A System of Drought Insurance for Poverty Alleviation in Rural Areas

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Bean farmers in the north-central mountains of Nicaragua perceive drought as their main production risk. They are keenly interested in weather insurance and provided clear evidence that they knew how to use it. Micro-finance institutions (MFIs) are also interested in weather insurance, since their ability to offer credit to poor farmers is currently constrained by climate risk. This situation occurs in many parts of the developing world.

Drought impacts crop yield according to its timing relative to the cropping cycle. By coupling MARKSIM - a spatially explicit weather generator - with the DSSAT drybean simulation model, we were able to estimate the effects of seasonal variation on crop yield for any location within Nicaragua. The method is applicable throughout the tropics, for any crop for which there is a DSSAT crop simulation model. Furthermore, the method can account for spatial variations in drought risk within a region, down to a resolution of 1km. This can be critical since variations in drought risk within a region are frequently well beyond the range described by weather stations.

We used this method to quantify drought risk as a rainfall index – suitable for setting insurance premiums – for four locations in the north-central mountains in Nicaragua. These representations were acceptable to both farmers and MFIs.

We improved the accuracy of the index by taking into account other factors that influence the severity of drought, such as soils, crop variety, slope position and crop management variables. Such information could be used to modify drought insurance products to reflect variable risk options.

We offer this methodology as a considerable improvement over existing methods of developing crop drought insurance products. Specifically it addresses concerns of insurers about basis risk caused by (a) insufficient long-run (>50 year) records; (b) the spatial variation between existing weather stations (both addressed by MARKSIM); and (c) the effects of site variation (soil and slope, addressed by DSSAT). Furthermore, DSSAT also takes account of detailed understanding of crop agronomy and physiology to define the crop responses to rainfall at a given site under specific agronomic management. In contrast, existing methods rely on generic relations developed for macro management of irrigation systems, which ignore these factors and are hence subject to substantial basis risk.