Economic Impact of Research Investment in the Development and Dissemination of Improved Cowpea Varietal Technology in Senegal

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Introduction
Since the early 1980s, the Senegalese Institute of Agricultural Research (ISRA) has worked with the Dry Grain Pulses Collaborative Research Support Program (CRSP) (now known as the Legume Innovation Lab) on the development and release of three cowpea varieties. These are short-cycle, semi-erect varieties: Mouride, released in 1991; Melakh, released in 1995; and Yacine, released in 2005.

Cowpeas are a high protein pulse crop harvested for both dry beans and green pods. As green pods they serve as a crucial source of nutrition before the main harvest. This paper summarizes the results of an adoption survey conducted in 2010 to assess the impact of cowpea research and seed system development efforts in three main cowpea growing regions in Senegal: Thiès, Diourbel, and Louga. These are the three largest cowpea growing regions in Senegal. In 2010, 40.0% of Senegalese cowpea production was in Louga, 22.2% in Thiès, and 9.0% in Diourbel. Results from a 2010 household level survey and past impact studies are used to derive the estimates of cowpea varietal adoption over time and the gains in yield from the adoption of improved varieties (IVs).

Methods
- Adoption rates were estimated for each variety using a logitistic adoption curve derived from survey estimates of adoption in the 2004 rainy season (Boys et al.) and the 2010 rainy season (Magen 2012). Adoption rates were projected through the year 2020.
- Yields for all CRSP varieties and Traditional Varieties (TVs) were determined using survey data from the 2010 season.
- Research costs for CRSP's investments and ISRA expenditures on varietal research were derived from data provided by the CRSP management office and the author of the previous impact study in Senegal.
- An economic surplus modeling approach is used to estimate aggregate benefits from the adoption of CRSP varieties. Costs and Benefits were projected through the year 2020.

Benefits from the adoption of CRSP varieties were compared with program costs using the ex post economic impact assessment approach. This method was used to derive rates-of-return estimates on these investments.

Adoption
- Adoption of CRSP varieties in the three study regions was estimated to be 42% of area planted to cowpea. The breakdown by Region was as follows:
  - Louga: 38.7%
  - Diourbel: 33.1%
  - Louga: 5.6%
- Adoption of all IVs was estimated to be 48% of area planted to cowpea.
- 27.8% of the cowpea area in Thiès was identified by respondents as a non-CRSP improved variety.

The high adoption of improved CRSP varieties primarily reflects the focused efforts by multiple entities in the past five years on the multiplication and dissemination of breeder seeds and certified seeds of Melakh and Yacine.

Results
- The Internal Rate of Return is 17.9% when benefits are projected through 2020.
- The Net Present Value is 78.6% using a discount rate of 4.25%.

- The majority of program benefits come from the Louga region, due to the confluence of high adoption rates, significant yield improvements, and the large area cultivated to cowpea.

Adopted CRSP varieties

Yields of Improved Varieties and Traditional Varieties
- Reported yields of CRSP varieties were consistently higher than TVs across all the regions.
- The yields of the three CRSP varieties varied significantly among regions.
- There was little difference between green pod yields for IVs and TVs.

Sensitivity Analysis
- Sensitivity analysis was performed in order to measure the effect of several factors on the rates of return.
- The factors with the most significant effect were estimations of research costs and supply elasticity.
- Other factors less significant included inclusion of cowpea price, intercrop rates, adoption rates and yields adjusted +/- 25%.
- Under every scenario with projected benefits, IRR was above 8%.

Conclusions
- Investments in cowpea varietal development research in Senegal have generated high economic returns of nearly 18% and contributed millions of dollars in production gains to the Senegalese economy.
- The benefits from growing IVs are two-fold: (1) yield increases reduce per unit production costs and thus provide economic gains; (2) increased supply of green pods to consume in the hunger season contributes to household food security.
- Further research is needed into how the seed system and variety traits influence adoption and yields in different regions in Senegal.
- The large area in Thiès devoted to other IVs is puzzling, since non-CRSP varieties have not been promoted in that region. This points to the difficulty in identifying varieties when using the simple farmer elicitation method to estimate adoption rates.
- This study has only examined the aggregate, economy-wide impact of production gains in cowpea grain. Further examination of the effects of IVs (especially of green pod production) on household income and food security is warranted.

Sources