How does geography affect or reflect genetic variation in bambara groundnut? (Code: CropB1-003)

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Research project

The initial objective in this research project is to improve the understanding about the relation between genotype, environment and geographic localization, and how this relation impacts on traits such as crop yield.

This research is important because it can help farmers to choose better landraces or cultivars to be cultivated in a specific region. It is especially relevant when discussing food security challenges.

According to FAO (2006), "Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life".

United Nations (2010) expects a world population of more than 9 billion people by 2050. To guarantee that food security is a reality for all people and find answers for questions such as how to produce food to feed this population, not only in terms of quantity, but quality, is a complex and interlinking challenge (Mayes et al. 2011).

Mayes et al. (2011) contends that neglected and underutilised crops have potential to help improve food security. This is supported by a number of studies related to aspects of neglected and underutilised crops in regions where food security is vulnerable (Jacobsen et al. 2013; Kahane et al. 2013; Kunwar et al. 2012; Oselebe, Nnamani, and Okporie 2013; Padulosi, Bergamini, and Lawrence 2011). Some of these studies present Bambara groundnut, a neglected and underutilised crop, as an interesting species to be investigated. The Bambara groundnut (*Vigna subterranea* (L.) Verdc) is an important food legume crop known for its resistance to drought when compared against others legumes. This legume is cultivated on small sale by subsistence female farmers, specifically in African producing countries.

The project and approach

This project uses Bambara groundnut as an example to try to understand the relation between genotype, environment and geographic localisation. This crop has been receiving significant attention from scientific community recently and a number of results of previous experiments are available, that makes Bambara groundnut an appropriate candidate for the experiments planned. It is expected that results from this study could be extended to other similar underutilised crops.

Currently, the data that will be used in the experiments are the results of molecular analysis generated by Dr. Molosiwa's PhD project (Molosiwa 2012). In his experiments, 35 landraces were planted in Sutton Bonington/UK, three plants of each landrace, totalling 105 plants. Morphological traits were measured as well as molecular analysis using SSR markers. After this first round, seed from one plant of each of 34 landraces (essentially an inbred line) was selected and planted in a small field trial in Botswana to generated morphological and molecular information. The molecular analysis using SSR markers indicates variation (allelic) of markers in the DNA of each line.

The approach chosen in the planned experiments is to use the origin of the seed of each landrace. This gave approximately 30 positions, one in England, two in Indonesia and the others in Africa – see Figure 1.

Current work

Currently, some exploratory methods have been applied to analyze the relationship between the result of molecular analysis (scored as a matrix of presence and absence for each allele size) and geographic location. One of these methods is Geographic Weighted Regression, a local spatial analysis, suitable to identify relationship between variables that are not constant over the space of the analysis. A similar work was conducted by Lasky et al. (2012) and applied to *Arabidopsis thaliana* and (Joost and Econogene Consortium 2005) applied to livestock in Europe. The actual plan is to finish these analyses by the end of April and use the results as a basis to define the plan for the next two years.

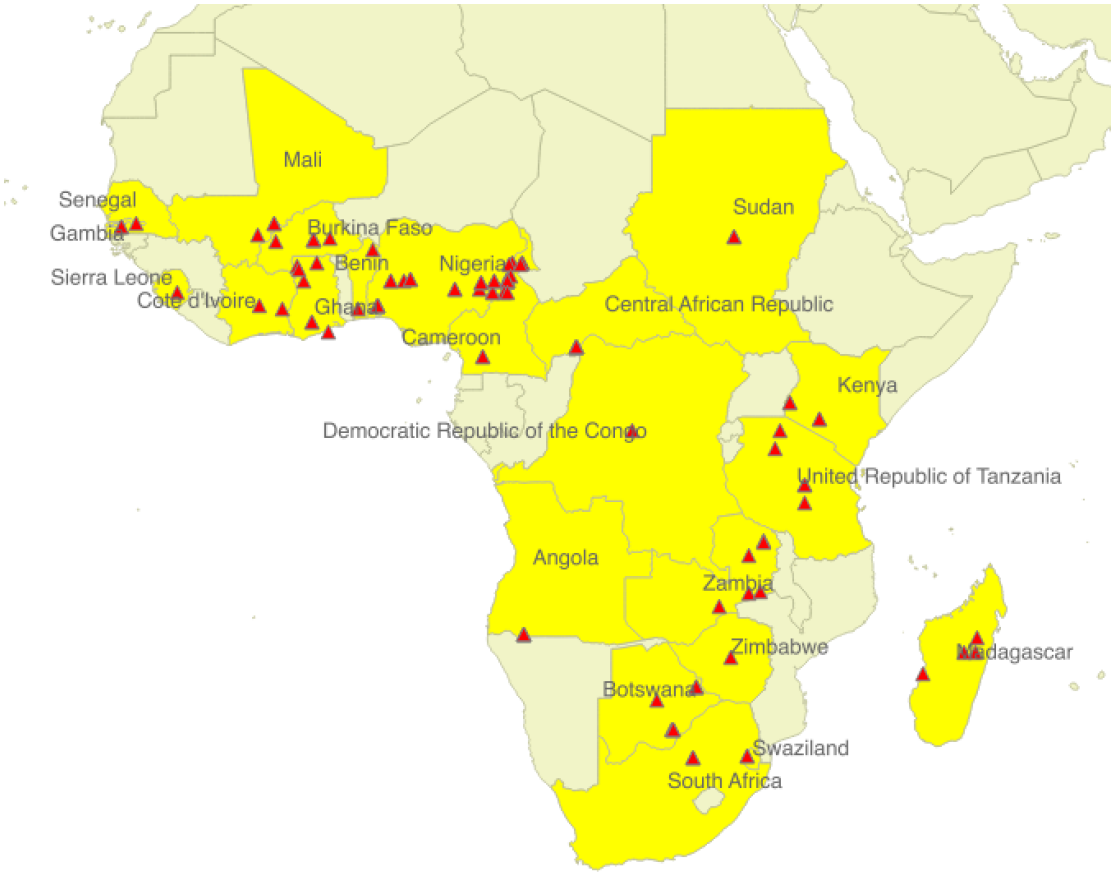

Figure 1: Origin of the seeds used in the experiments of Molosiwa (2012) in England and Botswana. Source: author.