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Reverberations on Biosafety Issues Pertaining to Genetically Modified Crops

Suchitra Kamle and Sher Ali*

Molecular Genetics Division, National Institute of Immunology, Aruna Asf Ali Marg. New Delhi-110067, India

Abstract

Genetically modified crops is gaining acceptance all over the world. Consequently, Biosafety issues are also being raised in the society. Relating to this, many protocols and treaties have emerged to resolve genetically modified issue encompassing their detection strategies and labeling system. The developed and developing countries, throughout the world were involved in the genetically modified race. This has become unavoidable in the light of the matters related to global climatic change and food in/security. The regulatory authorities and International organizations have formulated the Biosafety measures and guidelines. These have been implemented for the use and eventually release of genetically modified Crops to ensure harmony and synchronization in the society. Farmers in developing countries have reposed their faith in the major biotech crops and thus they have adopted this genetically modified technology.

It has been more than a decade since concept of Genetically Modified Crop (GMC) was introduced. In the context of GMC, speculations are gaining momentum on the biosafety issues with the results, consumers are also concerned. Despite this, the growth rate and acceptance graph of the GMCs have increased exponentially [1]. In view of the consumer acceptance for GMC in the developed countries, several biosafety protocols, rules and guidelines were made favoring gene transfer technology ensuring no ill effect on the human health and the environment [2]. Accordingly then, the regulatory frameworks of different countries were critically assessed to resolve issues like GMCs acceptance, biosafety aspects, foreign trade or even overall gene flow into the food chain [3].

Since, the introduction of the GM technology in 1996 at the international and national levels, several amendments have been made and finally parliamentary bills were implemented after due debates on the use and release of GMCs [4]. All this has been done keeping in view the general concern and stringent safety issues for the protection of society and the environment. Harmonization and synchronization in the society require rigorous verification, just to avoid any unintentional commingling of GM and non GMC [5].

With the concerted efforts, many countries are accepting GM technology and have started growing GMCs. Commercialization of GMC is also gaining acceptance despite occasional reverberation of the consumer concern's [1,6].

In this context, the legislative chambers and lawsuits members have critically examined this issue. On January 29, 2000, in Montreal, Canada, the Cartagena protocol on Biosafety was formulated and finally adopted which entailed an overnight discussion [7, 8]. This was the very first legally approved biosafety protocol on GMOs having a series of clauses and rules which were *de jure* bound in an agreement made for crossing trans boundaries. Incidentally, following overnight debates, this was approved during the early hours of the morning [9]. This Cartagena protocol was unanimously constituted based on the legal opinions of members of the committee. Thus, the much needed commencement of the biosafety issues were enforced amicably [10,11].

Upon the commencement on the safe use of modern biotechnology, technology transfer was finally activated after the adoption of the Cartagena Protocol. But that was not limited only to human health care system and consumer concern's as its scope was extended [12]. The developed countries accepted the Biosafety protocols to avoid any International sanction. While the GMOs acceptance was steadily gaining momentum the world over, the dispute also continued to simmer at an alarming rate. The politicians, lawmakers and green groups made interrogative remarks about the Biosafety rules and guidelines drawing the attention of the masses that Cartagena protocol on Biosafety. It was projected that the Cartagena protocol on Biosafety under the United Nations Convention on Biological Diversity (UNCB) has several potential loopholes and therefore does not ensure a secure future of the GMC [11].

On the other hand, the developing countries also felt the pressing need for regulatory frameworks to deal with GM Biosafety issues. Gradually, then attention was focused to develop national biosafety regulations both for the safety of the consumers and the environment. Accordingly, the countries like India and Brazil implemented the biosafety rules in 1990. The developed world policies and safety measurement dominated on the developing world crossing even the legal boundaries. It was found that a research institute in the United States, without the permission from the government of Argentina started genetically testing the rabies vaccine, which was ethically wrong. Clearly, a developing country should not have been used as a platform for unethical testing purposes [13]. It is obvious that developed and developing countries have several conflicting views about the Genetically Modified Organisms (GMO) and consequently this has become a world issue. The bottom line behind all these concerns were only the safety of human and the environment.

In defiance of prevalent resistance, GMC grows over a billion hectares of land with every passing year despite the lurking Biosafety issues [1]. European countries have their own regional directives and measurement [14,15]. According to the Cartagena Protocol on the Biosafety, consent of the country for any foreign trade or potential risk assessment for transfer of GMOs is mandatory [16].The Cartagena Protocol deal with the intend to release GMOs into the environment and to the GM products consumed by the animals and humans [17].

***Corresponding author:** Sher Ali, Molecular Genetics Division, National Institute of Immunology, Aruna Asf Ali Marg. New Delhi-110067, India, Tel: 91-11-26703753; E-mail: alisher@nii.ac.in

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Over the time, Cartagena meeting was held at several places, re-drafting rules and guidelines but ultimately Cartagena protocol failed because of several vital points that were found to be missing [11].

Often, the GMOs biosafety issue becomes the headlines in the broadcasting media where the society's rage and ferocity against GMCs are aired. The media outburst was seen despite the fact that regulatory bodies, legislatives, lawsuits members all were involved in drafting new agreement, documentation, measurement and guidelines to address the GM Biosafety issue and ensure harmony and synchronization between the developed and developing world [18]. As the situation stands now, a scientifically sound risk assessment is necessary together with the due safety concern. The "Biosafety Clearing House" has made it mandatory to have advance written official notice related to GM products both from the importer as exporter prior to any business transaction [11,16]. With the results, several countries got involved in it and imposed Biosafety regulations, formulated directives, and ensured measurement to make it a sound scientific practice across the world.

Subsequently, worldwide Biosafety regulations on GMCs are revised and published highlighting the safe guidelines. In the process, the Agenda 21emphasizing, ecofriendly management was introduced in the United Nation conference. In addition, the Convention on Biological Biodiversity, World Trade organization-Technical Barrier to Trade, Codex Alimentarius Commission, made effort to regulate Biosafety measures accordingly [2,18]. These regulatory bodies and organization took overall responsibility to monitor and enforces Biosafety rules encompassing global trade system [19]. By law, these regulatory frameworks ensure comprehensive Bisafety assessment of GMCs and administer enforcement, compliance, accreditation keeping in view of the national and international coordination of the policies.

To protect the environment, society and its economic interests, the detection strategies and labeling of GMC have to be as robust as that of its envisaged acceptance. The International directives were freshly regulated by the Biosafety guidelines to mandate the labeling of GMCs [20]. For instance, the GMC carrying the insecticidal genes needs to be detected both at the DNA and protein levels [21].These regulations require advancement in the detection system. After an extensive improvement in the current detection methods for the transgene, mRNA expression can be easily detected [22]. With the technical advancement and innovation, modern biotechnology has metamorphosed from the conventional PCR, ELISA to real-time PCR, immuno-PCR and finally to the biosensors and capillary electrophoresis for the detection of the GMC [3,23,24].The regulatory authorities mandate the labeling of GMOs which varies from country to country. GM crops 'precautionary principle' introduced by the European Union was also made mandatory for the Biosafety of the society [14,18].

The Codex guidelines 2003, World trade organization, International regulatory bodies and organizations have all made an agreement, treaties and protocols regarding the use and release of GMOs for the purpose of the Biosafety of human health including the safety of biodiversity of flora and fauna [19].The risk assessment and safety measures are strictly regulated by the governing bodies, throughout the world. Sometimes, owing to the insufficient scientific data and evidences, the Biosafety issue remains unresolved. The Governance, directs scientific analysis of the GMOs before its commercialization [16,25]. These safety guidelines and protective measurement are critically assessed and revised well in time. The country like India have number of regulatory bodies which include the Ministry of Environment and Forest (MoEF), the Recombinant DNA Advisory Committee (RDAC), the Institutional Biosafety Committee (IBC), the Genetically Engineered Appraisal Committee (GEAC) and the Biological diversity act which legally provide overall control on the GM issues [26]. Now, several nations like USA, Argentina, China, Brazil, Japan, South Africa, European Union, Australia, New Zealand, Korea, Malaysia, Thailand, Philippines, Uruguay, Paraguay, Romania, Mexico, Spain have accepted the GM technology and grow GMCs covering millions of hectares of land areas [1,18,27,28].

Owing to its acceptance or rejection, a GM dispute becomes like a pendulum but finally accepted throughout the world. GM technology, despite its acceptance, would continue to remain controversial as the issue related to Biosafety continue to crop up in one form or the other with the introduction of newer GMC. Thus, with each new crop, new technology is warranted fulfilling requirement of detection strategies, safety and security. The prime directive therefore should not be to impede the development of GMC instead to ensure the overall acceptance and then biosafety to both human and environmental. GM not only offers an alternate source of food but also provides food for thoughts in the context of ever changing global climates and status of food security.

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