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11. Overall conclusions

Taking the reviews of current knowledge, presented in the preceding chapters, as a scientific basis for expert opinions and projections about the development, use and risk assessment of genetically modified foods (GMFs) for human health and nutrition, workshop participants reached a number of overall conclusions, as summarised below.

The process of the development of transgenic organisms presents no new categories of risk compared with conventional methods for the improvement of plants, animals or microorganisms. However, specific traits introduced by either approach might pose unique risks, which need to be identified.

Food quality and human nutrition

The potential benefits of improving the nutritional quality of foods are higher for low-income countries, where food budgets account for two-thirds or more of total expenditures and where poor dietary quality and micronutrient malnutrition are widespread. Most consumers in rich countries have access to a relatively inexpensive supply of safe and healthy food.

Nutritional and quality traits of foods can be altered through transgenic methods. A large number of products are under development and testing.

The nutritional efficacy of these products and risks of unintended harmful effects have yet to be tested and demonstrated.

The commercial viability of these products has yet to be demonstrated.

The sustainable solution to malnutrition in developing countries is provision of a sufficient quantity of high quality diet, which the poor desire but presently cannot afford. During the long-term process of achieving this goal, biofortification is a low-cost strategy, which complements other technological and social interventions—assuming that the nutritional efficacy and commercial viability can be established.

Agricultural practice

The development of crops resistant to biotic and abiotic stresses is critical for sustainable food production in the developing world. The use of GMF crops should go hand-in-hand with other technologies such as plant tissue culture, marker assisted breeding and conventional plant breeding.

GMF crops could decrease the cost of production and have positive effects on the environment in both developed and developing countries.

It is, however, prudent that the outcomes and impacts of the use of GMF crops are scientifically monitored with respect to farming efficiency, food production and environmental impacts.

Gaps in knowledge about GMF crops include their efficacy compared with conventionally bred varieties with similar traits, and potential direct and indirect effects on the environment, such as their risks of invasiveness, their impact on non-target organisms, and possible unintended effects. Some of these gaps may be filled by new technologies under development and by continuing ecological research.

Industrial products and processes

Crops can be genetically modified to produce oils, starch, fibre, protein or other chemicals useful for industrial processes. For example, soybean oil, with high oleate content, and canola oil, rich in laurate, are both being produced commercially using these methods.

A principal concern is how to use genetic modification technology in a way that gains the advantage of using renewable resources to replace products from petroleum and other non-renewable resources while maintaining a safe and adequate human food supply.

It is also crucial to ensure that GM crops designed to produce industrial products but not registered for human use do not inadvertently enter the human food chain or contaminate food or other crops with their transgenes.

Fish

GM fin fish of a variety of species have been produced, many involving the use of model fish for fundamental

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research, although some of the modifications are applicable to species important in aquaculture.

The present and projected increasing demand for fish suggests that GM fish may become important in future in both the developed and developing worlds. However, this will only be possible if consumer acceptance is achieved.

Livestock and poultry

Food products derived from GM livestock and poultry are far from commercial use.

The methods involved are presently inefficient and expensive. There are significant issues for the introduction of GM animals into breeding stock and dissemination to producers.

Potential hazards to humans, involved in production or when products become part of the food chain, will require assessment through a regulatory process with appropriate licensing powers.

There are serious public concerns about the ethics of manipulating domesticated animals and the possible welfare effects.

Microorganisms

At present, apparently, no GM microorganisms (GMMs) are commercially used in food fermentations; however, many enzymes produced by GMMs are routinely used in the food industry.

The safety evaluation of products containing GMMs should be rigorous, with safety standards comparable with those applied to conventional foods.

The safety evaluation of GMM-derived food additives and processing aids should follow the same guidelines and practices as the conventional products; however, special emphasis should be placed on the detection of possible unintended effects.

Regulation and risk assessment

Safety assessment of GM foods is carried out on a case-by-case basis, taking the specific modification features into account, and comparing the properties of the new food with those of the traditional counterpart. This comparative approach, applying the so-called principle of substantial equivalence, is based on the assumption that conventional foods are generally considered as safe for consumption, based on a history of use. Identified differences between the GM food and its counterpart are assessed with respect to their safety and nutritional implications for the consumer. The concept of substantial equivalence is a starting point for a safety evaluation and contributes to an adequate food safety assessment strategy.

Safety testing of whole GM foods needs improvement. The use of specific *in vitro* models and new methods such as DNA microarray technologies may elucidate mechanisms of action and interactions of biologically active compounds in food.

Present approaches to detecting expected and unexpected changes in the composition of GM food crops are primarily based on a targeted approach (measuring a limited selection of single compounds). In order to increase the possibility of detecting unintended effects a non-targeted approach (using new technologies such as the gene expression technologies—proteomics and metabolomics) can be used.

The usefulness of post-market surveillance to obtain information on long-term effects of foods or food ingredients, either GMO-derived or traditional, should not be overestimated, given the multifactorial origin of many food-related diseases and the variability in genetic predisposition of the human population. It may be useful in cases with specific biological outcomes, for example allergenicity or food intolerance, or when the exposure assessment provides insufficient insight into the diets of specific consumer groups.

Socioeconomic considerations

The currently available GMOs are suggested to have both positive and negative effects on three indicators of sustainable agriculture and rural development (SARD). These are stocks (of natural resources and environmental capital), efficiency and equity. These bilateral effects depend on the socioeconomic conditions underlying the development, use and control of GMOs.

The three key policy options that shape socioeconomic conditions are intellectual property protection, trade liberalisation and biosafety implementation. The effects of applying these options on the socioeconomic conditions are very intricate, as optimising one option may have contrary effects on the other options and thus on the socioeconomic conditions.

Societal issues and public attitudes

Communication activities need to take account of the factors driving public concern, which may be different in different countries. This should include taking account of cross-cultural differences in information needs, if appropriate. In particular, discussion of ethical issues and effective communication about known and potential uncertainties and unintended effects must be addressed.

Failure to consult the public about policy development leads to a loss of public confidence in science and technology. The purpose of such consultations is to make a difference to policy development.