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Area of usage and policies of genetically modified organisms in Turkey

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ABSTRACT

In this study, applicability, usage, economic and social effects, advantages and disadvantages, legal procedures and practices of the European Union harmonization process of GMO 's in Turkey are examined. The most important risk arising from genetically modified organisms is seen as "loss of genetic diversity". GMO products are almost impossible to turn back to nature after having been released. Lack of information on GMOs may result with the loss of the existing genetic resources. This risk should be carefully analyzed in Turkey which is a country with rich genetic resources. On the other hand, modern biotechnological methods using the positive aspects can offer great benefits to science and humanity. Use of gene transfer applications in the field of agriculture faces with a great reaction in Turkey as well as in other consumer health and the environment-sensitive societies; thus, several measures and risk assessment techniques against GMOs are raised. Therefore, consumer health and environmental factors are required to be considered while implementing the policies of biotechnological research and applications in Turkey.

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KEYWORDS

Turkey;
GMOs;
Policies;
EU;
Agriculture.

INTRODUCTION

Since 1996 with the introduction of GM crops in world trade, debates are increasing about GMOs. GMOs are known as used not only in agriculture but also in the medical field (for example, some vaccines) and on industrial and environmental products^[23]. With the advantage of many technical methods of molecular biology, various interventions on the science of genetics, biotechnology of human beings or viral genes, genomes of organisms, biotechnology can be considered as the most controversial issue. Starting from the disso-

lution of the genetic code in 1965 and continuing with the famous sheep Dolly cloning in 1997, in today's world there are two poles diametrically opposite to each other in the form of pro-and anti GMO. This debate occurs and continues because of theological perspective, environmental policy, health and consumer issues, climate and energy policy, agricultural policy, research policy, social policy, labor market policy and socio-economic aspects mostly.

Supporters of GMOs believe that products which are fast-growing, resistant against disease, weather and insect and herbicide-resistant crop products as well as

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more delicious, more secure, more efficient, more nutritious, long-lasting health benefits and organisms have potential benefits for humanity to solve the problems of ecological and agricultural issues^[21]. By gene treatment, a lot of new products can be formed.

GMOs by increased carbohydrate tomatoes used in food processing can lead to have dense content of ketchup, tomato sauce, and so on. With the increased starch content Russett Burbank Potatoes produced by Monsanto Company, potato production has been achieved with less attracted oil during frying, reduced cooking time and cost^[15].

Increased nutritional value of products will help to reduce malnutrition and will meet the basic food needs of developing countries. Cassava, is an important source of food for 500 million people in many third world countries. In recent years these plants are genetically modified to produce a resistant product against Cassava mosaic virus in Africa and overall mosaic viruses and also having a high nutritional value of Cassava^[22].

Flavr Savr tomatoes produced by Calgene Company was the first genetically modified product approved by U.S. Food and Drug Administration (U.S. FDA). This tomato had a long shelf life by delayed ripening, softening and decay process. To a large extent ripening and softening are dependent on the production of ethylene by fruit cells^[14].

The world's population expected to exceed 8 billion by 2025 is considered to be a major problem to meet the need for food. It is not possible to increase the arable field and furthermore fresh water sources that can be used in agricultural production is decreasing rapidly. So, the product yield per unit area should be increased instead of extending quantity production of land. It is inevitable that the use of gene transfer technology while considering coming to the limits in biological yield obtainable from conventional breeding methods^[19].

Bt protein can be toxic to insects such as corn borer, potato beetle but not toxic to humans, and is broken by stomach acid. If plants are functioned to produce this protein, this modification can eliminate the need for chemical insecticides. Furthermore, predators such as bees can be preserved by insect damage. A more effective pest control can be achieved by Bt insecticidal protein production in all parts of the plant tissues^[14].

Especially opponents of GMOs in the European Union countries describe GMOs as "Frankenstein

foods" because they thought it would threaten the word agriculture, health and ecology^[16].

According to opponents of GMOs, particularly long-term effects of genetically modified products on health are not clear yet. For this reason, in terms of health risks, a right to choose and be informed for consumers is thought to be provided by labeling of GMOs^[20].

New features of the gene to the host by gene transfer technology can cause allergic reactions to consumers or sharpen existing allergic reactions^[24]. Independent genes do not work separately and always unexpected and unwanted adverse effects can be faced with transfer of the gene or genes to an organism^[23].

The negative effects of GMOs on the environment, either directly or indirectly, and in particular the risk of natural ecosystems with escape of genes from species are widely discussed. Since exchange of genes is easier between plants than animals; gene escape is thought to be the most important risk for genetically modified plants. Although genetically modified plants are thought to reduce use of herbicide, pesticide and fertilizers in the near future, in the long-term they are thought to cause occurrence of resistant herbs and insects. Thus, an increase in environmental pollution has been proposed as a result of necessity of increased use of agricultural chemicals (herbicides, pesticides and fertilizers)^[19].

Genetic diversity of natural species, as well as biological diversity are threatened with rapid loss of plant species that can not compete with the genetically modified products. Terminator technology is developed to take control of the seeds of genetically modified plants. Terminator technology was developed in order to avoid reproduction the seeds for the following year and known as the technology aim to produce sterile plants. Farmers need international companies every year and this brings some problems such as addiction to international companies to buy these terminator seeds and higher prices.

POLICIES OF GMOs IN THE WORLD

In 1996, cultivation area of GMOs in the world was 1.7 million hectares, whereas in 2010 it is increased to 148 million hectares. Number of countries producing GM products was 4 in 1996 and this number rised to 29 in 2010. United States, Brazil, Argentina, India

and Canada are listed as the top five countries that produce GMOs. According to 5-year estimation of The International Service for the Acquisition of Agri-biotech Applications (ISAAA), 11 countries will begin production of GM products by the year 2015. Thus, the total number is expected to reach 40. Despite, the total planting area of GM crops in the world seems more at developed countries, in recent years, rate of increase in developing countries is higher. For the last 10-year period, production of soy bean has been increasing continuously among the production of genetically modified plants. The International Service for the Acquisition of Agri-biotech Applications (ISAAA) Report was released by the year 2010.

According to the report; Through 29 countries that produce GM products and 19 are developing countries and 10 developed countries. In 2010, 48 percent of GM crops were produced in developing countries and production areas have recorded increased by 17 percent (10.2 million hectares) in these countries during the 2009-2010 period. In developed countries, only 5 per cent (3.8 million acres) has increased. Approximately 2.7 million people are working in the production of GMOs crops in 5 major developing countries which are China, India, Argentina, Brazil and South Africa. In these countries production of GMOs crops carried out in 2010 is about 63 million hectares. This figure consists 43 per cent of total global production. Brazil, with nearly 4 million hectares of GM products production area, has highest increase in 2010. 8 countries in the European Union is carrying out the production of GM products and 91 thousand 193 hectares are used for GM products at 6 EU countries especially at Spain. Significantly, allowing production of genetically modified potatoes, Germany reduced GM production in 2010. In 2010, three new countries joined between the countries that produce GM products. Pakistan started to produce cotton, Myanmar and Sweden started the production of the potato. On the African continent, whilst only Republic of South Africa produced GM products in 2007, Burkina Faso started to produce cotton and Egypt started to produce corn and the number of countries GMO production was increased to 3 in 2008^[17].

In 2010, soybean continued to take in the first place at product market with a production of 73.3 million hectares. Soybean, is about 50 percent of the global GM crop cultivation area. With 46.8 million hectares,

corn is in second place. Corn cultivation, constitutes 31 percent of the total area. Cotton is produced at 21 million hectares (14 percent), canola is produced seven million hectares (5 percent). GM production increases productivity per hectare significantly whereas decreases the cost. 1996-2009 period, in the market of GM products, approximately \$ 65 billion earnings were gained by reducing production costs at 44 percent. At that period, 83.5 million tons of soybean, 130.5 million tons of corn, 10.5 million tons of cotton, 4.8 million tons of canola, totally 229 million tons of genetically modified product were produced^[17].

TABLE 1 : Cultivation areas of GM crops in the world (2010, James).

Country	Million Ha	GM Product
USA	66.8	Soybean, Corn, Cotton, Canola, Papaya, Clover, Sugar Beet
Brasil	25.4	Soybean, Corn, Cotton
Argentina	22.9	Soybean, Corn, Cotton
India	9.4	Cotton
Canada	8.8	Canola, Corn, Soybean, Sugar Beet
China	3.5	Cotton, Domatoes, Papaya, Sweet Pepper
Paraguay	2.6	Soybean
Pakistan	2.4	Cotton
South Africa	2.2	Corn, Soybean, Cotton
Uruguay	1.1	Soybean, Corn
Bolivia	0.9	Soybean
Australia	0.7	Cotton, Canola
Philippines	0.5	Corn
Burma	0.3	Cotton
Burkina Faso	0.3	Cotton
Spain	0.1	Corn
Mexico	0.1	Cotton, Soybean
Chile	<0.1	Corn, Soybean, Canola
Colombia	<0.1	Cotton
Honduras	<0.1	Corn
Czech Republic	<0.1	Corn
Portugal	<0.1	Corn
Romania	<0.1	Corn
Poland	<0.1	Corn
Costa Rica	<0.1	Cotton, Soybean
Egypt	<0.1	Corn
Slovakia	<0.1	Corn

In TABLE 1, Cultivation Areas of GM crops in the world is shown. Although developing countries have 46% of total cultivation area of genetically modified crops, the remarkable point is this percentage is ex-

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pected to increase before the year 2015 with the reduced share of developed countries. The development goal of the new century by international community is given as reduction of hunger and poverty.

WHO and FAO partially have been discussing the risks arising from genetically modified organisms for both drugs, seeds, breeding, new products put on the market in terms of food or feed safety for human health, but it did not satisfy needs fully. However, there wasn't any arrangement to address the risks of GMOs to other organisms in nature, ecosystems, risks on biological resources and biological diversity. These risks are difficult to determine and in the long term it is hard to estimate its damage and able to be compensated for this kind of high-risk group. Therefore, as an additional protocol of the United Nations Convention on Biological Diversity, GMOs are addressed at the Cartagena Protocol on Biosafety in international law.

The safe use of modern biotechnology and its products at the international level, the cross-border movement of GMOs are carried out by the regulations and rules within the context the Cartagena Protocol on Biosafety.

The Cartagena Protocol on Biosafety to the Convention on Biological Diversity is an international treaty governing the movements of living modified organisms (LMOs) resulting from modern biotechnology from one country to another. It was adopted on 29 January 2000 as a supplementary agreement to the Convention on Biological Diversity and entered into force on 11 September 2003. The protocol defines a 'living modified organism' as any living organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology, and 'living organism' means any biological entity capable of transferring or replicating genetic material, including sterile organisms, viruses and viroids. The Protocol seeks to protect biological diversity from the potential risks posed by living modified organisms resulting from modern biotechnology. It establishes an advance informed agreement (AIA) procedure for ensuring that countries are provided with the information necessary to make informed decisions before agreeing to the import of such organisms into their territory^[1].

In summary, Protocol includes obligations of official announcement for export of GMOs, special permission prior to the first provision of cross-border move-

ment of GMOs, compulsory information of public and international partners in case of accidentally propagation, regulation of relevant rules with food, feed or processed GMOs to be exported and identification of GMOs intended to export^[12].

Accordance with the Cartagena Protocol on Biosafety, before the release to market, all GMOs are subjected to laboratory analysis, greenhouse and field trials in terms of characteristics, intended use, environmental impact, human and animal health risks. Then a decision is made for import, trade and use of them. This decision is expressed in the form of risk management including preventive measures. Countries are obliged to comply with the rules, the approval of GMOs in their safe use, to take the necessary measures during handling, transportation and to rules for packaging and labeling of GMOs. The protocol provides an exclusion of GMOs for "free trade" rules by agreements with the World Trade Organization. Countries take out the necessary measures for biosafety and biosecurity rules of international trade, the implementation does not fall below a certain standard^[12].

Basic mechanisms of Cartagena Protocol on Biosafety can be identified as information exchange, Pre-notification agreement, Simplified Process, Risk Assessment, Documentation, Decision-making and Risk Management. In Cartagena Biosafety Protocol, in order to protect biological diversity, bio-safety measures are based on the possibility of interaction of GMOs with the environment. In order to ensure bio-safety a "Pre-Notification Agreement" should be applied by the exporter and importer countries.

All countries will be informed in advance food for feed and processed foods. On labels or Located next to the label, documents to be prepared for this kind of products indicates clearly "May Contain GMOs" and shall state to not include release to the environment.

Rules applied to GMOs on transition are left to the countries. Countries inform other countries by exchange of information. "Pre-Notification Agreement" is not required for indoor use of GMOs and each country will determine indoor use conditions and standards itself and notify to exchange mechanism. The documentation expressing "Genetically Modified" should accompany this kind of products; safe handling, storage, usage information will be included. Subjected to processing, which have become vital activity of the SE products contain-

ing genetic material nature, but re-proliferate in an uncontrolled nature of this type of notifications according to the protocol in order to prevent the release of information relating to products and is expected to include the intended use of the product^[18].

GMOs STATUS AND POLICIES IN TURKEY

Ministry of Food, Agriculture and Livestock is the competent authority to take measures about GMOs and authorized for totally or partly collection of GMOs products in order to protect human, animal and plant health, the environment and biological diversity, for confiscation of property, for calling the product, temporary cessation of activity, product disposal, supply, trade and for process such as the prohibition. On the use of genetically modified crops, prepared by the United Nations, Cartagena Protocol on Biosafety was approved on 06.24.2003 by the Grand National Assembly of Turkey came into force on 01.24.2004^[12].

Field trials of genetically modified plants were performed by the General Directorate of Agricultural Research (TAGEM) according to "Field Trials of GM Plants Directive" under Authority Approval No. TGD/TOH-032 dated on 14.05.1998 until the entrance into force of the relevant laws about crop production. GM is not allowed in domestic production in Turkey. However, within the scope of the legislation named as Instruction on Field Trials of GM Crops in Turkey, the trials of GM crops have been performed since 1998. Resistance in cotton for pink and green maggot and herbicides; resistance to stub and stem maggot in corn; resistance to potato insects in potatoes are additional features found in plants from the GM trials. These trials were conducted by the Agricultural Research Institute of Harran at Akçakale for cotton; at Antalya by the Mediterranean Sea for corn and by Agricultural Research Institute of Çukurova in Adana at cotton; by the Institute for Nigde Potato Research at Afyon and Nigde for potatoes^[9].

In order to fulfill the obligations arising from Cartagena Biosafety Protocols about genetically modified products to as well as within the framework of harmonization with EU legislation and furthermore in order to audit imports, processing, exports and to determine the principles and procedures "Regulation of Import, Processing, Export and Control Genetically Modified

Food and Feed" has been published in the Official Gazette No. 27 388. on the date October 26, 2009.

This regulation has been prepared based on the Cartagena Protocol on Biosafety and EU legislation and it is aimed to ensure human, animal and plant health, the environment and to prevent biological diversity and the scientific applications that have the potential to harm human health is not allowed. Objective of the Regulation is described as to determine processing, import, export, monitoring, registration, labeling, control and inspection procedures and principles of genetically modified organisms products and food and feed containing genetically modified organisms so as to protect human life and health, animal health and welfare, protection of consumer interests and the environment at the highest level^[10]. Accordingly, GM food and feed import, marketing, registration, export and transit contrary to the requirements for the purpose of processing and consumption is prohibited.

In case of any negativeness of any imported, produced or distributed genetically modified food or feed produced or environment, in order to protect human or animal health and the environment food or feed operator has to take necessary measures, has to inform the Ministry, consumers and other relevant authorities urgently and is obliged to take back products from market.

GM products are prohibited to use at baby foods, infant formulas, follow-on formulas, follow-on foods and supplement the diet of infants and young children.

If any food or feed, contains at least 0,9% of one or more of genetically modified organisms at the total, it will be recognized as genetically modified. Food or feed containing more than 0.5% not allowed GM is banned for import, processing, transportation, distribution and sale. Label statement of Non-GMOs products identifying presence of no GMOs in the product is prohibited.

With the first amendment on November 20, 2009, transit operations of the products do not comply with the provisions of the Regulation was decided to determine by the Ministry. Threshold value of 0.9% was removed. Prohibition of "Without GMOs" phrase on non-genetically-modified products labels was removed. Also officials of the Ministry were removed from the list of experts. A re-arrangement was made to accept the document taken from accredited laboratories besides

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the requested document indicates that crops contain GM gene requested by the official authority. Temporary Article-1 has been added and importation of the products, having control certificate before the date of 10.26.2009, provisions of Articles 6, 9 and 11 on about application and imports could be performed from the date of 03.01.2010 only if these products are appropriate according to the criteria adopted by the European Union^[11]. By the entry into force of this Regulation, it was objected to solve problems of Turkey's foreign trade and to ensure compliance with the World Trade Organization rules and also to take into consideration the sensitivity of the public. Within this alteration, for the products having control document before the date of October 26, 2009, arrangements were made to be analysed of GMOs accordance with the criteria adopted by the European Union until March 1, 2010.

10th Bureau of the Council of State decided to stop of execution of that Regulation on 20.11.2009 and in accordance with this decision, instructions of the Ministry regarding the implementation of Regulation was repealed. Objection of Ministry of Food, Agriculture and Livestock to that decision of the Council of State was accepted on January 20, 2010 and published in the Official Gazette No. 27 468. Thus, with a second amendment, the regulation was entered in to force again. With this change, Temporary Article-1 was removed and Temporary Article-2 was added and provisions of Articles 5, 6, 9, and 11 about general provisions, permit requirements, application and imports were rearranged for implementation according to the criteria adopted by the European Union from the date of 01.03.2010^[2].

With the third regulatory change on April 28, 2010, ban on the import and release to market of products containing genes resistant to antibiotics was removed; a Scientific Committee shall inform the ministry by making an assessment of tradable genes considered appropriate via risk assessment and approved suitable for consumption in the European Union Also it was decided that terms of labeling of GMO crops can be set by the Scientific Committee^[3].

Threshold value for food and feed appropriate to consumption containing GMOs accepted 0.9% by the Scientific Committee. Products containing approved GMOs over 0.9% shall be labelled according to the Regulation. Also threshold value for products containing non-identified genes and without any risk assess-

ments conducted by the authorized bodies was considered as 0.0%. In this context, the threshold value is zero for unapproved GMOs.

Biosafety Law No. 5977 published in the Official Gazette dated 26.03.2010. The purpose of this law, within the framework of scientific and technological developments, is to prevent risks associated with genetically modified organisms and products derived from modern biotechnology; establishment and implementation of biosafety system in order to ensure the sustainability and prevention activities human, animal and plant health, conservation of biodiversity and environment and to determine and to monitor the procedures and principles related to regulation. It covers research, development, processing, launch, monitor, use, import, export, transport, transportation, storage, packaging, labeling, storage and similar activities on GM crops. Veterinary medicinal products and cosmetics products, medicinal products for human use licensed or permitted by the Ministry of Health are beyond the scope of this Law^[4]. Cultivating GMOs products is prohibited in Turkey under this law. And for GMOs products intended to be imported from abroad to Turkey, only after a risk assessment performed by the Scientific Committee of the genes and their products at entrance, it can be allowed to import for consumption.

GMOs or products are allowed to import, export, launch, release for experimental purposes, use in a closed area only after a risk assessment conducted according to scientific principles by taking into account human, animal and plant health, the environment and conservation of biological diversity and sustainable use. According to the results of risk assessment, period of validity for the decision considered without any risk is 10 years. For the first import of GMOs and products an application shall be made to Ministry of Food, Agriculture and Livestock. Information on the content of the application and use of purpose of GMOs and products shall be given^[4].

Risk assessment is made individually for each application. At risk assessments, field trials including laboratory, greenhouse and farm tests; results of food analysis, toxicity and allergy tests and the results of other tests that are deemed necessary shall be provided by the applicant^[4]. For each application, a socio-economic evaluation is done in order to determine the effects GMOs on consumers and users, on conservation

and sustainability of biological biodiversity^[4]. The principles of risk management is determined based on the results of the risk assessment and socio - economic evaluation for GMOs products application. A detailed plan about risk management is prepared. The applicant is responsible for the preparation and implementation of the risk management plan^[4].

Placing on the market of GMOs and products without approval, using or letting others use GMOs and products in violation of Scientific Committee 's decisions, production of genetically modified plants and animals, use of GMOs and products except from the purpose and using on baby foods and infant formulas, diet of infants and young children are banned^[4].

People importing, producing or releasing GMOs and products to the environment in violation of the Law are sentenced to five years to twelve years in prison and punished with an administrative fine up to ten thousand days and up to one hundred thousand Turkish Liras two hundred thousand Turkish Liras^[4]. A simplified procedure can be applied to applications without any risks of GMOs and products to human, animal and plant health, environment and biological diversity after risk assessment and by taking into account the socio-economic evaluation results.

After the release of GMOs and products and whether there is any unexpected effects on biological diversity and conditions are complied with the the decisions regarding human, animal and plant health and the environment are controlled and supervised by the Ministry. In order to ensure traceability, declarations shall be made to the Ministry of Food Agriculture and Livestock at entry and circulation of GMOs and products to the country and necessary record keeping, an instance of the decision taken and the labeling rules shall be adhered. Documents relating to GMOs and products recorded are required to be kept for twenty years.

After entry into force of the Law, dated 26.10.2009, Regulation of Food and Feed GMOs Products Import, Processing, Export, Control and Audit and the Ministry instructions related with the regulation and also Scientific Committee decisions were repealed. By the date of 26.09.2010, audit and controls on GMOs are carried out in accordance with "Regulation on Genetically Modified Organisms and Products" and "Regulation on Biosafety Council and Committees Working Proce-

dures and Principles" published in the Official Gazette dated 13.08.2010. There isn't any new product permitted within the scope of the regulation.

The purposes of the Regulation on Genetically Modified Organisms and Products prepared under the Biosafety Law are to determine the procedures and principles of applications of GMOs food and feed and related products; evaluation, decision, import, processing, export, labeling, tracking, launch, control; and determination of the control of the GMO 's research, development and activities to do for experimental purposes so as to avoid contact with the external environment^[5].

Regulation on Biosafety Council and Committees Working Procedures and Principles published in the Official Gazette No. 27 671 dated August 13, 2010 determines the procedures and principles regarding the list of experts and the formation of committees, their studies and duties^[6]. Biosafety Council, list of Experts and Committees are constituted in order to evaluate the release of GMOs and and products for food, feed and processing the market, release for experimental purposes and the use of GMOs in closed area and moreover for the purpose of carrying out other tasks specified in this Regulation. Board and Committees are independent in performing their duties. No authority, body or person can give orders or instructions to the Board and the Committee. The Council conducts a separate committee for each application and the committees make assessments of each individually. Secretarial services of the Council and the Committees are carried out by Directorate General of Agricultural Research and Policies^[6].

Risk-based control is carried out at the import stage for products and countries. For this purpose, documents including amounts, origin and genes types of GMOs issued by the competent authorities of importer country or an analysis report taken from an internationally accredited laboratory are required. 100% control frequency are performed if trade of GM products are imported from the countries which are at high risk and allowed GMOs production in their country. Analysis of GMOs in Turkey are performed at a total of 27 control laboratories and 10 of them are public laboratories (Ministry of Food Agriculture and Livestock Laboratories, University Laboratories, Laboratory of TUBITAK).

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AN EVALUATION OF SOYBEAN AREA OF USE IN TURKEY

3 soybean species (A2704 - 12, MON40 - 3-2 and MON89788) are allowed with Official Gazette dated on 26.01.2011 and numbered 27 827 and 13 corn species (BT11, DAS1507, DAS59122, DAS1507xNK603, NK603, NK603xMON810, GA21, MON89034, MON89034xNK603, Bt11xGA21, DAS59122xDAS1507xNK603, DAS1507xDAS59122 and MON88017xMON810) are allowed with Official Gazette dated on 24.12.2011 and numbered 28152 by Biosafety Council decisions only for animal feed or for use as a raw material for animal feed. Risk assessments are made for all those species by European Union and they are allowed for consumption by many countries. Because there has not any gene approved for food by Biosafety council so far, since the date of 26.09.2010, foods or products detected as GMOs are not allowed to enter the country at import controls.

Soy beans agriculture are increasing significantly due to highly nutritious context, wide variety of application fields and properties of a plant with the advantages of modern agriculture world. Within 38-40% protein content it can be consumed in order to meet protein needs and also it can be esteemed as an important oilseed due to 18% amount of fat. Soybeans and soybean-based products are very important for human nutrition and health. Particularly, in the United States which is the world leader in the production of soybeans and in developed countries milk, yogurt, cheese, boneless meat, ice cream, ice cream cone, cake, coffee, tomato paste, oil, margarine, alcohol, soy flour, bread, pasta, infant food, fodder, green manure, plastics and etc. products in various areas derived from soybean show how important it is and uses for a wide variety^[13]. Soybean production in major producer countries are given in TABLE 2.

Moreover, because laboratory experiments show that 453 g soy flour contains a protein content as high as 31 eggs, 6 large bottles of milk and 900 grams of boneless meat^[13].

Soybean is mainly consumed for feed industry but it started to be used in food sector recently. Soybeans and soybean pulp, as raw material for feed, especially are used in poultry feed industry highly because of very valu-

able source of vegetable protein. Need of soybean and soybean pulp in Turkey is corresponded mainly through imports because soybean production in Turkey is insufficient for the needs of industry. Large part of soybean is fried for animal feed and the rest is probably going to oil factories and used as soybean oil. Soybean oil is used in many products of food industry such as mayonnaise, coffee, cream, butter, margarine, sandwich oil and salad sauce. Soybean cultivation area, production and yield amounts in Turkey are given in TABLE 3.

TABLE 2 : Soybean production in major producer countries (Thousand Tonnes) (Anonymous, 2010 f).

Country	2004	2005	2006	2007	2008	2009	2010
U.S.A.	85.013	83.504	86.998	72.857	80.748	91.417	91.854
Brasil	49.549	51.182	52.464	57.857	59.242	56.960	67.500
Argentina	31.576	38.290	40.537	47.483	46.238	30.993	52.000
China	17.404	16.350	15.500	12.725	15.545	14.500	14.400
India	6.876	8.273	8.857	10.968	9.905	10.217	9.600
Paraguay	3.583	3.988	3.800	6.000	6.311	3.855	6.500
Canada	3.043	3.156	3.465	2.696	3.336	3.504	4.345
EU	2.479	3.064	3.610	2.583	2.742	3.353	-
Bolivia	1.586	1.693	1.619	1.596	1.260	1.500	-
Total	205.530	214.462	221.897	219.583	230.581	222.268	257.777

TABLE 3 : Soybean cultivation area, production and yield amounts in Turkey (Anonymous, 2010 f).

Years	Number of Farmers	Cultivation Area (ha)	Production (Tonnes)	Yield (Kg/Da)
2004	1.689	14.000	50.000	357
2005	1.787	8.600	29.000	337
2006	2.546	11.919	47.300	397
2007	1.422	8.675	30.666	354
2008	1.864	9.444	34.461	365
2009	2.412	10.521	38.442	366
2010	-	14.775	55.000	400

Because there is an insufficient amount of soybean and soybean pulp to meet consumption and high demand in the domestic market of Turkey, trade is based mainly on import. In order to provide Turkey's vegetable oil need, besides processed soybeans and soybean oil imports highly efficient seed is imported to increase productivity. Soybean and Soybean Oil Imports in Turkey carried out over the years is given in TABLE 4.

Soybean is the most important raw material for feed industry which has no substituent. Full-fat soybean and soybean pulp are primarily raw materials for poultry feeding with a rate of 25-35%. Today, almost all soy-

beans and soy products are needed to be imported and, the need for these products in Turkey is increasing with the rate of increase in the production of poultry feed. One of the reasons for imports in the feed industry is imported pulps have higher protein content than to domestic production.

Soybeans were subsidized for many years in Turkey to promote seconder crop production and in order to satisfy lack of vegetable oil. However, in 1994, it was excluded from the scope of subsidy within the framework of measures to support economic stability. Purchase prices and the market prices over the years is given below.

TABLE 4 : Soybean and soybean oil imports in Turkey (Anonymous, 2010 f).

Years	Soyabean		Soya oil	
	Amount (Tonnes)	Value (Thousand \$)	Amount (Tonnes)	Value (Thousand \$)
2003	831.454	226.525	133.601	72.801
2004	681.964	226.828	75.399	47.608
2005	1.129.091	328.533	190.998	105.484
2006	1.016.907	264.797	213.205	120.708
2007	1.230.908	409.656	50.799	37.372
2008	1.239.065	647.900	20.092	25.722
2009	1 140 812	629.299	10.178	10.480
2010	1.756.064	742.420	9.696	7.339

TABLE 5 : Soybean purchase prices in Turkey (Anonymous, 2010 f).

Years	Average Purchase Price (TL/Ton)	Çukobirlik Purchase Price (TL/Ton)	Karadenizbirlik Purchase Price (TL/Ton)
2006	480	500	375
2007	510	660	575
2008	610	640	550
2009	710	700	730
2010	760	760	700

TABLE 6 : Soybean purchase prices in the world (\$ / Ton) (Anonymous, 2010 f).

Years	U.S.A. Farmer Prices	U.S.A. ILIONIS	NETHERLANDS ROTTERDAM
2005/06	205	202	261
2006/07	254	264	335
2007/08	414	452	550
2008/09	368	365	421
2009/10	354	357	429

The main reason for falls of soybean production recorded in recent years in Turkey are shown as price

and market policies. Producers who can not get enough support chose products manufactured at lower cost (such as wheat) instead of high value-added products such as soyabean. Furthermore, industrialists were drawn toward to import soybean rather than getting from domestic market.

As a result of lower domestic soybean production to satisfy the growing demand of the domestic market raw oil deficit is seen in Turkey, feed industry can not satisfy the needs of pulp and prefers to import. Producers who plans to make a profit with estimated price for the next year faces with a loss due to realization of lower market prices than expected prices and thus are forced to retreat from production. In this case, deficiency occurred is tried to meet by imports. The amount of soybeans produced in Turkey is 55 thousand tons in 2010, while the amount of imported soybeans is seen that about 1 million 750 thousand tons.

Biosafety Council allowed 3 soybean species (A2704 - 12, MON40 - 3-2 and MON89788) are allowed with Official Gazette dated on 26.01.2011 and numbered 27 827 only for animal feeding, the use of these genes in foods is not permitted. After the registration of these three genes to be used in animal feeding, 80 thousand tons were imported and all traceability steps from import entry to consumption shall be informed the Ministry of Food, Agriculture and Livestock^[8].

CONCLUSION

Applications of modern biotechnology are expanding with the development of biotechnology research in today's world. Especially in the fields of medicine and agriculture, a large part of the inventions offered for benefit of humanity have been achieved by applications of gene transfer methods. The use of gene transfer applications in the field of agriculture are faced with consumer a great reaction amongst sensitive societies regarding consumer health and the environment and several measures and risk assessment techniques are raised against those applications. At this point, lagging behind developed countries in terms of biotechnological research and applications, it is important to determine a policy for the coming period in Turkey. If modern biotechnological methods are used in positive aspects, they offer great benefits to science and humanity. Today, the most criticized aspects of GMOs is working on bio-

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logical assets directly.

“Loss of genetic diversity” which is another risk arising from GM crops is very important to pay attention for Turkey who is rich in genetic resources. Turning back of GMO products are almost impossible after having been released to nature. Lack of information on this issue can be resulted with the loss of the existing genetic resources. These issues should not be overlooked and be included in the legislation.

Country input-output (import / export) of GMOs are not unchecked. Control and audit mechanisms of products declared as non-GM and GM crops prompted to be imported to Turkey are clarified within the framework of the rules and the process.

In regulations issued under the Law, labeling of GM crops is required after the decision of Biosafety Council allowed to enter the country. Thus, the introduction of GM crops is not possible with unclear and undefined way and contrary to popular belief consumers are provided with accurate information so consumers can distinguish between GMO and Non-GMO products and have right to choose products.

GMOs production are not allowed in Turkey. Contrary to the false claims in the public, cultivation of GM products is not allowed also. According to the Biosafety Law, the production of GM crops is prohibited.

GM products shall not be used in baby foods and infant formulas, follow-on formulas and follow-on foods and supplement of infants and young children according to the regulation prepared by the Ministry of Food, Agriculture and Livestock. Although there has been no restrictions on the use of this provision in all countries of the EU and the United States, Turkey authorities prohibits this kind of use with a precautionary approach in order to protect future generations.

Very heavy penalties are performed in case of non-compliance at the controls in the market. Depending on the fault, in accordance with the provisions of Article 15th of the law entitled as penalties; “People importing, producing or releasing GMOs and products to the environment in violation of the Law are sentenced to five years to twelve years in prison and punished with an administrative fine up to ten thousand days and up to one hundred thousand Turkish Liras two hundred thousand Turkish Liras”.

Biosafety Law introduced following the cavity of GMOs legislation in Turkey and regulations to ensure

enforcement of this law are expected to be solutions to the problems.

In addition, Turkey has sufficient potential and infrastructure for corn and soybeans which are seen as substitutes for each other in agricultural policy. Integrated pest management (integrated pest management), integrated crop management (integrated crop management) can be considered as an alternative to genetic applications to increase the quality and efficiency in Turkey primarily. Widely use of these methods shall be one of the most important tools to ensure sustainable agricultural development and food safety.

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