PROVIDING FOOD SECURITY IN THE EXISTING TENDENCIES OF POPULATION GROWTH AND POLITICAL AND ECONOMIC INSTABILITY IN THE WORLD

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Abstract: Food security, namely, the stability in availability of food for the population is important for the wellbeing and health of all mankind. In the modern world the destabilization of food the basic reasons of which are population growth, poverty, lack of investments into the agricultural industry, climate and weather, wars and resettlement, etc., is noted. The existing forecasts of the dynamics of population growth till 2050 are limited to 8–11 billion. The most part of this growth will accrue to the developing countries of Africa and Asia while the population of the developed countries, on average, will remain unchanged (except the United States of America due to international migration). The geographical distribution of undernourished people looks similarly, less than 5% of the population accrue to the developed countries, more than 12% – to the developing ones, on average in the world – more than 10%, with the prediction of further decrease. In spite of the fact that the percentage of mankind of the general biomass of our planet is insignificant, its activity is comprehended and anthropogenous as it became one of the most important forces changing processes in the biosphere. The interrelation of population growth and the necessary dynamics of food using the example of the protein, carbohydrate and fatty components in the world and in the former Soviet Union is considered in the work. The average forecast of population is used for the analysis. In case of the realization of the corresponding biotechnologies, the opportunity, if not of providing food security, then that of reduction of the number of undernourished people in the world, of food and energy resource conservation and of negative effect on the environment is quite achievable.

Keywords: Food security, growth of the number of mankind, hunger, Customs Union, Eurasian Economic Community

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INTRODUCTION

The mankind, in a varying degree, has faced hunger from the moment of its emergence. It is common practice to designate the decrease in agricultural production, industrialization and urbanization, armed and ethnic conflicts, the deterioration in the ecological situation as the reasons of hunger, however the uncontrollable population growth in the developing countries is considered to be the main one [1–2]. The global food deficiency is, as a rule, during world wars, natural cataclysms, epidemics, but it was until the 20th century when attempts to provide food security were made [3–6]. In 1945 the Food and Agriculture Organization (FAO) the main objective of which consisted in the assistance to agriculture for the reduction of the problem of hunger and poverty was created on the basis of the United Nations. In 1962 the World Food Programme of the UN was organized to confront world hunger. Ten thousand of people who annually help on average about 100 million undernourished people in 75 countries of the world (*www.ru.wfp.org*) work in the organization. In 1996 the member states of the UN adopted the Millennium Declaration (MPG) to improve the welfare of mankind by elimination of hunger, poverty and diseases (*http://www.un.org/millenniumgoals*) which resulted in the decrease in hunger by half during 1990–2015. In 2009 FAO organized the world summit on food security. Collateral events: the expert forum "How to Feed the World in 2050", the Committee on World Food Security and the World Food Day on which the declaration (WPS) with the statement for the decrease in hunger by half by 2015 (*ru.wikipedia.org*) was adopted. According to FAO (Fig. 1–3), (*http://www.fao.org/hunger*) the number of undernourished people in the world in 2015 was 793 million people (malnutrition and hunger, directly or indirectly, are the reasons of more than half of child deaths [7–10], the main reasons for death and invalidization of the person, owing to the reduction of body's immunity and the decrease in its immunodefences because of lack of nutrients [11–15]).

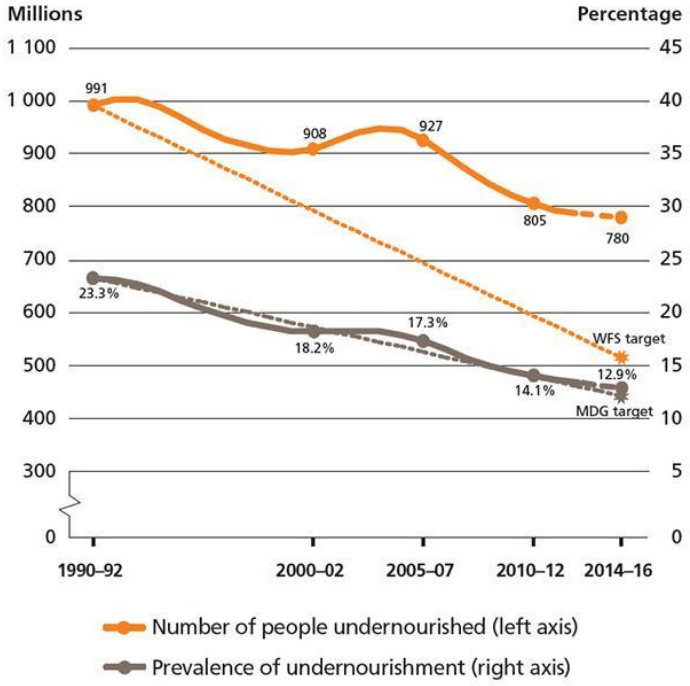
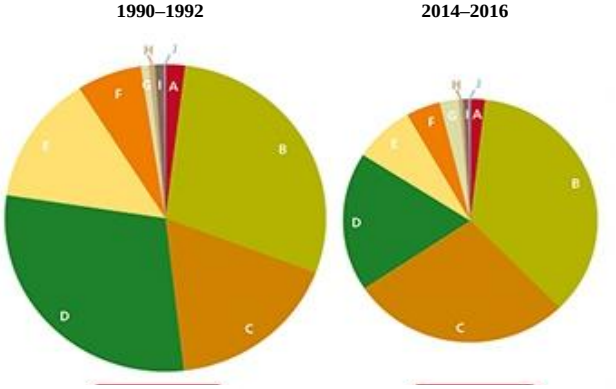


Fig. 1. Distribution of the number of hungry people in the developing regions: the real and expected result (Data for 2014–2016 are preliminary estimates, MPG is the Millennium Development Goals, WPS is the the World Food Summit).



		Population (mln)		Regional share (%)	
		1990–1992	2014–2016	1990–1992	2014–2016
A	The developed regions	20	15	2.0	1.8
B	South Asia	291	281	28.8	35.4
C	The countries of Africa to the South of the Sahara	176	220	17.4	27.7
D	South Asia	295	145	29.2	18.3
E	Southeast Asia	138	61	13.6	7.6
F	Latin America and the Caribbean region	66	34	6.5	4.3
G	West Asia	8	19	0.8	2.4
H	North Africa	6	4	0.6	0.5
I	The Caucasus and Central Asia	10	6	0.9	0.7
J	Oceania	1	1	0.1	0.2
	Total	**1011**	**795***	**100**	**100**

Note. * Including the data on Sudan which are not included in the indicators regarding the countries of Africa to the South of the Sahara, after the partition of the country in 2011 and the independence of South Sudan.

Fig. 2. Distribution of the number and percentage of undernourished people across the regions by 1990–1992 and 2014–2016. (The value of segments is proportional to the total number of undernourished people for every period. All the indicators are rounded. The data for 2014–2016 are preliminary estimates).

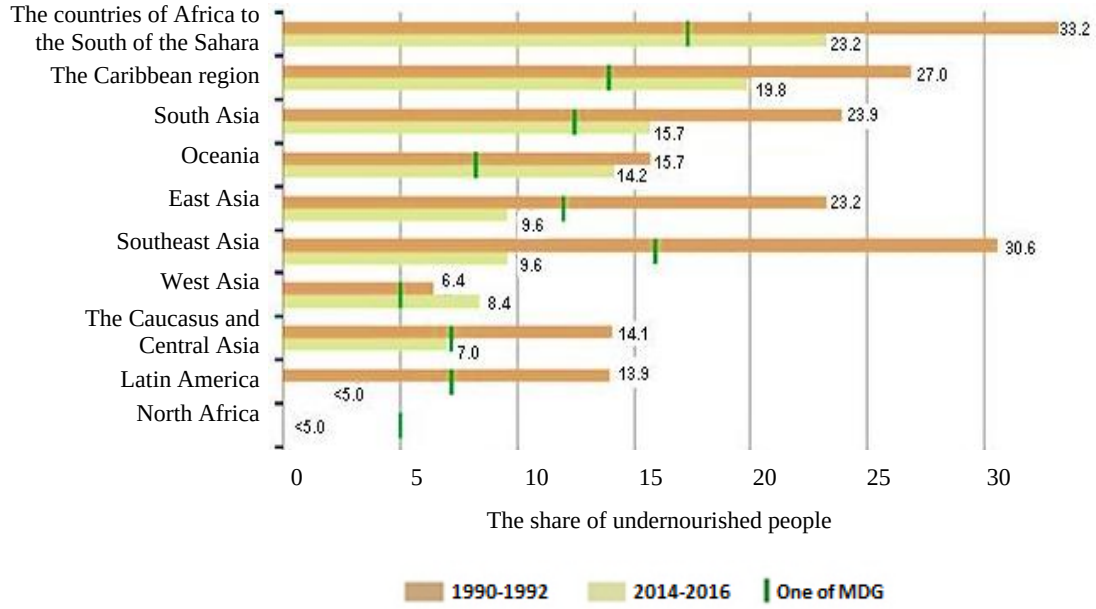


Fig. 3. Trends of decrease in malnutrition across regions.

In June, 2015 the head of FAO called for the global movement for full eradication of hunger, defining poverty as the reason for hunger. The last program of the UN "Zero Hunger" up to 2030 is based on a thesis about the possibility of eradication of the problem of hunger only after eliminating the interrelated reasons of poverty and, actually, hunger.

The actions and programs which performed by the UN act as the world platforms of discussion and development of the complex strategy of fight against hunger on the basis of scientific, ecological, technological, social and economic and political aspects [16–20].

The greatest intensity of addition of the population of the globe was in the 20th century, it is explained, first of all, by a significant industrial progress. According to different forecasts the population growth will continue [21–23], at least, to the middle of the 21st century and will have been from 8 to 11 billion people by 2050 (Fig. 4). For this reason, there is a need of providing all people with the available, good nutrition rich with nutrients [3, 6, 24–28]. The purpose of the overview is the analysis of opportunities of providing global food security and decrease in the number of undernourished people taking into account the population growth tendencies, including that of the developing countries (Belarus, Kazakhstan, Russia) of the Customs Union and the Euroasian Economic Community.

RESULTS AND DISCUSSION

The analysis and projection of population allow to regulate and, in case of need, to introduce amendments in the scenarios of distribution of the existing and the renewal of the missing resources. A long-term forecast allowing to distribute the efforts of mankind in the present circumstances of the civilization and distribution of natural resources is necessary for the the solution of the similar tasks.

The first attempt to estimate the population growth and the possibility of providing all people with food was made by the English economist Thomas Malthus [29, 30]. He considered that population increases exponentially if it is not restrained by any reasons, and it does not foretell anything good for the planet, a food and ecological crisis is ahead as the quantity of food resources grows only at an arithmetic rate.

There existed for a long time an opinion that the growth of the world population is subject to the hyperbolic law, however, the analysis of empirical data (past and the present) by modern science showed that the unrestrained growth is not possible under the conditions of the existing restrictions. And there was a delay of birth rate in the second half of the last century. The English biologist Julian Huxley gave the most exact forecast (1964) - the population of the planet will have reached 6 billion people by 2000, according to the UN, this date was October 12, 1999 [31, 32]. According to the UN, the increase in population is 74 million people now. The largest growth of the population occurs and will occur in the underdeveloped countries while the population of the developed countries will remain within the present limits. The USA can make an exception because of migration flows. According to FAO, it is supposed that the population of the planet will have exceeded 9 billion people by 2050.

Some of the most widely used forecasting models of population up to 2100 which, to some accuracy, have a single quality characteristic of dynamics are known, the difference is in quantitative values (Fig. 4).

These data include the forecasts of the UN, International Institute for Applied System Analysis (IIASA), the World Bank and the Russian science professor Sergey Petrovich Kapitsa who paid considerable attention to the study of problematics of population of mankind (Table 1).

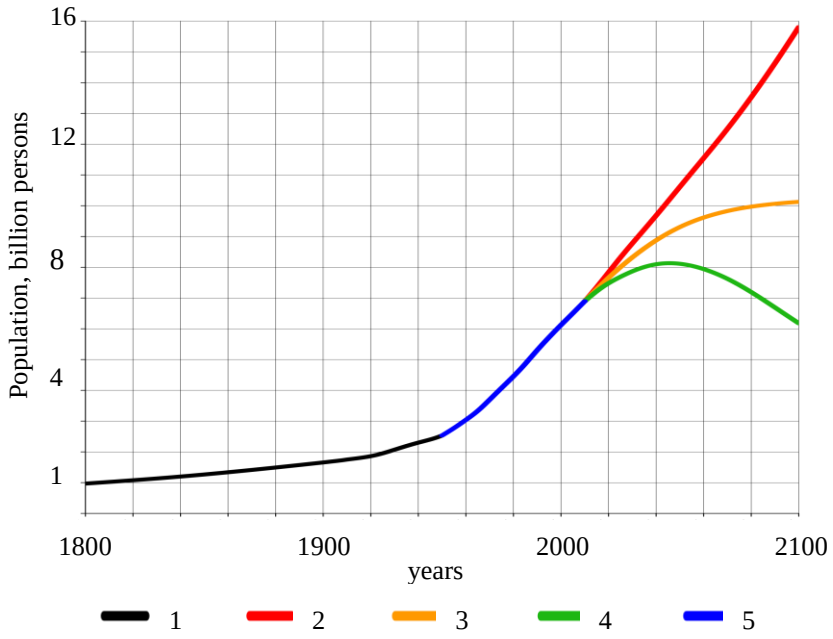


Fig. 4. Dynamics of growth of the world population with the results of the forecast till 2100 (*https://en.wikipedia.org/wiki/Projections_of_population_growth*): 1 – the calculated data (US Census Bureau historical estimates); 2 – the high case scenario of the UN; 3 – the medium case scenario of the UN; 4 – the low case scenario of the UN; 5 – the actual data.

Table 1. World Population Forecast by year (billion)

	2025	2100
UN	7.9–9.1	6.0–16.1
IIASA	8.1–9.91	9.2–16.0
WB	8.3	11.7
MK	8.1	11.0–12.0

The forecast of the UN is the total scenario of birth rate and mortality by nine regions of the world: the population of Earth will have reached the value of 11.600 billion by 2150 and further will be stabilized.

The forecasts of IIASA are based on the split of the world into six regions and the use of ten various scenarios of development, they will be in effect until 2100.

The World Bank is an international financial organization created for the purpose of providing the organization of financial and technical assistance to the developing countries, one of its activities is the strategic tasks of development of humanity and certain regions.

The mathematical model of Kapitsa S.P. (MK) defines the asymptotic transition to the limit of 12 billion in 2100, 11 billion are expected by 2050. Kapitsa's work showed that the growth of population of the Earth does not depend on additional variables during considerable time intervals, but only on the temporary variable and the population size. According to calculations, the stabilization of the world population is expected to be stabilized at the level of 14 billion persons by 2135 [33].

Fig. 4 provides the change of population of the Earth, taking into account the data of the UN (medium variant) and the existing forecasts. This situation will not go unnoticed in terms of providing the quality of life. There is already a certain territorial and food deficiency. Eleven children die of hunger every minute in the world. According to FAO, more than one billion people constantly suffer from hunger in the world. Most part of them lives in the Asian-Pacific Region and in Africa.

Fig. 5 provides the information about the percentage of undernourished people (*databank.worldbank.org*). Certain results of fight against hunger are obviously achieved. By 2012 the growth of the world population had been about 30% of the quantity in 1991 while the decrease in the number of undernourished people had been 25% against the background of the growth of total of the population. Considering the average prediction of population growth, the preservation of the existing tendencies of decrease in the number of undernourished people will have inherently provided the growth of their number by 2025. Neither programs of the UN nor the existing development of technologies including that in agriculture are effective to control this trend.

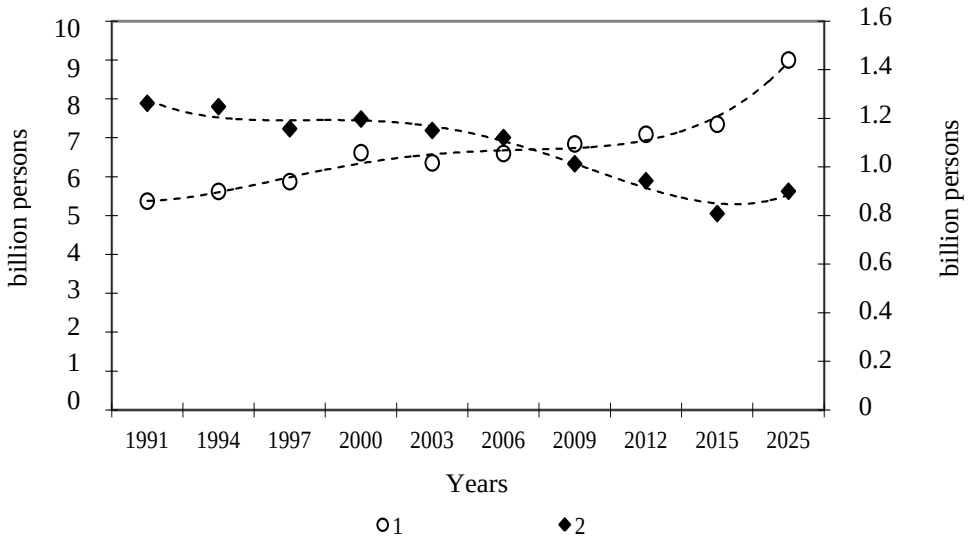


Fig. 5. Dynamics of growth of the world population and percentage of undernourished people in the world: 1 is population; 2 is the number of undernourished people.

There has been a sufficient increase in population growth with the absence of deficiency of livelihood [34] for centuries. During the last century the food production increased due to the development of technologies in the agro-industrial complex. However, the uncontrollable population growth results in lack of resources, poverty and hunger, on the one hand, and in problems of climate and more complex problems of mankind which in total will cause the shortage of food up to 25% of the necessary food (UNEP, 2009) in 2050.

On the one hand, the global problem of shortage of food is determined by the developed natural and ecological (lack of water, fertile lands, dense population) reasons, on the other hand, by political conditions (armed conflicts, economic crises) [35]. There is an opinion that any government, if desired, is capable to put an end to hunger [36]. Therefore providing food security is one of the primary needs of any state the effective solution of which is not possible without the integrated consideration of such problems as the dynamics of population growth, the availability of food resources, the amounts of food consumption, income level, etc.

There are more than 250 countries in the world, each of them has its own population and habits of food consumption. Meat, milk, cheese and eggs can be counted as the products used in the majority of the territories of the world, they can only differ [37] in type and grade. Anyway, however, not only providing food security of the country is desirable, but it is also necessary that this food should be both diversified and balanced. When planning rational nutrition, both age, sex, the level of physical activity and even climatic and national peculiarities are usually considered. The intensity of metabolic processes is determined by age and the its peculiarities of metabolic processes. According to (*total-rating.ru*) the data for July, 2013 the world population was 7.095 billion people, Table 2 gives the age distribution of them.

Table 2. Indicators of gender and age distribution of the world population

Age range, years	Percentage, %	Men, billions of persons	Women, billions of persons
0–14	26.0	0.956	0.894
15–24	16.8	0.614	0.578
25–54	40.6	1.479	1.447
55–64	8.4	0.298	0.312
> 64	8.2	0.265	0.331

Note. For January 1, 2016 the ratio of men and women was 50.4% and 49.6%, respectively.

It is known that a balanced diet is necessary for the satisfactory functioning of the human body, the ratio of its main components is considered to be the following: proteins: fats: carbohydrates = 1 : 1 : 4. The protein intake is, on average, 1.5 g per 1 kg of body weight (not less than 30% of proteins must be of animal origin), the fats intake is 1 g per 1 kg of body weight (not less than 30–40% of them are vegetable fats), the carbohydrates intake is 6 g per 1 kg of body weight (only 10–15% of them are simple carbohydrates). Depending on physical activity, state and age there is variation of amount of protein from 30 to 150 g, carbohydrates from 350 to 500 g and fats from 40 to 170 g a day. During pregnancy (starting from 4th month) the protein intake increases to 2 g per 1 kg of body weight. The same amount of protein can be considered sufficient during the period of breastfeeding. During high physical activity (for athletes) the protein requirement increases up to 120–150 g [38–47]. To provide the growth and formation of the body and its systems children need both proteins and carbohydrates enough. With age, especially after 60, regardless of the intensity of work, there is a delay of rates of metabolic processes, the World Health Organization (WHO) recommends persons of this age to consider the reduction of energy

consumption approximately by 5%, which demands a decrease in the caloric value of food, first of all, on account of carbohydrates. In our country people adhere to the recommendations developed by the Scientific Research Institute of Nutrition of the Russian Academy of Medical Sciences together with the Federal Service for the Oversight of Consumer Protection and Welfare taking into account the sex, age and the coefficient of physical activity (Table 3) [48].

Let us determine the necessary amount of consumed protein, fats and carbohydrates a day, considering the tendencies in the dynamics of population growth and the average body weight in relation to the necessary intakes. According to *expert.ru*, the average weight of the person in the world determined by the British scientists is 62 kg. Let us consider 93.0–124.0 g, 62.0–82.7 g and 372.0–496.0 g of protein, fats and carbohydrates a day, respectively, as the average indicator (Fig. 6).

Table 3. Physiological requirements of the human body for nutrients (g/day)

	proteins	fats	carbohydrates
Men	65–117	70–154	257–586
Women	58–87	60–102	257–586
Children*	36–87	40–97	170–420

Note. * older than 1 year old.

According to (FAO), 318 million tons of meat were produced during 2015: pork – 119 million tons, beef – 67.9 million tons, poultry – 111.8 million tons, the values of indicators for meat of turkey and rabbit are determined as approximately 5.0–6.0 million tons and 1.7 million tons, respectively. The production of meat is expected, in total, to be stable in 2016, and the production of poultry will increase. The world production of grain is predicted to increase by 2543 million (0.6%) in 2016 as compared to 2015. The production of wheat will decrease by 1.4%, barley – by 1.6%, the production of rice will increase only by 1%. The decrease is expected in Europe and is caused by the reduction of acreage, and also in Africa – because of dry weather, the most part of growth is planned in the countries of Asia, and also in Africa, North America and Europe. The production of corn in the United States of America, the world's largest producer of this crop, will increase. The world consumption of grain will be 2546 million tons in 2016/17 which is 0.9% higher than the corresponding indicator in 2015/16. The production of grain, from a global perspective, continues to improve though the expected world production and consumption of grain do not still correspond to each other. There are 37 countries needing the help from outside in providing with food, including 28 in Africa.

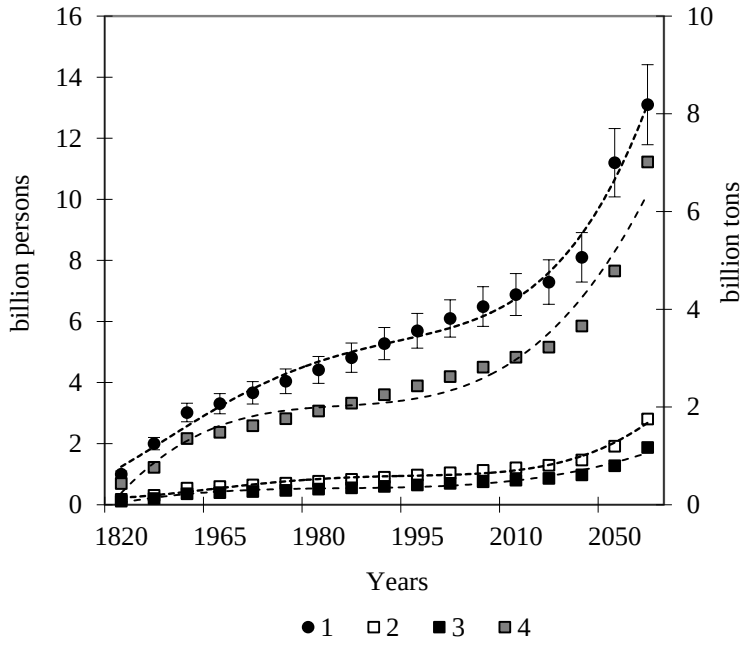


Fig. 6. Dependence of the world population and the protein intake by year: 1 – the world population, 2 – the necessary daily intake of protein, 3 – the necessary daily intake of fats; 4 – the necessary daily intake of carbohydrates.

FAO considers that it is necessary to increase the production of agricultural goods by 60% to provide the increasing population with food. According to the report on the agricultural markets for 2015/16, a possibility of achievement of the necessary increase by the investment of about $83 billion in the world sector of the agrarian and industrial complex is considered. It is obvious that to reach the necessary productivity (Fig. 5) of new territories and technologies, for example, modifications at the level of genomes, is not possible without investment attraction [49–52]. Critics claim that the development of agricultural technologies, including the creation of genetically modified organisms and products, provides an increase

in the income of the limited population group, but not globally at all to feed all the population. However this trend, sooner or later, will provide an environmental disaster. The remaining conflicts, degradation of agriculture and weather cataclysms are the main reasons for the destabilization of food security in 2016. Solving the arising problem of hunger of the planet needs to be begun already now. One of the obvious trends is the increase in sowing territories, the countries of the former Soviet Union have the largest potential in this perspective. At the time of the USSR, its territory occupied a sixth part of the land and approximately a tenth part of all the farmlands of the world. It is no wonder that a lot of developed countries the economic stability of which release them from hunger or malnutrition do not always show peaceful interest in these territories, especially in combination with the thoughts of open spaces of the undeveloped lands of the Russian Federation. It also explains both the imposed sanctions and the hostile rhetoric in a number of issues of the world culture. Providing with food security in the former Soviet Union was just one of the basic reasons for the creation both of the Customs Union and the Common Economic Space.

Table 4 provides the data (*databank.worldbank.org*, *faostat3.fao.org*, [54–60]) about the population and productivity by the main types of agricultural products. According to the physiological requirements of food, grain and grain crops, vegetable and animal oils and also meat and dairy products (have the property of interchangeability) can be referred to the group of main products. According to the offer of FAO, food independence is reached by the production of vital products at the level of not less than 80% of the requirement of the population.

The demographic recession in the former Soviet Union was determined by the political and economic processes accompanying the change of statehood. There is a positive change in the increase in the population both in the Russian Federation and in the Republic of Belarus last years, and Kazakhstan managed not only to restore the population to the Soviet maximum, but even to exceed it approximately by 7%. However, none of the considered models (Table 1) assumes a significant population growth in these territories, moreover, they insist on a considerable decrease in the population as well as in other developed countries of Europe and America.

Table 4. Dynamics of the population and production of foodstuffs (grain and meat products and fats) of the developing countries of the Euroasian Union: the Russian Federation, Kazakhstan and the Republic of Belarus

Years	1990	1994	1997	2000	2003	2006	2009	2013	2015
Russian Federation									
Population, millions of persons	148.292	148.336	147.915	146.597	144.648	143.0495	142.785	143.507	144.097
Cereal production, millions of tons	116.700	78.644	86.801	64.326	65.562	76.495	95.616	90.382	103.400
Meat production*, millions of tons	10.112	6.803	4.854	4.440	4.950	5.237	6.720	8.544	9.484
Fat production**, millions of tons	1.822	1.615	1.264	2.041	2.348	3.553	3.731	3.839	3.805
Kazakhstan									
Population, millions of persons	16.348	16.095	15.334	14.884	14.909	15.308	16.093	17.035	17.544
Cereal production, millions of tons	28.500	16.375	12.359	11.539	14.741	16.461	20.764	18.157	19.950
Meat production*, millions of tons	1.548	1.207	0.722	0.623	0.693	0.807	0.893	0.871	0.903
Fat production**, millions of tons	0.160	0.087	0.031	0.053	0.141	0.185	0.185	0.277	0.314
Republic of Belarus									
Population, millions of persons	10.189	10.227	10.117	10.005	9.797	9.604	9.507	9.466	9.513
Cereal production, millions of tons	7.000	5.938	5.924	4.565	5.117	5.685	8.154	7.233	9.104
Meat production*, millions of tons	1.181	0.743	0.632	0.598	0.605	0.768	0.921	1.172	1.150
Fat production**, millions of tons	0.087	0.094	0.098	0.0932	0.084	0.102	0.133	0.114	134.147

Note. * total of meat, offal and poultry; ** total of butter and ghee, sunflower oil and margarine.

Despite the increase in production of agricultural products, the food security of the developing member states of EEU is not reached. The best success in providing with food was achieved by Belarus, on some points – by Russia and Kazakhstan. Nevertheless, one should not postpone the solution of the problem of food security, as it is one of the reasons for creation of EEU. The productions of food by the states of the community must supplement harmoniously each other retaining the economic and political independence from other countries. The percentage of mutual export of the countries of Community, in its total amount, is at the level of 30%, import – of about 15%. The highest percentage of intraregional export accrues to Belarus (more than 85%), Kazakhstan and Russia – 10.7% and 14.9%, respectively. The highest percentage of intraregional import accrues to Kazakhstan (more than 40%), the lowest – in Russia (10–12%) [61].

CONCLUSION

An opinion has recently emerged [62–66] that the organic, i.e. non-synthetic, agriculture is the only that is capable to feed the world. The performed researches (FAO, 2014) led to a conclusion that small or family enterprises can provide food security and protect both certain regions and the world in general from an environmental disaster. The tendencies of increase in the productivity of grain, fruit and vegetable crops, the fruits and plants of which also act as the protein sources in the human diet, allow to consider the problem of the existing hunger as the one that can be positively solved [67–73]. And it is necessary to begin with providing with food for the population of each of the countries separately which will result in total in stability in the food security of the world. However, the increase in the productivity and quantity of food products on the existing farmlands is a necessary but not sufficient condition of achievement of the global food security. A third of all the produced foodstuffs spoils, but people die of hunger every day in the world. At the same time, in today's world (FAO, 2015), taking into account foodstuffs and vegetable raw materials of biofuel, enough food is produced for provide the day-to-day consumption of about 2850 calories for each person, at the same time it is not possible to put an end to hunger. Even if we assume that the production of food will remain at the present level, and the population will reach 9 billion, then the daily energy consumption will decrease to 2200 calories, this quantity is quite enough for the satisfactory functioning of the human body.

No more than 38% of total of acreage in the world have an agricultural purpose, more than 43% in Belarus, more than 80% in Kazakhstan and about 13% in the Russian Federation. There is obviously a certain potential of providing with agricultural products due to the increase in farmlands, especially for the Russian Federation. The development of agro-industrial complex of Russia will allow to provide with food not only for its citizens but for all the former Soviet Union. There was a certain opportunity to fulfil this stipulation by imposing economic sanctions and food embargo by a number of the European states in 2014 in relation to the events in Ukraine. To accomplish the purposes of agrofood policy of Russia the intensive import substitution of meat, milk, vegetables, seed potatoes and fruit and berry products was required. Unfortunately, the domestic manufacturer did not bring the expected support and instead of import substitution there was an "import exchange" of the producers of the EU by the producers of the countries of Latin America or the Middle East which affected without delay the prices of food [74]. As a result, we did not only come closer in providing food security, there was the aggravation of the existing problem, first of all, due to the power of consumption of Russians which had already been reduced by the considerable depreciation of internal currency at the end of 2014. And, though, according to FAO, there are no more than 5% of undernourished people in the countries of the Customs Union and Euroasian Economic Community, we should not forget about them, and all the efforts should be aimed at the increase in the availability of the received food, as well.

There is an opinion that poverty and the absence of political power are more paramount reasons of hunger and malnutrition than the capability of the region to produce foodstuffs. According to the estimates of FAO, there is a change of geography of poverty in the world markets, against the background of economy growth the income in a number of developing countries begins to be similar to the income of the developed countries. Before now, poor people generally lived in the countries with the low level of income, now 1 billion people who are below the poverty line live in the countries with the average level of income, for example, in India.

Therefore the global problems of hunger can not be solved by a simple increase in productivity, the integrated approach is needed including both the development of knowledge-intensive and breakthrough biotechnologies allowing to preserve the produced foodstuffs, at least, until its delivery to the consumer, the wide application of logistics and the reasonable development of agricultural productions locally. A lot of experts both in our country and abroad consider that a clear state policy in this area of the developed countries will help to address the problem of food security quite sufficiently.

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