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SCREENING CROPS FOR VULNERABILITY TO CLIMATE CHANGE IN THE SAHEL

A PHENOLOGICAL APPROACH

CONTEXT

The life cycles of agricultural crops are timed to coincide with seasonal changes in temperature and precipitation, both of which can be affected by climate change. In the Sahel, temperatures are expected to rise in the future; shifts in the patterns of rainfall, particularly the onset and length of the rainy season, could occur; and the extremes of drought, heavy rainfall, and flooding will likely become more frequent. An evaluation of how crops and plant varieties will adjust to climate change will need to consider not only annual changes (e.g., changes in total annual rainfall, average yearly temperature) but changes that occur throughout the year (e.g., onset and length of rainy season, occurrence of dry spells, maximum nightly temperatures) as well. Selecting crops and plant varieties suitable to those changes will require a systematic assessment based on the response of crops and varieties to changes in growing conditions at different phases of their lifecycles; this is known as phenological screening. By focusing on intra-seasonal effects of climate change, the proposed approach seeks to address the climate features most directly related to farmers' principal management challenges.

THE APPROACH

The steps in the proposed approach to phenological screening are as follows:

1. **Define an area of analysis.** The study uses the example of Senegal, Mali, Burkina Faso, and Niger, as well as the southern parts of Mauritania, western Chad, and northern Cameroon that are within the Sahel and sub-Sahel range (as defined by annual rainfall of 250–750 mm).
2. **Select weather stations.** Data should be gathered from all stations in the area of analysis and passed through quality control. With a sufficiently complete set of data, it might be possible to pool the data in subsets along a north-south or east-west divide, as the Sahel and sub-Sahel are not a single uniform agro-ecological area and the types of crops grown differ depending on location.
3. **Develop a phenotypic profile for each crop.** These profiles should include ideal conditions, tolerances, and terminal threshold temperatures (minimum and maximum) affecting reproduction and growth; ideal conditions and thresholds for minimum precipitation levels; and definition of tolerances to extremes of drought, heat, and flooding. These profiles should also reflect the differences in conditions and thresholds at different lifecycle phases of the crop.

4. **Conduct the screening.** Using the data from the selected observation stations, together with the profiles of crops and information regarding the conditions for each lifecycle phase, the database can then be queried to find events that would affect the crop. The frequency of such events, by year, across a given period (e.g., 1992–2012), and at various spatial scales (country, region) will establish trends that can be projected over the next decade.

The information on shifting thresholds can be used to develop guidance on crop selection and agricultural practices that would improve the chances of crop success. It would aid decision making about investments in adaptation; approaches could be differentiated based on the dominant change (rainfall or temperature) that occurs, as well as the type of crop. Screening results can also be used to alert policy makers to potential losses or gains in revenues from major cash crops, and they can indicate when long-term research into new, more tolerant varieties is necessary.

ADDITIONAL INFORMATION

This brief highlights key conclusions from Simpson, B. (2014). *Agricultural Adaptation to Climate Change in the Sahel: An Approach to Conducting Phenological Screening.* USAID. Interested readers are invited to review the full paper at http://community.eldis.org/ARCC/.