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**BIOTECH IN DEVELOPING COUNTRIES:  
FROM A GENE REVOLUTION TO A DOUBLY GREEN REVOLUTION?**

Eric TOLLENS and Matty DEMONT

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EUWAB-Project (European Union Welfare effects of Agricultural Biotechnology),  
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the Effects on Producers, Consumers and Governments and Development of a  
Simulation Model". This paper (pdf) can be downloaded following the link:  
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Department of Agricultural and Environmental Economics  
K.U.Leuven  
Willem de Croylaan 42, B-3001 Leuven – Belgium  
Tel. +32-16-321614, Fax +32-16-321996

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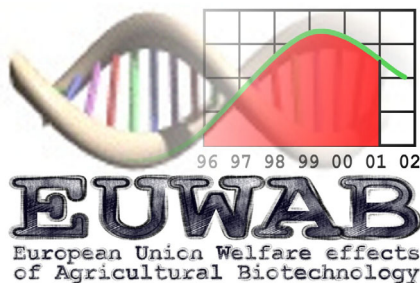
Chairman: Prof. Eric Tollens,  
Katholieke Universiteit Leuven, Leuven, Belgium  
de Croylaan 42, B-3001 Leuven (Heverlee), Belgium  
Tel.: +32 16 32 16 16, Fax: +32 16 32 19 96,  
Email: eric.tollens@agr.kuleuven.ac.be

Matty Demont,  
Katholieke Universiteit Leuven, Leuven, Belgium  
de Croylaan 42, B-3001 Leuven (Heverlee), Belgium  
Tel.: +32 16 32 23 98, Fax: +32 16 32 19 96,  
Email: matty.demont@agr.kuleuven.ac.be

Panel: Richard Bennett (University of Reading, UK), Yousouf Ismaël (University of Reading, UK), José Falck-Zepeda (ISNAR, the Netherlands), Matin Qaim (University of California, Berkeley, USA), Elisio Contini (Embrapa, Montpellier, France), Scott Rozelle (University of California, Davis, USA), Carl E. Pray (Rutgers University, USA)

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**The EUWAB-project (European Union Welfare Effects of Agricultural Biotechnology)**  
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Since 1995, genetically modified organisms have been introduced commercially into US agriculture. These innovations are developed and commercialised by a handful of vertically coordinated "life science" firms who have fundamentally altered the structure of the seed industry. Enforcement of intellectual property rights for biological innovations has been the major incentive for a concentration tendency in the upstream sector. Due to their monopoly power, these firms are capable of charging a "monopoly rent", extracting a part of the total social welfare. In the US, the first *ex post* welfare studies reveal that farmers and input suppliers are receiving the largest part of the benefits. However, up to now no parallel *ex ante* study has been published for the European Union. Hence, the EUWAB-project (European Union Welfare effects of Agricultural Biotechnology) aims at calculating the total benefits of selected agricultural biotechnology innovations in the EU and their distribution among member countries, producers, processors, consumers, input suppliers and government. This project (VIB/TA-OP/98-07) is financed by the VIB - Flanders Interuniversity Institute for Biotechnology, in the framework of its Technology Assessment Programme. VIB is an autonomous biotech research institute, founded in 1995 by the Government of Flanders. It combines 9 university departments and 5 associated laboratories. More than 750 researchers and technicians are active within various areas of biotech research. VIB has three major objectives: to perform high quality research, to validate research results and technology and to stimulate a well-structured social dialogue on biotechnology. Address: VIB vzw, Rijvisschestraat 120, B-9052 Gent, Belgium, tel: +32 9 244 66 11, fax: +32 9 244 66 10, [www.vib.be](http://www.vib.be)



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## **Introduction**

This paper reports the results of a round table organized for the 6th International Conference on Agricultural Biotechnology: “New Avenues for Production, Consumption and Technology Transfer”, International Consortium on Agricultural Biotechnology Research (ICABR), Ravello, 11-14 July 2002. The major focus of the round table consisted in providing a broad discussion on (1) the observed and potential impacts and (2) possible constraints of agricultural biotechnology (agbiotech) in developing countries (LDC’s). To narrow down such a broad concept, the debate was limited to ‘modern agricultural biotechnology’, such as the genetic engineering innovations currently introduced in a variety of industrial and developing countries since 1996. While the first *ex-post* studies of the impact of agbiotech in LDC’s clearly show the benefits of this technology, large areas (e.g. in Sub-Sahara Africa) still remain untouched by this innovation. Contradictorily, in these regions, neither adoption of these technologies, nor technological strategies for their development are taking place.

## **The Current State of Biotechnology in LDC’s**

In a first stage, the current state of different LDC’s was highlighted followed by a discussion. The discussion quickly identified the lack of biosafety regulations as a major constraint of LDC’s for the adoption of an agbiotech policy.

For the case of South Africa, today the adoption of Bt cotton has reached 90 % at an extremely high speed, due to the yield-increasing effect and the decline of spraying costs associated with this new technology. The variation in rainfall is a first constraint. A second constraint is the fact that cotton production is controlled by only

one firm supplying inputs and buying farm raw outputs. As a result, farmers are offered a limited choice in their tactical decisions. This year, a new company has entered the cotton market, which could alleviate this constraint. All together, young farmers seem to embrace the technology in a uniform way. The impact on gross margins seems to be very consistent. Moreover, the size of the impacts is negatively correlated with farm size. Small farms gain more than large ones. This is consistent with the Chinese Bt cotton experience.

Regarding Brazil, agbiotech has politically received strong support. It is one of the first LDC's featuring a strong capacity in genomics (structural genomics and genomic functions). Genetically engineered (GE) products include soybeans, corn, cotton, eucalyptus, etc. A regulatory framework is in place. Although some opposition exists in general, the Brazilian government is in favor of agbiotech. GE soybeans are only grown in South Brazil. Due to Brazil's dependence on EU and Japanese soybean import markets, only 50 % of the production is allowed to contain genetically modified (GM) traits. Today, only 10 % of the soybean production is GM. A major constraint is the fact that no differentiating practice is yet in place for segregating GM and non-GM products. If the EU and Japan allowed GM crop imports, Brazil would lift its 50 % ban on GM soybeans.

A crucial question is how agbiotech can address the needs of the poor. In Latin America, Bt cotton and herbicide tolerant (HT) soybeans are already grown. The lack of capacity is not the major problem. The main constraint is the lack of biosafety regulations. As to capacity building, public-private sector partnerships are needed to

strengthen the generation of germplasm. In Honduras for example, capacity is lacking in this domain. Investments in germplasm are a priority.

Regarding the Bt cotton experience in Northern Mexico, parallel to the before-mentioned observations the benefits are biased towards small landowners. But besides the commercial sector, important benefits from agbiotech are expected for orphan crops and semi-subsistence crops. In the latter case, consumers gain a lot since the share of food in overall expenditures is high. By depressing food prices, agbiotech has hence the potential to create real income effects. The ‘food argument’ is often used by multinationals to promote agbiotech. This is valid to a certain extent since 70 % to 75 % of developing country people live in rural areas, with incomes largely depending on what happens in the agricultural sector. Agbiotech has not to be considered as the ultimate solution, but rather as a tool in an overall toolbox, also containing Integrated Pest Management (IPM) for instance.

In China, the government has the largest agricultural program of all developing countries, spending as much as all other developing countries together. Moreover, the national agricultural research system, featuring virtually no private sector component, covers the highest variety of crops (cotton, soybeans, corn, oilseed rape, peanuts, sweet potatoes, fruit, horticultural crops, etc.). Many agbiotech innovations, all domestically developed, are near commercialization. The gene insertion techniques used are different from the conventional ones. Only one crop, Bt cotton, has been released successfully thus far. The first impact results suggest that China’s cotton varieties are almost performing as well as other industrial countries’ varieties. China

seems even prepared to export its Bt cotton varieties, which could lead to a spill-over of China's early Bt cotton success.

### **Discussion Points**

As a starting discussion point, the need to separate two things is emphasized: the diffusion of agbiotech at the one hand, and the question as how to alleviate poverty on the other hand. In Brazil for instance, many initiatives have been undertaken to add value to extracted products. By using the already existing knowledge and marketing efforts, orphan crops can be transformed to commercial crops. A second question is how biotechnology can be acquired and capacity developed. One answer seems to be partnerships and the development of public-private R&D institutions in order to allow developing countries to participate in the technology innovation chain. Also, agbiotech innovations have often to be combined with organizational changes. In China for example, even Bt crops are sprayed 3 or 4 times although this is strictly speaking not necessary. In India, last year illegal GM cotton has been introduced. The GM varieties comprise a set of 3 hybrids, without strong regional adaptation. Restrictions through the introduction of buffer zones have been imposed. Another restriction is the fact that each time the same technology is introduced, a new variety has to be approved.

### **Biosafety**

As a major constraint for agbiotech development, public policy regarding biosafety is a primary concern, and more specifically the capacity to implement this policy. In Nigeria, the biosafety regulation has been approved. The first transgenic plantains, developed by the Catholic University of Leuven, are ready to be transferred, but the

government did not want to take any responsibility regarding the introduction of these varieties. This example clearly shows the difficulty developing countries face to get a biosafety regulation in place, especially when the country has no experience at all with these novel crops. These regulations are still not in place for a majority of developing countries. Countries that have adopted them typically have a licence for a non-food crop like Bt cotton. The latter is relatively safe for consumers. Indonesia has such a license since two years, while India obtained it this year.

The biosafety regulation constraint is also a problem for other reasons. Generally, environmental and food safety are the rationales for these regulations. The problem is that biosafety is a last barrier before the introduction of a new variety onto the market. Anti-globalisation groups are maybe using biosafety, as a label for all fears, as an excuse to hamper the introduction of a new GM variety in its last phase. On the other hand, the biosafety constraint can also be considered as a wise constraint in that it prevents massive and hazardous introduction of a crop that potentially increases the risk of pesticide resistance in insect populations. An example is the introduction of Bt corn varieties in the US, together with a refuge requirement. Experience has shown that the latter is difficult and costly to implement and control.

### **Capacity Building**

Besides the biosafety regulation constraint, capacity building is the next largest constraint, especially for small developing countries. Partnerships with other countries to create larger capacity blocks is a possible answer. Human capacity is the major component of this constraint. In South Africa for example, regulatory constraints have been less important in the diffusion process of Bt cotton. Introducing

the gene in all locally adapted varieties has shown to be the factor that has relatively slowed down the adoption process.

### **Conclusion**

As a conclusion, the title's question mark is still there. For some reasons, some countries embrace agbiotech as an opportunity to increase productivity and decrease poverty, other countries are reluctant or ignorant about these technologies. Each year, high amounts of pesticides are sprayed on West African cotton fields. And there are vested interests in the pesticide lobby. But from the discussions it became clear that cotton is a prime candidate for agbiotech, because its non-food use and requirement of massive spraying with harmful pesticides.

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