Geographic priorities for research and development on dryland cereals and legumes

ABSTRACT - Dryland cereal and legume crops have often received less attention than maize, wheat and rice in terms of research and development priorities. But these crops are important globally because they serve populations living in poverty and particular socioeconomic and environmental niches. Compared to other crops, less is known about the global distribution of dryland cereal and legume crops and the conditions where they are grown. This research reports on an international effort to compile geographic information on cereal and legume crops and the conditions under which they are cultivated. The study suggested that dryland cereal and legume crops should be given priority in 18 farming systems worldwide, representing 160 million ha. The priority regions include the drier areas of South Asia, West and East Africa, Middle East and North Africa, Central America and other parts of Asia. These regions are prone to drought and heat stress, among other biotic and abiotic constraints. They represent 60% of the global poor and malnourished and make up half of the global population.

INTRODUCTION - The CGIAR (hereafter referred to as DCL) requested an analysis of the principal commodities of their proposed program and the farming systems in which they are found. The 12 priority crops of the Dryland Cereals and Legumes Agri-Food System research program are chickpea, common bean, cowpea, faba bean, groundnut, lentil, pigeon pea, soybean, barley, pearl millet, small millet and sorghum (DCL, 2015). The research builds on a global classification of farming systems, on maps of the spatial distribution of all 12 DCL crop commodities, on socioeconomic data on population, poverty, malnutrition, on market access, and on soil and climatic data.

The analysis identifies

- Where these crops occur in the context of constraints and opportunities for their development
- How can DCL technologies be geographically targeted for reducing poverty and malnutrition?

The analysis examines

- The spatial extents of key constraints to DCL crop production, using the most recent spatial data available
- The first global farming systems information resource for specifically evaluating priorities for DCL crop improvement and management

The analysis and resulting database provides

- The DCL crops are found in environment prone to heat and drought stress – two constraint key to crop improvement efforts.

RESULTS

- DCL crops should be given priority in 18 farming systems worldwide where they cover 160 million ha.
- These dryland system areas are home to the majority of the world’s poor and food insecure.
- The DCL crops are targeted based on biophysical and socioeconomic information organized according to the 63 Dixon farming systems (Dixon et al., 2001) but with a focus on the 12 principal commodities and farming systems of DCL. A key advantage of this research was that instead of analyzing crop information by country (250 in total), subnational estimates of crop distribution are generated based on pixel level data (Hyman et al., 2008). Spatial overlay was used to generate the data into spatial units according to farming system and combinations of farming systems and country. The result of the overlay procedure is a set of database files (dBase format) organized by farming system region and combination of farming system region and country. The process facilitated an analysis of DCL crops in 18 farming systems where these crops are concentrated.

DISCUSSION

- South Asia and Sub-Saharan Africa are the most important regions for crop improvement and adapted crop management practices
- Adverse biotic and abiotic constraints and socioeconomic conditions set the context for research and development in these priority systems
- Future geographic research is needed to update maps to latest conditions, improve spatial resolution and carry out genotype-by-environment analysis.