

**9th International Conference on
Agricultural Biotechnology: Ten Years After**

organized by the:

**International Consortium on Agricultural Biotechnology
Research (ICABR)**

and the:

Catholic University of Leuven

CEIS - University of Rome "Tor Vergata"

Centre of Sustainable Resource Development, University of California at Berkeley

Economic Growth Centre, Yale University

Ravello (Italy), July 6-10, 2005

**“The Economic Impacts of Bt Cotton and Bt Maize in West
Africa: A Sector Model Approach”**

Jeffrey D. Vitale¹

Rafael Uaiene²

John H. Sanders³

ABSTRACT

Cotton and maize are two of the most important field crops in sub-Saharan Africa (SSA). Smallholder farmers rely on these crops for satisfying both income and staple food requirements. For agricultural policy makers, increasing productivity in the fiber and food sectors are important objectives to maintain export earnings and to feed growing urban populations.

Both cotton and maize are particularly prone to lepidopteran borers. Corresponding yield losses can reach as high as forty percent (cotton) and fifteen percent (maize). Existing pest management practices, which rely primarily on frequent insecticide applications, are becoming increasingly outdated. In addition to substantial out-of-pocket costs, these approaches have associated environmental costs to both humans and animals, have high labor demands, and diminish in effectiveness over time as pests develop resistance.

¹ Research Scientist, Purdue University. Email: jvitale@purdue.edu. Phone: 765-496-3955.

² Graduate Student, Purdue University.

³ Professor, Purdue University.

Biotechnology is expected to be a much better alternative for SSA farmers. Through incorporating known toxins to the lepidopteran family of borers within the plant itself, the number of sprayings can be significantly reduced and more effectively administered. Existing Bt cotton and maize technologies developed in the US are expected to provide significant benefits to African farmers. Initial field trials in Burkina Faso indicate yield gains and reduced pesticide applications using Bt cotton. In South Africa, Bt maize yield increases of over ten percent have been reported. The combination of higher yields and reduced production costs generate increased farm profits. Previous research has shown that a typical West African cotton farmer (Mali) would increase his income by as much as thirty-five percent. Further gains are expected to be realized once the Bt technologies have been more completely adapted to local conditions.

Despite the potential benefits Bt technology has yet to be diffused in SSA. In part this is due to the negativity associated with biotechnology. Providing policy makers with an objective view of biotechnology's benefits, as well as the costs of non-adoption, is a critical need. This will generate a more balanced and well-informed debate on biotechnology issues within SSA.

The purpose of this paper is to estimate the potential economic benefits of introducing Bt cotton and maize technologies. An agricultural sector model has been developed to estimate the economic impacts of Bt cotton and Bt maize in Mali. This is an economic model that accounts for the benefits that would accrue to both producers (higher farm income) and consumers (reduced food expenditures). A distinguishing feature of the model is its micro-level foundations. This allows for a detailed treatment of the socioeconomic aspects of Bt crop technology on the African smallholder farmer. Various factors are included in the model to provide adoption profiles for both Bt cotton and Bt maize. GIS technologies have been used to spatially delineate distinct production zones within the model according to geographic, agro-ecological, and climatic characteristics. This details the varying extent of pest infestation, agricultural productivity, and marketing opportunities.

Field interviews have been conducted to assess expected yield increases, changes in spraying costs, and adoption profiles; a handful of scenarios were then generated. The sector model results portray within each scenario a side-by-side comparison of the economic impacts of Bt cotton versus Bt maize. Since typically maize and cotton have a high degree of substitutability, such a side-by-side comparison is considered to be particularly meaningful. Our preliminary results show that in Mali, the benefits of Bt cotton (US\$ 66 million) outweigh Bt maize (US\$ 15 million) by nearly a factor of four. Further policy implications and conclusions will be drawn to highlight the importance of Bt cotton and Bt maize within the SSA context.