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Genetically modified crops

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Genetically modified organisms (GMOs) are here to stay. Scientists in both public and private sectors clearly regard genetic modification as a major new set of tools, while industry sees GMOs as an opportunity for increased profits. Yet the public in many countries distrusts GMOs, often seeing them as part of globalization and privatization, as being "anti-democratic" or "meddling with evolution". In turn, governments often lack coherent policies on GMOs, and have not yet developed and implemented adequate regulatory instruments and infrastructures.

As a result, there is no consensus in most countries on how biotechnology, and GM crops in particular, can address key challenges in the food and agricultural sector. FAO recognizes both the great potential, and the complications, of these new technologies. We need to move carefully, with a full understanding of all factors involved. In particular, we need to assess GMOs in terms of their impact on food security, poverty, biosafety and the sustainability of agriculture. GMOs cannot be seen in isolation, simply as technical achievements.

Nor can we talk intelligently about GMOs if debate remains at the level of generalities. For this reason, FAO has been conducting a worldwide inventory of agricultural biotechnology applications and products, with special reference to developing countries. Preliminary findings indicate that the total area cultivated with GMO crops stands at about 44.2 million hectares, up from 11 million hectares just three years ago. About 75% of this area is in industrialized countries. Substantial plantings largely concern four crops: soybean, maize, cotton and canola. About 16% of the total area planted to these crops is now under GM varieties, and two traits - insect resistance and herbicide tolerance - dominate. There are also small areas of potato and papaya, with inserted genes for delayed ripening and virus-resistance.

Only seven developing countries cultivate GMO crops commercially, with most of the areas involved (except in Argentina and China) being smaller than 100,000 hectares. Here again, the dominant crops are soybean and cotton, and the traits are herbicide tolerance and insect resistance. Only China is using a locally developed and commercialized GM crop (cotton) - other countries have obtained genetic constructs or varieties from industrialized countries. The FAO survey also found that several forest tree species - including conifers, poplar, sweet gum and eucalypts - have been transformed using recombinant DNA technology, but have not been released for commercial purposes. Tropical fruit tree species seem to have been largely neglected.

FAO's conclusion is that current GMO crop releases are still very narrow in terms of crops and traits and have not addressed the special needs of developing countries. But what is in the pipeline? Throughout the world, several thousand GMO field tests have been conducted or are under way, again mostly in industrialized countries. Some 200 crops are currently under field testing in developing countries, the vast majority (152) in Latin America, followed by Africa (33) and Asia (19). Many more countries are involved than the seven that have already released GMOs, and many more crop-trait combinations are being investigated, with greater focus on virus resistance, quality and, in some cases, tolerance to abiotic stresses.

It can therefore be expected that the number of GMOs ready for commercial release in these countries will expand considerably in the next few years. However, many important crops - such as pulses, vegetables, and fodder and industrial crops and certain traits - such as drought- and aluminum-tolerance - are still almost entirely neglected.

As the portfolio of GM applications increases, the international community needs to ensure that GM crops make an optimal contribution to world food security, to food safety and food quality, and to

sustainability, and that they remain available to the public at large. However, despite some hopeful signs, FAO's inventory suggests that genomics and related research are not being directed to meeting these key challenges.

Indeed, the perceived profit potential of GMOs has already changed the direction of investment in research and development, in both the public and private sectors, away from systems-based approaches to pest management, and towards a greater reliance on monocultures. The possible long-term environmental costs of such strategies should not be overlooked.

Developing transgenic crops implies massive investments, and the need for massive returns. The small number of GM technologies currently in use suggests that there is a real danger that the scale of the investment may lead to selective concentration on species and problems of global importance, and concomitant capital inertia. At the same time, there is a growing use of "hard" intellectual property rights over seeds and planting material and the tools of genetic engineering. This changes the relationship between the public and private sectors, to the detriment of the former.

A policy question that governments must take up, in both the national and international contexts, is how to ensure that public research does not become a "poor relation". In developing countries in particular, it is important for the public sector to retain enough capacity, resources and freedom of action to provide the services on which their national private sectors can build. They will also need to build their policy and regulatory capacities with regard to transgenic crops that originate elsewhere. In this area, the International Plant Protection Convention (IPPC) is establishing practical cooperation with the Convention on Biological Diversity and its Biosafety Protocol. It is also developing a detailed standard specification for an International Standard for Phytosanitary Measures that identifies the plant pest risks associated with Living Modified Organisms, and ways of assessing these risks.

Another issue of concern to FAO is access to research and new technologies for developing countries, poor producers and consumers. Biotechnology in agriculture is applied to genetic resources that are the fruit of selection and development by farmers throughout the world since the Neolithic age. This poses the immediate question of how to guarantee continued access by farmers and breeders.

A major step forward is the International Undertaking on Plant Genetic Resources, which aims at creating a multilateral system of facilitated access and benefit-sharing for the world's key crops. Multilateral access provides multilateral benefit-sharing, which includes the sharing of the benefits arising from the commercialization of materials from the multilateral system through a mandatory payment. The access of breeders to genetic material for further breeding - which becomes ever more difficult with GM crops under patents - is a public good that needs to be protected. On this issue, FAO is involved in discussions on food and agriculture and IPRs in association with the World Intellectual Property Organisation.

While genetic modification has increased production in some crops, the evidence suggests that the technology has so far addressed too few challenges, in few crops of relevance to production systems in developing countries. Even in developed countries, a lack of perceived benefits for consumers, and uncertainty about their safety, have limited their adoption. The scale of investment involved, and the attraction of advanced science, may distort research priorities and investment.

Genetic modification is not a good in itself, but a tool integrated into a wider research agenda, where public and private science can balance each other. Steering research in the right direction and developing adequate, international agreements on safety and access is a difficult and responsible task. While we are more aware than ever of the need to manage international public goods responsibly, the political tools to do so are weak, and, in a globalized economy, the voices of small countries and poor producers and consumers often go unheard.

If research is to address the challenges in agriculture, we need to put genetic modification in context, and realize that it is but one of the many elements of agricultural change. Scientists must not be blinded by the glamour of cutting-edge molecular science for its own sake. Governments must not let this glamour, or private industry's perception of major profit opportunities, draw investment away from research in other, more traditional fields, such as water and soil management or ecology, and from public sector research. At the same time, the best science is developed in a climate of intellectual freedom without much direct government interference. It will be a difficult balance to strike!