Section 5: Assessment of Impact of Technologies in West Africa: Estimation of Welfare Effects of Technologies Developed in One Location and Used in Another Location

One of the methodological objectives of this study was to develop and evaluate methods for extrapolating the impact of new technology from the areas in which experimental or field trial data exist to other locations. In Section 1, we describe the use of the concept of geographic equivalence to provide first order approximations of zones of adaptation or areas where the geographic similarities would allow one to predict the results of using the new technology. In Section 4, we describe the use of the ACT and EPIC to compute predicted yields based on biophysical considerations with results summarized in politically defined areas. In this section, we describe two case studies in West Africa which were used to estimate regional impacts of new sorghum and peanut technology. We modeled the extrapolation of the sorghum production system described in Section 4 for Mali for other areas in Mali (past where experimental data were available) and in Senegal and Burkina Faso.

To provide an indicative result of another USAID sponsored program, we conducted a limited economic assessment of new germplasm developed in Senegal under the Peanut CRSP. We modeled the impact of introduction of the new germplasm in Mali, Senegal, and Burkina Faso. To provide input to the economic models, it was necessary to estimate yields of relevant crops using methods described in Section 4. To assess the credibility of the methods, comparisons were made of observed yields and biophysically simulated yields in Mali, Senegal and Burkina Faso.

A previously developed ASM for Senegal by Martin (1988) was updated and evaluated as part of this study. The full development of national and subnational agricultural sector models (ASM) for Kenya and Mali proved to be time consuming and relatively expensive. While we believe that ASMs provide the more accurate method of assessing the impact of technology or policy options at these levels, we elected to explore the utility of an alternative method that was less demanding. A spatial extrapolative economic surplus model (SPEC) was developed for Senegal and Burkina Faso (an ASM did not exist for Burkina Faso) and used to evaluate the economic impact of the INTSORMIL CRSP and Peanut CRSP variety improvements. In combination, the ASM’s for Mali and Senegal assisted in calibrating the SPEC model.

The SPEC model is a variation of the closed economic surplus model described by Alston and Purdey. The model was used to assess the PEANUT CRSP technology in Mali and Burkina Faso. An INTSORMIL CRSP sorghum variety assessment was performed in Senegal and Burkina Faso. Figure 5-1 describes the general methodology used to estimate the potential economic impact of a new agricultural technology using the SPEC approach.
5.1 Problem Definition

In the Kenya and Mali studies, we examined the national and regional economic benefits of introducing a technology into a country by developing and using a multi-commodity ASM and farm level models. In this section, we describe methods to extrapolate these results to other countries with similar geographic and social circumstances that might also benefit from adoption of the technology. Quantifying the value of such benefits requires extrapolating productivity changes from a base country to other country environments and estimating resulting price, quantity, and economic welfare changes in recipient countries.

The two sorghum varieties considered, N’tenimissa and Seguetana, on average respectively yielded 25% and 33% more than traditional sorghum varieties in Mali. In Senegal, EPIC simulations modified by expert opinions of expected yields were used as no observed yields were available for the N’tenimissa and Seguetana varieties. Yields for improved varieties in Senegal that are similar to these two variety types were used to simulate expected yields. Traditional and expected improved variety yields for each country are provided in Table 5.1.1. These yields are weighted national yields, weighted by the hectares and simulated yields for each geographic area comprising the country, as presented in equation 5.4.2-2 of section 5.4.2 of this report.

Four regionally specific peanut varieties developed in Senegal were considered. Data on peanut yields were obtained from Dr. Ousmane Ndoye of the Institut Senegelais de Recherche Agriculture (ISRA).