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Benefits and Risks of Agricultural Biotechnology

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Abstract: Inassessing the advantages and risks involved within the use of recent biotechnology, there are a series of issues to be addressed in order that informed decisions could also be made on the appropriateness of the utilization of recent biotechnology when seeking solutions to current problems in food, agriculture, and natural resources management. These issues include risk assessment and risk management within an efficient regulatory system also because of the role of property management in rewarding local innovation and enabling access to technology developed by others. In terms of addressing any risks posed by the cultivation of plants within the environment, there are six questions of safety proposed by the OECD that require to be considered. These are gene transfer, weediness, trait effects, genetic and phenotypic variability, expression of genetic material from pathogens, and worker safety. In making value judgments about risks and benefits within the use of biotechnology, it's important to differentiate between technology-inherent risks and technology-transcending risks. The previous includes assessing any risks related to food safety and therefore the behaviour of a biotechnology-based product within the environment. The latter emanates from the political and social context during which the technology is employed and the way these uses may benefit and/or harm the interests of various groups in society.

Technology inherent risks

In terms of technology-inherent risks, the principles and practices for assessing these risks on a case-by-case basis are well established in most Organization for Economic Cooperation and Development (OECD) countries and a number of other emerging economies. These principles and practices are summarized during a series of OECD reports published over the past decade or more. National, regional, and international guidelines for

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risk assessment and risk management provide a basis for national regulatory systems. Biosafety guidelines are available from several international organizations including the OECD, United Nation Environment Program, United Nations Industrial Development Organization, and International Bank for Reconstruction and Development.

Principles, practices and experience

Regulatory trends to control the safe use of biotechnology so far, include undertaking scientifically based, case-by-case, hazard identification and risk assessments; regulating the top product instead of the assembly process itself; developing a regulatory framework that builds on existing institutions instead of establishing new ones, and building in flexibility to scale back regulation of products after they need been demonstrated to be of low risk. The biosafety risk assessments conducted before thousands of experimental and field trials within we specialize in the characteristics of the organism being assessed, including its novel traits, the intended use of the organism, and features of the recipient environment. The concept of considerable equivalence between new and traditional products has been used as a basis for determining what safety tests are needed before the commercialization of products derived from gene-splicing, and if product labeling is required, and if so, what information would be useful to consumers. Familiarity has emerged as a key biosafety principle in some countries. Although familiarity can't be equated with safety, it's provided with the idea for applying existing management practices to new products and is premised upon case-by-case and step-by-step risk assessment and management of the latest products. This approach has been recommended by the OECD and is that the basis of the U.S. regulatory system.

A recent development, partly in response to negative public reactions to the growing use of genetically modified crops in agriculture in some countries, has been the introduction of measures during a number countries, especially in Europe, and last Japan, to label some or all biotechnology-based products, to offer consumers more choice. There's also a view by some regulatory authorities for regulatory requirements concerning GMOs to be supported a more precautionary approach. This approach is predicated on the proposition that not enough could also be known about long-term adverse effects of GMOs, and thus requires prior evidence of the security of biotechnology-based products for human health and therefore the environment. The present debate on labeling includes the problems of whether product labeling should be mandatory or voluntary, what information should get on the label to tell

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consumers on their choice, and whether labeling is possible in bulk commodities which will contain a mix of GMO and non-GMO crops.

Toward a world Biosafety Protocol

During the negotiations to determine the Convention on Biological Diversity within the early 1990s, there was concern expressed by some governments that GMOs may pose a risk to biological diversity. Consequently, intergovernmental negotiations are ongoing over the past several years to barter a legally binding biosafety protocol under the Convention on Biological Diversity (CBD). The centerpiece of the draft protocol is an advance informed agreement (AIA) procedure to be followed before the transboundary transfer of GMOs (called living modified organisms or "LMOs" within the protocol). LMOs which will inherit contact with the environment of an importing country are to be covered under the AIA, to assess them for any potential adverse impacts on biodiversity. There's debate, however, on which LMOs should be regulated by the protocol and for what purpose. Is that the intention to supply international oversight of specific traits in LMOs which will adversely affect human health and therefore the environment and/or impact on biodiversity, or is that the AIA procedure to be focused on oversight of the gene technology processes by which the LMOs were produced?

These LMOs, called "commodities," would come with GM crops like soy or corn, which form a growing component of the international agricultural commodity trade these crops. A gaggle of major agricultural exporting countries (the Cairns group) argues that agricultural commodities should be excluded from the AIA procedure because such LMOs aren't intended for release into the environment and thus cannot pose a threat to biological diversity. This is often according to current trade commodities, under existing international agreements, where seed contaminated with plant diseases are often marketed internationally for consumption but not for planting. The Cairns group also contends that providing detailed information on LMOs in bulk agricultural commodity shipments isn't feasible, given the commingling of genetically modified and traditional seed, also because of the lack of an immediate business link between seed growers and exporters. Other countries are calling for all first-time transfers of LMOs, including commodities, to be covered by AIA, because of the only thanks to monitoring entry of such LMOs into a rustic.

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Another key dispute within the biosafety protocol negotiations is how decisions under AIA are often supported science and precaution. Those calling for sound science to be the idea for deciding note that reliance on an excessively precautionary approach could end in discriminatory or unjustifiable barriers to international trade LMOs. Those favouring additional precautionary approaches note that unambiguous scientific evidence of harm concerning LMOs might not be forthcoming within the short term. The latter argue, therefore, for the necessity for precaution within the face of scientific uncertainty to make sure the security of genetically modified products for human health and therefore the environment. Countries also disagree about whether socioeconomic effects of LMOs, liability and compensation and pharmaceutical products should be included within the protocol, although these topics fall outside the scope of the protocol, as set by the Conference of the Parties to the CBD in Jakarta in 1994 (Decision 2/5).

Effects on Human Health

The health effects of foods grown from genetically modified crop varieties (sometimes called GM foods) depends on the precise content of the food itself and should have either potentially beneficial or occasional harmful effects on human health. For instance, a GM food with a better content of digestible iron is probably going to possess a positive health effect if consumed by iron-deficient individuals. Alternatively, transfer of genes from one species to a different can also transfer allergic risk and these risks got to be evaluated and identified before commercialization. Individuals allergic to certain nuts, for instance, got to know if genes conveying this trait are transferred to other foods like soybeans and would labeling be required if such crops were to be commercialized. There's also some concern on the potential health risks from the utilization of antibiotic resistance markers in GM foods, although there's no evidence of this.

Labeling could also be needed in some countries to spot other novel content resulting from genetic modification for cultural and non-secular reasons or just because the consumers want to understand what's the content of the food and the way it had been produced to form an informed choice, independent of any health risks.

Risks to the Environment

Among the potential ecological risks identified is increased weediness, thanks to cross-pollination whereby pollen from GM crops spreads to non-GM crops in nearby fields.

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This might allow the spread of traits like herbicide-resistance from genetically modified plants to non-target plants, with the latter potentially developing into weeds. This ecological risk could also be assessed when deciding if a GMO with a given trait should be released into a specific environment, and if so, under what conditions. Where such releases are approved, the monitoring of the behaviour of GMOs after their release may be a rich field for future research in crop ecology.

Other potential ecological risks stem from the widespread use of genetically modified corn and cotton with insecticidal genes from *Bacillus thuringiensis* (the Bt genes). This might cause the event of resistance to Bt in insect populations exposed to GM crops. An effort to manage this risk is being wiped out the first plantings of GM crops by planting "refuge" sections of Bt-cotton fields with insect susceptible varieties to scale back the chance of the insect population to evolve towards resistance to the plants having the Bt gene for resistance. There also could also be a risk to non-target species, like birds and butterflies, from the plants with Bt genes. The monitoring of those effects of the latest transgenic crops within the environment and therefore the devising of effective risk management approaches is an important component of further research in risk management.

Technology-Transcending Risks

Technology-transcending risks include the social and ethical concerns that modern biotechnology may increase the prosperity gap between the rich and therefore the poor, both internationally and within individual societies, which it's going to contribute to a loss of biodiversity. There are also ethical concerns on the moral dimensions of patenting living organisms and therefore the cross-species movement of genes. These risks relate to the utilization of technology, not the technology itself. The management of those risks requires policies and practices that give consumers choices while also promoting environmentally sustainable development through the judicious use of the latest developments in science and technology.

The reduction of biodiversity may be a technology-transcending risk. The reduction of biological diversity thanks to the destruction of tropical forests, conversion of more land to agriculture, overfishing, and therefore the other practices to feed a growing world population are more significant than any potential loss of biodiversity thanks to the adoption of genetically modified crop varieties. This is often not a problem restricted to transgenic crops.

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Farmers have adopted new commercially developed varieties within the past and can still do so once they perceive this to be to their advantage. Once in a while, introduced varieties may enhance biological diversity, as for wheat in Turkey and corn in Mexico where new landraces are evolving by genetic introgression of genes from improved varieties into traditional landraces. To slow the continuing loss of biodiversity, the most tasks are the preservation of tropical forests, mangroves and other wetlands, rivers, lakes, and coral reefs. The very fact that farmers replace traditional varieties with superior varieties doesn't necessarily end in a loss of biodiversity. Varieties that are struggling with substitution can also be conserved through in vivo and in vitro strategies. Improved governance and international support are necessary to limit the loss of biodiversity.

Regulatory Systems

Risks and opportunities related to GM foods could also be integrated into the overall food safety regulations of a rustic. The regulatory processes are a matter of continuous scrutiny and debate at the national and international levels as more products of biotechnology compared to the market. A science-based, efficient, transparent regulatory system, which enjoys the arrogance of the general public and therefore the business and farming communities, is important in enabling the effective use of biotechnology. This technique should be closely related to existing regulatory arrangements for brand spanking new pharmaceuticals, foods, and agricultural and veterinary products. National regulatory systems are complemented by international technical guidelines. National food safety and biosafety regulations should reflect international agreements, a society's acceptable risk levels, the risks related to not introducing modern biotechnology, also as alternative means to realize the specified goals.

Intellectual Property Management

Trade-related property rights (TRIPS) are also getting to be a drag related to biotechnology and food at the forthcoming Seattle round of WTO negotiations. There is a requirement for an honest system for property (IP) management that protects the interests of the inventors while promoting the safe use of the new biotechnologies. All countries who are signatories to WTO have agreed to put in place a system for the protection of property rights, including protection of latest plant varieties, although many have still to undertake to do so. These new IP systems need to include ways to reward not only the inventors of latest

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technologies but also those farmers who are traditional improvers of plant varieties over centuries. There's also a requirement to plan suitable systems for property protection that encourage and reward innovation within the least levels and for all countries, not only for the technologically sophisticated.

Conclusion

The major issues concern about the long-run applications of biotechnology to crop improvement include the evaluation of any risks to human health and thus the environment; the need for mandatory and/or voluntary labeling of GM foods and/or agricultural commodities for international trade; the connection between countries' responsibilities under the WTO; and international environmental treaties. These include the international protocol on biosafety being negotiated under the Convention on Biological Diversity, and whether this might provide oversight on traits and/or processes of genetic modification. Governments and other responsible parties should effectively communicate with the overall public about the character of latest crop types and new crop varieties, about the unity of life processes altogether organisms, and about the risks and benefits of agricultural biotechnology in their own country and internationally. There's also a requirement to repeatedly improve the transparency and broad participation within the deciding processes concerning biotechnology, the discharge of genetically modified organisms into the environment, and thus the approval of genetically modified foods for commercial use.