UKZN-TANZANIA RESEARCH PROJECT DELIVERS STRIGA-RESISTANT SORGHUM

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The Striga parasitic weed is one of the major biotic constraints limiting the production and productivity of cereal crops on the African continent. Researchers at UKZN and in Tanzania have bred candidate Striga-resistant sorghum lines, providing excellent control of key Striga species in sorghum.

A mutually beneficial partnership and landmark study between South African and Tanzanian academics have added a critical element to the management of Striga infestations in sorghum in resource-poor communities on the African continent.

Spanning seven years, a study by UKZN and the Tanzania Agriculture Research Institute (TARI) has resulted in two new Striga-resistant sorghum varieties significant for improved food security in Africa.

Striga, a parasitic weed, is one of the major biotic constraints limiting the production and productivity of cereal crops on the African continent. These include maize, sorghum, pearl millet, finger millet and rice. Yield losses of between 30% and 90% are regularly reported in Africa's resource-poor and rural communities.

While sorghum is increasingly topping the menu as a superfood and 'powerhouse grain' among the world's vegan and health-conscious elite, the nutrient-rich grain has featured as a staple among some of Africa's poorest people for centuries.

Developing strategies to improve crop yields has never been more urgent as experts predict that climate change will have a dire impact on food security, particularly in the continent's semi-arid regions.

Deputy Director of UKZN's African Centre for Crop Improvement (ACCI), Professor Hussein Shimelis said the two new sorghum varieties were released in January 2021 and approved and registered through the Tanzania Official Seed Certification (TOSCI) agency. Seed propagation is the next crucial step following the certification agency's regulations for commercialisation.

"Tanzanian farmers are keen on using the seeds of these two new varieties which will now undergo trials in South Africa and neighbouring Southern African Development Community (SADC) countries in phase two of the study," Shimelis said.

The Striga-resistant varieties are used together with a biological control agent called Fusarium

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oxysporum F.sp strigae or FOS."Over the years, several control methods were recommended to reduce the Striga infestations such as resistant varieties, bio-control agents, cultural practices, and chemical control methods. However, the cost of some of these was beyond the means of smallholder farmers," he said.

Furthermore, research has shown that the parasitic weed requires a toolbox of effective and durable antidotes. "No single option has proven effective to stop the spread of Striga. Farmers have also consistently resisted using previously released sorghum varieties capable of increasing yield as they lacked preferred traits such as tall stems," said Shimelis.

He added that the best option for successful control is an integrated Striga management (ISM) approach. "The use of FOS is a critical component of the ISM. It has been confirmed as an eradication method, particularly when used with resistant crop varieties which have the expressed traits the farmers prefer. However, FOS is yet to be registered and commercialised in South Africa or Tanzania."

The partnership with the Tanzanian research institute began in 2013 when Dr Emmanuel Mrema accepted a place to study for his PhD at UKZN's ACCI in the School of Agricultural Earth and Environmental Sciences. Mrema's studies were funded by the Alliance for a Green Revolution in Africa (AGRA). His thesis was titled: *Integrated Striga Management in Sorghum through Resistance Breeding and Biocontrol in the semi-arid regions of Tanzania.*

In his report, Mrema noted that research and strategies to develop an ISM system through the development of resistant varieties together with the use of FOS was based on the reality that sorghum is the "staple crop of millions of households" on the African continent.

PhD student, Dr Rebeka Gebretsadik from Ethiopia, and South African MSc student, Athenkosi Makebe, worked with Mrema on the research.

"In the first year of their studies, the students carried out rural evaluations in Tanzania, Ethiopia, Uganda, South Africa, Kenya and Zimbabwe. They interviewed hundreds of farmers to establish the abiotic and biotic factors affecting their crops. The impact of Striga on crop losses was discussed in-depth. The picture that emerged showed that infestation was on the increase, particularly in the drier regions of the continent and disproportionately where sorghum was traditionally grown. Furthermore, the discussions revealed that Striga was worse where soil fertility was poor, or no fertiliser was applied to the fields. Further contributors included cereal mono-cropping, the production of susceptible varieties and a lack of adequate agricultural land to allow for inter-cropping or longer fallow or rest periods between harvests," Shimelis said.

The new Striga-resistant lines have been shared with students across the countries to enable the transfer of candidate genes into locally adapted and farmer-preferred sorghum varieties. "This reduced breeding costs, saved time and meant less duplication, which speaks volumes for the benefits of partnerships and teamwork between academics and universities on the African continent as they search for solutions to Africa-specific problems to ensure that the billions of people who live on this continent have the necessary tools to provide food for themselves in the face of the challenges racing towards them due to climate change and global warming," said Shimelis.