

Farmers, Climate Change and Food Security

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Structure of Presentation

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- Problem Statement and Context
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Some Major Facts about Potatoes

- Potato is a source of subsistence for millions and millions of people around the world.
- Get more energy, calories, protein and nutrients out of a hectare of potatoes per unit time than you do with grains.
- The humble potato - relatively untouched by the world food price crisis- continues to offer a haven of food security for some of the poorest regions of the world.
- It is the most universally-loved food; people are passionate about potatoes



Problem Statement and Context

- Very Few empirical studies on the impact of climate change on African agriculture (Kurukulasuriya & Rosenthal, 2003).
- Most existing studies have focussed on grains, (see for example Rosenzweig & Parry, 1994).
- Hardly any economic analyses of specific crops or specific regions have been carried out (Molua, 2002; Gbetibouo & Hassan, 2005; Deressa et al., 2005).



Problem Statement and Context

Potato is the third crop in Mauritius after sugarcane and tomato. It is an important component of the diet in Mauritius.

- Three categories of growers are engaged in potato production.
 - Some sugar estates and a few large-scale cane growers plant relatively large areas (> 15 ha) on their own sugar cane lands.
 - Many small-scale growers lease land from sugar estates for potato.
 - Many others plant relatively small areas on their own lands..
- Three main varieties: *Mondial* and *Delaware* and *Spunta*
- Potato is a high investment crop and if climate affects the crop, it affects the livelihoods of the growers.
- lowland tropical conditions and a warm climate: result = easily get infected plant material.



Problem Statement and Context

- The annual consumption of potatoes is around 24,000 tonnes and local production is between 18,000 and 19,000 tonnes.
- The country needs 2,300 tonnes of potato seed, but only about 560 tonnes are produced in Mauritius.
- The farmers who engaged in the cultivation of potatoes received financial facilities for the purchase of seeds through the Food Security Fund.
- Very few growers sell potato directly to the public .
- Mauritius is getting drier, which means that it will become harder to grow potatoes unless have irrigation.



Methodology-Ricardian Method

The Ricardian method is a cross-sectional approach to studying agricultural production.

- it does not only depict the direct effect of climate on productivity but also mirrors the adaptation actions of farmers to local climate.
- it regresses net revenues on explanatory variables (Mendelsohn et al., 1994; Mendelsohn et al., 2001).

$$V = B_0 + B_1F + B_2F^2 + B_3H + B_4Z + B_5G + u$$

- V= farmland net revenue (reflecting net productivity)
- Pi= market price ; i= crop i; Qi=output;
- X is a vector of purchased inputs (other than land);
- F is a vector of climate variables; H is water flow;
- Z is a vector of soil variables; G is a vector of economic variables;
- Px is a vector of input prices
- U= error term



Methodology-Ricardian Method

- The quadratic term shows a non-linear relationship between net revenue and climate change variables:
 - when the term is +, net revenue function is u-shaped
 - when the term is -ve, net revenue function is hill-shaped
- The change in annual welfare ΔU caused by climate change is given by :

$$\Delta U = V(C_1) - V(C_0)$$

- Two models are run:
 - One without adaptation
 - One with adaptation (which include economic variables)



Data and Variables Included

- *Survey:* A farm survey was administered to collect information on 57 potatoes farmers' production activities in the Northern Plain of the island.
- Data on temperature and precipitation was collected from the *Mauritius* Meteorological Services
- Soil data was obtained from the Ministry of Agriculture, Food Technology and Natural Resources, Agricultural research and Extension Unit
- Hydrological data was obtained from the Water Resources Unit
- The dependent variable was measured as crop net revenue per hectare of cropland calculated as gross revenue from crops less total variable cost of production (CEEPA, 2006)
- The effect of cost of household labour was controlled for by including household size as a proxy for household labor as a regressor in the model (CEEPA, 2006)
- Economic variables include: irrigation type, the area of cropland, a dummy for livestock ownership, access to electricity, access to public extension services,



Results

- Findings reveal that the climate variables of temperature and precipitation statistically affect potato yield, with precipitation having the highest impact.
- Irrigation does to some extent cushion the adverse impact of climate change.
- There is a bell-shaped relationship between increases in temperature and precipitation on potato farming since initially the effects of on the latter will be positive but beyond a certain point the reverse will occur.
- The 'without adaptation' model show that both the scope and features of the impact of climate factors will be shaped by the type of soil and the extent of precipitation and runoff.



Results

- The “with adaptation “ model highlights larger cultivated areas may act as a cushion against the adverse impacts of climate change given that they allow risks to be spread.
- In Northern plains of Mauritius, ownership of livestock did not prove to a statistically significant adaptation option.
- Given no major divergence in temperature between summer and winter in the North, seasonal differences in the effects did not turn to be statistically significant.



Policy Implications

- Need for further awareness creation on climate change and adaptation methods;
- Creation of opportunities for off- farm employment;
- Research on new potatoes' varieties that can face drier conditions;
- Developing informal social net works for sharing knowledge, know-how, specific skills and adaptation ideas;
- Investing in technology aimed at increasing yield to ensure food security.

