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

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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: Diourbel, 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).

Research Questions
This study uses results from a survey of cowpea farmers in the 2010 rainy season in order to answer the following questions:
1) How much of the total land devoted to cowpeas can be attributed to improved varieties?
2) How much of the total cowpea grain production is attributed to improved varieties?
3) What is the yield gain from growing IVs of cowpea?

An adoption curve was projected for each variety based on the 2010 survey data and past impact studies (Boys et al. 2007). The adoption estimates were combined with yield data and available research spending figures to determine:
1) What is the economic welfare gain from the adoption of improved cowpea varieties?
2) What is the rate of return to research investments by the CRSP and ISRA on cowpea development and dissemination?

Methods
- Adoption rates were estimated for each variety using a logistical adoption curve derived from survey estimates of adoption in the 2004 rainy season (Boys 2007) 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 47% of area planted to cowpea. The breakdown by Region was as follow:
  - Louga: 38.7%
  - Diourbel: 31.4%
  - Thiès: 27.9%
- Adoption of all IVs was estimated to be 48% of area planted to cowpea.
- 27.2% of the cowpea area in Thiès was identified by respondents as planted to a non-CRSP improved variety.

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.

Dry Grain Yields By Variety (kg/ha)

<table>
<thead>
<tr>
<th>Year</th>
<th>Diourbel</th>
<th>Melakh</th>
<th>Louga</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>218</td>
<td>460.7*</td>
<td>393.9*</td>
</tr>
<tr>
<td>2011</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2018</td>
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</tbody>
</table>

Source: Median yields from cowpea farmer survey in 2010 season.

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 with less influence when adjusted included cowpea price, intercrop rates, adoption rates and yields adjusted +/- 25%.

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 for households from growing IVs are two-fold: (1) yield increases reduce per unit production costs and thus provide economic (social welfare) gains; (2) increased supply of green pods to consume in the hungry 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.

Sources

Citations
Map from: http://www.mapggsources.com