ECNC Brief

Biosafety and biodiversity

The issue of genetically modified organisms (GMOs) is one of the most important ones facing policy makers today. There are strongly held differences of opinion, and so far a lack of consensus between the European Union and the United States. This paper is not an original research study, but seeks to present a brief and balanced analysis of the main biosafety and biodiversity issues in question. It provides a brief summary of the issues, risks and opportunities presented by the use of GMOs in the environment, in particular in relation to the implications for nature in European landscapes. It sets out the viewpoint of ECNC in relation to the safe and appropriate use of GMOs in ways that will encourage the sustainable use of Europe's natural environment. Given the poor state of knowledge on the relation between GMOs and biodiversity, ECNC calls for careful analysis of possible impacts before any major policy decisions are taken to continue with GMOs.

Background

Biotechnology is the term used to describe a range of advanced genetic techniques used to change the characteristics of plants, animals and microorganisms. It includes genetic modification, in which a range of techniques is used to transfer DNA in one or more different organisms into another organism, giving it modified or novel genes (transgenes). This brief deals specifically with the issues raised in relation to Genetically Modified Organisms (GMO) as a component of the biosafety debate. Genetic modification can be defined as '*the modification of the genetic characteristics of a micro-organism, plant or animal by inserting a modified gene or a gene from another variety or species. GMOs may be micro-organisms designed for use as biopesticides or seeds that have been altered genetically to give a plant better disease resistance or growth*'. GMOs are framed in the context of biosafety. Within the Cartagena Protocol on Biosafety, a component of the Convention on Biological Diversity, biosafety refers to '*the protection of biodiversity from the potential risks posed by living modified organisms resulting from modern biotechnology*'. The FAO defines biosafety somewhat broader: '*safety aspects related to the application of biotechnologies and to the release into the environment of transgenic plants and other organisms, particularly microorganisms, that could negatively affect plant genetic resources, plant, animal or human health, or the environment*'.

GMO applications include agriculture, forestry, aquaculture and medicine; however, agricultural biotechnology is the most advanced sector with GM crops being widely grown, including in Europe. The development and release of GMOs is a particularly controversial issue with arguments both for and against them. The extensive disagreement between the experts or with independent scientists indicates a clear lack of consensus in the scientific circles on the issues at stake in these proceedings.

It is clear that GMOs have the potential to contribute positively to human livelihoods and well-being through increasing the productivity, adaptation to climate change and environmental sustainability of (among others) agriculture, forestry and fisheries. As such they may provide a vital component in the future management of European landscapes, their land and water resources. Sustainable production of food, fuel and fibre to meet the current and future needs of human society is potentially one of our greatest challenges. GM crops could contribute significantly to the need for food security, reducing costs and increasing the productivity of a range of crops and farmed animals.

Conversely, they could harm the environment. The new techniques allow genes to be transferred between unrelated organisms; specifically, when they are released into open fields, such organisms may cross breed with wild native species and the alien genes they carry may then enter native populations. Such transfer of genetic material is generally hard to control, raising concerns about their potential environmental impacts. Since engineering these traits may require manipulation of large groups of genes, it is likely to be more difficult to model the impacts, either direct or indirect, on biodiversity.

Productive agriculture presently (and traditionally) makes use of monocultures by replacing ecological systems that contained a number or many species with fields containing only one: for example, just rice, just corn, etc. GM crops take this one step further. Not only is the field planted with only one species, but all the individuals within the species are genetically identical because they all came from one genetically modified source plant. Aside from the fact that monocultures inherently contain very little genetic diversity, they also make the crop species more vulnerable to invasion by pests and diseases (such as insects, fungi, viruses, etc.). This enhanced vulnerability will encourage scientists and farmers to develop and apply crops that are resistant to pests and diseases.

This development of resistant crops might discourage farmers from rotating their crops, thereby leading to an increasingly monocultural approach to farming, which could result in further losses in biodiversity and adverse impacts on landscape character. It must be remembered that farming the land serves quite different purposes, particularly in Northern Europe. The primary goal of agriculture is obviously the production of food, but secondary goals and other functions, such as the conservation of biodiversity and giving city dwellers opportunities for outdoor activities, are also important. Multifunctional land use is a key aspect of many rural landscapes in Europe.

Some of the key possible positive and negative impacts of GMOs on biodiversity include:

- out-crossing: the possible transfer of characteristics from GMOs to wild relatives which could change their ecological role and potentially enable them to outcompete other species;
- reduced/increased use of chemicals and therefore reduced/increased pollution;
- unintended transfer of genes through cross-pollination or cross-breeding (intraspecific);
- lethal effects on non-target species that feed on GM crops that produce their own pesticides (e.g. larvae of Monarch butterflies on Bt maize; reduced lifespan and productivity of ladybugs eating aphids on GM potatoes);
- adapted agricultural practices, e.g. improved weed management in relation to herbicide tolerant GM plants, or no till farming;
- loss of cultivar biodiversity with associated higher susceptibility to outbreaks of pests and diseases;
- further spread of intensive agriculture into (semi)natural habitats that are currently not in human use, to the detriment of landscapes and biodiversity.

To date, knowledge on the risks, benefits and uncertainties related to GMOs and biodiversity is fragmented and not well-developed, largely because of the complexity of the relationship between natural and human-modified systems. Evidence of indirect impacts and of direct impacts on laboratory situations however calls for taking a very prudent approach in applying GMOs and taking political decisions in relation to their use and extension.

- On the positive side, we believe that GMOs have the potential to create a more sustainable platform for agriculture, forestry and fisheries production that could increase food security for Europe and the world more generally and provide significant environmental benefits and adaptation to climate change.

- However, we call for a very careful analysis and more research into GM applications before continuing with the further application of GMOs.

- We therefore support the precautionary, case by case assessment of applications to deliberately release GMOs into the environment as required under EU directive 2001/18/EC (on the deliberate release of GMOs).

- We also advocate an approach to the development of novel biotechnology products that closely integrates their production and release with good management practices such as rotation, integrated pest management and agro-ecological systems; in order that they enhance current sustainable production (that combines suitable varieties of plants, animals or microbes with appropriate ecological conditions).

- We believe it is particularly important that the environmental, social and economic impacts of any GMOs should be fully researched and understood prior to their release into the environment; such impacts should be communicated in a fully synthesized form to politicians, policymakers and civil society prior to any release in order that well informed decisions are made by key people at the right time.

- There should also be adequate investigation of alternatives to GMO release and compensation for any environmental harm caused by GMOs should be included as a requirement in any licences granted for their release.

www.ecnc.org
Mr Lawrence Jones-Walters, Programme Manager, joneswalters@ecnc.org

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