

# *Public Research & Regulation*

Foundation with the objective to involve the public research sector in regulations and international agreements relevant to modern biotechnology

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## **Gene switching and genetic use restriction technologies**

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### **1. What are gene switching and genetic use restriction technologies?**

Gene-switching is a natural process whereby genes are switched “on” or “off” as a reaction to the presence of water, sunlight, chemicals etc. For example, water and light activate plant genes that are responsible for seeds to start growing, hormones activate reproduction stages, insect damage on plants starts defence mechanisms, etc. In the functioning of every organism, whether a plant, bacterium or the human body, a constant switching “off and on” of genes is essential.

Researchers in developed and developing countries all over the world are exploring these gene switching mechanisms to control one or more specific traits in plants. These biotechnological applications are called “gene switching technologies”.

A specific use of these gene switching technologies is aimed at controlling genes responsible for plant reproduction, for example by limiting production of pollen or by producing non-viable seed. The resulting plant variety can be planted and harvested normally, but that plant variety will not be able to reproduce. These applications are called “genetic use-restriction technologies” (GURTs).

There is a great variety in the different applications of gene switching, and the Public Research and Regulation Initiative (PRRI) will provide an overview of scientific publications on its web site. The International Service for the Acquisition of Agri-Biotech Applications has produced a brochure for non scientists, which can be found on [www.ISAAA.org/kc](http://www.ISAAA.org/kc) (select “pocket K’s” under “info resources”).

### **2. Why are researchers exploring gene switching and genetic use restriction technologies?**

There are different reasons why public sector researchers are exploring the use of gene switching to control the expression of specific genes in plants:

- *For basic studies of gene function.*  
Since the discovery of genetic principles by Gregor Mendel in the 19<sup>th</sup> century, geneticists have studied the nature and function of genes. Our new knowledge of plant genomes has allowed us to continue this research at a more detailed level. Our abilities to regulate the expression of plant genes will again enhance our ability to understand the functioning of genes as they would be naturally
- *To limit the activation of certain genes to the moment that it is necessary.*  
For example to switch “on” a gene or genes contributing to drought tolerance when drought occurs. In better weather or soil conditions, the plant will not activate the gene, and the plant’s resources will be channelled to other important activities, such as the production of nutrients.

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- *To let genes be expressed only in certain parts of the plant.*  
For example, when considering the use of plants to produce a pharmaceutical or a vaccine, gene switching can limit expression of the pharmaceuticals to specific parts of the plants in which the gene is activated, for example not in parts of the plant that are dispersed, such as pollen. Another example is the so called “Golden Rice”, where gene switching is used to produce the provitamin A carotenoids in the part of the grain that ends up in polished rice

Similarly, there are different reasons why public sector researchers are exploring genetic use restriction technologies (GURTS) in plants, such as:

- The development of plants that cannot reproduce can be one of the tools used in combination in risk management or in risk assessment research, during stages when there are still insufficient data about the biosafety of new genetically modified plant varieties.
- The possibility to prevent the spread of certain newly introduced genetic traits in plants, such as pharmaceuticals, vaccines and monoclonal antibodies, to other crops or wild relatives.

### **3. Concerns about these technologies and the ongoing debate under the CBD.**

Publications of early work on genetic use restriction technologies were quickly met with concerns from environmental groups, who renamed these technologies ‘Terminator technologies’ (because the reproduction of those plant varieties ‘terminates’). Early concerns focused on claims that use of this seed would prevent poor farmers from saving seed for the next year.

Since 1998, genetic use restriction technologies have also been discussed intensely under the CBD. The 5<sup>th</sup> Conference of the Parties (COP5) discussed the issue and came to a clear recommendation with regard to genetic use restriction technologies. In more recent years, the discussion has broadened to include debate about other types of gene switching technologies which have no impact on reproduction and therefore have nothing to do with seed saving issues. COP6 established an expert group to consider potential socio-economic impacts of these technologies. COP7 asked SBSTTA and the working group on article 8j to look into the matter and report back to COP8.

The Steering Committee of the PRRI welcomes a general debate on these technologies and supports the overall thrust of the COP5- recommendation, but is concerned about the way in which the debate following that COP5-recommendation has been conducted.

We are concerned about the quality of the report of the expert group, which shows that the debate lacked adequate scientific input and was confused because of a constant mixing of gene switching and genetic use restriction technologies. We are also concerned about statements of some groups requesting governments not to approve genetic use restrictions technologies for field testing or commercialization, which would effectively stop all research in this area and which does not take into account their benefits. We believe that insufficient attention has been given under the CBD to understand WHY research on these technologies is ongoing around the world and that too little consideration has been given to the potential benefits of these technologies for food and feed production, health care and environmental protection.

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The PRRI fully recognizes the need of indigenous and local communities to be informed about any new technology that may have an impact, be it positive or negative, on their traditional lifestyles. Members of the PRRI who are knowledgeable in the fields of gene switching and genetic use restriction technologies, are more than prepared to provide further information about the objectives and technical aspects of gene switching and genetic use restriction technologies.

With regard to the concerns raised, we believe that there will be little if any of the impacts mentioned because indigenous communities may choose not to purchase such products when they become available. Secondly, claims that plants containing GURTs elsewhere or imported for food or feed will somehow disrupt the cultivation of conventional seed plants or prevent seed saving by peoples who do not purchase these products are simply unfounded. Examples of similar well-accepted technologies that prevent seed saving are hybrids in maize and nonviable seeds in seedless watermelons.

Referring to the ongoing debate under the CBD, the Steering Committee of the PRRI strongly urges the delegates to bear in mind the COP-5 decision, which recognizes that these technologies are still in early stages of development, and that any assessment of the potential benefits and risks can, and should, be made on a case by case basis only.

As the COP-5 Decision states, decisions on field trials and commercialisation of plants containing gene switching technologies should be based on an assessment on the potential adverse effects for biological diversity, food security and human health. Such assessment should be based on scientific data and be carried out in a transparent manner and the conditions for their use should be validated. We believe this is precisely what the Cartagena Protocol on Biosafety sets out to do.

We firmly believe that a partial or full ban on these technologies would be detrimental to the potential of modern biotechnology to contribute to improving food and feed production, health care and environmental protection. Consistent with the SBSTTA decision on this topic, we therefore urge delegates to recommend that this issue be addressed on a case by case basis, and that research on this technology, including any potential socio-economic impacts, continue to be undertaken with the results shared via the Clearing House Mechanism.