Pilot Project: Economic benefits of seasonal climate forecasts in Farm Management in Zimbabwe

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1. Project Description

Zimbabwean farmers operate in a highly unreliable rainfall regime. The risks confronted by farmers are many. The consequences of decisions or events are not known with certainty until long after the outcome of those decisions or events occur. In an ever changing environment, a more sophisticated understanding of risk and risk management is important to help farmers make better decisions in risky situations and to assist policy makers in assessing the effectiveness of different types of risk protection tools. The goal of this pilot project was to improve the livelihoods of the poor smallholder farmers in selected study areas of Zimbabwe through improved climate risk management. The specific objective of the study was to demonstrate the gross margins associated with adjusting crop management strategy given an ENSO based seasonal climate forecast for selected sites in Zimbabwe over a three-year period.

Two main sources of risk for the farmers are – the recurring cycles of drought and the changing economic value for farm produce in relation to cost of production. Over dependence on a single agricultural commodity, maize for livelihoods exposes the smallholder farmers to both production and market risks. Despite recent advances in El Nino – Southern Oscillation (ENSO) forecasts, most farmers have not been able to translate the forecasts into better farm management practices to minimize yield losses and maximize profits. It is assumed that an effective application of climate information is that which leads to a change in a decision and results in either an economic improvement or a reduction in risk.

It is further assumed that, for farmers to adopt new technology in their decision-making, that technology has to:

- Be effective within farmer circumstances
- Increase food production
- Reduce risk
- Enhance soil fertility
- Blend with what the farmer already knows, and
- Bring about a positive net economic return

A case study approach involving 400 households (poor and relatively rich) and the Agricultural Production Systems Simulator (APSIM) crop simulation model were used for the investigation. In order for a region to be considered for a demonstration project on the application of climate information, there must be adequate historical records to support basic analyses of the relationship between climate and agricultural production in the area. Crop simulation modeling in conjunction with historical climate records from

the selected study sites is used to assess economic and agronomic consequences of shifting crop management strategies in response to ENSO phase shifts during July to September each year. The APSIM is a simulation environment designed to simulate the production and resource consequences of agricultural systems.

The hypothesis explored in this study is that smallholder farmers in areas of Zimbabwe where the ENSO signature on inter-annual rainfall variability is strong can realize net positive gross margins from their cropping enterprise by shifting certain crop management strategies according to ENSO phase shifts. It is assumed that the following management strategies offer potentially the best response to ENSO phase shifts:

- Adjustment of planting window,
- Adjustment of Nitrogen management,
- Adjustment of plant density
- Adjustment of row spacing
- Varying crop choice/mix and
- Varying cultivar choice.

Justification

The current population in Zimbabwe is about 13 million with an estimated annual growth rate of over 3%. It is estimated that up to 70% of the population live directly off the land. The annual growth in agricultural output is currently estimated at 2.5%, but fluctuates with weather conditions. Whereas in years of good rainfall the country produces enough food to feed the nation and enjoys surpluses for export, in years of drought the reverse is the case. Additionally, even in good years many households are not able to grow enough food for home consumption largely because of poverty, the erratic rainfall pattern, and limited farming skills coupled with inadequate access to land. About 80% of the rural population lives in Natural Regions III, IV and V where rainfall is erratic and unreliable, making dry land cultivation a risky venture. The success rate of rainfed agriculture in Natural Regions IV and V has been known to be in the order of one good harvest in every four to five years.

2. Partnerships

The investigators in this pilot project came from four different disciplines including, climatology, agronomy, agricultural economics and statistics. A partnership was also established with community based agricultural extension officers and smallholder farmers who provided invaluable insights and assisted in the preliminary study design and sampling process.

During the course of this study it was also possible to work with hybrid-seed and fertilizer suppliers who provided useful experiences on how past seasonal climate forecasts have impacted on their business enterprise.

Although NOAA/OGP and USAID/OFDA provided the bulk of the financial support, additional technical support from AGIAR through ICRISAT provided the much needed modeling support.

3. Lessons learned

There were several lessons learned during the course of this pilot project. Some of the lessons are:

- Staggering planting dates, adjusting crop mix and fertilizer application management offers small-holder farmers in some parts of Zimbabwe scope to minimize yield and income fluctuations associated with ENSO phase shifts. However, the greatest economic benefit is during the neutral ENSO phase, possibly because of the high frequency of occurrence of that phase in relation to the other two.
- For the rural farmer – farming is a source of livelihood and does not allow for a lot of experimentation. For a project of this nature it is therefore imperative to use an agricultural research station or demonstrate plots close to the community of interest and crop simulation modeling instead of experimenting directly with the farmers.
- Because of grinding poverty in some parts of rural Zimbabwe, initially the households selected for the project expected financial handouts from the project. As this was not the purpose of the project, morale for participation reduced amongst the selected households.
- Partnerships with community based organizations and other stakeholders, coupled with a strong education and extension drive will be important for climate information to be properly infused into agricultural decision-making by smallholder farmers.
- Because of geographical differences in soil, climate and farmers' attitude towards risk and their ability to manage risky situations, climate risk management strategies cannot be generalized even in the same Natural Farming region.
- No two warm ENSO events are likely to produce identical impacts on rainfall at a given location. It is the temporal distribution of rainfall in a season that can make or break a cropping season. Currently no seasonal forecasting tool can provide information on the temporal distribution of rainfall in a season, making the application of seasonal climate forecasts a tricky business.
- Whereas, seasonal climate forecasts are still imperfect, farmers' decision making is much better guided by some climate information instead of no information at all. The climate information should comprise, the forecast, climatology, analogue and even information for the preceding season. In other words, there is a lot that farmers can learn from past climatic records if these are made available in an appropriate way.
- Climate information alone may not be adequate for a smallholder farmer to manage through a severe drought. A more concerted intervention including

the provision of irrigation infrastructure might be the only way to assist the poor rural farmers live with drought.

The investigators also experienced a number of challenges during the course of this project, such as the volatile political climate, macro-economic instability, erratic disbursements of funding, and lack of cooperation from some of the households.

4. Impact

The main impact of this project has been on knowledge generation and capacity building. The researchers now have a better understanding of the dynamics of climate risk management among the rural poor in Zimbabwe and the possible economic benefits. This knowledge is spread across four institutions, namely the Zimbabwe Meteorological Services, the University of Zimbabwe, ICRISAT and the Agricultural Research and Extension Services in the Ministry of Agriculture. One MSc student from the University of Zimbabwe participated in the project. However, changing attitudes amongst the rural poor is a long process, so is having an impact on their livelihoods. The biggest impact of the project on the communities involved was on improving their awareness of the availability of seasonal climate forecast information to guide their crop production plans.

5. Future plans

This pilot project could benefit immensely from establishing a partnership with a community-based organization, which is already working with a few households to improve the productivity of agricultural systems and ultimately improve the livelihoods of the rural poor, particularly the vulnerable women and children. Establishing demonstration plots in those areas for a sufficiently long period of time coupled with provision of climatological information will be crucial to bring about an infusion of climate information in decision making among smallholder farmers. By extending, improving on the design and implementation of the project, the operators hope to contribute to the country's solution to one of the most enduring problems of rainfall variability induced food insecurity among the world's most vulnerable rural poor.