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“Biophysical and Socio-economic Frame Conditions
for the Sustainable Management
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Agricultural Biotechnology and Sustainability: Evidence from Shandong Province, China

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Abstract

In this paper, the question of sustainability of biotechnology solution in Chinese agriculture is addressed by means of a case study in five cotton growing villages in Linqing county, Shandong Province, China, where Bt cotton varieties were first approved in 1997. Panel data of village and farm characteristics as well and in particular on cotton production were collected from 150 farmers through season-long monitoring in 2002 and 2005, leave samples from all the monitored fields were also collected in both years to assess the actual concentration of Bt toxin.

The study consists of both descriptive statistical analysis and modelling approach. The descriptive comparison of cotton production in the two observation periods shows even higher pesticide dosage, still large proportion of high toxic pesticides and dramatic drop of Bt toxin concentration in the later period, which indicates that the cotton farmers in China have to fight against the considerable uncertainty about the quality of seeds, fertiliser and pesticides as well as various pests and casts cloud over the sustainability of biotechnology in the study area. A stochastic bio economic simulation model is used to probe into different combinations of three different seed choices - high or low quality Bt, conventional varieties - and three intensity levels of insecticide use - no spray, moderate spray, farmers' practice, according to which it can be shown that under the institutional conditions with considerable input uncertainty the cotton farmers in China behave economically rational when opting for cheap local genetically modified Bt cotton seeds combined with moderate use of pesticides rather than high priced Bt cotton seeds and reduced insecticide use against the cotton bollworm. The paper shows that agricultural biotechnology requires supportive institutional conditions in order to provide a sustainable solution to biotic stress factors such as insect pests. The paper also identifies some gaps in knowledge and deficiencies in the institutional frame conditions that need to be addressed if agricultural biotechnology through genetically modified crop varieties will live up to its promise.

Keywords: Biotechnology, China, sustainability