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Study on progress and environmental strategies of GMO technology

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ABSTRACT

Based on the progress and the industrial GMO technology, analysis of the rapid globalization of GMO cultivation and management, it was discussed in the process of environmental, ecological and safety issues on the human body itself and potential risks. It was also analyzed about GMO on ecosystem long-term effects of uncertainty. On the international GMO management, it was discussed the environmental management of the corresponding countermeasures and suggestions.

KEYWORDS

GMO (Genetically modified organism);
Ecological risk;
Technology;
Environment.

INTRODUCTION

GMO (Genetically Modified Organisms) is genetically modified organisms, by means of genetic engineering, gene fusion and gene replacement of related organisms, the introduction of foreign genes, which are generated from the characters to the genetic material changes in the modified or new species[1]. Exogenous gene derived from animal, plant or microorganism, the current animal and microbial GMO is mainly used for scientific research and experiment, GMO mass market operation is mainly reflected in the production and processing of crops. Because of the exogenous gene does not depend on the particular species, through gene manipulation, transplanted into the cell, can quickly change the characteristics and traits of the species, application prospect of this kind of biology technology is very broad, including immune, medicine, health care reform, breed improvement; in the aspect of improving crop varieties, GMO has been widely used, and its advantage is obvious: to reduce costs, increase crop yield and nutrition structure, reduce the use of pesticides.

INDUSTRY AND TRADE GLOBALIZATION OF GMO

In the early seventy of last century, Professor Stanley Cohen of Stanford University's first successful implementation of different species gene fusion and grafting, first appeared in 1983 in the commercial application of GMO tobacco company Calgene, developed in 1993 cold delay tomatoes Flaver-SavrTM marked, genetically modified crops mass production since then, crop GMO technology has been very rapid development, reflected in the the following aspects:

Technology and industry development of seeds

The key to GMO is the introduction of foreign genes suitable, first of all need to advanced biological technology, followed by the need for large sums of money to support; driven by commercial interests, related by large companies recruit talent and substantial injection of development cost, improving on the seed, the upstream product way monopoly production and operation of GMO seed. GMO and source the product is the company's laboratory. GMO seed development business, mainly monopolized by a few big companies, often through the "male" technology allows growers left no seed. Monsanto, Astra, Dupont, Novartis, Aventis control the GMO seed (soybean, corn, rapeseed, cotton) development and sales market. Because GMO technology rich reporting and the potential for greater profits, the United States of America's Monsanto and other large biological technology company on the one hand, to further strengthen the pace of development of GMO. So far, already has more than 100 can be used for planting GMO crops, including vegetables, food, textile fiber crop seeds. In 2000, the United States has 54 kinds of scale production of GMO crops. On the other hand, in the world scope greatly promote GMO products and cheap, reliable and high quality, to avoid possible risks, its purpose is to let more people to accept the GMO, so as to create a favorable market environment, and to let more people to consume GMO products.

Planting scale

GMO scale cultivation began in 1994. America is now planted GMO major, including In the United States, Argentina, Brazil, Canada and Mexico, Europe, Bulgaria and Spain, South Africa and Monaco, Oceania, China. Since the 1950s the GMO planting area and yield growth quickly. From the GMO planting country data, the total planting area of soybean, corn 63%11% from GMO crops. Globally, 46% of the soybean and cotton from GMO[2, 3] 20%. Now all processed foods containing GMO component of the United States is 70%. The global GMO in 1996 planting area is 1700000 hectares, by 2012 this figure increased to 171600000 hectares. Area of the increase is almost 10%[2, 3] (annual growth rate). In developing countries, developed countries planting area increased 26% 17%[2, 3](see TABLE 1). These crops to soybean planting area is the largest. TABLE 2 lists the main transgenic crops of corn, cotton, rape planting area.

China in 1996 began the resistant transgenic tobacco (TMV-CAV tobacco) planting, planting area of 300000 hectares in 1999. By 2000, GMO planting area of more than 500000 hectares, according to the ISAAA newsletter, 2001 China reached 1500000 hectares. The growth trend is obvious, mainly because the Bt cotton area increased by 3 times, the other GMO crops are anti-cold and extension of cooked tomato, tobacco, rapeseed, pepper and other antiviral.

TABLE 1 : Distribution of global GMO planting countries and area (million hectares)

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
USA	30.3	35.7	38.0	42.8	47.6	49.8	53.7	56.1	61.9	63.2	64.7	65.3	65.9
Argentina	10.0	11.8	13.5	13.9	16.2	17.1	18.8	19.3	20.6	20.8	21.3	21.7	21.9
Canada	3.0	3.2	3.5	4.4	5.4	5.8	6.1	6.4	7.2	7.9	8.4	9.3	9.9
China	0.5	1.5	2.1	2.8	3.7	3.3	3.7	4.0	4.2	4.4	4.4	4.5	4.7
other	0.4	0.4	1.6	3.8	8.1	14.0	19.4	26.8	29.1	39.9	48.3	59.5	69.2
total	44.2	52.6	58.7	67.7	81.0	90.0	101.7	112.6	123.0	136.2	147.1	160.3	171.6

TABLE 2 : The types and area of major global GMO crop distribution (million hectares)

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
soybean	25.8	33.3	36.5	41.4	48.4	53.9	58.3	59.8	65.3	69.4	73.0	77.2	80.4
corn	10.3	9.8	12.4	15.5	19.3	21.4	25.9	33.8	37.3	43.7	47.5	53.9	57.0
cotton	5.3	6.8	6.8	7.2	9.0	10.2	12.7	13.9	15.1	17.4	20.7	22.0	21.9
rape	2.8	2.7	3.0	3.6	4.3	4.5	4.8	5.1	5.3	5.7	5.9	7.2	8.9
total	44.2	52.6	58.7	67.7	81.0	90.0	101.7	112.6	123.0	136.2	147.1	160.3	171.6

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GMO in global trade

Because of the tremendous business opportunities and GMO first in the success of GMO crops, crops and products in the market to expand rapidly, according to the ISAAA report, the global GMO sales increased from $75000000 in 1995 to $1500000000 in 1998 to 3000000000 in 2000, participation of farmers planted more than 2000000[4]. In 2005 amounted to $6000000000, to $40000000000 in 2013. The United States is the biggest GMO technology development and production of China to the United States in 1998, for example, the GMO export trade amounted to $435000000, including products contain GMO ingredients, accounted for about35%, agricultural exports $12000000000, if the GMO fed livestock exports are also included in the word, the number rises to 70%, $24000000000. In fact, GMO crop to crop the proportion of the total increase every year. FAO is expected in the next 10 years, the GMO crop proportion will rise by 10%-20%. With the innovation of science and technology, GMO and its products of commercial applications will expand to the United States. SIOUX CENTER is making the human can obtain valuable immunoglobulin[4] directly from the milk cow eggs. It is changing the way by he GMO animal. The scale of operation is only a matter of time the problem.

THE UNCERTAINTY OF GMO

GMO has achieved great success in the large-scale application of crop planting area. The world will be further expanded, and the GMO has broad prospects in the immune, medicine, animal husbandry and so on. But the safety of GMO has been paid more and more attention, boycott GMO people think of transgenic organisms and their products with great potential hazard, mainly reflected in the two aspects of environmental ecology and human itself.

Environmental and ecological problems

The loss of resources

The development of GMO technology, for the less developed countries there are species gene pool and ecological security. The use of funds, embodied technological advantages in foreign companies. Closely related to human biological gene registered action, specifically for the first study to identify genes one or some biological, then apply for a patent, claim right, any other organization or individual to engage in research or if corresponding production, need to pay fees or the use of their products. This result is a developing country in a very unfavorable position. Even if a living wild in the country, but may not belong to it. This is more unfair situation already missed opportunity for economic development of the country. For example, in 1994, Monsanto Company (Monsanto) for[5] by patent, announced on a India wild rice genes of ownership. India spent up to 5 years of litigation finally back. Monsanto announced on China's Shanghai suburb of wild soybean gene fragments the ownership of[6] in 2001. Now to counter the results is not clear. Along with the integration and globalization speeding up, the human ecological system security threats increase in gene.

Effect of biodiversity

Some traits of species once changed, it will affect biodiversity. Research shows that stability of insect community in cotton fields of Bt than normal conditions of the poor. In 1999 March the United States of America scholar Losey in "natural" issued proof of Bt corn pollen by hurting American monarch butterfly larvae and interference effects of development and population structure of[7]. The results of this study came out, immediately announced: the EU will decide in the next step for further research results. In the meantime, a meeting of EU environment ministers will make the final decision granting the right of transgenic maize. Effects of food chain, to a certain extent, such as: eating GNA transgenic potato leaf aphid fecundity drops 38%, and incubation time prolonged. As a result of aphids than normal state, affect the food chain link — ladybug populations[8, 9]. A lot of genetically modified crops makes a single trend of species, genetic diversity and gene library.

Anti removal of large number of genetically modified crops herbicides, due to the addition of extensive use of herbicides kill weeds, in does not affect the crop condition, damage and changes in species on ecosystem habitat. For example:planting herbicide in the beet, due to the use of herbicides, the herbicides to kill the weeds, affect the bird food, resulting in significantly reduced the number of birds and herbicide pollution. GMO biological crossability. Transgenic plants can be-

come weeds. In 1997 Bartsch[10] et al found that transgenic beet and common beet hybrid become weeds. The harm and effect needs further observation.

Specification of gene and instability

GM sources are not the only, can be in plants, microorganisms, animal, or even gene fragment of human. At present mainly by viruses and bacteria to obtain desired gene. The corresponding laws and regulations are not complete. So for the large-scale application of GMO and its products, management and related standards lag.

The intention of transgenic approach the target creature is: get a stable recombinant target genomes. And expressed by correlation like progeny genetic pattern. However, due to many environmental factors, the fact is not the case. GMO in the introduction of foreign genes is not normal expression of genetic information, present transgenic silence (Trans-gene Silencing). In 1986, R. Peerbotle *et al* confirmed GMO tobacco appeared transgenic silence phenomenon. In 1994 Jean and David through the investigation of biological products company found that all companies have encountered such a situation[11]. GM may through genetic drift and close species fusion. Correlation characteristics will appear in other species. For example, once the weeds have herbicide resistance genes, the corresponding agent needs to update.

Effect on the microbial environment

GMO is the gene technology to achieve. But the gene cloning through gene mapping, molecular nucleic acid series, label and protein information code in theory and practice are limited. At present transgenic source biological mainly bacteria, viruses and other. Harmful bacteria and viruses new fusion once inadvertently will produce. On the other hand, GM may be induced by viruses and other microorganisms new. The United States reported in 1994: the cauliflower mosaic virus coat protein gene into cowpea. Get antiviral cowpea. After that, researchers will have no coat protein of the virus and then inoculated transgenic rainbow bean. The results showed that 4 strains of Hong Dou 125 lines and infected with mosaic. Therefore, viruses and transferred to the gene fragments can produce new virus[12].

Natural protection and ecological security of uncertainty

Ecological invasion refers to the non local source through human activities intentionally or unintentionally was introduced in the local biological, natural or man-made ecological system in the formation of the self regeneration capacity, but also on the structure of the system to cause significant damage or effects of[13]. GMO is a new species through genetic engineering or variants, belonging to the non local sources of biological. The influence of such organisms on ecological environment is not immediately apparent, the need for a process, once specially adapted and eruption of invasive species, is a disaster for natural protection. The American white moth (*Hyphantria cunea Drury*) for patients with[14], after years of lurking, first discovered in 1979, this kind of biology in Dandong. At the outbreak of the trees into a film, now dead, this pest has spread to the northwest, Southern China area. Other typical species have invaded: *Mikania micranthaH.B.K, Alternanthera philoxeroides Mart, Spartina anglica, Ambrosia artemisiifolia L., Hemiberlesia pitysophila Takagi sudden Park scale, Coccobius azumai Tachikawa, Bursaphelenchus xylophilusNickle, Opogona sacchari Bojer, Aedesalbopictus*. GMO scale is less than 20 years, effect of GMO itself and produced through genetic drift and new species of ecological safety of the show also requires a process[15].

The direct effect of GMO on the human body

GMO and its products have been widely exists around us. For commercial purposes, large companies to introduce their products to all corners of. On the human body, first is allergic problems. Because the crop in the template for the synthesis of proteins containing genetically modified, this protein as a heterologous protein to new, some people may cause allergic reaction. The first is the age of 90 years London has edible GMO soy allergies. Nordlee confirmed: GM soybeans contain Brazil fruit methionine labeled gene, improved nutrition structure of soybean, but someone because of sensitive to the Brazil fruit and the soybean allergic reaction. The second is the problem of drug resistance. Biological products carrying food anti antibiotic gene, may produce the immune system disorders. Because the human body once ate the food, the immune response through the formation of drug resistance, then once the antibiotic treatment, the drug no effect. Finally is the toxicity of GMO and its products. For the earliest GMO

toxicity is a British scholar Arpad Putsai. His results show that: the mice were fed with Lectin marker gene of potato. The consequence is the destruction of the[16] liver and immune mechanism in mice. They concluded that GMO is unpredictable, on the human body may be unsafe. Due to the large international firms, the 1999 Arpad Putsai had to retire early.

THE MAIN ATTITUDE TO GMO INTERNATIONAL

The United States is the world's largest scale of operation of GMO seed production and cultivation of China, has encouraged to fund the development of GMO, the influence of vested interest and huge market potential, and will expand the field of GMO industry, the National Corporation to sell their products, consumers in the United States on the use of GMO be accustomed to; the toxicity of GMO is the first identified in Europe the EU, for GMO intense reaction, also because of trade barriers, the EU has adopted boycott attitude, Britain, Holland and other Western European countries have banned the import of food products containing GMO and[17], exports to Holland, a Chinese enterprise soy was found to contain genetically modified ingredients (raw material for the United States of America soybean) by destruction into the sea; in the impact of EU tough attitude, Japan, Russia and other countries to strengthen the regulation of GMO, Japan imports from the United States soybean GMO hybrid rate can not exceed 5%, Russia deems it necessary to continue the potential hazard of GMO, and the provisions will be necessary to separate the GMO and traditional biological area.

On GMO production, management has the following two modes. Product based management pattern, the management object is the product. On GMO and traditional biological treated the same way, the key to see the condition of the product, without considering the genetic engineering technology. The United States of America, Canada adopted this approach. Process management model based on the gene, in view of the source of complexity and uncertainty of GMO, the GMO development, production, planting, evaluation of the whole process management. Take many factors into account, including the gene recombination technique, gene biological source, analysis of the effect of GMO, to monitor the. The implementation of this model. The mode of consumption, the identification model based on. The main reason to consider the consumer's right to know, to allow consumers to choose their own mode of management. The dealer must be the product of GMO and its components are the clear accurate information. According to the requirements of different, divided into mandatory labeling system and voluntary labeling system.

Although some uncertainty in GMO, but the prospects for the development of biotechnology for countries to take a very positive attitude to GMO, to support research and scale of operation. The United States has been the leading. The Japanese release in 1999 "to create the biotechnology industry policy" in put forward "bio industry country" point of view. Approach "to the development of transgenic technology for the beginning of rapid progress, technological innovation". The European Union on the one hand against the GMO imports, on the other hand is increased in the GMO technical input. Now, Spain, Germany, Romania, Bulgaria, Czech, Hungary and other countries have been GMO plantation.

ANALYSIS AND COUNTERMEASURES OF ENVIRONMENTAL MANAGEMENT

In view of the development of GMO and the speed of international trade is very fast and its potential problems, need to take more active measures, protect environment, ecological security in China:

To strengthen international and regional cooperation and negotiation

January 1, 1994 entry into force of the North American Free Trade Agreement (NAFTA) in environmental agreements create environmental problems involved in the trade agreement of its kind in the[18]. At present, free trade within the framework of the WTO has made considerable progress. Due to the environmental problems, all countries in the process of trade liberalization to consider environmental factors. GMO trade has been the introduction of WTO management framework. After our country joins WTO, reduce the conditions of domestic market access. The process of

GMO and its products imports will have a growth. Due to GMO potential ecological security, be familiar with WTO environmental clauses and related protocols (such as TBT). China will actively participate in multilateral trade negotiations, increase the right to speak, lifting component to speak, to seize the initiative. In addition, in the areas of bilateral cooperation, further environmental cooperation, mutual absorption environmental management experience. The potential risks of GMO is global. International cooperation is a must. In fact, from the ozone protection effect, because of the global CFCs usage restrictions, the ozone layer over Antarctica is slowly recovering[19].

To improve the laws and regulations on environmental protection

China has "the people's Republic of China Environmental Protection Law", "genetic engineering safety management" on the biological and ecological security law. But now due to the rapid development of GMO, the GMO management is not smooth, related laws and regulations need to improve. Also the lack of a specialized from the perspective of biological and ecological security legislation. Therefore, we must perfect the legislation in this area. On the other hand, need to clear the appropriate GMO management mode. Identification model is the most basic management mode. This is allowed by the TBT.

To improve the monitoring level and tracking assessment efforts on GMO

The current pace of development for GMO in the world behind the monitoring of gene technology. International companies have the capital and talent advantage. Now the monitoring problem of GMO is a long time, high cost. And mixed with monitoring of GMO monitoring, GMO products containing ingredients not mature. The need to increase investment. On the other hand, tracking investigation and scientific assessment of GMO should be further to the environmental factors, including GMO, ecosystem structure, ecological invasion, nature conservation, biodiversity etc..

The popularity of the GMO related knowledge

The lack of adequate understanding of genetically modified products in the western 48% of consumers, can not affect the biological technology on their own point of view, really have their own scientific and rational view on GMO were less than 4%[4]; in China, did not know that the higher GMO proportion, as ordinary consumers, a large number of people in the consumption of GMO and its products, but they should have the right to know about GMO is how to return a responsibility, should also have the right to choose, there needs to be more channels for them to get these knowledge.

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