Tropentag, September 11-13, 2024, hybrid conference

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Defining a target population of environments in Africa for *Brachiaria* sp. and guinea grass breeding

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Abstract

The Tropical Forages breeding programme based in Colombia, aims to develop superior cultivars for particular target population of environments (TPE). A TPE consists of a set of environments and future conditions where the newly developed cultivars will be grown. Defining the TPE and assessing its heterogeneity is a key step to improve selection efficiency and genetic gain in the breeding program. For this, a spatially- explicit environmental characterisation and cluster analysis was conducted in Southeast Africa (Ethiopia, Kenya, Rwanda, Uganda, Tanzania, Zambia Malawi, Zimbabwe, Botswana, Lesotho, Eswatini and South-Africa) and West Africa (Senegal, Mali, Ghana and Burkina Faso). The defined TPE in Africa, were used as reference to conduct an analysis of similarity in Colombia to identify potential areas with similar edaphoclimatic conditions. In this way, the correlation between the selection environments in Colombia and the TPEs in Africa can be determined.

The environmental characterisation included key climate indicators and soil conditions that explain the performance of forages. Monthly climate variables were calculated using daily data collected between 1983 and 2022, at a spatial resolution of 5 km^2. Soil property data, on the other hand, are relatively constant over time, with only one data point per pixel. After calculating the climate indicators, the dimensionality reduction technique known as Empirical Orthogonal Functions (EOF) was applied. This technique captures the greatest variability of the data and represents it through principal components, considering the temporal and spatial dimensions of the data. Subsequently, environmental clusters were generated in the target countries using the classic clustering algorithm K-Means. This method groups pixels (areas of 5 km^2) considering the principal components generated through EOF. K-Means was then used predict these groups in Colombia using the principal components calculated for this country. Finally, the process was adjusted by calculating the similarity between the centroid of one of the groups defined in Southeast and West Africa and the same group using the prediction for Colombia. A percentage of pixels (10 %, 20 %, 30 %) representing high similarities in terms of climate and soil conditions of each identified cluster was selected as the potential area for locating the selection environments.

Keywords: Forage breeding, *Panicum urochloa*

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