

By Umar Nsubuga

For centuries, Uganda's expansive coffee plantations have been at the heart of rural economies, while providing some of the world's finest Robusta beans.

However, this vital crop faces growing challenges due to climate change. Rising temperatures and unpredictable rainfall are beginning to undermine yields, threatening not only Uganda's position as a key global coffee exporter, but also the livelihoods of millions.

In response, a groundbreaking initiative is underway at the National Coffee Research Institute (NaCORI) in Kituwa, Mukono district. Researchers are working to develop drought-resistant, high-yielding Robusta varieties that could safeguard the future of the crop.

According to NaCORI, over 1.8 million households depend on coffee farming, making the success of this research crucial to Uganda's agricultural economy.

Supported by the European Union and the French research organisation CIRAD, these efforts aim to adapt Uganda's coffee sector to the changing climate and ensure its sustainability.

In the 2024/25 financial year, coffee exports generated \$2.2 billion (sh8.36 trillion), highlighting the crop's critical importance.

QUEST FOR RESILIENCE
Uganda's Robusta coffee is diverse, but the current varieties struggle to withstand extreme weather that includes dry spells and high temperatures.

"Climate is changing faster than anticipated, which means our varieties must change too. We are not just breeding plants; we are building resilience for millions of families. Our job as breeders is to predict the future and prepare farmers for it," says Dr Pascal Musoli, senior coffee breeder and researcher at NaCORI.

The drought-tolerant breeding programme began in 2022 after the European Union (EU) and CIRAD committed €713,000 (about sh2,987,600,000), to support a three-year project aimed at identifying, testing and releasing coffee varieties that can survive dry spells while maintaining high yields and good cup quality.

At the heart of the research is NaCORI's coffee gene bank that includes hundreds of accessions gathered over decades. To accelerate the search for resilience,

CLIMATE CHANGE: SCIENTISTS RACE TO DEVELOP DROUGHT-RESISTANT COFFEE



Arinaitwe (left) educating stakeholders about the different coffee agronomic practices

A GLOBAL EFFORT WITH LOCAL IMPACT

CIRAD experts working alongside NaCORI highlight Uganda's significant role in the global coffee industry. According to the International Coffee Organisation, Uganda is the world's second-largest producer of Robusta coffee, contributing approximately 40% of the global supply.

Dr Mathieu Gonin from CIRAD emphasises that as global temperatures rise, climate-resilient coffee varieties like Robusta are becoming increasingly vital.

Studies show that Robusta accounts for over 30% of global coffee consumption, especially in instant coffee production. Uganda's leadership in breeding climate-resistant Robusta varieties positions the country as a key

player in securing coffee supply for future generations.

This effort supports global food security and strengthens Uganda's agricultural economy, with coffee exports valued at \$1.5b in 2022 alone.

The EU's broader support to the sector includes the Coffee and Cocoa Value Chain Development project (CoCoDev), being implemented by the of agriculture ministry, worth sh25.5b.

However, researchers say more long-term funding is needed to bring drought-tolerant coffee to farmers.

"This is not just a Ugandan issue; it is a global food security issue. A stable coffee supply benefits everyone, from farmers to roasters to consumers in Europe, Asia and Africa," Gonin adds.

researchers first screened this genetic material under controlled dry conditions.

"We created an artificial drought in a screen house to force the plants to reveal their natural strengths. We wanted to see which plants could endure stress without dying," explained Ali Milton, a Makerere University PhD student attached to NaCORI.

Milton subjected promising varieties to three weeks without water, observing physiological and physical responses. Some wilted within five days. Others survived a week. And a small group, remained green for the 21-day period.

"Those plants taught us

that the genes for drought tolerance already exist in Uganda's Robusta population. Our work is to find and multiply them," Milton says.

Thus far, 17 highly tolerant candidates have been identified.

TRIALS IN DROUGHT-PRONE DISTRICTS

Drought-tolerant behaviour in controlled environments is encouraging, but the real test is in the field where conditions are harsh. To confirm their potential, NaCORI researchers established trials in drought-prone districts of Nakaseke, Sembabule and Ntungamo.

Here, temperatures soar, rainfall is erratic and farmers

have endured years of declining yields.

So far, the results are promising. Four of the 17 varieties continue to demonstrate strong tolerance in field conditions.

"These new materials are showing big, well-filled cherries and impressive dry spell stability. They are still young, but their performance suggests they may give farmers new hope in the future," says Musoli.

RACE AGAINST DEFORESTATION
While greenhouse and field trials continue, another critical part of the project is unfolding inside Uganda's forests. Mildred Nakanagi,

a Makerere PhD student working under NaCORI and CIRAD, is leading expeditions to collect wild Robusta varieties in their natural habitats.

"Forests hold the original Robusta, the pure genetic material from which all domesticated types came. But these forests are disappearing fast, and with them, unique coffee traits we may never recover."

Since 2022, the team has scoured 10 forests including Zoka, Semuliki, Mabira, Budongo, Itwara and Maramagambo, gathering germplasm that may carry resilience traits.

"In Zoka, in northern Uganda, we found Robusta growing in extremely harsh, dry conditions. These plants have adapted over generations. That makes them priceless for breeding," Nakanagi notes.

However, she warns that deforestation, driven by charcoal burning, illegal settlements and land clearing, is rapidly erasing this natural heritage.

According to the Food and Agriculture Organisation (FAO), Uganda loses about 92,000 hectares of forest cover annually, contributing to a total loss of 47% of its forests since 1990.

"People are cutting down wild coffee trees because they believe the wood burns better. If this continues, Uganda

could lose genetic material that is irreplaceable. Protecting these forests is protecting the future of our coffee sector," she says.

LONG ROAD TO A NEW VARIETY

Despite promising results from ongoing research, developing a new coffee variety in Uganda is a slow process, taking five to six years for approval. Researchers must gather extensive data on plant behaviour, pests, diseases, yields and cup quality to ensure the new variety's reliability.

Musoli says: "The science is slow because it must be accurate; farmers only plant what they trust. We must present strong evidence."

However, limited funding is threatening to delay progress. The EU-supported project was supposed to end last year, but researchers need at least three more years to complete their work.

Musoli adds that: "Without consistent funding, we sometimes miss field visits. Every gap in data pushes the release date further away."

He estimates that without additional support, it may take up to six years to gather sufficient data for approval.

WHAT DIFFERENCE WILL THIS RESEARCH MAKE?

Dr Geoffrey Arinaitwe, the executive director of NaCORI, says this research will significantly impact Uganda's coffee industry by developing climate-resilient, high-yielding coffee varieties, particularly Robusta, which is vital to the country's economy.

"This research aims to ensure that coffee farmers can continue to produce high-quality crops despite the challenges posed by climate change," he says.

The new varieties will be more resistant to drought, pests and diseases, ensuring stable yields even under unpredictable weather conditions.

Arinaitwe emphasises that these improvements will not only protect Uganda's export revenues, but also sustain the livelihoods of over 1.8 million households dependent on coffee farming, thus contributing to long-term agricultural stability and food security.