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AGRONOMIC PROFILES OF FIFTEEN CROPS IMPORTANT TO THE SAHEL

CONTEXT

To help farmers adapt to the changing climate, a document titled *Agricultural Adaptation to Climate Change in the Sahel: An Approach to Conducting Phenological Screening of the Impact of Climate Change in the West African Sahel* was developed to outline options for conducting a phenological screening of the impact of climate change on the principal crops grown in the Sahel. The process outlined in that document includes the development of a phenotypic profile for each crop, incorporating the norms of response to climate parameters, the definition of "rainfall years" for each crop under consideration, and the querying of climate records for the occurrence, timing, and magnitude of events breaching the thresholds defined by the profiles. This brief summarizes aspects of the first component by presenting detailed crop profiles, which include the growth parameters that could be used as a "screen" against trends in observed intra-seasonal climate characteristics to help determine when critical crop tolerance thresholds may be passed.

The full document assembles, in an accessible and updated format, critical information useful to understanding potential climate related threats to the principal crops important to the food security and economies of countries in the Sahel. Beyond its application in the process outlined above, the full document provides a useful reference tool in assessing climate based threats to crops across the Sahel, wherever specific climate information is available.

OVERVIEW

Profiles were developed for 15 crops grown in the Sahel, mainly in Niger, Burkina Faso, Mali, and Senegal. The 15 crops are presented by type: cereals (maize, pearl millet, rice, sorghum); fiber crops (cotton); fruit crops (cashew, mango, shea nut); grasses (bourgou [*Enchinochloa stagnina*]); legumes (néré [*Parkia biglobosa*], cowpea, groundnut); oilseed crops (sesame); and root crops (cassava, sweet potato). The profiles are based on existing research literature, supplemented by interviews with experts. Each profile describes the geographic distribution and importance of the crop, its life cycle, and its known rainfall and temperature requirements at different stages of development. Profiles also identify growth thresholds related to soil conditions, water availability, and temperature, and provide a description of the crop's adaptability to a changing climate.

The following general insights were gleaned from the development of these 15 profiles:

Temperature requirements. All crops have basic requirements to complete a given phenological stage. If the temperature falls outside of the thresholds at any stage, crop growth and development — and yields — can be affected. However, a crop can still be viable even if temperatures exceed the thresholds if other conditions are optimal. For example, excessive heat can be offset by high levels of soil moisture.

Rainfall requirements. Water requirements for rain-fed crops are extremely difficult to correlate with precipitation because other factors affect the amount of moisture available to a plant. For example, plants grown on steep slopes or in soils with lower moisture retention capacities require higher amounts of rainfall. Evapotranspiration levels — dictated by temperature, solar radiation, and plant architecture — also affect the amount of moisture available to a plant. Even surrounding vegetation may limit the availability of water.

Soil requirements. The interaction between the crop, soil types, and other growth parameters is complex, and data on those interactions is incomplete. In general, however, clay soils and soils with higher levels of organic matter have more potential to retain water than sandy soils. That characteristic can mitigate the effect of decreased rainfall, dry spells, and high temperatures due to climate change.

Crop variety. Profiles have been created only for general crop types and the range of varieties cultivated in the Sahel; they do not cover specific varieties. A phenological profile by variety would require extensive, specific data on varietal performances, genetic background, breeding pedigrees, and agronomic features. The research literature does not currently include this information for varieties cultivated in the Sahel.

Crop modeling. While more than 20 modeling approaches have been developed to calculate the complex interactions of crop, soil type, temperature, and rainfall, together they provide only enough information to make generalizations about the characteristics of crops grown across the Sahel. Modeling of climate change impact on crops across the Sahel is currently constrained by a lack of data.

Crop adaptability. The adaptability of crops and their numerous varieties to changing climate conditions varies significantly. Certain crops are more tolerant to climatic variation, while yields of others may decrease significantly if certain conditions are not met.

ADDITIONAL INFORMATION

This brief highlights key conclusions from Del Rio, A., and Simpson, B. (2014). *Agricultural Adaptation to Climate Change in the Sahel: A Review of Fifteen Crops Cultivated in the Sahel.* USAID. Interested readers are invited to review the full paper at http://community.eldis.org/ARCC/.