THE ECONOMIC IMPACT OF THE NEW SORGHUM CULTIVARS FOR DAIRY PRODUCTION IN NICARAGUA

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INTRODUCTION

- Economic growth leads to qualitative improvements in consumers' diet. High protein food demand such as milk grows rapidly in developing countries.
- Dairy producers need to increase production to meet the growth of milk demand and rise yields per cow by adopting new technologies.
- Public sector in Nicaragua has invested in agricultural research to produce new technologies that will allow dairy farms to increase their productivity.
- Improved sorghum cultivars were developed to respond the farmers' need for more efficient alternatives to feed dairy cows and to rise milk yields in Nicaragua.

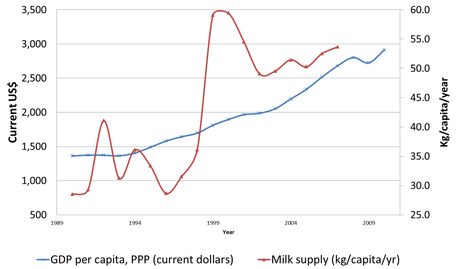
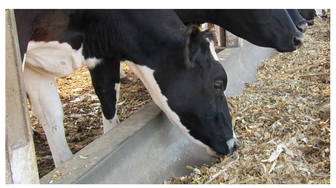


Figure 1. Figure 3. Evolution of the GDP and Milk Supply in Nicaragua, 1994-2009. Source: FAO Statistics (2012). and World Bank (2013).



- The new sorghum cultivars have shorter growing periods and higher grain and forage yields per hectare than the traditional cultivars.
- The new cultivars are also more tolerant to drought and sorghum diseases than their predecessors.
- Farmers can take advantage of forage multiple cuts feature in a number of the new sorghums which provides an important advantage over maize crops.

RESEARCH QUESTIONS

This study addresses the following questions:

1. What is the economic benefit and return of investment in agricultural research on improved sorghum cultivars developed for dairy production in Nicaragua?
2. Which is the sector that benefits most from this type of public investment?
3. How can the public sector accelerate the adoption of the new technologies and increase the economic benefits from agricultural research?

FARM COST SAVINGS

- We estimated the cost savings at farm level by comparing the feeding cost per liter of milk produced in farms with and without the new sorghum technology within small, medium, and large dairy farms. Producers were classified by number of lactating cows.
- Data of herd size, feed cost, milk yields per cow, farm technology, sorghum area and grain uses was collected using questionnaires at 120 dairy farms in Pacific coast plains of Nicaragua. R&D costs were estimated from public

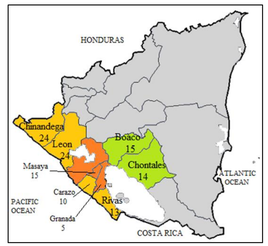


Figure 2. Map of the Study Region.

Table1. Feed Cost Savings of Milk .

	Farm Size		
Concept	Small Farms	Medium Farms	Large Farms
Milk Cost with the technology (US$ /Ton)	93	97	135
Milk Cost without the technology (US$ /Ton)	101	98	139
Milk Reduction Cost (US$ /Ton)	7	1	4
Cost Reduction per bottle (US$ cents/bottle)	0.7	0.1	0.4

Source: Author's calculations from survey data 2011.

ECONOMIC IMPACT MODEL

- The economic surplus method was used to estimate the benefits and evaluate the distribution of surpluses between consumers and producers.
- The model calculates the stream of benefits for consumers, producers, and retailers in the Nicaragua dairy market for the period 1985 to 2010.
- The economic benefit due to the adoption of a cost-saving technology was calculated using the following equations adapted from Freebairns et al. (1982):

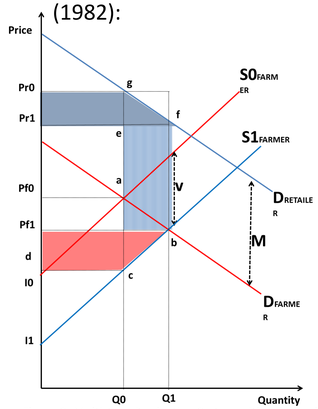


Figure 3. Multistage Production System with a Technological Change
Source: Adapted from Freebairns, Davis, & Edwards, 1982.

Change is Consumer Surplus

$$\Delta CS = \frac{Q_1 * \beta * v}{\alpha + \beta} - \frac{1}{2} * \frac{\alpha * \beta^2 * v^2}{(\alpha+\beta)^2} \quad [1]$$

Change in producer Surplus

$$\Delta PS = \frac{\alpha Q_1 v}{\alpha + \beta} - \frac{\alpha^2 \beta v^2}{2(\alpha + \beta)^2} \quad [2]$$

Change in retailers Surplus

$$\Delta RS = M * \frac{\alpha * \beta * v}{\alpha + \beta} \quad [3]$$

Total surplus Change

$$\Delta TS = Q_1 \beta - \frac{\alpha\beta v^2}{2(\alpha + \beta)} + M * \frac{\alpha * \beta * v}{\alpha + \beta} \quad [4]$$

Where:
Q= Milk Production
P= Milk Price
V= Cost Saving
M= Margin
β= Slope of the Supply
α= Slope of the Demand

Price Elasticity of Supply $\eta = \alpha * \frac{P_1}{Q_1}$

Price Elasticity of Demand $\gamma = \beta * \frac{P_1}{Q_1}$

RESULTS AND DISCUSSION

The economic surplus analysis of the new sorghum cultivars in dairy production suggests the following:

- The investment in improved sorghum cultivars for dairy production has an IRR of 20% . The opportunity cost of Nicaraguan public funds.
- Agricultural research projects are very important for consumers since they are the main beneficiaries from the shift of milk supply.
- Large dairy farms are more willing to adapt more sophisticate technology and obtain higher benefits than small and medium dairy farms.
- Milk price increase will create more incentives for producers to rapidly shift to more intensive systems of milk production.
- In making this public decision it is important to remember that consumers are expected to be the major beneficiaries of the expansion of the dairy production.
- This study can be extended by incorporating the benefits in the grain market.

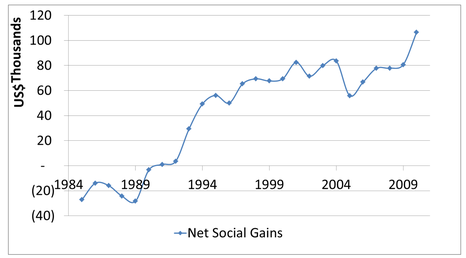


Figure 4. Net Social Benefits from the Introduction of Sorghum for Milk Production.

Table 2. Benefits and Return in the Dairy Market

Concept	US$(Thousands)
Consumer	1183
Retailers	36
Producers	291
Small Farms	104
Medium Farms	54
Large Farms	133
Social Gains	1510
Research Costs	379
Net Social Gains	1131
IRR	20%

Note. Nicaraguan milk Demand elasticity (η) is -0.2 and a supply elasticity (γ) is 0.6 .

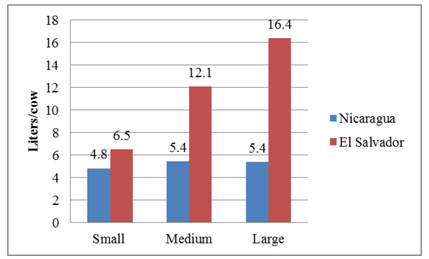


Figure 5. Milk Productivity per cow by Farm Size and Country for Nicaragua and El Salvador.

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