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## Multi-period Analysis of Bt-cotton Varieties in China - Using Farm Level Panel Data

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### Abstract

Previous studies of Bt-cotton adoption in China have reported high farm level benefits. However, there is evidence that the farmers continue to use high levels of pesticides in spite of the adoption of bollworm resistant transgenic Bt-cotton. Most of these studies relied on cross section farm level data comparing adopters and non-adopters. In the present study we aim to contribute to a better understanding of the role of the insect resistance trait in Bt-varieties in productivity and profitability of small-scale cotton farmers. The analysis is based on panel data collected in 2002 and 2005 from some 150 farmers in five villages in Linqing County, Shandong Province, East China. Since Bt-cotton varieties account for 100 % of all the cotton planted in the research area, its impact cannot be captured by an adopter non-adopter comparison. Instead, the toxin concentration of Bt-plants has been used as a variable to measure the effect of the new varieties on bollworm control. A two-period production function following the damage control concept was estimated using an instrumental variable approach. Results allow assessing the productivity and profitability effect of the Bt-trait and chemical pesticides. Cotton production activities of farmers in the panel were monitored season long and data on inputs and outputs were recorded. In addition, in order to quantitatively capture the Bt-trait in cotton varieties, cotton leaves from each of the monitored fields were sampled and tested for Bt-toxin concentration. Results indicate that overuse of pesticides continues to exist in spite of 100 % Bt-cotton variety adoption. A possible reason is that the variation in Bt quality is high and farmers are faced with considerable uncertainty of their control effectiveness. Hence, farmers still use many sprays targeting cotton bollworm. At the same time, the effectiveness of pesticides is limited largely due to a similar problem with quality control. The uncertainty inherent in the key determinants of the productivity of pest control inputs calls for an integrated analytical framework that combines ecological and economic factors.

**Keywords:** Bt-cotton, China, damage control, panel data