Accelerating forage breeding to boost livestock productivity

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4,000 new *Brachiaria* hybrids during initial forage biomass evaluations in the Colombian Llanos. Credit: CIAT

The Genome Analysis Centre (TGAC), with partners in the UK, Colombia and Kenya bring together their leading expertise in forage breeding for animal nutrition, cutting-edge genomics and phenomics technologies to accelerate the improvement of Brachiaria, a vital livestock feed crop in central Africa and Latin America.

More than 80 per cent of the world's agricultural land is for grazing to

support the ever increasing demand for meat and milk for an expanding and growing urban population while boosting the income of rural families. The scarcity of grass feed is a worrying constraint standing in the way of this livestock productivity.

Some *Brachiaria* species have been cultivated as forage grasses, providing nutrition for ruminants across the globe. As well as nutrition, the grasses have desirable genetic characteristics linked to drought and pest-resistance and adaptation to poor and acidic soils. Over the past 25 years, several African species of *Brachiaria* have been used commercially as forages in the tropics; the most widely sown forage plant in tropical America.

With its combined high nutritional value and stress resistant properties, the *Brachiaria* breeding programme at CIAT is crossing different species to produce new varieties with superior traits. A particular *Brachiaria* species, *B. decumbens*, grants resistance to aluminium, which has a high concentration in acid soils. Most low-income livestock keepers live in tropical grasslands in countries in central Africa with great grazing potential but are vulnerable due to the growing problem of increasing acid soils and longer extreme weather seasons.

TGAC is working to identify high aluminium-resistant genes and chromosome regions in the *Brachiaria* genome, contributing to the international breeding programmes developing the new generation of forage crops. This genomic approach to forage breeding will help to produce varieties of high nutritional value under physical stresses, such as low soil fertility.

Cattle graze new *Brachiaria* hybrids to a uniform height after initial forage biomass evaluations in the Colombian Llanos. Credit: CIAT

Strengthening and improving livestock forage-systems will contribute to the sustainability of food production while helping to reduce carbon dioxide and mitigating the effects of climate change. The international team of scientists will apply next generation sequencing (NGS) technologies and genomics to help improve forage breeding by reducing the length of the *Brachiaria* breeding cycle.

Ultimately, these approaches could be applied to other crop species. Future developments of the CGIAR (Consultative Group for International Agricultural Research) Research Programmes will provide opportunities to leverage UK investment to support the internationalisation and expansion of UK agri-science.

Project lead, Sarah Ayling, Crop Genomics and Diversity Group Leader at TGAC, said: "Our scientists are working towards a common goal of increasing sustainable agriculture, and collaborations like this allow us to exploit our combined expertise to contribute to the important issue of food security.

"This project will deepen our interactions with international centres in Africa and Latin America, and improve forage breeding for livestock production."

Jose De Vega, co-project lead and Post-Doctoral Scientist in the Crop Genomics and Diversity at TGAC, added: "The most valuable part of the project is in relation to the link between tropical forage improvement and reducing poverty and ecosystems degradation. Improving livestock forages will give many small farmers in the tropics the opportunity to improve their livelihoods.

"Our experience in genomics of temperate forage species (cool weather species) will assist with the tropical species of forage grasses in our cross-continent collaborative project, bringing the power of genomic technologies to tropical forage breeding."

This project is in partnership with the Institute of Biological, Environmental and Rural Sciences (IBERS), UK, the International Centre for Tropical Agriculture (CIAT), Colombia, and the International Livestock Research Institute (ILRI), Kenya. These activities are supported by a BBSRC International Partnering Award, which aims to support the development of long-term international collaborations, and funding from the Research Councils UK (RCUK) and British Council's Newton Fund, which through science and innovation partnerships, promotes the economic development and welfare of poor people in partnering countries.

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