.3	93.7	47.6
2009	70.0	89.3	49.6
2010	68.9	85.6	51.2

The dynamics of production of basic kinds of agriculturcal products in Ukraine is presented below [4]. Table 2 shows changes in production of some kinds of products. It is evident that dairy products and potatoes have the constant downward trend. However, production of eggs, vegetables and melons rapidly increases.

In 2009–2010 actual consumption for the majority of basic kinds of food was below the rational norms. The largest lag of actual consumption was for fruits, berries and grape (46–49%), milk and dairy products (44–46%), meat and meat products (35–38%), fish and fish products (24–28%). It should be noted that in 2009 actual consumption of milk, meat and fish decreased because of falling population incomes. So, in comparison with previous year consumption of meat and meat products per capita decreased by 0.9 kg, milk and dairy products – by 1.4 kg, fish and fish products – by 2.4 kg, eggs – by 8 pcs [5].

Actual consumption for three food groups, notably, «bread and bakery products», «potato», «vegetable oil of all kinds», exceeded the rational norm. However, such surplus in specified food groups, especially, bakery products and potatoes, testifies population nourishment imbalance, which tries to compensate energy needs through more affordable products.

In 2009, for the first time in the past 5 years, sugar consumption per capita in Ukraine was 37.9 kg (less the rational level), which is the result of the sharp increase of prices for this product in the world and internal markets in 2009–2010 because of decreasing production of raw materials for it. In 2009 the consumer price for sugar in Ukraine increased by 1.8 times.

In 2009 the indicator of grain reserves sufficiency was 22%, despite the fact that the Law «About state support of agriculture of Ukraine» stipulates that in 2009 the state intervention fund must keep 16% of internal grain consumption (a threshold level of this indicator is 17%; the method for calculation of this indicator does not consider the amount of grain, which is in the state material reserve, as such information is a state secret).

The investigation shows that over the past years the trend in direction of increasing specific share of raw materials export with corresponding decreasing specific share of products of processing industry (Table 3).

Reckless desire for participation in the integration processes is associated with significant risks, which sharply increase for the states with insufficiently sustainable social and economic systems. It is evidence that the economy is not able to be developed on the endogenous basis and there are a high level of external denendance (in particular, on export incomes), disbalanced internal structure, social polarization and environmental degradation. Because of the inability to adhere to nationally oriented behavior strategies in a globalized space such countries can only count on the role of satellites of developed states determining, based on self-interest, amount and assortment of resources and products available for the world market [6].

The way out of the current situation is in reforms and attraction of investments in the ABI of Ukraine, together with identification and solution of issues arising when investing.

Today, Ukraine has a rather unfovourable investment climat, notably:

- Instability of the economic system and social – political situation in the country;
- High level of moral and physical depreciation of equipment, what makes products initially unprofitable;
- Instability and ambiguity of the legal and regulatory framework;
- Lack of investment incentives;
- Low level of intellectual property protection;
- Lack of own financial resources.

In the international rating of reliability of countries claiming to foreign investments, Ukraine occupies 130th place (out of 170) and is attributed to the countries with the highest political and economic risks [7].

Academician N. D. Bezugly, President of the National Academy of Agrrarian Sciences of Ukraine (NAAS), former first deputy minister on Agrarian Policy and Food of Ukraine, knows very well about necessary reforms in the ABI. Conventional approaches, when a development is created over the years with the following testing, do not work yet. Today, manufacturers should pull out the development from laboratories and jointly with developers bring to its speedy implementation. To do this, it is important to seek novel forms of cooperation between different elements of the innovation process on creating and bringing a new product or technology to market.

An outstanding example of successful cooperation between academia and government is a land reform: there was an urgent need in attraction of additional means in agriculture. It was proposed to do it through mortgage, land tenant right and sell. This idea saw the light in the NAAS. Within six months bills necessary for the second stage of reforms (moratorium lifting, land market introduction, creation of the state mortgage bank, development of a new system for agricultural producer crediting) have been elaborated. The Ministry of Agrarian Policy and Food of Ukraine, as a body of the central executive authority managing the branch, is the customer, scientists of this Academy are developers.

Table 2. Dynamics of production of basic agricultural products in Ukraine in 2005-2010, % (basic 2000)

Products	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*Relative average annual increase*
Meat and meat products	-4.00	7.90	11.00	-0.30	0.60	7.40	3.62
Milk and dairy products	8.30	-3.10	-7.70	-4.10	-1.30	-3.10	-1.95
Eggs	48.20	9.20	-1.20	6.30	6.50	7.20	11.67
Potatoes	-1.90	0.00	-1.90	2.30	0.60	-4.90	-0.98
Vegetables and melones	22.80	15.00	-16.30	16.00	5.70	-1.10	6.17
Fruits and berries	8.50	-33.70	29.30	4.90	8.80	3.20	1.53

Table 3. Dynamics of agri-food exports and import of Ukraine

Parameters	*2009*	*2010*	*2010/2009, %*
Agri-food export, $ mln	9514.9	9936.6	104.43
Including by sections of UC FTA*			
- Live animals, animal origin products	596	771.4	129.43
- Plant origin products	5034.9	3976.2	78.97
- Fat and oils of animal and plant origin	1796	2617.3	145.73
- finished food products	2088	2571.7	123.17
Agri-food import, $ mln	4936	5763.6	116.77
Including by sections of UC FTA*			
- Live animals, animal origin products	1267.5	1242	97.99
- Plant origin products	1259.9	1563.9	181.7
- Fat and oils of animal and plant origin	374.3	451.6	116.3
- finished food products	2034.3	2506.1	119.8
Saldo +/-, $ mln	4578.9	4173	-
* Ukranian classification of goods of foreign trade activity Calculated on data of statistical collections «Ukraine in figures» for 2009 - 2010			

The land market plays a key role in the reforming of the branch, and sale of the land is only 10% of the reform. The most important thing is when the land becomes a commodity and the agricultural producer can use it for operations in financial markets, first of all, as a pledge to obtain credit resources for development of production. The recent sociological survey showed that only 11% of share owners are willing to consider the question of land selling. 89% of farmers, who have land, it is about 6.3 mln people, see no reason to sell their plots of land at all.

Shortage of circulating assets in agriculture of Ukraine without fixed assets is 56 billion UAH, i.e. 2000 UAH per hectare [8]. To equip the fleet of vehicles to carry out the grain programme for 80 mln tons, it is necessary to have 224 billion UAH. If we allocate them to five years, it would take 45 billion UAH per year and another 56 billion UAH of circulating assets, i.e., as a whole, 100 billion UAH per year. In addition, livestock breeding still needs 43 billion UAH. The only material resource comparable to the required sum is the Ukranian land. Everything that was built or is moving on it is worth by times lower. The funds required for production would be never attracted, if the land does not become the object of the market. Today, Ukraine is building a system for farming reformation. It is planned in six – five years to produce 80 mln tons of grain, about 15 mln tons of oil-bearing crops, 4 mln tons of meat, 15.5 mln tons of milk [8].

Fig. 1 presents a diagram of predictable grain production in Ukraine untill 2017.

Selective work, fertilizers introduced, plant pest control are of great importance for increasing of field yield. All this needs means. The great disadvantage of the ABI is lack of close connection between science and practice existing in developed countries.

The Academy is funded in two ways: fundamental and applied work, but the state does not fund the innovation activity at all; it is not a subject of the state`s order. Whether to introduce a development into production depends on developer`s willengness. Neither salary, nor his position depends on it. In the USA, for example, each state has dozens of centers for introduction of developments into production and consulting of farmers for public funds. The proposal to change directions of Academy funding was submitted in the Ukrainian government: about 20% of its funding is to be channeled for fundamental and applied research and innovation activity. Each research institute should have a department, which is responsible for introduction of innovations. Only material incentive of an owner of intellectual developments in their introduction is being formed so far. The relevant law has been accepted, but its adaptation is going on. If legitimize innovation work and interest those, who must do it, the process will be put into motion. There is one more element, but it does not have a solution at present. This is funding of science in general that is currently financing by a leftover principle. The law on Science in terms of financing is implemented in 25%.

Today, the strategic significance of agribusiness in the West is already apparent; it is ahead of many other types of business by priority and prospects.

Domestic agricultute is not subsidized because of lack of state`s funds. Formely, rich countries allowed themselves for account of subsidies to make products cheap for their citizens, and a family in Europe spent 20% of incomings on foodstuffs. In Ukraine it is 55%. But it will not go on; growth of food prices in Europe is inevitable. Ukraine works practically without subsidies, profitability of agriculture production will increase. Although subsidies per hectare are negligibly small in comparison with the West ones: the Baltic States have 200 euros per hectare, Poland – 400 euros. The entiere budget of the Ministry on Agrarian Policy and Food of Ukraine for 2012 is 1.5 bln UAH. It is 50 UAH per hectare.

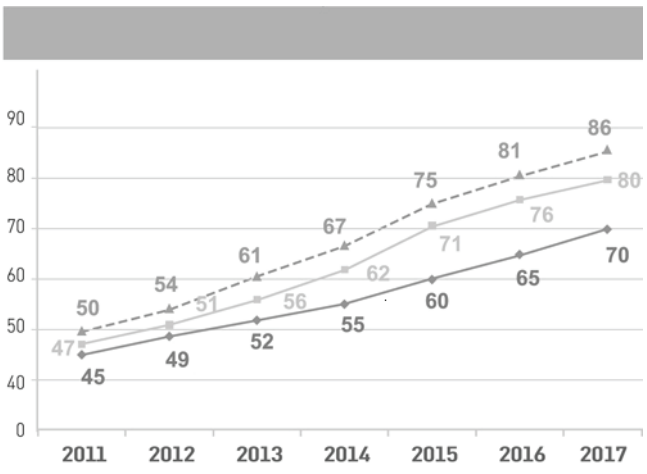

Fig. 1. Grain production in Ukraine [8]

Ukraine is practically creaing unsubsidized agriculture and soon must compete with other countries. Only long-term business, as storage infrastructure, vegable storage facilities, diary livestock sector, needs the help [8] (Fig. 1).

Search for new forms of cooperation between scientific institutions, production firms, business, state and local governments playes a significant role in solution of existing issues in the Ukrainian ABI related to introduction of innovations.

One of such effective forms of cooperation is technological platforms (TP), whose task is development of economically viable research programmes and rapid introduction of scientific results into practice.

Work on creation of the national TP in Ukraine taking into account experience of the current European TP is carried out since 2006. The initiator is a group of scientists (Professor N. Boyko, Uzhgorod) with support of the Nationa Information Centre (NIC) of Ukraine (Director E. Koval, Kiev). The idea of TP creation has emerged at the meeting in Kiev on 9 – 10 February 2006 organized by the Ukranian NIC with participation of representatives of the European Commission Directorate on the priority «Biotechnology, Agriculture and Food» of Director K. Paterman and direct consulting support of Director R. Fenik from the Institute for Food Research.

Over the past years more than 30 TPs have been created, whose activity covers different areas of science and practice. In 2012 a first Ukranian scientific and technological platform «Agri-Food» (USTP «AF») was registered, which is the official partner of the European TP «Food for Life». It is a free-will association of national organizations, political, scientific and industrial structures, whose representatives, the best experts in their fields, head 12 thematic clusters. The USTP «AF» was created by the example of European TPs, which are, according to definition of the European Research Consulting Council, one of the substantial initiatives on strengthening of innovation potential of Europe and providing efficiency of investments in scientific research. The TP should be an effective tool for strengthening of innovation potential of Ukranian small- and medium-sized enterprises in a food sector, in particular, through their attraction to implementation of European programmes for scientific and technical cooperation.

Main principles have been formed, domestic and foreign partners have been involved. 12 clusters have been formed: 1) food technologies and industry 2) agro-food biotechnologies 3) agroecology 4) safety and food quality 5) plant health 6) animal health 7) human health 8) nanotechnologies 9) information and communication technologies (ICT) 10) markets 11) social and economic issues 12) coordination.

On April 27, 2012 a working meeting of the chairpersons of the clusters, where a structure of the Ukranian STP «AF» has been discussed and agreed, whose prototype is the European TP «Food for Life». The main founder is the group of companies «Benissa Energy» (Kiev). N. Boyko, Doctor of Biological Sciences, professor of the medical faculty of Uzhgorod National University is the coordinator of the Ukranian national TP.

Issues to be be solved by the USTP «AF» are predetermined by tasks, which were put by clusters and a part of the TP. Due to the fact it is the first TP in Ukraine, it makes sense to list the main directions of clusters:

Cluster 1. Food technologies and industry

1. Develop a range of food products with preset properties and food value for different age groups of population.
2. Adaption of food raw materials of different regions to use in production of various food products.
3. Flow sheet for production of foodstuffs on the base of the-state-of-the-art technologies used at processing of food raw materials.
4. Introduction of new resource-saving technological methods focused on improving energy efficiency of food production.
5. Varification in industrial conditions of different instruments for measuring of food characteristics influencing on the food and nutritional value.
6. Regulatory documents for production of accepted food assortment.
7. Evaluation of quality and safety of finished products.

Scientific and production coordination of the work is carried out by the Odessa National Academy of Food Technologies (ONAFT), because it is the best organization for systematic solution of issues related to increase of food industry productivity and competitiveness, development of strategies for its sustainable progress, introduction of research results in small- and medium-sized enterprises.

Cluster 2. Agro-food biotechnologies

1. Introduction of microbial preparations for organic farming, whose effect is aimed at reduction of the mineral fertilizers and pesticides use, soil fertility and agricultural plants yield increase.
2. Ecosystem monitoring of plants deseases (bacterial, viral, fungal): their diagnosis and prevention.
3. Bioindication and biological testing in modern agriculture, bioindication tests of soil contamination.
4. Biotechnologies to obtain save and effective preparations for livestock farming and veterinary.
5. Biotechnology for microclonal breeding and improvement of field and decorative plants using biosupramolecular preparations.
6. Microbial biotechnologies in different industries to obtain high-quality products (food ferments, biologically active substances, microbial synthesis of exopolysaccharides, enzymes, proteins).
7. Microbial biotechnologies for bioremediation of soils, treatment of domestic and industrial waste water, waste utilization.
8. Regulatory documents to produce biological preparations, probiotics.
9. Evaluation of quality and safety of biological products, food and probiotics.
10. Guaranteed safety and quality of food, fodder; territory protection against bringing agents of especially dangerous diseases.
11. Analysis of causes of origination and spreading of animal diseases, participation in localization and elimination of a communicable diseases outbreak common for animals and people.
12. Monitoring spreading of especially dangerous animal deseases agents and identification of their biological characteristic.
13. Protection of lives and health of people and animals against the risk related to animals diseases.
14. Evaluation of veterinary preparations, food additives, premixes and finished fodder, its influence on animal health.
15. Development of regulations in accordance with international requirements on veterinary preparations, food additives, premixes and fodder, means for veterinary medicines and animal care.
16. Standards and technical regulations prescribing minimum specifications for food products quality.
17. State quality control, standardization, examination and certification of immunological veterinary medicines and preparations.
18. Investigation on regulations in regard to testing of veterinary immunological preparations and means of their standardization.
19. Scientific research to develop new means and improve existing ones for veterinary, methods of their control; development of normative and technical documents for veterinary medicine.

20. State control on adherence to requirements of standards, pharmacopoeial provisions, technical conditions, technological, veterinary and sanitary regulations and other documents for the use of veterinary medicine in the process of their development, testing, introduction, production, storage, transportation, sale and use in enterprises of any ownership.

21. Certification of veterinary medicine means, accreditation of animal protectants production and laboratories to control quality of veterinary immunological preparations.

22. Testing of veterinary medicine to investigate their effectiveness and safety.

23. Deposit and maintain viability of microorganisms (viruses, bacteria, fungi and other biological substances) used for production of animal protectants.

24. Biosafety of laboratory works with microorganisms strains.

25. Storage and maintenance of industrial, reference, control and unique strains of viruses, bacteria, fungi in order to use them in veterinary medicine.

26. Certification of biological materials using modern methods.

27. Development of collection business.

28. Preservation of microbial diversity.

29. Control of GMOs.

30. Biosafety and bioethics.

The cluster is directed by heads of the Institute of Microbiology and Virology of the National Academy of Sciences of Ukraine (IMV NASU) and State Scientific Control Institute of Biotechnology and Strains of Microorganisms (SSIBSM).

The IMV NASU is the largest scientific centre in Ukraine in the field of taxonomy, physiology, biochemistry and microorganisms genetics, biotechnology, ecology, general virology. The institute works on two main lines: study of fundamentals of biological activity of microorganisms in order to regulate it; ecology and taxonomy of microorganisms and viruses, identification of species and strains for development of biotechnological processes. Fundamental research is the basis for creation of new biotechnologies for industry, agriculture, health and environment protection.

The SSIBSM is the leading organisation for development, examination, registration, re-registration, control of quality of veterinary immunological preparations in Ukraine.

Cluster 3. Agroecology

1. Regional climate changes and their impact on rural areas and agricultural production.

2. Adaptation to climate changes and introduction of the best agrarian production practices.

3. Determination of indicators of soil degradation according to cosmos data (Eearth remote sensing - ERS).

4. Determination of chemical and biological criteria for soil contamination, classification and development of resource- and energy-saving technologies for their recovery.

5. Development of regional models for agro-ecosystems providing accumulation of carbon in soil.

6. Determination of effect of soil degradation and its contamination on products quality.

7. Management of semi-natural areas in agro-ecosystems to maintain biodiversity.

8. Regional models of bioenergy agro-systems based on the closed cycles of biogenic elements and biomass transformation into energy.

9. Improvement of the structure of forest-agricultural landscapes in the proecess of adapting to climate changes.

10. Technologies for the intensive use of biological nitrogen, phosphorus, plant protection against pests and diseases.

11. Methods for testing seeds on presence of pests and disease-producing factors to improve plant health and biodiversity.

12. Risk assessment in respect of GMOs in natural conditions and agro-ecosystems.

13. Post-market monitoring GMOs for determination of risks.

14. Regional models for production of ogranic products.

15. Satellite data for monitoring agricultural landscapes, land use systems and agricultural technologies.

16. ERS-based monitoring moisture provision of crops.

17. Ecological condition of wetlands and nature-conservative areas on the base of ERS data.

18. Regional resource- and energy-saving models of agro-sociosystems as a basis for restoring the natural resource potential of areas.

19. Significance of soil quality in a food chain.

20. Criteria and indicators of environmental life cycle assessment of production, processing and consumption of agricultural products, including fodder.

21. Technologies for cultivation of bioenergy crops.

22. Monitoring of reclaimed area (irrigation, drainage), resource- and energy-saving technologies for their usage.

The Institute of Agroecology and Environmental Management (IAEM) of the NAAS of Ukraine exercises administration and scientific guidance. The IAEM is a head organization of Scientific and Methodological Centre «Agroecology». It allows to conduct comprehensive study on the safe use of naturalas resources, increase in productivity and formation of agricultural products quality in all soil-climatic zones of Ukraine.

Cluster 4. Safety and food quality

1. Overcoming of the lack of population education in the field of nourishment and low culture level in consumption.

2. Decline in incidence of alimentary genesis diseases.

3. Improvement of the legal framework in the field of nourishment safety.

4. Introduction of new methods to control safety and quality of food.

The Belozerkovsk National Agrarian University (BNAU) exercises administration of the cluster. This is a powerful regional training and methodological, scientific and cultural center, where 9 faculties train specialists for the ABI of Ukraine. The university structure includes 8 colleges, 7 research institutes, 16 research laboratories, the Institute of Postgraduate Education of Managers and Specialists of Veterinary Medicine, the Institute of European Integration, training and research institutes and the Center for Economics, Business and European Development, 15 training and practical centers, scientific establishments and agriculture enterprises. 14 Academicians, 56 doctors of science, professors, 228 PhD, 22 Honoured Science and Technology Workers, distinguished workers of education, higher school, agriculture, veterinary medicine are employed at the university.

Cluster 5. Plant health

1. High-performance environmentally friendly technologies for nutrition and protection of spicate grains and other crops.

2. Methods for determination of inorganic ions and pesticide residues in spicate grains and other crops.

3. Biofortification of wheat. Technologies for cultivation of the state-of-the-art spicate grains for preventing the lack of minerals in a wheat grain (Fe, Zn, Cu, Ca, Mg, Se, Mn, Mo, etc.).

4. Investigation of variety and cultivation technologies features in respect of main component content in a wheat grain as a factor of its nutritional value: protein, gluten, other elements, including P, S, Ca, Mg, Se, Zn, Fe, Cu.

5. Examination of new plant varieties and hybrids in respect to resistance against diseases and pests in order to single out high-resistant varieties and make recommendations for their including in the state register of plant varieties suitable for distribution in Ukraine and introduction in production for cultivation of environmentally friendly products with a minimum chemical load.

The Institute of Plant Physiology and Genetics of the NAS of Ukraine (IPPG NASU), world-class research institution, is a coordinator of the cluster, which is registered on the institute address. The Institute under the direction of V. Morgun, the NASU academician, has created more than 100 plant varieties and hybrids. For example, a record grain corp of winter wheat variety «Favourite» in volume of 131.8 dt/ha was gathered over an area of 136 ha. More than 2,000 licence agreements have been concluded and supported on the use of developed varieties already introduced over an area more than 1.7 mln ha that is a significant contribution to strengthening food safety of Ukraine. To increase the production base the joint order of the Ministry of Agrarian Policy and NASU secured 178 base commercial farm units in all soil-climatic zones of the country for the IPPG. The IPPG NASU collection of valuable plant varieties samples was included in the state register of scientific objects of the national treasure.

The cluster also includes the Institute for Hygiene and Ecology of the Bogomolets Medical University, the Ukranian Institute for Plant Variety Expertise, some business organizations.

Cluster 6. Animal health

1. Animal health and state.
2. Garanteed quality and safety for consumers of food products.
3. Descending and ascending monitoring of biological and chemical risks in a food chain of livestock production.
4. Ongoing production of livestock products and proper practices.
5. Microbiological risk assessment of new and known microorhanisms in raw materials and food products in connection with climate change and environmental issues.
6. Harmonization of national food legislation with current international requirements on veterinary control over quality and safety of livestock products.
7. Strengthening the scientific and technological base of food industry in sanitation, hygiene, quality systems and food safety.
8. System management of food products quality and safety.
9. Development of identification systems for labeling of agricultural products.
10. Formation of safety and efficiency criteria in agricultural and food sectors.
11. Improvement of education in veterinary quality control and safety of food products.

The Sumy National Agrarian University (SNAU) coordinates the work. Its scientific lines comprise main elements of agriculture and the ABI.

The university closely cooperates with the Institute of Plant Protection of the UAAS, Research Institute for Poultry, Research Institute of experimental and clinic veterinary medicine, NSC «Institute of Agrarian Economics» of the UAAS, Institute of Botany, and Research Institute of Mechanical Engineering of the NASU.

The university carries out projects with more than 16 countries, among them Australia, Austria, England, Germany, Denmark, Poland, the USA, France. 31 agreements were concluded with foreign partners on scientific and technological cooperation, personnel training, and implementation of educational and professional programmes. The cluster includes research institutes, universities, government officials, business structures.

Cluster 7. Human health protection

1. Investigation of the most important factors causing food allergies of population: random and unbalanced diet, taking food rich in additives, admixtures, pigments and preserving agents, drinking water quality, especially from a city water supply network.
2. Identification of markers of diseases related to nutrition: diabetes, depression, etc.
3. Investigation of factors adversely affecting way of life of student youth: accommodation, recreation and education conditions, occurrence of chronic infectious and somatic diseases, reduced physical activity, psychological discomfort, smoking, taking of alcohol, drugs, eating pattern and quality, investigation of genetic factors, risks of allergic diseases of young people.
4. Need for early clinical laboratory and immunological diagnosis of immunodeficiency disorders against the replicative activity of Epstein-Barr virus, especially when atypical and latent infection caused by this virus takes place. It is known that Epstein-Barr virus refers to immunotropic ones able to affect immunocompetent cells and cells of significant organs and systems.
5. Determination of the risk of rare diseases (Churg-Strauss syndrome) of patients with allergic and autoimmune illnesses. Investigation of immunological parameters, polymorphism of IL-5 genes and IL-5 receptor, as possible triggers of синдром Чарджа-Стросса of patients with bronchial asthma and systemic vasculitis with eosinophilia.
6. Non-invasive diagnosis of specific allergy through identifying cause-relevant concentrations of specific IgE in saliva with the help of solid-phase immune-enzyme analysis of patients in any phase of allergic process.
7. Investigation of influence of intestinal microflora on development of dietary-related diseases.
8. Investigation of the role of vitamin D when celiac disease, complications in pregnancy takes place.
9. Investigation of the role of vitamin D in development of male and female infertility.

10. Development of a nutrition-related disease spread map for different regions and age groups in Ukraine (obesity, type II diabetes, cardio-viscular system diseases, allergic, iodine-, vitamin- and microelement deficient conditiones).

The cluster is coordinated by the Galizky Lviv National Medical University (lines 1-4) and Gorky Donetsk National Medical University (lines 5-10). The cluster includes several medical institutes and universities, institutes on genetics, biology, biochemistry, including genetics and rheumatologists from Poland, business organizations and private firms.

Cluster 8. Innovations and nanotechnologies in agrarian and food sectors and medicine

1. Serch for reliable and inexpensive methods of protection against infectious agents.

2. Investigation of issues related to search for new methods of organism immune status balancing at the level of receptor-ligand interactions in case of infectious diseases.

Creation of new biotechnological preparations, immunobiotics based on preliminayr selected and characterized lactobacillus and bifidobacterium strains with a high level of ability to induce cytokines of different nature and balance the organism immune response at different forms of infectious diseases (bacterial, viral, fungal).

3. Early clinical-laboratory and immunological diagnosis of immunodeficient disorders against viral infections, especially in atypical or latent course of infection, the cause of which is the virus of genital herpes.

4. Fundamentals for creation of new remedies based on cerium dioxide nanoparticles and their compositions with biologically active macromolecular compounds effective and affordable. Their introduction into practice to increase efficiency of infectious diseases prevention and treatment.

5. Introduction of powerful antioxidant, nanocrystal cerium dioxide, in a diet of quails and hens with potable water to increase their adaptive capacity against oxidizing stress and reproductibility.

6. Biological properties gold nanoparticles as biosafe and biocompatible nanostructures for target delivery of cardiotropic preparations (in particular «Simdax»).

7. New methods to process foodstuff and veterinary complexes by ecologically safe nanodisinfectants of a new generation, innovation methods to control safety and quality of foodstuff at different stages of a food production chain.

8. Prevention of population illnesses caused by lack of some elements, introduction in a food chain of nanotechnological modifiers and oligodynamic metals to increase immunity of population.

9. Improvement of the legislative base in terms of safety nutrition, in particular, the use of nanomaterials in accordance with EC specifications.

10. Improvement of culture to use fertilizers, process, pack and consume foodstuff.

11. Design fundamentals and methods to obtain artificial coatings based on biopolymers, high-molecular compounds and bioactive photocatalytic nanoparticles of metals and their oxides jointly with bio- and immunostimulators of a natural origin to protect hens' incubatory eggs and improve metabolism of birds` embryos.

12. Influence of a chemical composition of substances, mainly, glycoproteins, on a crystal structure of composites based on calcites to obtain coatings «artificial cuticle» with controlled parameters for gas permeability and release rate of biologically active substances assisting embryo development during the incubation period.

13. Photocatalytic destruction with participation of ultra- and nanodispersed particles of oxides of titanium, iron and other metals to obtain construction materials with biocidal properties.

14. Introduction of the newest methods in agriculture manufacture to process waste products of animals and birds, ecologically safe nanodisinfectants of double action possessing ultrahigh biocide activity caused by the ability effectively to oxidize organic substances of environment pollutants and pathogenic microorganisms with the following use of disinfected waste products as fertilizers.

15. Methods for regulating increase of mineral substances content in food and incubatory bird eggs using sonophoresis technologies.

16. Protection action of mangan as the basis for development of methods protecting animals and birds against peroxygen compounds and metal oxides nanoparticles.

17. To improve consumer qualities of products, influence of secondary potato metabolites (glycoalkoloids) of local, European and American selection on environmental contamination of Ukraine, presence of phytopathogens and pests.

18. New techniques of rapid analysis of secondary plant metabolites based on the-state-of-the-art mass spectrometer devices and their introduction in agriculture and processing manufactures to produce high-quality, non-polluting food stuffs for human and animals, to carry out scientifically proven forecasting of resistance of new plant breeds and hybrids against illnesses and pests in model systems in vitro.

19. Rapid diagnostics of tumoral diseases of agricultural animals and birds based on low-ionizing mass spectrometry.

20. Mass spectrometer analysis of a chemical nature of active substances of pesticides, bioadditives, pharmacological preparations for veterinary and humane medicine.

Sumy State University, Institute of microbiology and virology of the NASU, Institute of superhard materials of the NASU are coordinators of the cluster. Research institutes and small and medium enterprises (SME) are participants of the cluster.

Cluster 9. Communications, training and technology transfer

1. An analysis of needs of management and industrial cooperation in terms of SME.

2. A concept and tools facilitating deepening and widening of cooperation of SME among themselves and with large enterprises.

3. Assistance to development of knowledge networks for support of innovations.

4. Organization of information management systems to improve cooperation, control and management of risks in enterprises, networks and sectors.

5. A concept of information systems, structure, standards and formats of data transfer.

6. Development of institutional infrastructure to support management of SME, as well of an organization infrastructure.

Lvov Center of Science, Innovations and Information, SO «Agency of European Innovations», national contact points 7FP in Ukraine «Information and communication technologists» and «Research in interests of small and medium enterprises» are coordinators of the cluster.

Cluster 10. Markets

1. Analysis of the necessity to create a wholesale market of agriculture products.

2. Creation of favorable conditions for SME, adaptation of national legislations to European standards.

3. Integration of resources of partner countries (Hungary, Poland, and Slovakia) by transboundary cooperation within the framework of the project «Agroindustrial park» Coast – Carpathians»:

a. Transboundary cooperation of manufacturers, processers and sellers of agriculture products;

b. Joint development of the-state-of-the-art infrastructure of the wholesale market of agriculutre products;

c. Creation of an effective marketing network.

4. Formation of a consulting and training center for target groups (manufacturers, processers, sellers of agriculture products).

5. A monitoring system to control quality of agriculture products corresponding to the European standards.

A board of public organization «National Association on Development of Territories» (Transkarpathian region) and CE «Agency of Local Development of Vinogradovo area» are coordinators of the cluster.

Cluster 11. Social and economic cluster

1. Sociological monitoring of innovation opportunities of educational, scientific and business establishments in the field of the agrarian and industrial complex.

2. Theoretical and methodological background of the optimum use of a scientific and technical potential of Ukrainian agrarian science.

3. Scientific and technological, innovation medium- and long-term forecasts of development trends in the national, European and world agrarian markets.

4. Study of commercialization issues of scientific and technical activity results of agrarian science in conditions of transition to knowledge-based economy.

5. Organizational and methodological support at formation and realization of scientific, technological and innovation priorities in agrarian manufacture and process industry.

6. Key factors and consumers` behaviour assisting transition to more healthy nutrition.

7. Development of new ways of effective interaction and transfer of target information about healthy balanced diet for different population layers with different requirements, including various ethnic groups, women, children, old people, who are exposed to the highest risk.

8. Planning of nutrition culture in Ukraine.

9. A role of prices for different food stuffs, their influence on various population layers.

10. Improvement of social, economic, organizational and information mechanisms for formation and effective use of scientific, technological and innovation potentials of Ukraine, their interaction with the same potentials of foreign countries, integration of the national agrarian science in the world and European scientific system.

11. Social aspects of activity of transnational networks, communications and organizations in an industrial and marketing system, infrastructural support of complex solution of tasks in scientific sphere, agriculture, food processing industry and business environment.

National contact point FP7 «Science in society», Dobrov Research Center of Scientific and Technical Potential and History of Science of the NASU are coordinators of the cluster. The cluster structure includes academic institutes, establishments of higher education, business organizations.

Cluster 12. Coordination and international management

1. Strategic informing of Ukrainian science employers and the interested institutions on declared competitions, programs, etc., including those financed by EU.

2. Consultations on preparation of interstate and interregional scientific projects.

3. Assistance to establishment of contacts of Ukrainian scientists and businessmen with foreign partner organizations, in particular, located in adjacent frontier regions (priority line is knowledge-based bioeconomy).

4. Carrying out of trainings, conferences and broker events.

5. Activity focused on successful functioning of Ukrainian Technological Platform «Agri-Food» in «Food for Life» ETP network and its official representation in EU.

N.V. Bojko, professor, and P.I. Bilak, academic secretary, PhD, (Uzhgorod National University) are coordinators of the cluster and platform.

Conclusions

1. The Ukraine`s agrarian and industrial complex has a number of issues, which are only in part mentioned in the article presented.

2. There is a positive tendency for solving these issues, which becomes visiable in action undertaken by bodies of state authorities and local government institutions, research institutes, business structures, for example, land reform and the national «Agri-Food» Technological Platform.

3. The encouraging circumstance is that Ukrainian scientists, in spite of existing difficulties, continue to work in all lines of agrarian and industrial complex on creation of innovation technologies and products.

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Developments of Ukraine

Agrochemistry

UKR-01

Highly effective plant growth regulators

Purpose

Biolan and Radostim: treatment of seeds and spraying seedings of corn, leguminous, industrial, fodder, vegetable, cucurbits, berry crops, grapes, mushrooms.

Biosil: treatment of seeds and spraying of seedings of winter wheat, summer barley, soya, buckwheat, peas, rape, medick, clover, flax. Decorative and wood trees, bushes, flowers and grasses.

Biomax: treatment of sugar beet seedings.

Application field

Agriculture, biotechnology, forestry and dendrology.

Description

Plant growth regulators are natural phytohormones and artificial analogues or composite preparations containing balanced complex of phytoregulators, biologically active substances, microelements allowing purposefully to adjust major processes of growth and development of plants, effectively to realize potential possibilities of a grade or hybrid, incorporated in a genome by nature, selection or a gene engineering process. They increase resistance of plants against adverse factors of a natural or anthropogenous origin (critical temperature differences, moisture deficiency, phytotoxic action of pesticides, illness and pest infestation).

Plant growth regulators of a new generation are characterized by high efficiency and ecological safety. They increase vital activity of plants (membrane processes, cell fission, fermental systems, photosynthesis, respiration and nourishing), biological and economic efficiency of plant cultivation, reduce in products the content of nitrates, heavy metals ions and radionuclides.

Research demonstrated that joint application of plant growth regulators with up-to-day herbicides and insectofungicides allows to decrease by 20-25% per 1 hectare of seedings a norm of pesticides used without reducing protective effect.

Biolan is characterized by increased content of phytohormones analogues, polyunsaturated fatty acids responsible for elaboration of phytoncides, phytoalexines and chelate forms of biogenic microelements.

The preparation of a wide spectrum of action is authorized for processing of seeds and spraying of plants, reduces phytotoxic action of pesticides, possesses antimutagen effect. Resistance of plants against illnesses, stressful factors increases under influence of the preparation.

Technical characteristics

Consumption rate:

- Preseeding treatment - 20-25 ml per 1 ton;
- Spraying of seedings - 10-20 ml per 1 hectare.

Advantages

New plant growth regulators are as good by efficiency as the best world preparations, and considerably surpass them by technological parameters and cost.

Development stage

It is introduced into manufacture

Cooperation proposals

Sale of licenses.
Realization of finished goods.

Adsorbents for agro-industry

UKR-02

Use of saponite rock of Tashkovo deposit in agriculture and industry of Khmelnitskiy region

Purpose

Practical use in agriculture, development of cleaning pastes.

Application field

Industry. Cleaning of strongly polluted surfaces. Main application is effective limy fertilizer.

Description

Physical and chemical properties of natural saponite of Tashkovo deposit of Khmelnitskiy region, including ability of its activated and modified forms to adsorpt various substances, have been investigated. Saponite activation is carried out by heating at 300°C within three hours (thermal activation) and treatment of a 20% sulfuric acid solution (36% of saponite weight) at 95°C within six hours (acid activation). The modification was carried out by 0.1 M solutions of magnesium, aluminium and iron salts at 20°C within five days (cation modification). Investigated were such its properties, as bulk and true weight, pH index of water saponite suspensions, a degree of its saturation, saponite sorption properties were investigated in terms of organic dyes of a various chemical structure - direct bright orange (anion dye), methylene blue (basic dye) and cation dark blue 4K (cation dye).

Natural saponite has good sorption properties in terms of the cation and basic dyes and low in terms of the anion one. Natural saponite activation and modification were carried out to increase its sorption properties. Thermal activation does not lead to its increase of sorption properties in terms of dyes of different classes. Acid activation strongly increases sorption properties of saponite in terms of the anion dye (2.18-fold sorption increase), increases adsorption of the basic and cation dyes.

Adsorption properties of acid-activated saponite can be compared with properties of activated coal. Chemical modification by multivalent metals salts questionably influences on change of saponite sorption properties. Saponite modified by magnesium salts has the best results in terms of increasing adsorption of direct bright orange and cation dark blue dyes, saponite modified by aluminium and iron salts has the worst results for dye sorption. Chemical modification significantly increases sorption properties against the basic and cation dyes and in a less degree against the anion dye. The acid-activated saponite has the best sorption properties against the anion dye. Investigation of its physical and chemical properties showed the possibility to use the material in industry as a sorbent for caloured sewage decolaration, cleaning polluted surfaces, in preparations for textile industry.

One of the main fields of saponite application is agriculture. Investigation showed possibility to use it as an effective limy fertilizer.

Novelty

A complex analysis of saponite properties in terms of their practical application in agriculture and industry has been carried out; dependence of different dyes adsorption on an activation character and natural saponite modification has been shown; a physical and chemical approach at choice of practical saponite usage fields by means of selection and substantiation of research methods has been proposed.

Practical value of the results consists in the saponite use to increase efficiency of agriculture, in industry and everyday life.

The agent is effective for cleaning of strongly polluted surfaces, does not influence on environment, it is economical and effective.

Advantages

There are no analogues in Ukraine.

Development stage

It was tested at pilot operation.

Cooperation proposals

Joint bringing the deposit to an industrial development level.

Biosafety

UKR-03

Mobile installation for purification of tapwater and artesian water

Purpose

Potable water purification.

Application field

In all spheres of human life and activities, agrarian business.

Description

Human health by 10% depends on doctors and medicines; the rest in an organism is formed by a way of life, inhabitancy, and foodstuffs. Water is everyday need; it is a basis of life, longevity. It is a solution of substances of a complex chemical composition.

Water contains ions of inorganic conmounds, dissolved gases, finest particles of hard impurities, organic substances of a natural and artificial origin, microorganisms and products of life. The sizes of particles contained in water can vary from several ten-thousand shares up to 100 microns.

There are many microns installations for additional purification of potable water. It

produces an impression that developers compete in that as much as possible to remove dissolved substances from potable water.

The advanced tendency of increasing efficiency of devices for potable water purification consists in its treatement directly at a consumer.

Otherwise, when purification takes place at a source, water becomes polluted again while flowing in a delivery pipe. Pollution can be mechanical (dissolved impurities) and bacterial ones.

To avoid it, it is expedient to use water treatment systems directly on a spot of its consumption. Scientists and engineers of Ukraine managed to create an innovative technology and develop design of installations, which allow to obtain healthy water from existing chlorinated mutagen one.

The Zhitomir City Consumer Society to obtain biologically active potable water «TALA-WATER» uses installations of the «Cascade» series. Unique filtering and sorption materials and «know-how» are used at their manufacture; installations have been patented in Ukraine and Russia.

They well proved themselves in life and industry. Installations function successfully in Ostrog Factory for Mineral Waters, Berdichevsk Municipal Enterprise of Water Supply and Waste Water Treatment, Simferopol firm «Union–Viktan», Kamenez-Podolsk Foodstuff Factory.

Novelty

Patents of Ukraine and Russia are available.

Advantages

Outstanding features of «TALA-WATER» potable water:

1. The use of a multistage scheme of purification. Filtering elements successively trap particles with the size of more than 1 micron. These are mechanical suspended impurities, microseaweed, and other suspensions.

Filtering cartridges have an innovative multilayered design functioning on the deep filtration principle. In comparison with surface filtration it is carried out by a filter with chaotically tangled pores functioning much more effective than a surface filter.

2. The use of an agent creating a structure similar to quasicrystal water in an organism like a structure of crystal ice lattice.

The water having an ice-like structure is included into a system of alive molecules, well waters them, and provides an optimum path of oxidation-reduction reactions, a metabolism level. The structured water is a catalyst of biochemical reactions for organism tissue. It increases efficiency of organism`s regulatory systems and tissue resistance against adverse influences.

3. The use of an unique sorption element with activated fibrous carbon material, which practically completely removes smell, smack, turbidity, colour by adsorption, molecular screening, electrostatic attraction in filtered water. Decrease of pergamanate oxidability by 60-90% shows reduction in organic substances content in water. Ammoniac nitrogen, nitrate nitrogen, total iron are effectively removed from water by 60-90%, 50-65%, 70-95% respectively.

4. The use of a mineralizer, a vessel with specially matched minerals, interacting with which water gets earlier absent biologically active healthy properties.

It was determined in experiments on animals that «TALA-WATER» possesses a pronounced antitumoral and antimetastasis effect. The conclusion was received in Kavezky Institute of Experimental Pathology, Oncology and Radiology of the NASU.

Development stage

It is introduced into manufacture.

Cooperation proposals

Sale of patents, licenses.

Biosafety

UKR-04

FTB filtering element

Purpose

Purification of liquids, gases, microorganisms from mechanical contaminants with size of up to 0.3 microns.

Application fields

Various branches of economy, including agribusiness, where purification of liquids and gases from mechanical impurities is required.

Description

Filters are made of ultrathin synthetic fibres. Filtering materials and filters on their base are produced on a fundamentally new technology from thermoplastic polymer.

The technology allows to adjust the pore size and total porosity of the material. It is characterized by simplicity, productivity, low power consumption, absence of harmful emissions in atmosphere and water reservoirs, realized with extrusion equipment. Using filters on the base of ultrathin synthetic fibres, it is possible to purify water, gases, organic solvents, concentrated mineral and organic acids, alkalis and their solutions, oils, oil, photoemulsions, photoresists, etching agents, peroxides, developing agents, radioactive aerosols, dust.

Filtering materials do not bring iron, copper, silicon, manganese, magnesium, nickel, aluminium, calcium, organic impurities in a filtrate; they are high-effective sorbents of harmful gases, vapours and liquids, do not become foul.Filtration surface is 0.1m^2 for the flat filter, 1m^2 for the filter with a developed surface, which can be increased by the order due to goffering. The developed filtering compositions are applied instead of materials made of natural fibres, which can be used for manufacture of goods.

Characteristics

- Efficiency of mechanical particles entrapment, %: gaseous medium: 99.999, liquid medium: 80-99;
- Filter parameters (FTB-1/FTB-2):
  - Diameter, mm: 72;
  - Height, mm: 125/250;
  - Productivity, l/hour: 500/1000.

Novelty

Three patents of Ukraine are available.

Advantages

Analogues are not known. In contrast to existing methods for creation of filters with the developed surface the technology provides goffering of not filtering material, but a semifinished item that excludes mechanical damage of a filtering layer.

Development stage

It is introduced into manufacture.

Cooperation proposals

Sale of licenses.

Sale of finished articles.

Biotechnologies

UKR-05

Energy-saving non-polluting technologies for production of microbiological preparations

Purpose

Preventive and medical measures at gastroenteric diseases of animals and birds.

Application fields

Agriculture.

Description

Microbiological preparations are used for preventive and medical purposes at gastroenteric diseases, increasing productivity, stimulation of young stock growth and development, forages siloing, increasing in agricultural crops productivity.

Preparations are the alternative to chemical compounds.

Theire is practically no industrial manufacture of them in Ukraine.

The need for preparations of microbiological synthesis is dozens of thousands tons. Ukraine has the raw material.

The Institute of Technical Thermophysics and D. Zabolotny Institute of Microbiology and Virology of the NASU have developed technologies and equipment for manufacture of preparations based on methods of dispersed-pulse energy input.

Approbation of the technology was carried out in industrial conditions in Lotoshino Biochemical Plant, in farmes of the Chernigov area.

Novelty

Two patents of Ukraine are available.

Advantages

- Preparations are granulated;
- The output of viable cells is increased in comparison with a powder form;
- The technology is ecologically safe.

Technical and economic effect

- Morbidity rate for dyspeptic disorder of of animals is reduced by 15%;
- survival rate of young stock increases by 20-29%;
- weight of animals grows by 8-15%;
- egg-laying capacity is increased by 10-15%.

While using azotobacterin yield of vegetables grows by 15-23%; permanent grasses by 15-18%.

A pay-off period is 1-1.5 years.

Development stage

It is introduced into manufacture

Cooperation proposals

Sale of licenses.

Sale of finished goods.

Food-processing industrys

UKR-06

Technology for granulation of hop, odoriferous and medical plants

Purpose

Long storage of raw material without loss of quality.

Application fields

Food-processing industry, including brewing, pharmaceutics, perfumery, cosmetics.

Description

The technology for granulation of hop and medical plants, including the main process to transit vegetative raw materials into granules, namely: preliminary drying, two-stage crushing in fractions (primary in 25 mm and secondary in 4 mm ones), mixing of the crushed organic raw material, its granulation, granulate cooling, separation of high-quality granules (separation of granules from dust).

The feature of the technology consists in that all processes are carried out at pressure close to atmospheric, and temperature is kept in a range from 100°C to 600°C. Preliminary drying of raw material is conducted at humidity of 14±4%. Cooling of granulate and separation from it of high-quality granules are carried out simultaneously.

Novelty

One patent of Ukraine is available.

Advantages

Losses of valuable hop plant components at granulation according to the biochemical analysis carried out in Ukraine are minimal. The analysis of quality of obtained hop plant granules, which was conducted in the Bavarian Center of Hopgrowing of the Institute of Plant Cultivation and Protection (Huell, Germany), also proved high quality of obtained products. They practically did not differ by quality from original raw cones of the «National» grade hop.

Granules can be kept without loss of quality much longer than cones that is important at their use in brewing. Similar results were received at granulation of lavender, mint and other odoriferous and medical plants.

Development stage

It is ready to introduction.

Cooperation proposals

Sale of licenses.

Joint bringing to an industrial level.

Agriculture

UKR-07

Enomelanin – preparation for adaptation to adverse environmental factors

Purpose
Protection of immune system against damages.

Application fields
Medicine, agriculture, farmaceutical industry.

Description
Enomelanin is a polyphenolic complex obtained from a red grapes peel. It exhibits antitoxic properties reducing influence of nitrogen dioxide, carbon oxide, tetrachloroethane, dinitrobenzene. It increases functional activity of macrophages and natural-killer cells. While acting of adverse environmental factors, it protects immune system against damage preventing development of immunodeficient states. Enomelanin restores an antioxidant system of cells, which is damaged by toxicants with oxidizing action.

Novelty
The author's certificate is available.

Advantages
There are no known analogues. For the first time Enomelanin pharmacological properties obtained from higher plants were investigated. Presence of antitoxic and immunomodulating types of action was proved. Preparation is more effective and cheap in comparison with existing ones.

Technical and economic effect
Taking into account that Enomelanin is obtaine from winemaking waste products its cost is insignificant (1.5 c.u. for 1 g) in comparison with animal melanin (150 c.u. for 1 g) available in the market.

Development stage
It is introduced into manufacture.

Cooperation proposals
Sale of licenses.

Agriculture

UKR-08

BIOMIX DE200 biological product

Purpose
Enterprises of the dairy industry.

Application fields
- Production of fresh milk and pasteurization;

- Extraction of whey from sewage at cheese factories;
- Production of tallow oils that is connected with presence of factory flushing waters and waters with high content of oils;
- Production of dry milk, when condensates frequently have low pH;
- Production of ice-cream and yoghurts.

Description

Drains of dairy plants have a specific composition, which is necessary to bring to the certain norms before discharging in a sewer system.

Some of them: high values of BOD, oil and fat content, flushing water of dairy production and lorries containing caustic soda, acid washing substances, ammonium from dairy amino acids (proteins) and phosphates from caseins.

Advantages

- splitting of fats and oisl contained in waste products as particles;
- decreasing of BOD and amount of suspended particles in sewage of the dairy industry excludes imposing of penal sanctions;
- restoration of natural biomass after reset of a system caused by the usage of caustic soda and acid cleaning substances;
- improvement of organic decomposition in inlets with short presence of drains before discharging in the city water drain system;
- preventing of anaerobic conditions and H2S formation, what is the reason of smell in waste products of dairy enterprises;
- elimination of formed organic depositions from pipes and walls of biological ponds;
- improvement of sedimentation and restriction of silt accumulation allows to increase efficiency and capacity of a factory.

Development stage

It is introduced into manufacture.

Cooperation proposals

Realization of finished goods.

Land restoration

UKR-9

Contour-strip land cultivation

Purpose

Design of contour-meliorative agrarian landshafts for soil protection against water and mechanical erosion, dust storms and dry winds, moisture accumulation in a zone with insufficient humidifying.

Application fields

Soil protection against erosion.

Description

Using contour-strip treatment of soil, strips fixing is made by planting of tall-stalked agriculture plants, for example, corn, topinambur, mustard, with the distance of up to 30 m between strips.

To treat spaces between strips, low-power agricultural techniques with tractors of the first - second draft class, whose short turning radius allows to carry out technological operations without gaps.

Improvement of the way by strip fixing using planting of tall-stalked agriculture plants allows to mitigate negative influence of climatic factors, to provide preservation of rich soil horizon, to create erosion-safety interstrip terraces with appropriate conditions of water accumulation and prolonged action of mineral fertilizers.

Novelty

One patent of Ukraine is available.

Advantages

The method allows to decrease influence of climatic factors (rain, snow, wind, dry wind) resulting in destruction of a humus layer, preserve a rich horizon. Creation of interstrip terraces provides increasing of the agriculture vegetation period, extending of mineral fertilizers action. There is no need for additional expenses to use special irrigating technics.

Development stage

It was tested in a pre-production operation mode.

Cooperation proposals

Sale of licenses.

Joint bringing to an industrial level.

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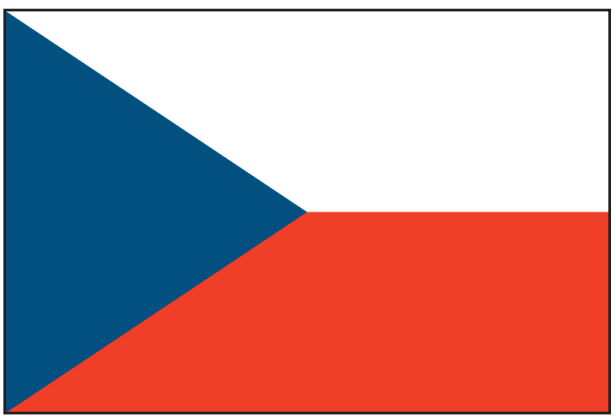
CZECH REPUBLIC



Technologies and developments are presented by the Association of Innovative Entrepreneurship of the Czech Republic

Food-processing Industry

CZH-01

The new Czech beer without gluten

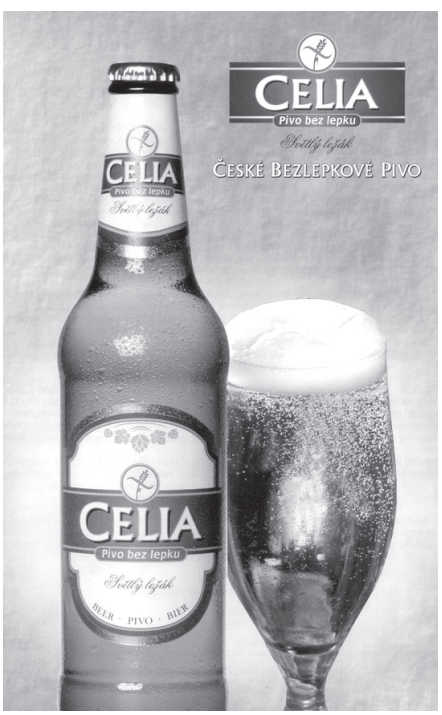
Purpose

In the competition for the Innovation of the Year prize the Research Institute of Brewing and Malting (RIBM) won honorable mention for the successful completion of the development of technology that enables a safe production of Czech beer for celiacs.

Description

As a rule, gluten-free beers differ significantly in sensory properties from typical Czech beer, because their production makes use of raw materials unusual for Czech beers, such as maize, millet, buckwheat or rice.

The RIBM project team has developed a unique technology, in which the Czech malt remains the main ingredient of beer for people with celiac disease. It is specifically processed in the brewhouse and is subjected to a modified main fermentation and secondary fermentation.



Gluten, or toxic pentapeptides which evoke in celiac patients an autoimmune response of the organism, are removed through the application of specific enzymes and nonspecific precipitation of proteins with tannin. An important part of the project was also to find suitable methods for the determination of substances dangerous for celiacs, including these pentapeptides.

Competitive enzyme immunoassay, called the ELISA system, was used for the determination of these substances.

The technological process so developed makes it possible to reduce the gluten content of the final product to less than 5 mg of gluten per 1 liter of product, a value four times lower than the legal limit for gluten-free foods.

The project was conducted under collaboration with the Advisory Center For Celiac Disease And Gluten-Free Diet, which was one of the initiators of the project. With the contributions of the Center the research team organized exploratory clinical tests showing that moderate consumption of gluten-free beer does not cause any changes in the antibody response of celiacs or other health problems.

On the contrary, volunteers among celiacs positively appraised the fact that they can include in their diet Czech beer, an important part of the national cuisine.

The technology of production of Czech beer for celiacs, whose development was subsidized by the CR Ministry of Industry and Trade in the IMPULS program, is protected by two utility models and two patents. The Saaz brewery, Ltd. immediately expressed interest in the license rights, and launched the production of gluten-free beer under the brand name CELIA.

Characteristics

Lager beer meeting the requirements of the specification for the protected geographical indication Czech beer.

Gluten content is below 0.5 mg/100 ml.
Alcohol content: 4.5% by volume
Gravity: 11%

Development stage

The beer offers characteristics typical for Czech lager, such as golden color, pleasant malty aroma, refreshing tang and a harmony of flavors in which initial sweetness meshes well with delicious lingering bitterness. A characteristic feature is rich foaming.

Contact Informaton

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Agriculture

CZH-02

Mulch machine for side throwing of plant mass with the help of bent blades and variable working width to work in hop gardens

Purpose

Innovation of horizontal mulch machine for hop gardens is based on the possibility to adjust working swath and throw of plant mass into the sides of the rows with the help of specially bent knives.

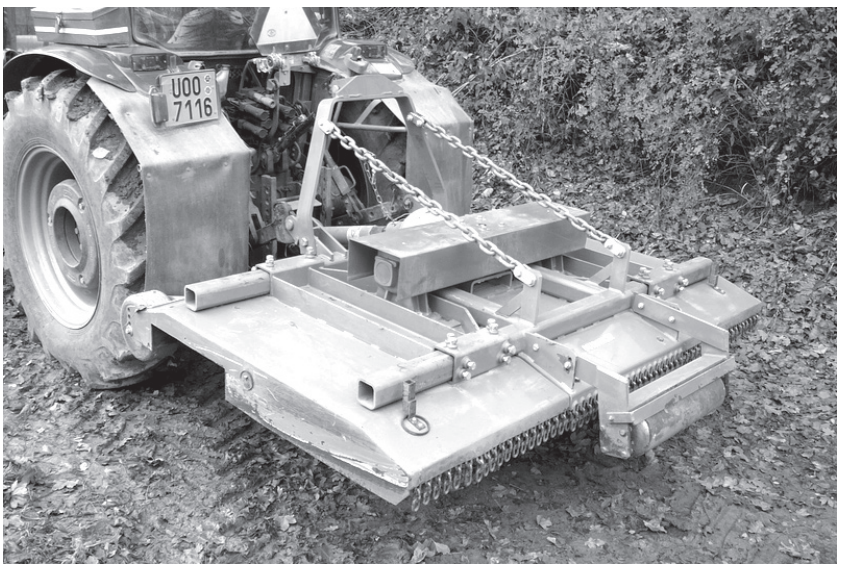
Description

The machine is suitable for the surface mowing and mulching of grass, weeds, natural seeding of shrubs and trees till the diameter of 1 cm not only in hop gardens but also in vineyards including crush of bines.

Machinery for side throw of mulch interim crop in the space between rows with variable working width consists of three sections: central, right and left.

Supporting frame with the main gearbox, which shifts rotating moment from shaft outlet of the tractor to the right and left sections, forms the central section. Two diagonal brackets are placed at the central section. They support right and left section.

The both sections are secured with a socket and fixing screws for adjustment of the working width. Terminal gearboxes are put on the adjustable right and left sections. They shift the motion from the main gearbox to the rotors.



Rectifiers have been installed in the front, central, right and left sections to throw mulch mass. With their help plant material is put aside into the outlets placed on the right and left sections.

Working width of this machine (2050 mm – 2200 mm – 2300 mm) can be set up and in this way we are able to regulate the swath of mulching according to the width of rows in the hop garden.

This operation is carried out with the help of fix screws so as to shift right and left sections on the demanded width. Fix screws also serve to fix right and left sections back to the diagonal supports. Better grinding and throwing of mulch mass through the outlets are provided with the help of bent knives.

Three-point tow is placed in the front part of the carrying part as a pendulum. Chains connect it with the rear carrying profile. Pendular suspension of the third point is necessary for optimal terrain tracing.

Development stage

Technical certification of the machine is following: working machine supported, horizontal mulch machine, trademark: OSTRATICKÝ, type HM4/HM5. Technically is the machine identical with the type authorized by Ministry of Transport (no. S-0243-03-02). Weight of the machine is 590 kg; maximal transport speed of all the machine alternatives is 20 kilometers per hour.

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