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Transgenics: The Silenced Science

In Chile, the use of transgenic crops could imply a revolution not only for the agricultural world, but also for the forestry, aquaculture and mining sector. Transgenic crops are really an opportunity, not a threat. The sooner the subject is dealt with, the greater our competitive advantages in the international scenario. Otherwise, as more time passes, our competitivity runs a greater risk.

The options offered by vegetable genetic engineering are enormous, and its consequences still greater. Plants which are more resistant to frosts, droughts and pests are today true facts, causing a direct impact on the agricultural world's productivity. Likewise, food with more nutritional value and/or having better taste and appearance are now available to a population with increasing needs.

The use of transgenic crops can entail many advantages; these products are traded and consumed in the world since 1996.[i] In the last 16 years, we have seen a sustained growth in fields with transgenic crops and an increasing number of countries which have adopted them.

But not everyone approves this evolution. An evidence of this is that, after a long and intentional delay of more than 10 years, the approval for the famous "golden rice" trade is just seeing the light. This crop, genetically modified to produce the predecessor of vitamin A (beta-carotene) could have been cultivated a long time ago to help the world's poorest population who suffers sight problems or child blindness caused by a vitamin A deficiency in their nourishment.

There is a strong prejudice against transgenic crops, leading to an often excessive and inappropriate regulation which in a way has managed to delay its global expansion. In spite of this, genetically modified crops will probably go on gaining ground.

What are Transgenic Plants?

A genetically modified organism, or transgenic, contains a new gene that has been artificially inserted, becoming a part of its genetic heritage. This new gene gives them a characteristic that they did not have before, and which can be transmitted to the following generations through the gametes.[ii]

In the case of transgenic plants, the process consists in the introduction of a strange gene, its incorporation to the genome in a regular way, and its transmission to the progeny. The choice of the gene depends on the desired objective for the transgenic plant; for example: fighting pests, increasing the resistance to herbicides and insects, growth in saline soils, less water requirements, changing fruit maturity cycles, embellishing ornamental plants or improving the quality of food. In the latter, improvements can be made in the nutrition value of food or serve as an oral vaccine.

Among the benefits ascribed to transgenic products is the increase of productivity and economic benefits in the agricultural activity, which contributes to fiber and food security. Furthermore, the productivity of traditional crops entails savings in land development, thus avoiding deforestation and promoting care of biodiversity; meanwhile, greater benefits derived from the agricultural activity, generally developed by small farmers, help mitigate the poverty condition, as is already being evidenced in the developing countries. But what is still more important is that genetic engineering offers agriculture the possibility of improving its yield and adaptation capacity to adverse conditions, which is an important contribution for mitigating starvation around the world.

On the other hand, the development of transgenic crops has enabled important achievements related to the reduction of pesticide and fossil fuels use, and CO2 emissions. Concerning the climate change – which foresees more droughts, floods and temperature variations – biotechnology promises an important progress in the development of varieties and hybrids that can adapt more quickly to the climate condition changes.

Nevertheless, transgenic crops are not a panacea nor will they end up replacing traditional crops; they will probably coexist in the world with organic crops, requiring certain safeguard measures. In turn, genetic engineering will have a permanent task in order to improve transgenic crops. Recently, a mutation in corn worms was discovered

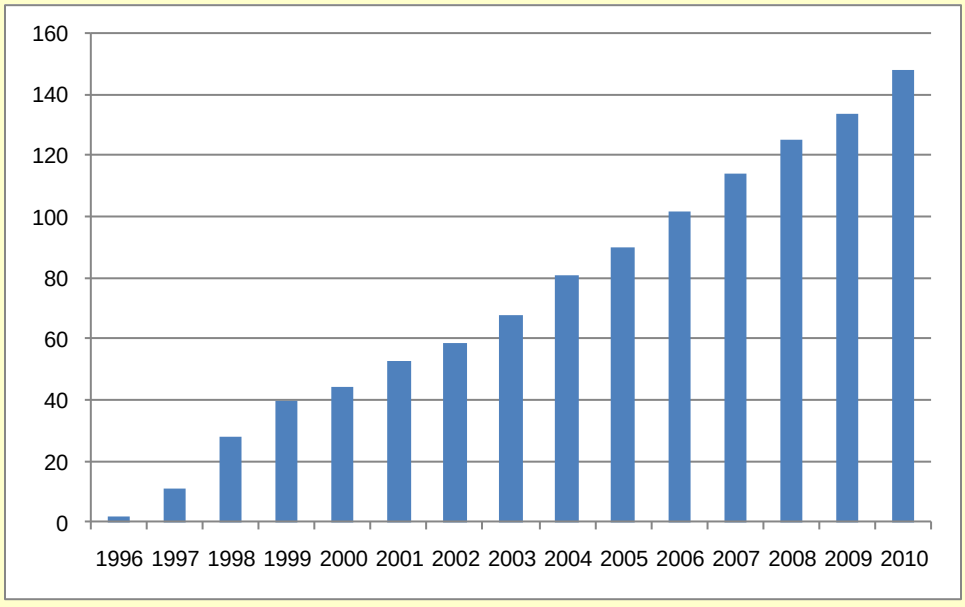
that makes them resistant to the corn genetically modified by Monsanto. This demonstrates that nature is always evolving, and in the same way as pesticides and antibiotics have been developed in the past to deal with new resistances, a persistent job will be necessary to find new genes to fight these new resistant individuals. Anyway, the truth is that it is still more harmless to use transgenics than pesticides.

Transgenics Expressed in Figures

Between 1996 and 2010, transgenic crops accumulated more than a billion hectares, equivalent to more than 10% of the world's cultivable land. In 2010, 148 million hectares were planted with these crops, which in more precise terms meant an increase to 205 million "trait hectares" during the year, 14% more than in 2009.[iii]

Chart 1

GLOBAL SURFACE OF TRANSGENIC CROPS
(MILLIONS OF HECTARES)



Source: ISAAA

In 2010, the number of countries with transgenic crops increased to a total of 29 (4 more than in 2009), and it is estimated that each one of the 10 leading countries – USA, Brazil, Argentina, India, Canada,

China, Paraguay, Pakistan, South Africa and Uruguay – cultivated more than 1 million hectares with these products. Even in the European Union, historically more reluctant regarding the incorporation of transgenic crops, the countries that have introduced them increased to 8. It is estimated that towards 2015, another 40 countries will have adopted transgenic crops.[iv] In this process, the emerging countries' crops will probably surpass the industrialized countries, led by China, India, Brazil, Argentina and South Africa.

Table 1

TRANSGENIC CROPS SURFACE BY COUNTRY, 2010

Ranking	Country	Surface (th. ha)	Transgenic Crops
1	USA*	66.8	Corn, soya, cotton, canola, beet, alfalfa, papaya, squash
2	Brazil*	25.4	Soya, corn, cotton
3	Argentina*	22.9	Soya, corn, cotton
4	India*	9.4	Cotton
5	Canada*	8.8	Canola, corn, soya, beet
6	China*	3.5	Cotton, papaya, poplar, tomato, pepper
7	Paraguay*	2.6	Soya
8	Pakistan*	2.4	Cotton
9	South Africa*	2.2	Corn, soya, cotton
10	Uruguay*	1.1	Soya, corn
11	Bolivia*	0.9	Soya
12	Australia*	0.7	Cotton, canola
13	Philippines*	0.5	Corn
14	Burma*	0.3	Cotton
15	Burkina Faso*	0.3	Cotton
16	Spain*	0.1	Corn
17	Mexico*	0.1	Cotton, soya
18	Colombia	<0.1	Cotton
19	Chile	<0.1	Corn, soya, canola
20	Honduras	<0.1	Corn
21	Portugal	<0.1	Corn
22	Czech Republic	<0.1	Corn, potato
23	Poland	<0.1	Corn
24	Egypt	<0.1	Corn
25	Slovakia	<0.1	Corn
26	Costa Rica	<0.1	Cotton, soya
27	Rumania	<0.1	Corn
28	Sweden	<0.1	Potato
29	Germany	<0.1	Potato
	Total	**148**	

*17 biotechnology power countries growing in 50,000 hectares of biotechnological crops, or more.

Source: ISAA

In 2010, the main type of crop was soya resistant to herbicide, which occupied 50% of the global transgenic crop surface, followed by corn (31%), cotton (14%) and canola (5%), all genetically modified. As for the trait, the resistance to herbicides showed by soya, corn, canola, cotton, sugar and alfalfa accounted for a dominant 61% of the transgenic crops' global surface, followed by double- and triple-traits (22%) and resistance to insects (17%).

The global value of the transgenic seed market was estimated in US$11.2 billions in 2010, increasing the value of genetically modified corn, soya and cotton to approximately US$150 billions in the same year. It is worth mentioning that a very high percentage of the world-traded soybean, soya bran, wheat and oils come from transgenic plants; therefore, humans, birds, pork and vaccines have been consuming these foods for years.

Are Transgenic Crops Harmful?

Transgenic crops have been strongly questioned by environmental groups throughout the world, who believe that they could have an impact on both biodiversity and human health. Among others, it is argued that transgenic food could activate certain virus, which could be toxic and produce allergies, besides reducing the native flora, with its consequent effect on biodiversity. However, there is no scientific evidence to date which demonstrates that they have done any harm whatsoever to neither human nor animal health.

So then, where does this fear come from? Apparently, it comes from certain false beliefs and/or inappropriate experiments that, thanks to the decided action of the groups opposed to transgenic crops, have succeeded in strongly influencing public opinion. It is worth mentioning, for example, that the idea that the transgenic potato could be toxic came up from an experiment carried out by A. Pulsztai, who fed rats with raw transgenic potato, and the consequences were fateful for the animals. However, it is well known that feeding with raw potatoes, either transgenic or not, necessarily damages the nervous and immunological system and the digestive system, which invalidates the results obtained. On the other hand, the assumption that transgenic products produce allergies is also a consequence of work inducing to wrong conclusions. Here, a soybean was transformed by a gene isolated from the Brazil nut; since nuts produce allergies, the genetically modified bean obviously did too.

All in all, negative prejudices regarding transgenics have proven to be groundless. In fact, several international agencies and science academies have endorsed the use of transgenic crops and have questioned the subjectivity of the negative criticism.

The scientific community has been very clear in its position regarding the development and use of transgenic crops. As an example, we can mention the joint statement of 2000 of the Academy of Sciences of the USA, Brazil, China, India, Mexico, United Kingdom, and the Third World (TWAS), which called upon the use of the genetic engineering technology, indicating that "it is possible to produce transgenic foods which are more nutritious, easy to store and, in principle, health-promoters, thus favoring consumers of industrialized and developing countries".

More recently, in May 2009, the Pontifical Academy of Science (PAS) expressed its opinion on this matter. Among the conclusions, it declares that genetic engineering techniques should be liberated from the excessive and non-scientific regulation, in order to increase the crops' productivity and nutrition, and additionally, that public-private cooperation should be strengthened in the developing countries to ensure the free utilization of genetic engineering technology for public welfare. A decade ago, the PAS had already made a statement along this line, saying that the "use of new technologies for creating genetically modified plants is essential for the development of sustainable agriculture that is capable of nourishing not only the eighth part of the world who is starving today, but also to face the demand imposed by the global population's growth.

On the other hand, the National Research Council of the USA[v] published a report, in April 2010, called "The Impact of Genetically Engineered Crops on Farm Sustainability in the United States", where it points out: "studies indicate that, if the best management practices are introduced, transgenic crops are effective in reducing pests problems, showing economic and environmental benefits for the farmers. Genetic engineering could be used potentially in more crops, in new forms which go beyond the resistance to herbicides and insects, in order to obtain a wide range of purposes. For example, transgenic crops could help dealing with global food insecurity through the development of plants with improved nutritional value or with better tolerance to a changing climate".

The *Academia Chilena de Ciencias* has also determined the advantages of the use of transgenic crops and the need to deal with this subject with no myths.

Finally, we should mention that international organizations such as the Food and Agriculture Organization of the Unites Nations (FAO) and the World Health Organization (WHO) have discarded the idea that using genetic engineering produces foods which are less safe.

What has been done in Chile?

Although the use of this biotechnology is allowed in Chile, the domestic consumption of transgenic foods grown in the country is not allowed, so until now, the entire production of transgenic crops is intended for the production of seeds which are exported. In general terms, there is no standardized and agreed regulation in the country concerning genetically modified organisms. There are only isolated standards scattered in laws, regulations and decrees in health, environment, agriculture and fishing matters.

An important industry of seeds and genetic improvement has been developed in Chile. This industry exists for more than 30 years in the country, and biotechnological events are registered since 1996. During the season 2009-2010, 29 thousand hectares of transgenics were cultivated, and the *Servicio Agrícola Ganadero (SAG)* authorized 628 licenses. In 2009, Chile exported US$370 millions in seeds, being the fifth biggest net exporter at global level. The industry associated to this activity generates more than 57,000 employments per season.

The SAG is in charge of evaluating and monitoring the risk, and it is important to highlight that since 1996 no harmful or undesirable events related to the reproduction of genetically modified seeds have been verified neither for animal, vegetable nor human health. In spite of this, among public opinion and some parliament members there is a certain apprehension regarding transgenic crops; this may conduce to an erroneous legislation and regulation.

Currently, several bills on transgenic products are still pending; among them, the controlled use of genetically modified vegetables, plant breeders' protection, access to genetic resources, transgenic food labeling, etc. It is surprising that the issue of transgenic crops is dealt with such negative prejudice, directly contradicting the scientifics' opinion on this matter. A clear example is the bill that

seeks to make transgenic food labeling obligatory, pretending to "warn" against the use of these crops, as if it was in itself a risk for the consumer's health.

The latter is concerning, since projects based on groundless prejudices may have fateful consequences upon the investment in this industry and its future development. Progress should go in the opposite direction, encouraging the use of genetic resources and protecting its access. Chile has important advantages in the development of the industry related to genetic resources, such as its diversity of agroclimatic zones, its geographical isolation, good technological level and high development of science and research; all this constitutes an opportunity for the country's economic and social future.

This does not mean that we have to progress carelessly. On the contrary, it is highly convenient to take measures that allow preventing any environmental and/or sanitary risk due to the introduction of transgenic products. In this perspective, a strict regulation should be encouraged which forces transgenic crops to pass all stages requiring approval for a new food or variety.

The message should be clear: the country must be determined to develop its potential in this matter. The lack of political will to support transgenic crops may put at risk the country's opportunity to take part in this revolution of modern agriculture and permanently putting our crops in a non-competitive, lower productivity condition. On the other hand, public opinion has the right to be seriously and objectively informed about the benefits and risks of transgenic foods which are daily consumed since 1996.

Conclusions

Transgenic products are probably not a panacea, but they will no doubt end up imposing themselves, even in the most reluctant countries. In a world that will increasingly require food and where there are still more than a billion people who are starving, the contribution of genetic engineering is essential to guarantee food security and mitigate, at least partially, the existing poverty.

In Chile, the use of transgenic crops could imply a revolution not only for the agricultural world, but also for the forestry[vi], aquaculture and mining sector. Transgenic crops are really an opportunity, not a threat. The sooner the subject is dealt with, the greater our

competitive advantages in the international scenario. Otherwise, as more time passes, our competitivity runs a greater risk. Let us just imagine what will happen with the counter-season advantage offered by our fruit exports in the light of biotechnology progress, which will allow changing the ripening time of the fruit species.

Therefore, a cost-effective regulatory system concerning transgenics is urgent. With the knowledge and experience coming from 16 years of trading this products in the world, it is possible to design adequate regulatory systems that are sufficiently responsible, rigorous and not too expensive for the country.

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[i] In 1996, Monsanto launched into the market its first genetically modified product: the Roundup Ready soybean, resistant to the herbicide.

[ii] Arce, P. y Vicuña, R. "*El debate de los transgénicos: una perspectiva desde la ciencia*", *Revista Diplomacia* Nº 87, April-June 2001.

[iii] The "trait hectare" (or "trait acre") measurement is similar to the "passenger miles" measurement used in air flights.

[iv] ISAAA Brief 42-2010.

[v] It includes the National Academy of Sciences, National Academy of Engineering, Institute of Medicine, and National Research Council.

[vi] It is already possible to modify trees to increase their cellulose content or reduce the amount of lignin.