ECOECONOMIC AND BIOECONOMIC IMPACT OF FOOD SAFETY AND SECURITY IN PERSPECTIVE INCREASED CONSUMPTION OF FOOD AND FEED DURING 2030-2100

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Abstract:
The present study predicts the ecoeconomic and bioeconomic impact of food safety and security in perspective the increased consumption of food and feed during 2030-2100.The dynamic of food's world population projection to 2050 year and consumption dynamic of cereals, animal products (meat, milk, eggs) in terms of respect international standards of food safety and security; the known european principles "from the farm to the fork" and "from the farm to the plate" which have restricted rules established by European Food Safety Authority, must be respected in agrifood products 2050 year perspective also. In this framework, the food safety and security must be correlated with the respect of known principles of Hazard Analysis and Critical Control Points, based on actual international standards from ISO 9001-9002 series (Quality Management System), ISO 14001: 2004 (Environment Management), ISO 22000 (Food Safety). The projections for the future socio-economic environment and the assessment of the situation and prospects of the natural resource base raise the question as to whether and under what conditions the estimated future food demand can be met and how food security can be achieved.

Keys Words: dynamics food and consumption, bioeconomy, eoeconomy, food security.

INTRODUCTION

The sustainable economy of the future has to become a bioeconomy, adapted to the rural area and based on a large biodiversity that will create first of all an opportunity for more producers of primary organic synthesis and further on for a longer line of consumers up to the final state of dead organic matter that must be mineralized. In this context, Nicolas Georgescu-Roeger's world-wide-known Bioeconomics paradigm of improving the agricultural efficiency becomes most topical, particularly as mankind's limited natural resources are being depleted.

Currently, humanity is in a new phase of economic and social development at the beginning of the XXI century - the century and millennium III - century, with numerous and varied characteristics knowledge society based on science and education. At the same time manifests successive economic-financial crisis, this requires integrated prevention and control of risk management and crisis situations. Knowing the food problem in complex relationships with explanations of population dynamics (10.6 billion-2050) issued with maximum credibility of organizations such as: NATO, the World Bank, FAO, and recognized experts in scientific forecasts and projections of long-term main focus of the United Nations Summit, held between 20-22 September 2010. Eradicating poverty and hunger are clear targets of global strategies.

Net population losses are still projected to occur in some countries around 2200 but by 2300, all countries will be experiencing population increases in the medium scenario.

Globalization of the food chain causes constant new challenges and risks to health and consumer interests. The main objective of EU food safety policy is to achieve the highest possible degree of protection of human health and consumer interests in relation to food. In this regard, the EU strives to ensure food safety and proper labeling, given the diversity of products, including traditional ones by specific certification bodies (EFSA). The EU has developed a comprehensive body of legislation on food safety, which is continually monitored and adapted as new developments. Thus, traceability is managed by European legislation and the regulations nr.178/2002 1642/2003 on food safety and the local law no. 150/2004 on food safety and feed quality and standards, such as: 22005:2007, ISO 22000:2005 and ISO / TS 22004:2006 for traceability in the food chain. The EU actively promotes high standards of consumer safety and consumer support organizations to strengthen their role in decision making. Biotechnology researches and development related to food (including genetically modified organisms) is a way to eradicate hunger, which takes into account the basic principle of EU food safety policy by applying an integrated approach, such as "farm to fork" covering all sectors of the food chain, including feed production. The EU has a comprehensive strategy on food safety. It covers not only food safety but also health and welfare of animals and plants. The strategy provides the ability to track food from farm to consumer even if it is needed to move within the EU borders. EU food strategy is based on three main elements: legislation on food and feed safety, basic scientific advice necessary decisions in the field and implementing a policy and control. The law covers many areas, from food and feed, up to food hygiene, applying the same high standards throughout the Union. Community legal framework on food safety is common to all Member States, but adapted diversity. EU efforts significant because traditional foods are not removed from the market due to food safety standards and that innovation should not be discouraged and do not have the quality of the Romanian scientific. The context of our paper approach: eco- and bio-economy (the socio-economic priorities and humanities), biodiversity as a resource of sustainable development, biotechnology, food safety including food chemistry, health (a consequence of ecosanogenesis) environmental and implicitly (through the environmental impact on human health aspects and animals;) Each EU country is obliged to ensure that product safety was not compromised in its food chain, and this can be achieved through the implementation and certification of a Food Safety Management System. HACCP is a system of internationally recognized food safety, based on a systematic analysis and preventive production process, which shows that food safety risks are identified, assessed and controlled. HACCP involves risk identification, control and monitoring of critical points where the process could be compromised food quality. The system is based on the Food Code (Codex Alimentations) developed by the UN Food and Agriculture Organization and World Health Organization.

NEW CONCEPTS

The main socio-economic factors that drive increasing food demand are population growth, increasing urbanization and rising incomes. As regards the first two, population growth and urbanization, there is little uncertainty about the magnitude, nature and regional pattern of their future development. According to the latest revision of the UN population prospects (medium variant), the world population is projected to grow by 34 percent from 6.8 billion today to 9.1 billion in 2050 (fig.1).

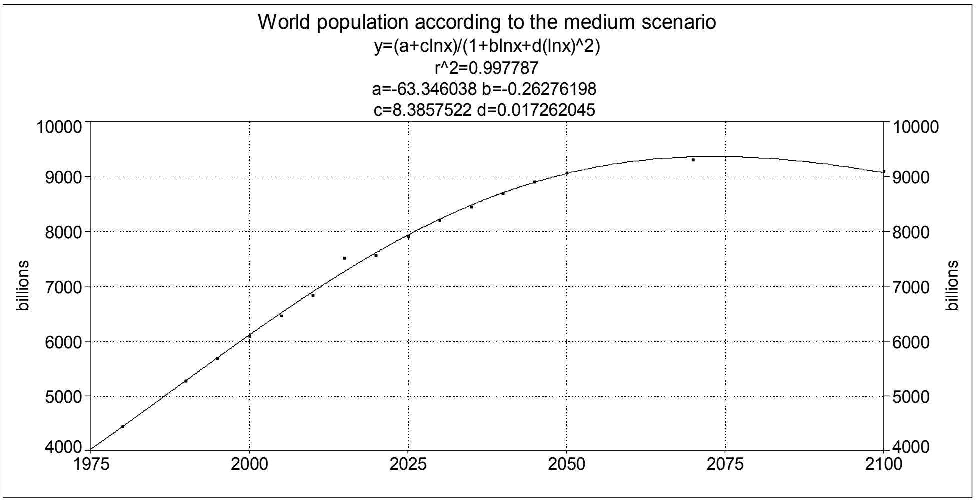

Fig.1 Population development 2100
(correlation calculate using UN, 2007. World Population Prospects)

Compared to the preceding 50 years, population growth rates will slow down considerably. However, coming off a much bigger base, the absolute increase will still be significant, 2.3 billion more humans. Nearly all of this increase in population will take place in the part of the world comprising today’s developing countries. The greatest relative increase, 120 percent, is expected in today’s least developed countries. (UN World population prospects fig.2, table 1, 3, 4).

The dynamic of food‘s world population projection to 2050 year and consumption dynamic of cereals, animal products (meat, milk, eggs) in terms of respect international standards of food safety and security; the known european principles “from the farm to the fork” and “from the farm to the plate” which have restricted rules established by European Food Safety Authority, must be respected in agrifood products 2050 year perspective also.

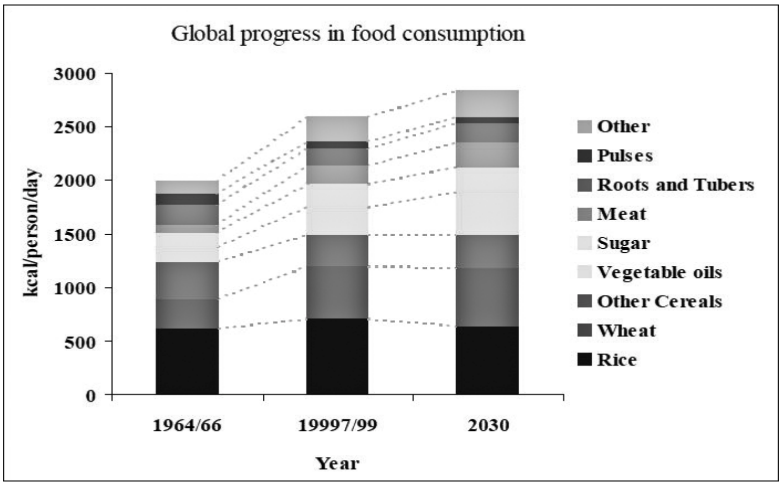

Fig.2 Global progress in food consumption
Surse: UN World population prospects: The 2006 revision

The growth in per capita food consumption was accompanied by significant change in the commodity composition, at least in the countries that experienced such growth. Much of the structural change in the diets of the developing countries concerned the rapid increases of livestock products (meat, milk, eggs), vegetable oils and, to a smaller extent, sugar, as sources of food calories.

Growth in the agricultural sector has a crucial role to play in reducing poverty. Agricultural growth spreads its benefits widely. Cereals are still by far the world’s most important sources of food, both for direct human consumption and indirectly, as inputs to livestock production. What happens in the cereal sector is therefore crucial to world food supplies.

Table 1.

Change in the commodity composition of food by major country groups
Source: Source: FAO (2003), World Agriculture towards 2015-2030.
FAO (2006), World Agriculture towards 2030-2050

Consumption/Kg/person/year	1969/71	1979/81	1989/91	1999/01	2030	2050
World						
Cereals and food	148.7	160.1	171.0	165.4	165	162
Sugar (raw sugar equiv.)	22.4	23.4	23.3	23.6	26	27
Vegetable oils, oilseeds and products (oil equiv.)	6.8	8.3	10.3	12.0	16	17
Meat (carcass weight)	26.1	29.5	33.0	37.4	47	52
Milk and dairy, excl. Butter (fresh milk, eq.)	75.3	76.5	76.9	78.3	92	100
Other food (kcal/person/day)	216	224	241	289	325	340
Total food (kcal/person/day)	2411	2549	2704	2789	3040	3130
Developing countries						
Cereals and food	146.3	161.7	173.7	165.7	166	163
Sugar (raw sugar equiv.)	14.7	17.5	19.2	20.7	25	26
Vegetable oils, oilseeds and products (oil equiv.)	4.9	6.5	8.6	10.4	14	16
Meat (carcass weight)	10.7	13.7	18.2	26.7	38	44
Milk and dairy, excl. Butter (fresh milk, eq.)	28.6	34.0	38.1	45.2	67	78
Other food (kcal/person/day)	123	140	171	242	285	300
Total food (kcal/person/day)	2111	2308	2520	2954	2960	3070
Industrial countries						
Cereals and food	132.3	139.4	154.4	162.4	159	156
Sugar (raw sugar equiv.)	40.5	36.7	32.6	33.1	32	32
Vegetable oils, oilseeds and products (oil equiv.)	13.2	15.7	18.5	21.5	24	24
Meat (carcass weight)	69.7	78.5	84.3	90.2	99	103
Milk and dairy, excl. Butter (fresh milk, eq.)	189.1	201.0	211.2	214.0	223	227
Other food (kcal/person/day)	486	500	521	525	565	580
Total food (kcal/person/day)	3046	3133	3292	3446	3520	3540

Table 2.

Per capita food consumption (kcal/person/day)
Source: FAO (2003), World Agriculture towards 2015-2030.
FAO (2006), World Agriculture towards 2030-2050

	1969/71	1979/81	1989/91	1999/01	2015	2030	2050
World	2411	2549	2704	2789	2950	3040	3130
Industrial countries	3046	3133	3292	3446	3480	3520	3540
Transition countries	3323	3389	3280	2900	3030	3150	3270

In the first half of this century, global demand for food, feed and fiber is expected to grow by 70 percent while, increasingly, crops may also be used for bio-energy and other industrial purposes. New and traditional demand for agricultural produce will thus put growing pressure on already scarce agricultural resources. And while agriculture will be forced to compete for land and water with sprawling urban settlements, it will also be required to serve on other major fronts: adapting to and contributing to the mitigation of climate change, helping preserve natural habitats and maintaining biodiversity. To respond to those demands, farmers will need new technologies to produce more from less land, with fewer hands.

Table 3.

Milk and dairy products
Source: Source: FAO (2003), World Agriculture towards 2015-2030.
FAO (2006), World Agriculture towards 2030-2050

	1999/ 2001	**1961-2001**	**1971- 2001**	**1981- 2001**	**1991- 2001**	**1999/01- 2030**	**2030- 2050**
	'000 tones	**Growth rates, percent p.a.**					
Production							
World	5777494	1,4	1,2	0,8	1,1	1,4	0,9
Developing	231385	3,4	3,6	3,7	4,0	2,5	1,4
Industrial countries	250681	0,8	0,7	0,3	0,8	0,5	0,2
Transition countries	95426	0,3	-0,7	-2,1	-3,3	0,1	-0,2
World excl. transition countries	*482118*	*1,7*	*1,8*	*1,7*	*2,2*	*1,7*	*0,9*
Consumption							
World	572025	1,4	1,2	0,8	1,0	1,4	0,9
Developing	251097	3,4	3,5	3,4	3,7	2,5	1,3
Industrial countries	228583	0,6	0,6	0,3	0,5	0,4	0,2
Transition countries	92342	0,2	-0,9	-2,3	-3,4	0,1	-0,2
World excl. transition countries	*479789*	*1,7*	*1,9*	*1,7*	*2,1*	*1,7*	*1,0*
Net Trade (thousand tones)							
	1969/71	**1979/81**	**1989/9 1**	**1999/01**	**2030**		**2050**
World	2388	1625	-1163	4652	4084		4050
Developing (Stat discrepancy)	-7379	-17647	-18028	-19716	-32700		-38750
Industrial countries	9659	18545	15031	21288	33800		39800
Transition countries	109	729	1837	3083	3000		3050

Table 4

Meat consumption – present and future
Source: FAO (2003), World Agriculture towards 2015-2030.
FAO (2006), World Agriculture towards 2030-2050

	Population	**Total meat (t)**	**Per capita meat (kg)**
2010	6.842.923	296.199	43,3
2030	8.199.104	447.475	54,6
2050	9.075.903	624.530	68,8
Total increase			
2005-2050	40,4%	135,5%	67,7%

The anthropogenic activities and changed agricultural system, intense use of chemical fertilizers and artificial irrigation have increased abiotic stresses and caused yield losses annually to a greater extent (fig.3). To overcome the yield losses due to abiotic stresses, plants need to possess mechanisms of avoidance and tolerance to stress. Abiotic stresses such as, heavy metals, salinity, drought, temperature, UV-radiation, ozone, cause drastic yield reduction in most crops (Khan et al, 2007).

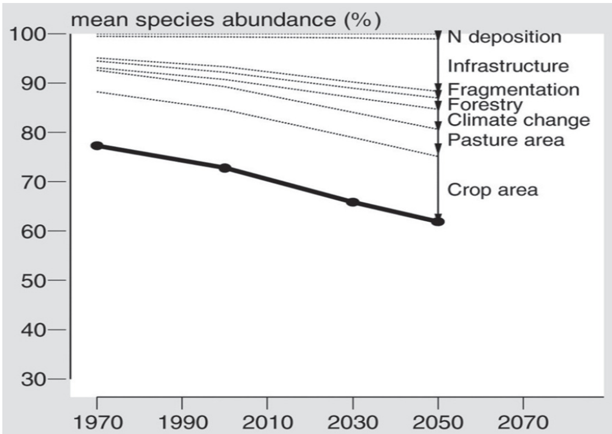

Fig.3 Biodiversity development for the world, and contribution of stress factors to the decline in the reference run. From GLOBIO 3, graphic from Rosegrant et al. (2009).

Plant breeders, specialists in plant physiology and plant biochemists studied world wide a field marked by the integration of new substances with phytohormonal effects, their involvement in future agro-technical procedures.

In developing countries 80 % of the necessary production increase would come from increases in yields and cropping intensity and only 20% from expansion of arable land. In recent years, yield growth rates of cereal yields have been falling.

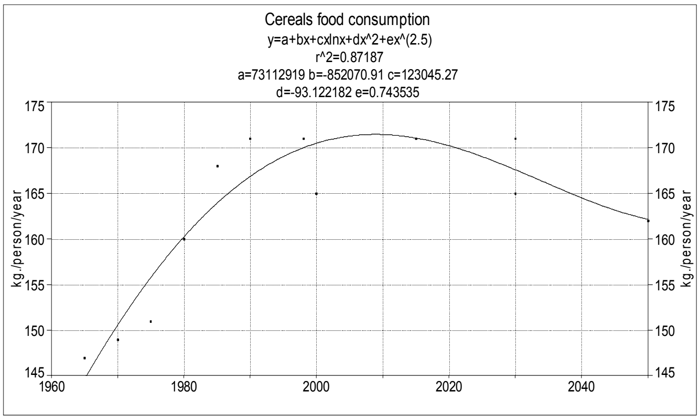

Fig.4. Regression curve to describe the dynamic of cereals food consumption (source: **FAO** (2004a), *The State of Food Insecurity in the World 2004*)

There is a big interest apart of breeders and veterinarians for a certain identity of animals and for their paternity. Current animal identification practice in the EU is based on administrative tracking of the animal ID by using visual animal ID devices (e.g. visual ear tags) and procedures (e.g. animal passport, abattoir batch no.). A major drawback of this approach is its susceptibility to fraud as reliable control instruments are missing. Today, molecular genetic technologies are available to provide such control instruments. These technologies ("DNA fingerprinting") not only provide the means to 100 % reliable traceability of livestock and livestock products, but also represent a powerful instrument to improve animal health and animal welfare.

MATERIAL AND METHODS

The research team used modern tools to identify the traceability the original materials (meet or milk) of different species from traditional products-molecular tests based on identification, amplification and characterization of nucleic acids for food traceability (PCR techniques).

Many ways and methods were tested and applied. The best of them seems to be the DNA analysis as "Genetic Fingerprint", which is found in every cell of the body and the more recent method of microsatellites genetic markers. Using PCR techniques to multiply DNA segments it is possible to dispose of enough genetic material to compare DNA from different cells, let say from under skin tissue and from muscle fibers, and know if they have or don't have the same genotype origin. This scientifically paper presents results of research concerning recognition of genotypes by microsatellites genetic markers collecting and preserving the tissue samples by TypiFix method. Concerning traceability of animal products there are hopes as well. The way to apply genetic identity in monitoring the traceability of products is given in figure 4.

The method based on microsatellite markers gives concrete results and is a valuable tool for the specific meat of breed. The applicability of the methods is very important because give the transparency needs of the market in very short time.

The analytical methods used for species identification and authenticity of foods rely mainly on protein and DNA analysis. The protein-based methods include immunological assays electrophoretical and chromatographic techniques.

More recently, DNA molecules have been the target compounds for species identification due to the high stability compared with the proteins, and also to their presence in most biological tissues, making them the molecules of choice for differentiation and identification of components in foods, and a good alternative to protein analysis. Most DNA-based methods for species identification in foods consist on the highly specific amplification of one or more DNA fragments by means of polymerase chain reaction (PCR). DNA microsatellite markers are proposed for meat traceability.Ten microsatellites were amplified in multiplex reactions and analyzed on ABI310 genetic analyzer. The samples was tested in Agrobiogen Laboratory in Vienna.

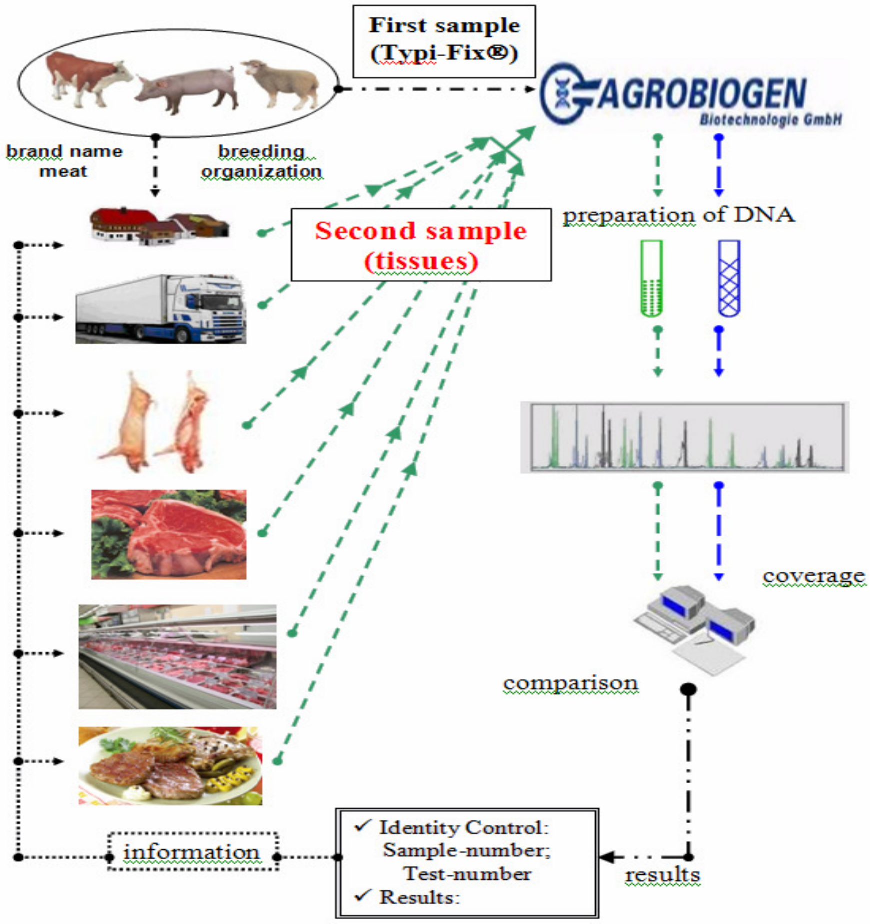

Fig.5. The leading lab correlation with traceability of meat products trough the new method of prof. G. Brem (By A.T. Bogdam at all, published 2009 in Bulletin UASVM, nr. 66 (1-2)/2009 - Veterinary Medicine, Print ISSN 1843-5270; Electronic ISSN 1843-5386, pg. 427).

Tissue collection with TypiFixTM –System The TypiFix™ ear tag system is a combination of a conventional ear tag with a simultaneous tissue sampling technology. By ear tagging the farm animals, the tissue samples are automatically collected and sealed in the TypiFix™ sample containers, where the tissue samples are preserved at ambient temperature and can be used for protein or DNA based assays. The easy handling of the TypiFix™ ear tag system allows economic sampling of whole populations and is therefore an effective tool for analysis of genetic markers for paternity control, traceability and breeding traits. The Typi-Fix-System is a procedure for the collection of DNA containing tissue samples avoiding all these hurdles and problems. With the Typi-Fix-ear tags the animal is marked - in the usual convention - with a plastic ear tag. At the same time, however, a tissue sample is taken by the spike of the ear tag which immediately after the collection is packaged in a special plastic container (sample receiving container) labeled with the (bar coded) animals ear tag number.

After collection the preservation and preparation of the DNA is initiated automatically by substances which are hold in stock in the sample receiving container. The identification number of the samples can be registered by a reading device (scanner). The sample container is connected to the ear tag by a plug and socket and is easily removed after the ear tag has been affixed and the tissue sample simultaneously collected. If desired, the sample container can also be used without the ear tag. After pigs tissue collection with ear tagging, we collected meat probes in abattoir. The porcine agreed microsatellite markers use for: Set I is: S0005 for chromosome 5 and range 205-248, S0090 for chromosome 12 and range 244-251, S0155 for chromosome 1 and range 150- 166, SW857 for chromosome 14 and range 144-160, SW240 for chromosome 2 and range 96-115; Set II is: SW24 for chromosome 17 and range 96-121, SW951 for chromosome 10 and range 125-133.

DNA purification with DNA FIX columns an extremely simplified and shortened one-step high-throughput separation procedure of genomic DNA from TypiFix samples. The sorbents retain protein and other contaminants, while the DNA passes the column in the exclusion volume. DNA isolation and purification can be automated through the use of a pipe ting robot and a special one-step procedure (Nexttec technology). PCR reactions with hese samples can also be prepared automatically. The results of the multiplex PCR 565 analyses are linked with the scanned identification number and saved in the animal data bank. *Gel electrophoresis of NCC purified DNA from 88 TypiFix eartag sample*: 5 µl (total elution volume: 240 µL) of each sample were loaded on a 1% agarose/ EtBr gel. The DNA concentration is about 10 ng/µl or greater = negative control

In the future, many developed countries will see a continuing trend in which livestock breeding focuses on other attributes in addition to production and productivity, such as product quality, increasing animal welfare, disease resistance and reducing environmental impact. The tools of molecular genetics are likely to have considerable impact in the future. For example, DNA-based tests for genes or markers affecting traits that are difficult to measure currently, such as meat quality and disease resistance, will be particularly useful (Leakey et al. 2009). Another example is transgenic livestock for food production; these are technically feasible, although the technologies associated with livestock are at an earlier stage of development than the equivalent technologies in plants. In combination with new dissemination methods such as cloning, such techniques could dramatically change livestock production. Complete genome maps for poultry and cattle now exist, and these open up the way to possible advances in evolutionary biology, animal breeding and animal models for human diseases (Lewin 2009). Genomic selection should be able to at least double the rate of genetic gain in the dairy industry, as it enables selection decisions to be based on genomic breeding values, which can ultimately be calculated from genetic marker information alone, rather than from pedigree and phenotypic information. Genomic selection is not without its challenges, but it is likely to revolutionize animal breeding.

New tools of molecular genetics may have far-reaching impacts on livestock and livestock production in the coming decades. But ultimately, whether the tools used are novel or traditional, all depend on preserving access to animal genetic resources. In developing countries, if livestock are to continue to contribute to improving livelihoods and meeting market demands, the preservation of farm animal genetic resources will be critical in helping livestock adapt to climate change and the changes that may occur in these systems, such as shifts in disease prevalence and severity as the tools and techniques of breeding are changing.

CONCLUSION

- The future of agriculture and the ability of the world food system to ensure food security for a growing world population are closely tied to improved stewardship of natural resources. Major reforms and investments are needed in all regions to cope with rising scarcity and degradation of land, water and biodiversity and with the added pressures resulting from rising incomes, climate change and energy demands. There is a need to establish the right incentives to harness agriculture's environmental services to protect watersheds and biodiversity and to ensure food production using sustainable technologies.

-The main objective of EU food safety policy is to achieve the highest possible degree of protection of human health and consumer interests in relation to food.

- Many ways and methods were tested and applied for identification traceability of animal products; the best of them seems to be the DNA analysis as "Genetic Fingerprint", which is found in every cell of the body and the more recent method of microsatellites genetic markers. In order to apply DNA analysis using microsatellite test there are much hopes but it is necessary to know precisely how this trait, microsatellite presence in different chromosomes is inherited in the progeny.

- The DNA-based methods, namely the PCR, proved to be reliable, fast, sensitive and extremely specific techniques for the detection of frauds

- The method based on microsatellite markers gives concrete results and is a valuable tool for the specific meat of breed. The applicability of the methods is very important because give the transparency needs of the market in very short time.

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