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**“Irreversibility, Uncertainty and the Adoption of Transgenic
Crops: experiences from applications to Ht-sugar beet, Ht-corn
and Bt-corn”**

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ABSTRACT

Traditional ex-ante assessment of the costs and benefits of a new product of agro biotechnology do not take into consideration that the adoption of a new technology might be associated to higher risks and uncertainty with respect to both its costs and its benefits. Some

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of these costs and benefits might be irreversible in nature. Irreversible costs and benefits imply that, once the decision is taken, it is not possible to go back to the equilibrium the economy was before such decision. Examples of irreversible costs associated to the adoption of genetically modified organisms (GMOs) are losses in biodiversity. Examples of irreversible benefits are gains in human health due to reduced poisonings from pesticide use. In this context the option to delay the release of a (GMO) until more information on its risks becomes available may become of value to society. The value of the possibility of delaying the decision of releasing transgenic crops into the environment can be explicitly taken into consideration by analysts via a *real option approach*.

The *real option* decision criteria for releasing GMOs immediately requires reversible private net-benefits from GM crops, such as net-benefits accruing to farmers, to be greater than irreversible social net-costs by a factor that depends on the uncertainty associated with the adoption of a new technology. This factor is the so called hurdle rate.

Following Dixit and Pindyck (1994) hurdle rates associated to GM crops can be quantified by assuming that additional private net-benefits from transgenic crops follow a geometric Brownian process. The hurdle rate becomes then a well specified function whose parameters can be inferred from time series data on farmer gross margins and secondary literature, by assuming that GM crops constitute a normal technological change.

As hurdle rates are always greater than one, the *real option* decision criteria for releasing transgenic crops immediately, differs from the traditional decision criteria as it requires reversible social net-benefits to be greater than irreversible social net-costs. The traditional decision criteria for releasing GM crops immediately, requires, instead, reversible private net-benefits to be at least equal to irreversible social net-costs.

Demont, Wesseler and Tollens (2004) computed hurdle rates for herbicide tolerant (Ht) sugar beet and reassess whether the 1998 moratorium of the European Union (EU) on Ht-sugar beet is justified from a cost-benefit perspective.

In this study we carry out a similar assessment computing hurdle rates and the maximum tolerable amount of irreversible social net-costs associated to Ht-corn and *Bacillus thuringiensis* (Bt) corn in the EU. Incremental private net-benefits from Ht-corn and Bt-corn are computed on the base of field trials carried out in France for the EU funded project ECOGEN (Soil ecological and economic evaluation of genetically modified crops).