



PABRA

Pan-Africa Bean Research Alliance
Transforming agriculture since 1996



PABRA Annual Report 2016/2017
20th Anniversary Special Edition

BURUNDI

*Building partnerships
to fight malnutrition*

TANZANIA

*Finger on the pulse of
drought-resilient beans*

UGANDA

*Snack bars with
a winning twist*

KENYA

*Nutritious meals for
cash-strapped women*

MALAWI

Magic beans

**Defining a new
approach: better
beans for Africa**

**"When spiders
unite, they can
tie up a lion"**

**Finding
white gold**

20
YEARS
OF *impact*

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EDITORIAL

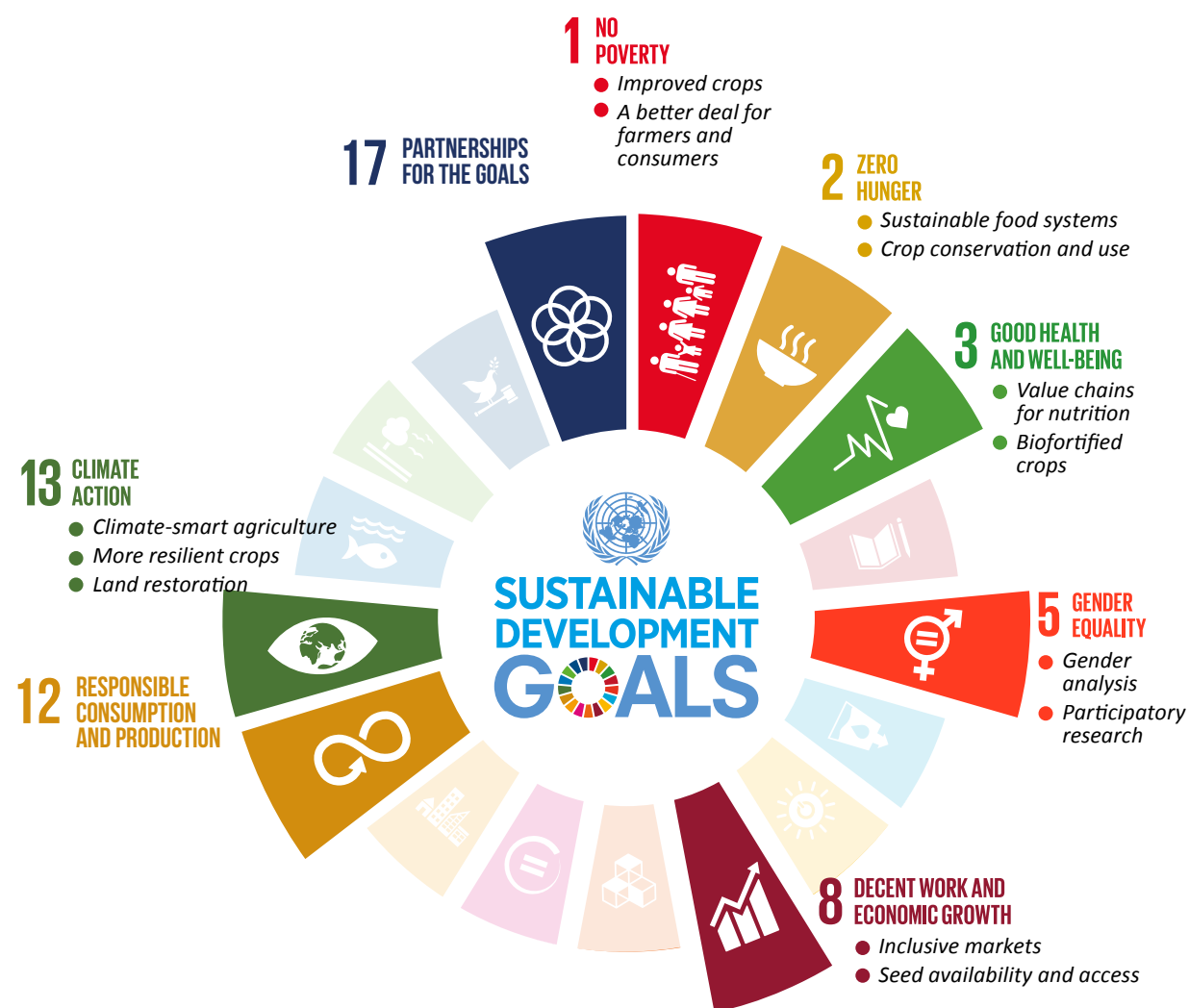


DEFINING A NEW APPROACH: better beans for Africa

By Dr Robin Buruchara
Director, PABRA

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Roadmap TOWARDS FOOD SECURITY IN AFRICA



- Beans provide protein, carbohydrates and valuable micronutrients for more than 400 million people in sub-Saharan Africa
- In East Africa, people eat on average 50 to 60 kg of beans a year – the highest per capital consumption in the world
- Beans are a valuable staple in the fight against malnutrition, in particular iron deficiency - the world's leading nutritional ailment, and cause of anemia.

Acronyms defined

A4NH: CGIAR Research Program on Agriculture for Nutrition and Health
ACIAR: Australian Centre for International Agricultural Research
ACOS: Agricultural Commodity Supplies
AGRA: Alliance for a Green Revolution in Africa
BMGF: Bill & Melinda Gates Foundation
BMZ: Germany's Federal Ministry of Economic Cooperation and Development
CGIAR: A global partnership of research organizations
CIAT: International Center for Tropical Agriculture
CIDA: Canadian International Development Agency
DFID: Department for International Development
ECABREN: Eastern and Central African Bean Research Network
EIAR: Ethiopian Institute of Agricultural Research
FAO: Food and Agriculture Organization
GAC: Global Affairs Canada
GIZ: German Society for International Cooperation
ICRISAT: International Crops Research Institute for the Semi-Arid Tropics
IDRC: International Development Research Center
IFPRI: International Food Policy Research Institute
ISABU: Institut des Sciences Agronomique du Burundi
KALRO: Kenya Agriculture and Livestock Research Organization
NACRRI: National Crops Resources Research Institute
NARO: Ugandan National Agricultural Research Organization
NGO: Non-Governmental Organization
PABRA: Pan-Africa Bean Research Alliance
RAB: Rwanda Agriculture Board
RESAPAC: Réseau d'Amélioration de Phaseolus en Afrique Centrale
SADC: Southern Africa Development Community
SABRN: Southern Africa Bean Research Network
SDC: Swiss Agency for Development and Cooperation
SDG: Sustainable Development Goal
UGOE: University of Göttingen
UHOH: University of Hohenheim
UNICEF: United Nations Children's Fund
USAID: United States Agency for International Development
WECABREN: West Africa Bean Research Network
WFP: World Food Program
WHO: World Health Organization



DEFINING A NEW APPROACH:

better beans FOR Africa

By **Dr Robin Buruchara** Director,
PABRA

“Yet across Africa, many farmers don’t realize some of their beans can be sold for twice the price.”

Venture onto any small farm in Rwanda or Uganda at meal time, and I can guarantee you that you will find beans on your plate. Come to think of it, venture onto any low income urban home or boarding school across Africa at meal time, and you are more likely than not to find beans or some kind of pulse on your plate.

And that’s despite the most severe drought that parts of the continent have seen in decades. Rains have been late or not come at all; water scarcity has devastated harvests and incomes have been crippled.

Yet legumes, such as beans tolerate drought relatively well compared with annual food crops partly due to their short growing season. Farmers value them for this - and because they’re inexpensive and easy to grow, with seeds sourced from neighbors or family members. They also know that legumes, are a good bet: if most of their harvest fails and they can’t sell anything – at least they have some food at home.

Yet across Africa, many farmers don’t realize some of their beans can be sold for twice the price. Many don’t know which varieties can help fight anemia, or reverse iron deficiency. Many don’t realize that beans fix nitrogen, improving soil fertility and farm productivity.

Too many don’t know that growing beans uses less water and energy compared to many other crops. It is for all these reasons that PABRA was launched, to strengthen resilience among smallholder farmers and provide nutritious food.

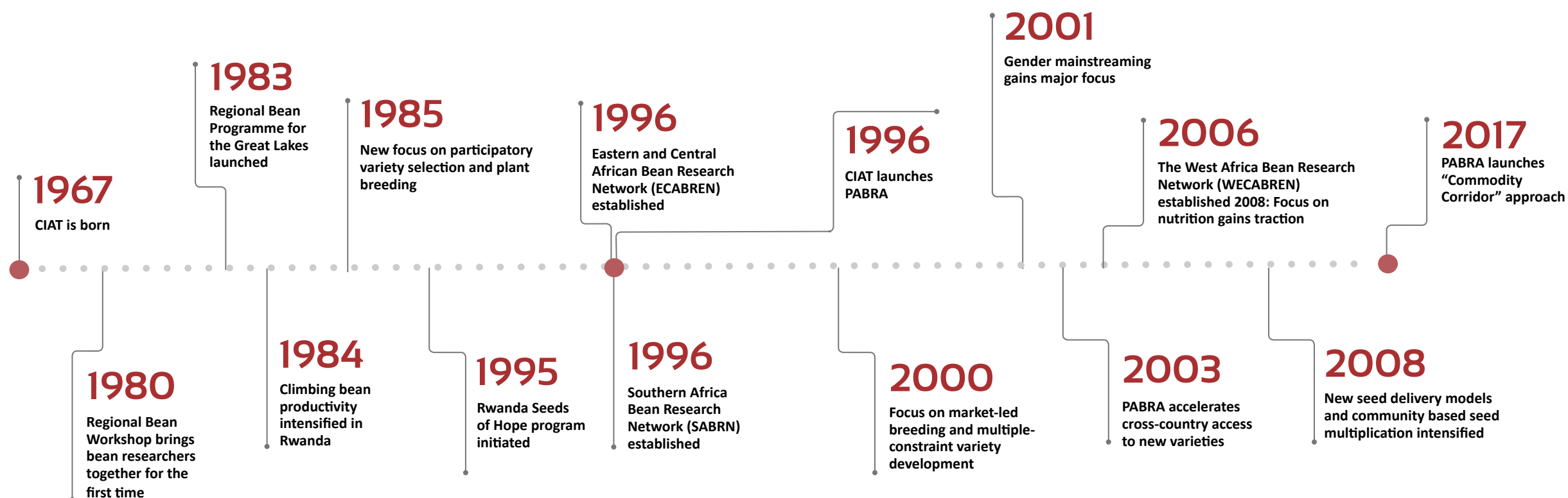
This needs to change. These are vital factors for farmers in Africa, who must prepare for more drought, longer dry seasons and unpredictable rainfall. Our farmers need more resilient crops, and beans are an excellent case in point.

Towards this vision, we will not stop working until more farmers know it – and can benefit for the next 20 years to come and beyond. Our new Commodity Corridor approach, explained in these pages, is an example of how we continue to strengthen our focus, leveraging our research results to provide better beans for our farmers and consumers.

Significant challenges block the road to improved production – not least because beans are not recognized as they should be in climate policy, in nutrition programs, in health initiatives. Yet our research shows that when farmers grow improved beans, they can expect yield increases in their fields; extra income in their pockets, and more nutritious meals on their tables.

At a glance

20 YEARS *OF growth*



Milestones



1967

CIAT is born

In cooperation with the Colombian government, CIAT is founded to function autonomously, governed by an international board of trustees. Dr. Ulysses J. Grant, a plant breeder and the Regional Director of the Agricultural Program of the Rockefeller Foundation in Colombia, is designated Interim Director. Grant, a man of both vision and action, is lauded as chief negotiator, promoter, and executer behind the establishment of CIAT.

1980

Regional Bean Workshop in Malawi brings bean researchers together for the first time. The meeting, intended to review the status of bean improvement in Eastern Africa at country level, identifies major constraints to bean production and kicks off the formation of different networks later to form the Pan-Africa Bean Research Alliance, which CIAT is invited to facilitate.



1981

CIAT staff are posted to Africa with the Great Lakes Programme, to work on bean improvement in Burundi, Rwanda and today's Democratic Republic of Congo. CIAT's vision for expansion calls for more staff in the region, with emphasis on decentralization through global networking and collaboration. The three countries form a bean research network which later becomes the Réseau d'Amélioration de Phaseolus en Afrique Centrale (RESAPAC), the "Network for bean improvement in Central Africa." ensure animals survive the dry season, when other feed sources are scarce.

Regional Bean Programme for the Great Lakes is initiated with the support of the Swiss Agency for Development and Cooperation (SDC) in collaboration with CIAT in Burundi, Democratic Republic of Congo and Rwanda. This regional program, established in Sub-Saharan Africa to overcome production constraints in dry beans, is the first sub-regional bean network. CIAT and the Rwanda Agriculture Board (RAB), formerly Institute des Sciences Agronomiques du Rwanda (ISAR), begin the long journey to intensify bean production in Rwanda with climbing bean technology, which compared to bush bean can produce more than double the yields.



1983



1984

Regional Programme of Beans in Eastern Africa supported jointly by United States Agency for International Development (USAID) and Canadian International Development Agency (CIDA) is established. This later becomes the East Africa Bean Network (EARBEN).

Participatory technology development is initiated: with more emphasis on including farmers in varietal selection and breeding.



1986

The East Africa Bean Network (EARBEN) is established, coordinating research in: Ethiopia, Kenya, Uganda, Tanzania, Madagascar and Sudan.



Southern Africa Development Community (SADC)-CIAT Bean Network is established with the support of CIDA to cover countries in southern part of Africa where beans are considered a major crop: Angola, Botswana, Democratic Republic of Congo, Lesotho, Malawi, Mauritius, Mozambique, South Africa, Swaziland, Tanzania-South, Malawi, Zambia and Zimbabwe. Later the network becomes the Southern Africa Bean Research Network (SABRN).

1987

1996

The Southern Africa Bean Research Network (SABRN) is established, previously known as the SADC-CIAT Bean Network, including Angola, Botswana, DRC- South, Lesotho, Malawi, Mauritius, Mozambique, South Africa, Swaziland, Tanzania-South, Malawi, Zambia and Zimbabwe.



1995

Rwanda Seeds of Hope: After the genocide and civil war in Rwanda in 1994, researchers intervene to preserve bean genetic diversity – both of local landraces and promising new varieties – under threat of becoming lost during intense turmoil. At a time, when research involvement in emergency relief is not common, the Seeds of Hope project provides advice to relief agencies about where to find particular bean varieties, and also works to preserve local varieties. More than 40 percent of bean-producing households in Rwanda have already started growing new climbing beans.



2000

Market-led breeding and linking farmers to markets: A new focus on linking farmers with markets is introduced. Instead of breeding varieties with resistance to particular constraints, focus is now on building resistance to multiple constraints.

The Eastern and Central African Bean Research Network (ECABREN) is established: EABREN and RESAPAC are merged to form ECABREN, covering Burundi, Democratic Republic of Congo, Ethiopia, Kenya, Madagascar, Rwanda, Tanzania (North and West), Uganda; southern Sudan.



One common PABRA Research and Development Framework: A common framework is developed based on partners' national interests. The framework allows for joint priority setting, planning and agreed division of responsibilities to increase efficiency and enhance collaboration. It includes different value chain actors and takes into account research areas including nutrition, markets, gender, and monitoring and evaluation.

2003



1996

CIAT launches PABRA: The Pan-Africa Bean Research Alliance fosters collaboration within and between three regional bean networks in an effort to transform beans from a subsistence crop to a cash crop. It involves a wide range of stakeholders - farmers, rural communities, NGOs, and private sector organizations - to increase smallholders' access to improved and marketable bean varieties, new crop management techniques, and market chain information.



PABRA initiates the Wider Impact Programme to get better beans to millions more farmers. The new strategy moves away from centralized government extension systems towards linking with the private sector, to ensure farmers produce beans that meet customer preferences on characteristics such as colour or shape.

Focus on nutrition: A new drive to tackle malnutrition in Africa takes hold. While many other programs focused on supplementation, PABRA focuses on directly improving the content of iron and zinc in beans.



2016

PABRA launches a “Commodity Corridor” approach to better link bean value chain actors and enhance market opportunities across PABRA countries. Supported by Global Affairs Canada, the approach focuses on research gaps and aims to enhance opportunities in different “hubs” for bean production, distribution and consumption.

2006

The West and Central African Bean Research Network (WECABREN) is formed, consisting of Burkina Faso, Cameroon, Central Africa Republic, Congo Brazzaville, Ghana, Guinea, Mali, Senegal, Sierra Leone, Togo.



2008

New bean improvement priorities: New focus is put on genetic improvement for abiotic factors such drought and heat tolerance, and adaption of climbing beans to medium altitudes. Focus intensifies on improving levels of iron and zinc in beans.

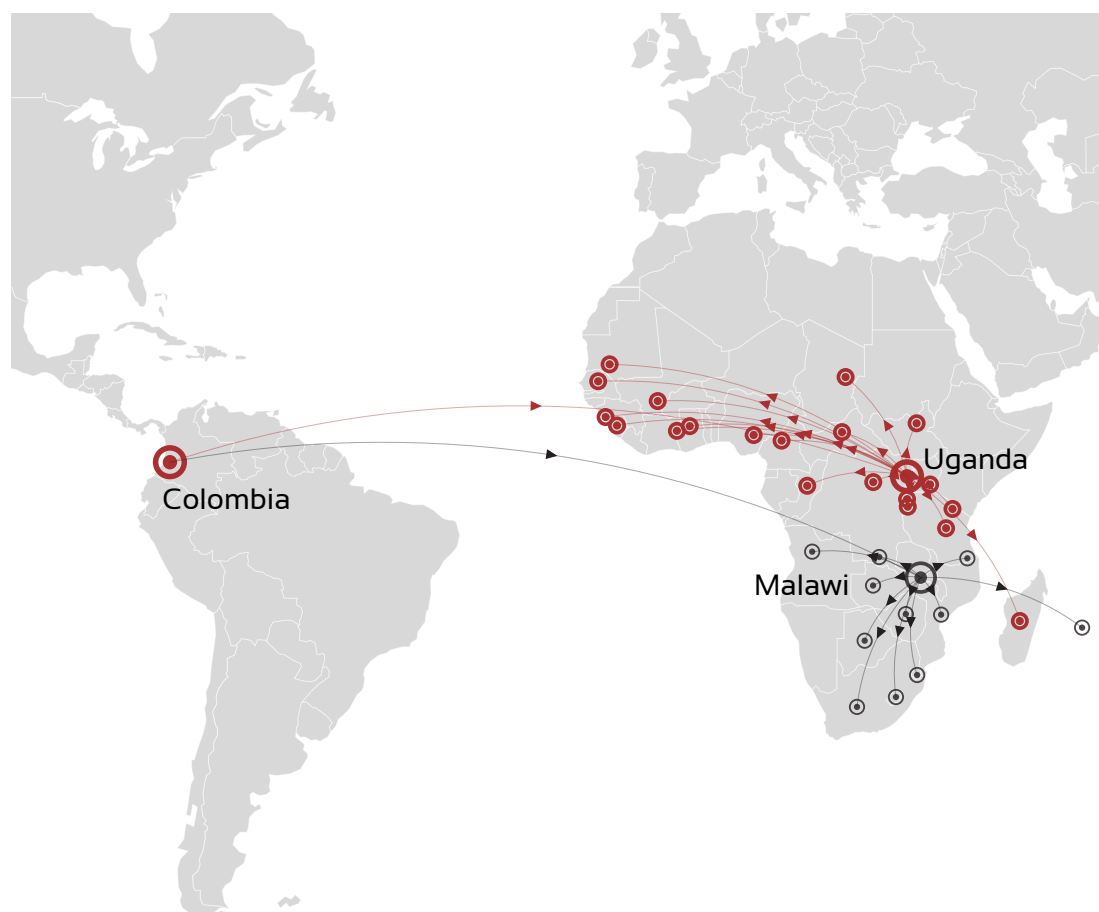


2014

Burundi and Zimbabwe identified as priority countries. PABRA gives extra attention to improving bean production in these countries through the support of the Swiss Agency for Development and Cooperation.



Banking ON A SUSTAINABLE FOOD FUTURE: FROM ONE *diverse* CONTINENT TO ANOTHER



PABRA's bean breeding programs are closely integrated with CIAT's program at its headquarters in Cali, Colombia, which hosts the largest *Phaseolus* bean genebank in the world, containing over 37,000 bean types. Beans with high iron, resistance to diseases such as root rots, heat tolerance, drought tolerance, tolerance to soil problems, and insect resilience, are uniquely bred in Colombia, or made available to PABRA's partners.

This represents huge potential: for example, using *Phaseolus coccineus*, the scarlet runner bean, researchers in Rwanda continue to breed beans with even higher levels of acid soil tolerance of up to pH 4 – which could dramatically improve yields in environments in western Rwanda, northern Zambia, and other countries.

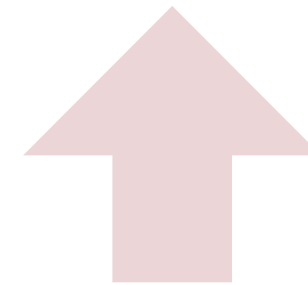
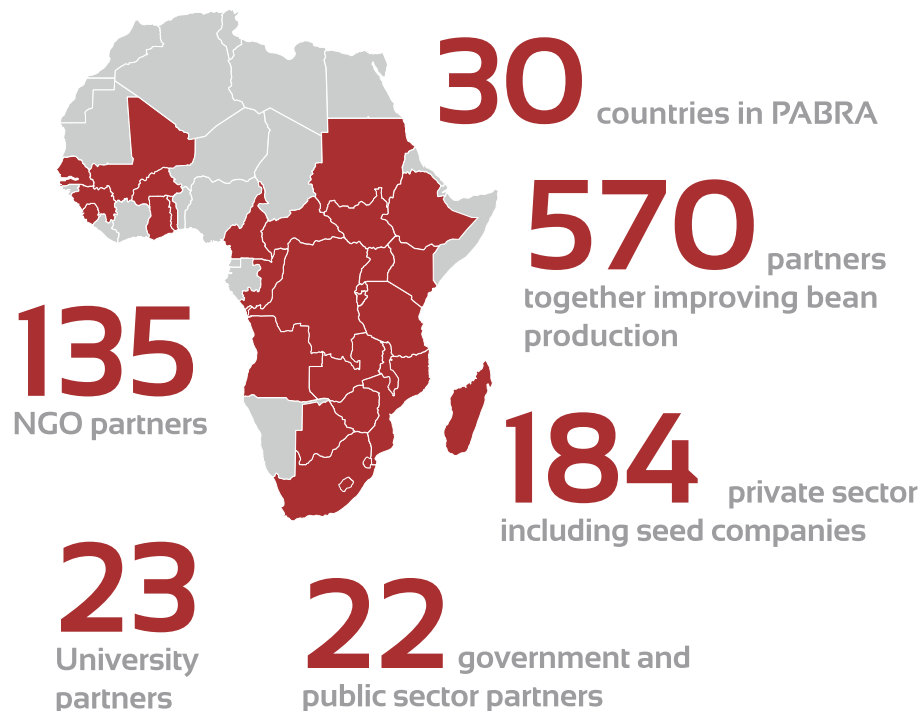
Beans stored in the genebank show potential for unique disease resistance that has not yet been tapped in Africa. Reports suggest that some bean species may carry resistance to the most destructive pest of bean in Africa - bean stem maggot. If beans resilient to bean stem maggot could be released in Africa, that would be a major step forward, making beans more profitable for farmers.

*“Common beans evolved in often extreme environments. They offer important opportunities for breeders across Africa to breed beans in varied conditions – from humid highland environments, to near-arid environments with high temperatures and drought. The *Phaseolus* genus has what it takes to confront problems that for years we thought to be intractable.*”

Dr. Steve Beebe, CIAT's Bean Program Leader



20 *years* *impacts*



86% increase in bean production areas
36% increase in bean yields per hectare

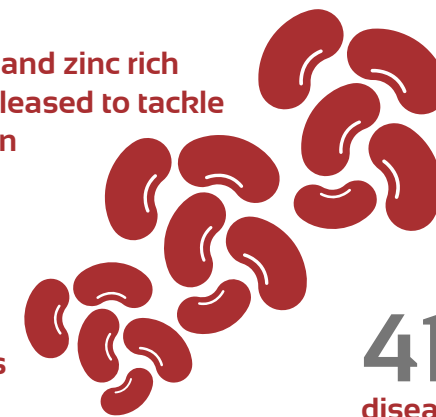
41 iron and zinc rich varieties released to tackle malnutrition

38 drought resilient varieties

180 climate-smart beans

52 early maturing beans

412 pest and disease tolerant beans



US\$192 MILLION
value of quality bean seed produced

\$1000 more per hectare, per season, with new beans in irrigated conditions

US\$500-800 more per hectare, per season, with new beans in rain-fed conditions



1.4 MILLION FARMERS
are closer to bean markets, more than half women

27,000,000 FARMERS
reached

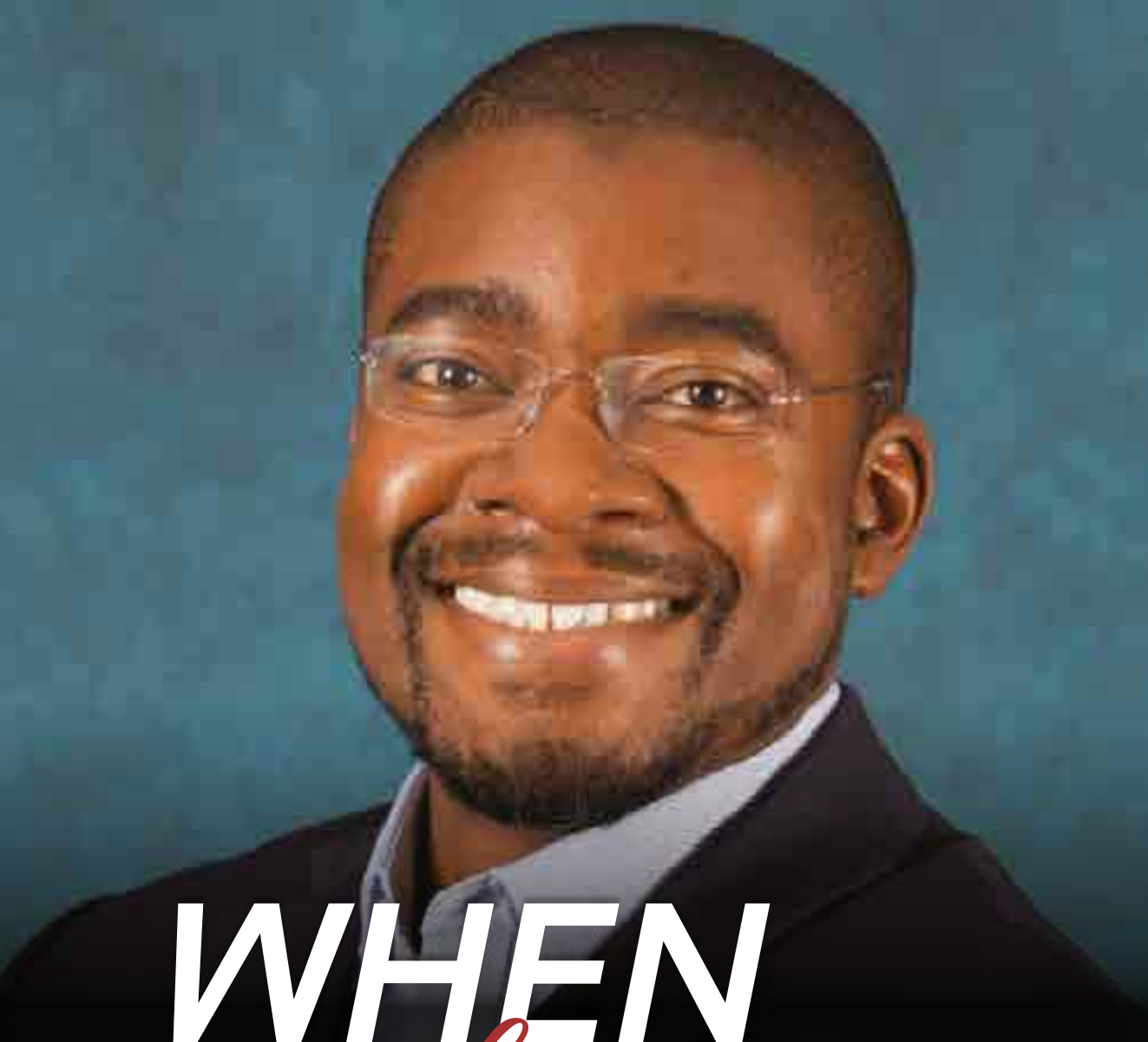
96,000 TONS
of quality bean seed produced across **22 COUNTRIES**

86,880
people trained through PABRA, a third women

A top-down view of a group of people's hands, mostly of African descent, holding a circular woven basket. The basket is filled with various types of beans and lentils, including light-colored beans, dark red kidney beans, and brown lentils. The hands are arranged in a circle around the basket, with some fingers resting on the rim. The background is dark, making the basket and its contents stand out.

Visions

FOR A MORE
*sustainable,
resilient*
**FOOD
FUTURE**



WHEN *spiders unite,* THEY CAN *tie up* A LION

By Dr. Debisi Araba
Regional Director for Africa, CIAT

There's an Ethiopian proverb: "When spiders unite, they can tie up a lion." I've always been fascinated with the potential of sustained thinking and collaborative effort.

PABRA is a great example of both. That's because while Africa is such a diverse continent, with so many tongues and tribes, we are united in the pursuit of prosperity and economic opportunity.

Our approach to improving prosperity in African agriculture must consider the myriad of complexities which make blanket interventions inadequate. We need a more robust, networked, united approach to spreading innovation and know-how, like improved crop varieties, while paying attention to the nuances of local contexts.

African agriculture needs more site-specific solutions. Spanning 30 countries - with over 570 partners and counting - for the last two decades, PABRA has taught us lessons we can't afford to miss: by building deep and wide networks with local partners, paying attention to local similarities and differences, we can boost yields, double – even triple – incomes, improve nutrition and transform the livelihoods of entire communities.

It is a shining example of sustained thinking, backed by a unique collaboration among academic, public and private institutions.

Over the last 20 years, the work of PABRA has ensured that farmers in Africa can be more responsive to challenges like climate change, market price volatilities, pests and diseases. They are more informed of new technologies, new practices and emerging market opportunities. That will not only

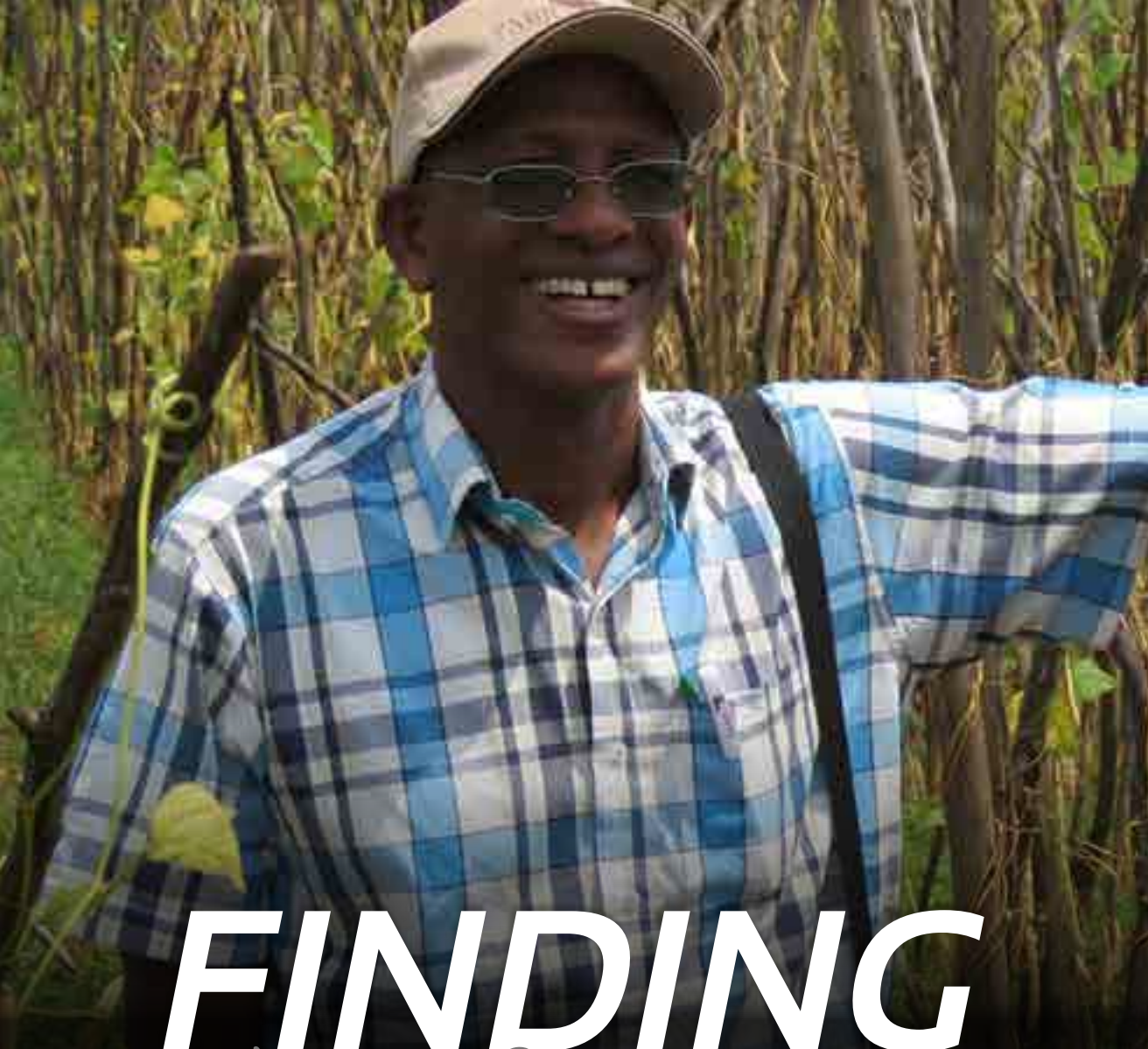
improve productivity and boost yields, it will enable farmers to grow and feed their own families more nutritious food.

The time is ripe for us to apply these insights to other crops, as we work to transform the agriculture sector across the continent.

The PABRA model presents a pathway for innovative engagements between the CGIAR and all external partners, particularly the private sector agribusinesses – at both small and large scales. I see a vibrant future with the PABRA model being extended to catalyze investments and improve productivity in the value chains for other crops.

The road ahead may well present new challenges, but we are undaunted, because, as Voltaire said: "No problem can withstand the power of sustained thinking." We, along with our partners within PABRA are stronger and more resilient to face any future challenges. Together, we will tie up more 'lions'.

"I see a vibrant future with the PABRA model being extended to catalyze investments and improve productivity in the value chains for other crops."



FINDING White gold

By **Dr. Jean-Claude Rubyogo**, Seed Systems Specialist and Eastern and Central Africa Bean Research Network (ECABREN) Coordinator

There was a time when, as researchers, our focus was on breeding beans to have varieties resilient to challenges like soil fertility, or disease and pest tolerant. These improved beans would be released to farmers, and we would go back into the lab, to breed more beans capable of beating more challenges.

But this is not the case anymore.

Today, this is where much of our research starts. If we are to call our work a success, we need to learn a lot more about what happens to those beans after they are released.

Since PABRA began 20 years ago, we have released over 500 new, improved beans and reached more than 27 million bean farmers. It's an impressive figure but we need to reach a lot more people.

From the two decades of PABRA work, one thing is clear: partnerships mean progress. By linking scientists with private businesses including small and medium enterprises; companies with government agencies, impact is achieved.

Let's take the story of the white pea bean in Ethiopia as an example.

The company Agricultural Commodity Supplies (ACOS), identified growing demand for "baked beans," as they are known in Europe. But they were in short supply. So, they asked the Ethiopian Institute of Agricultural Research (EIAR) for help.

Through a PABRA partnership, EIAR and CIAT bred higher-yielding beans, that were more resilient to local pests, diseases and drought. EIAR, CIAT and seed value chains actors designed an impact oriented seed systems to access these varieties to millions of farmers in Ethiopia.

Between 2004 and 2016, the adoption of the white pea bean varieties jumped from less than 10 to 70 percent. Now more than 2 million small holders are growing white pea beans. Production of the bean, now called "white gold", has quadrupled: where before farmers were harvesting 0.75 tons of beans per hectare, now they are harvesting 1.6 tons per hectare.

Export volume has increased 15-fold, from US\$8 million to US\$120 million. The price of white pea beans has increased from US\$200 to US\$600 per ton.

The lesson is clear: when we know what consumers want, we can connect buyers with producers, and producers with improved varieties. It excites me to see small-scale farmers and entrepreneurs earning a better living as a result of beans.

In East Africa beans are among the most traded commodity. That translates to millions of dollars going to farmers - particularly women who make up the majority of bean farmers.

"In East Africa beans are among the most traded commodity."

But we need to invest in more production, better distribution and more educated consumption of nutritious foods. We need investors and policy makers to see beans for what they are: a cash crop, like coffee, tea and cotton - which can put more food on the table, and more money in people's pockets.



BUSINESS *unusual*

By Dr. Mercy Lung'aho,
Nutritionist.

I'm passionate about working in nutrition. I do what I do because I know how it feels when everybody looks the other way. I was a "preemie" – a premature baby. Weighing a mere 1.08 kg and anaemic, the doctors gave me 72 hours to live. But I'm still here; against all the odds I survived, and now I want to be part of the solution. As a nutritionist, I cannot look the other way while women and children are dying of anaemia and malnutrition on our watch.

Worldwide, malnutrition is responsible for almost half of the deaths of children under the age of five. Some 90 percent of those occur in 34 countries; 22 of which are in Africa. Although malnutrition has multiple causes, I strongly believe the root of the problem in Africa is due to dysfunctional food systems that fail to provide the right nutrients in the right quantities in order for people of all ages to thrive. This has to change.

Fortunately, nutrition has become accepted as a global priority – it even has its own Sustainable Development Goal (SDG). But if we're going to meet SDG3 – for good health and wellbeing – we're going to need less business-as-usual, and more unusual business.

First, we need to radically rethink the concept of food security, and focus on nutrition security as well. Having enough calories is not enough – we need better food production and distribution systems that ensure everyone has equal access to safe, diverse, and nutrient-dense foods, produced with minimal damage to our environment. Yes, it's a tall order.

But I've already seen how small changes in eating habits can be life-changing. For example, daily consumption of specially bred, high-iron beans can prevent and even reverse anaemia in women and children. That's a quick, effective response to a condition that can blight their entire lives – entire nations.

*"I've already
seen how
small
changes in
eating habits
can be life-
changing."*



BEANS

WITHOUT

boundaries

By Dr. Clare Mukankusi,
Regional Bean Breeder

My dream has always been to reach the poorest in Africa through science. And now, as a “doctor of plants,” as my children call me, I help regulate the flow of beans between the world’s largest bean genebank in Colombia and many countries in Africa.

Beans are essential in sub-Saharan Africa. In East Africa alone, they are among the most-traded commodity, and a meal is often considered incomplete without them. In many African countries, every woman, with only a very small piece of land, can grow and sell beans, to put a nutritious meal on the table.

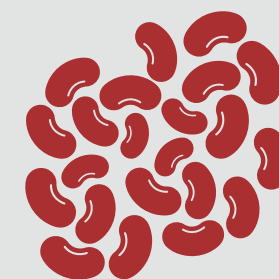
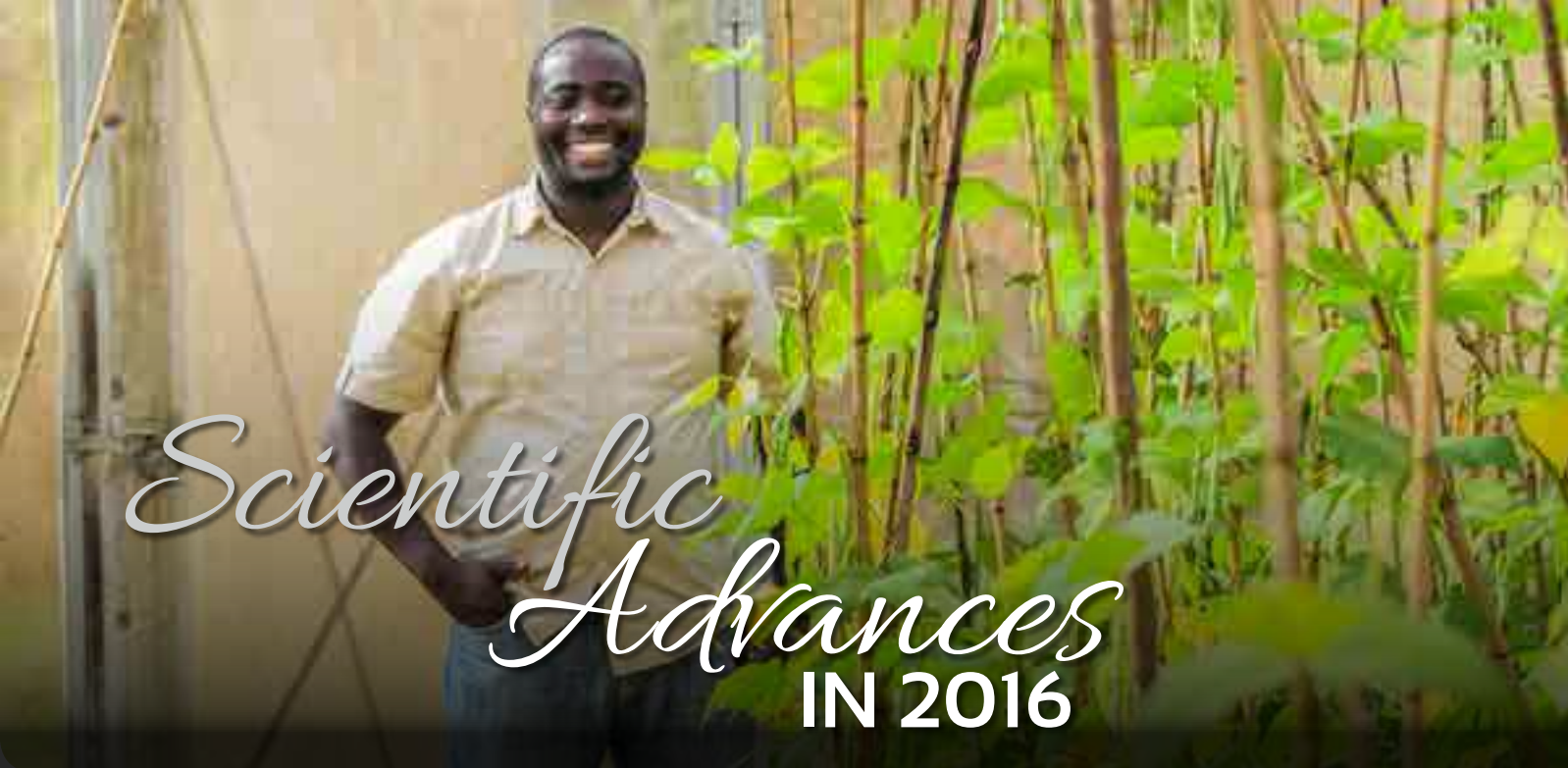
Thanks to decades of research, we have already made huge progress in improving beans. They are now more nutritious and affordable, and the plants are more productive and hardy in the face of heat and drought.

But if we’re going to meet the Sustainable Development Goals, end hunger, achieve food security and improved nutrition, we’re going to need to raise the bar even higher.

That’s why the 37,000 accessions at CIAT’s global bean collection in Colombia, and the 3,000 at our genebank in Uganda are at the heart of the work of PABRA to improve beans for the continent.

As a breeder, I rely on genetic diversity to make progress. If one bean variety is lost forever, we might never know how its unique attributes could have helped us – and future generations – tackle specific challenges, especially in light of future threats like weather extremes.

“Beans are essential in sub-Saharan Africa. In East Africa alone they are among the most-traded commodity.”



22

high yielding, drought and stress tolerant beans released

7

varieties tailored to consumer demands



8

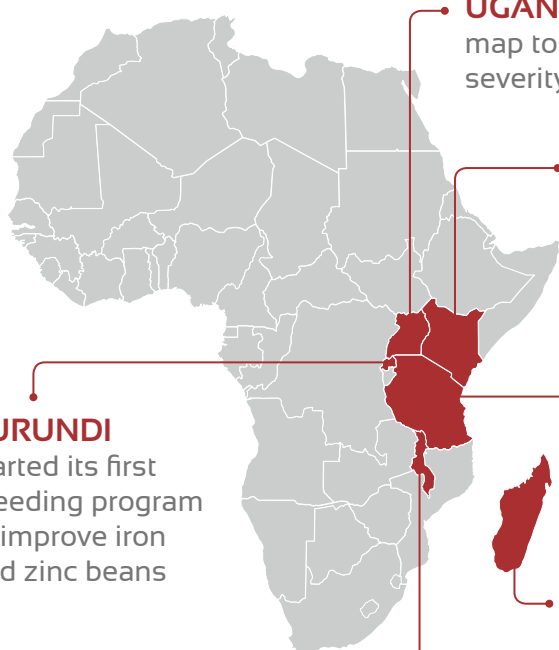
bio fortified bean varieties released



5

beans discovered to have resistance to root rot

Scientific Advances IN 2016



UGANDA

map to track bean rust severity developed

KENYA

2,602 kilograms per hectare reported in bio-fortified bush bean lines

ZAMBIA

root and crown rot disease pathogens discovered

MADAGASCAR

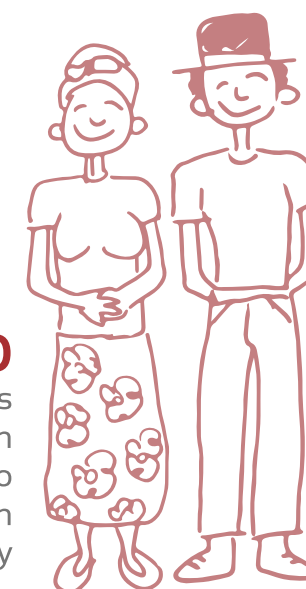
large white bean yields were doubled using friendly soil bacteria

BURUNDI

started its first breeding program to improve iron and zinc beans

MALAWI

new, improved beans produced yields 22 percent higher than local varieties



859,000

new farmers trained in techniques to boost bean productivity

14,536.8
TONS

certified seed produced and disseminated



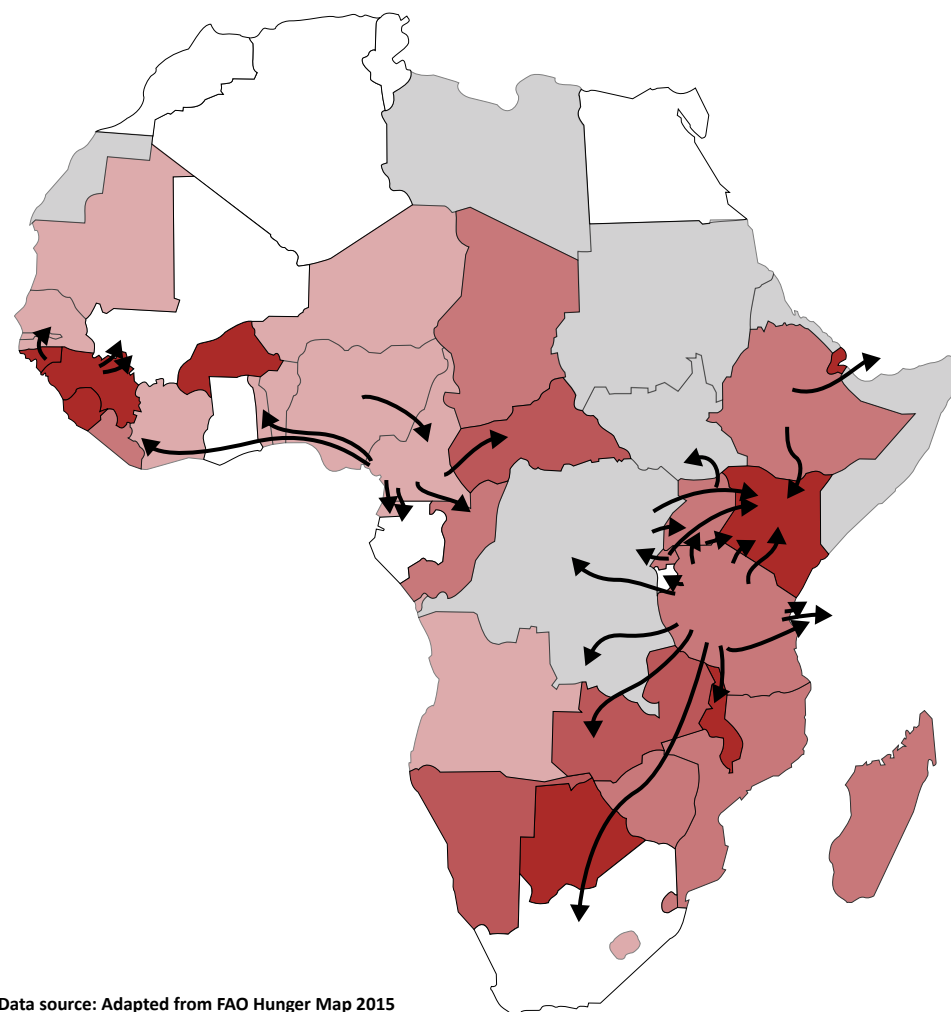
40%

representation by women in PABRA steering committees



Commodity Corridors

A PARADIGM SHIFT IN PABRA'S BUSINESS



Data source: Adapted from FAO Hunger Map 2015

In the last 20 years, PABRA researchers have found that novel approaches are needed to eliminate bean production bottlenecks. We have made significant progress towards getting better beans to more consumers, allowing farmers to access better seeds.

“Our assessment of the bean trade in Africa has revealed major flows of different types of beans between production and consumption areas, connected by distribution networks.”

said Eliud Birachi,
Market Economist for PABRA.

For example, in Tanzania and Burundi, high demand for the yellow bean drives trade, which happens along a particular route. In Ethiopia, white pea beans are in major demand, driving production there, and a trade route can be traced linking farmers with consumers.

These routes, or Commodity Corridors can shed light on the largely informal bean market. If we can find out more about them and how they work, we can improve the business

environment in these areas, strengthening relationships between farmers and buyers. We can improve policy support for improving trade routes, and investment in structures to help bean traders.

Commodity Corridors can focus on different commodities including beans - a promising new framework through which PABRA can create market-driven, rural agricultural transformation. The Commodity Corridor approach analyses trade flows, to find out where production, distribution and consumption can be supported and intensified.

Commodity Corridors are characterized by production hubs – areas where large volumes of beans are produced. Distribution hubs include warehouses, storage points, or commodity exchanges, distributing beans to consumers. And consumption hubs include supermarkets, processing units, and bean buyers.

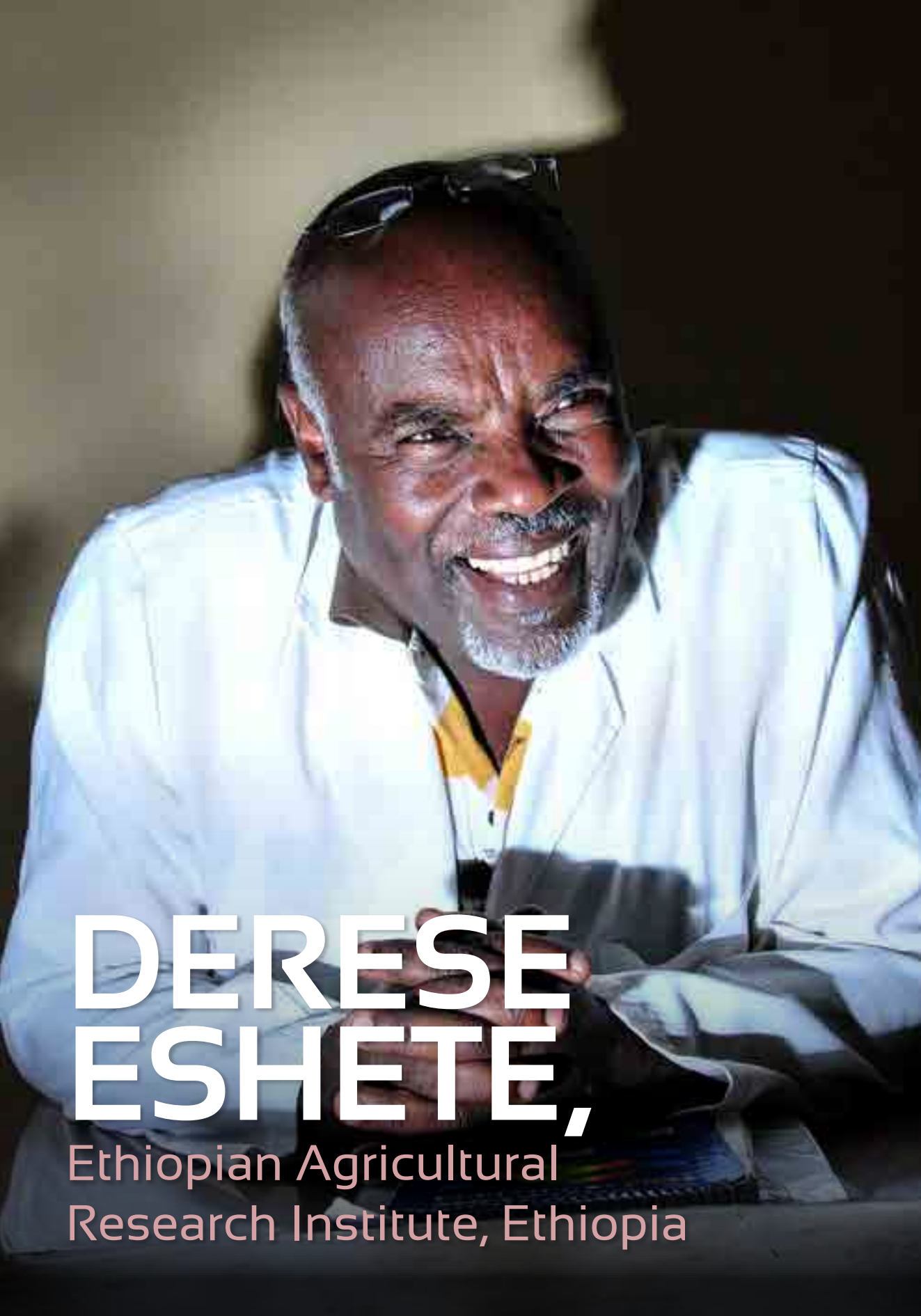
The Commodity Corridor approach will link all members of the chain while stimulating, developing and intensifying financial investment, linking to credit institutions and Information and Communication Technologies to bean boost production.



Partner Spotlight

INTERNATIONAL
YEAR OF
**PULSES
SERIES**

As part of the 2016 International Year of Pulses campaign, we highlighted the work of PABRA members to bring us better beans.



DERESE ESHETE,

Ethiopian Agricultural
Research Institute, Ethiopia

As a senior researcher, Derese Eshete has spent his career with one goal in mind: to improve the living conditions of the farmers he believes he is working for. Having worked on many crops previously, including the country's "super-grain" teff, he has settled on beans for now.

At his desk, looking out onto several fields of the rural Arsi-Negele sub-station in southeast Ethiopia, his dedication is obvious, as he describes the painstaking efforts he and his team go through, to test, evaluate and analyze bean seeds to ensure they help smallholder farmers improve their lives.

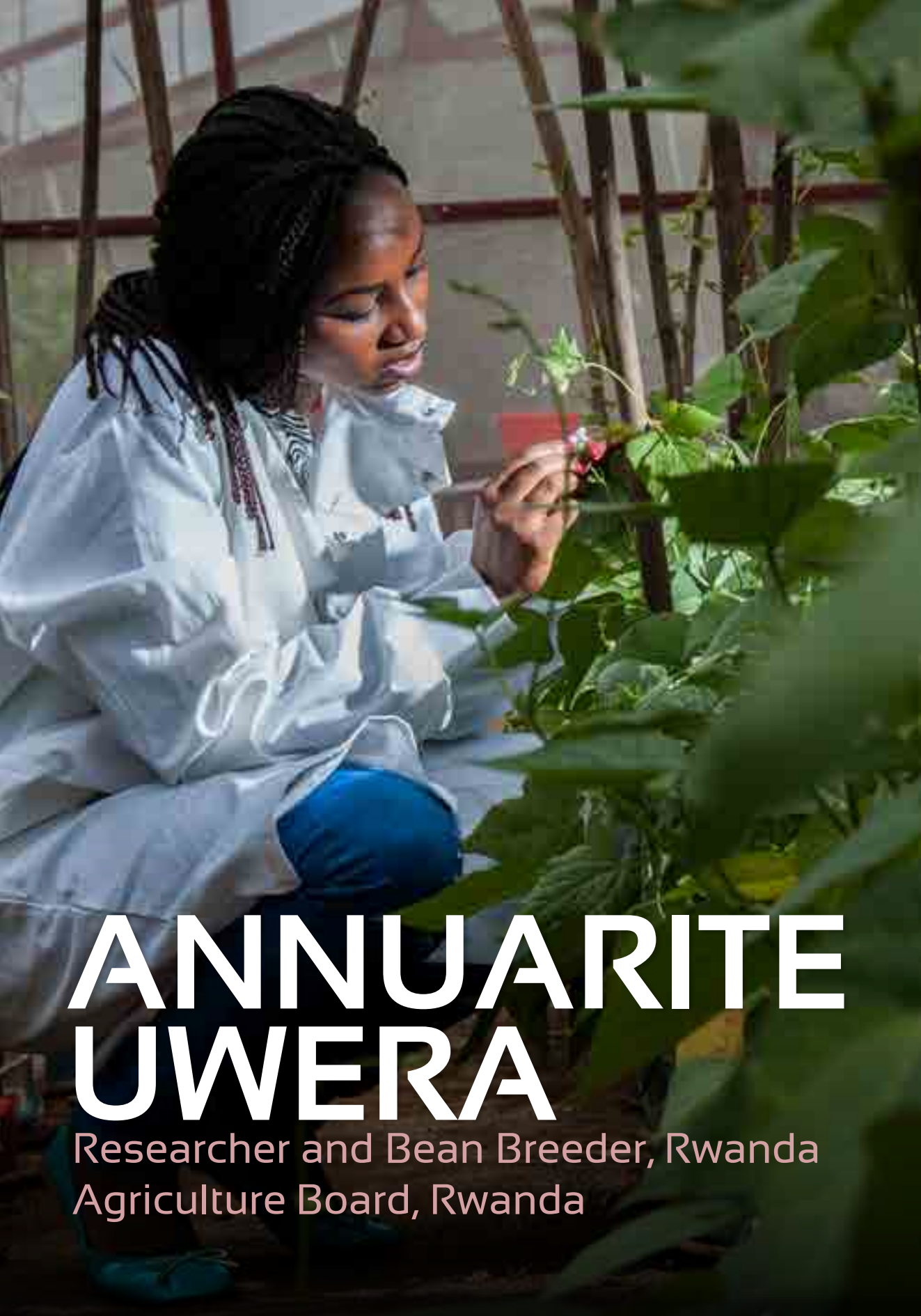
"As I'm an Ethiopian, I like our farmers to have a very nice income – and they are eager to plant the white pea beans if they can get seed," he explains.

That, in fact, is the major challenge. While local bean varieties are in large supply, improved beans which can deliver higher yields, while being resilient to increasing swathes of pests and diseases and drought – especially with the onset of climate change – are harder to come by.

Walking through the rows of different bean varieties at the research station, Eshete makes notes on a large clipboard detailing his latest observations, for example, the effects of recent weather, or damage caused by pests or diseases. Eshete's grandson runs behind his white lab coat, watching him work.

"We are selecting varieties which resist disease, those which are early maturing – the ones which perform better," he explains. After that, we have state farms or seed growers here in Ethiopia. These growers can multiply the beans in a huge area – then they will distribute to our farmers. The beans will undergo more rigorous tests for drought resilience, disease resistance and canning quality, in the local context.

The best varieties are whittled down over years. This process of improving, multiplying and disseminating beans is part of a seed system delivering improved beans to farmers on a much larger scale than has been possible in the past. Part of this success is due to relationships built over decades between researchers, private sector business and other partners – including farmers, he says.



ANNUARITE UWERA

Researcher and Bean Breeder, Rwanda
Agriculture Board, Rwanda

“**A**nnuarite Uwera cuts a tall, elegant figure. Sporting pink nail varnish and sparkling blue “pumps”, she stands out among the swathe of dark green leaves in the greenhouse of climbing beans.

She dives into a detailed explanation of her work, complete with details of the science behind breeding for improvement in the common bean – making crosses, using molecular tools in breeding like Marker Assisted Selection – to fight fungal and viral diseases.

“Climbing beans yield three times more than bush beans, so we are focusing on those,” she says, walking between the neat rows of potted beans. “In future, we will be looking for drought-resilience other climate-related characteristics as well.”

“I’m doing my training and my dream in the future is to become a bean breeder,” she explains. “It’s what I’ve always wanted to do,” she says. “My first step towards success will be to help farmers differentiate between different diseases.”

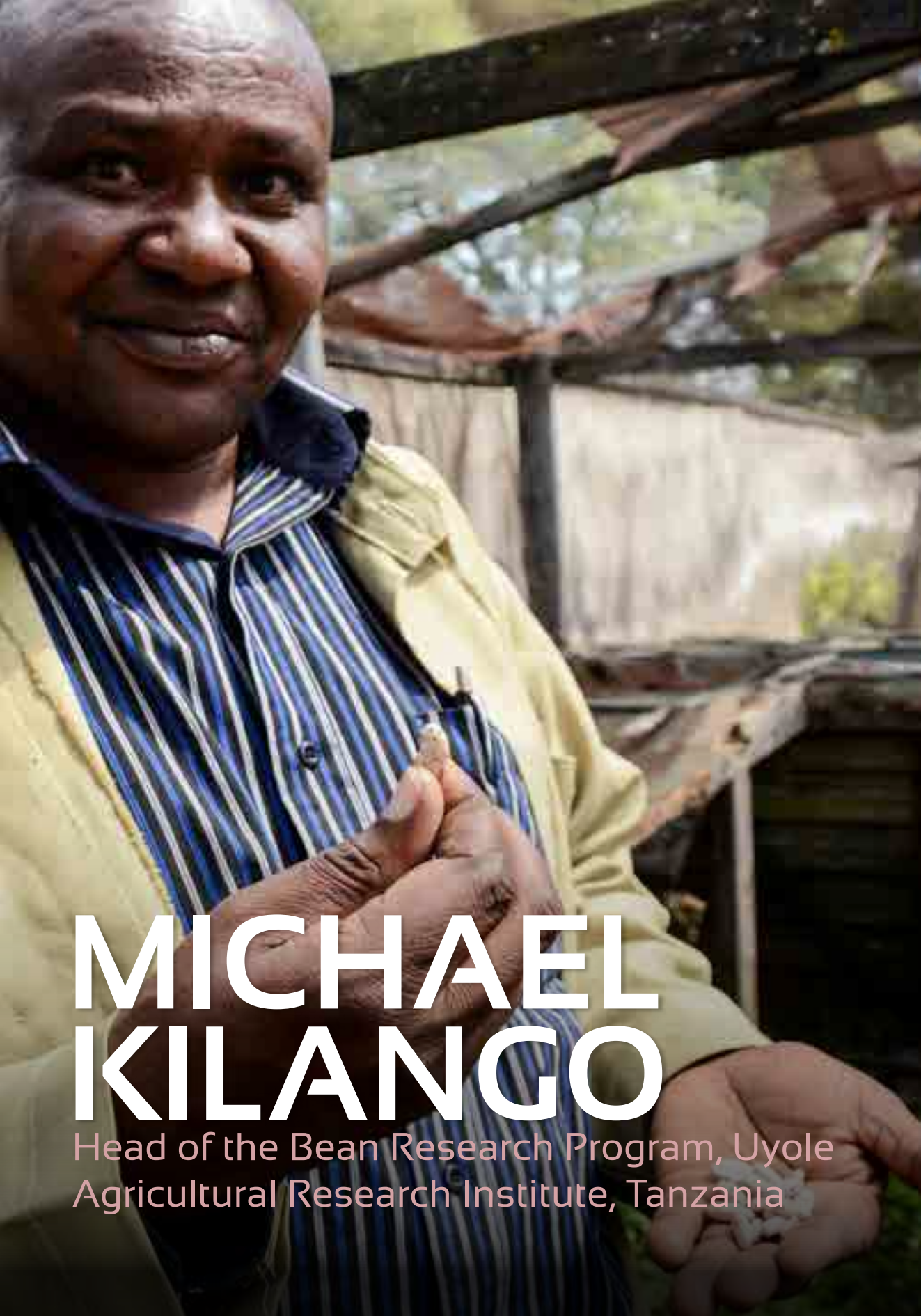
She will know she’s on the right path if she can do that. “That will be a big step

for me and a contribution to my country,” she says. “We are here to develop varieties for farmers and give them access to better seeds, to be sure they don’t have to worry about diseases.”

Together with her colleague, she begins dissecting an open flower with tweezers to illustrate how the crossing and breeding is done. “I will be very proud if I know that those farmers are able to differentiate diseases by themselves,” she continues. She is now completing her studies in Rwanda, as part of a bigger bean program team. She explains enthusiastically that she cannot work alone – the team she works with is essential to attaining success.

“I can’t work alone,” she says. “We have the scientific means, we are able to work hard. We are already producing seeds, and high-yielding varieties as well. We are already making a difference, and as a young breeder, my dream is to make sure that Rwanda is among the highest bean producers in Africa.

“We are already working on this and we are proud. As a team, together we can accomplish greater things, so that our smallholder farmers can reach their own goals too.”



MICHAEL KILANGO

Head of the Bean Research Program, Uyole Agricultural Research Institute, Tanzania

The sun peers through the early morning mist as Michael Kilango passes through the doors of the Uyole Agricultural Research Institute, in Tanzania's Southern Highlands.

The morning starts as he paces through a green field and surveys the latest batch of improved Uyole beans, named after the station. He carefully checks the leaves and steps back, gesturing at the expanse of the research plot.

"We have different sections for breeding and agronomy work," he says. "In my bean breeding work we deal with varieties from different sources. Some we receive from CIAT's headquarters in Colombia, or partners in Malawi and Uganda; others come from farmers in Tanzania."

"We plant the beans, evaluate them, cross them. In the end, we're making sure we get the best variety for our farmers," he explains. Farmers are looking for a particular size, color, shape and taste; otherwise they might not sell or be eaten.

As mid-morning approaches, it's time to visit the market. A hub of activity and color,

this bustling corridor is where food of all kinds is traded across Tanzania's borders – to Malawi, Zambia and South Africa.

Pointing to a woven bag of brown beans, he explains that the beans need to cope with a host of environmental challenges – but once they've passed those hurdles, one thing is for certain: they will be in demand at the market.

A group of feisty traders eye him suspiciously as he runs his fingers through a batch of beans stacked up for sale by the side of the road. "These are mixed improved and local beans," he explains. A lifetime of working with the small seeds has honed his expert eye – to any casual observer it's impossible to tell the difference.

"In Southern Tanzania, people prefer sugar beans like Uyole 03. We are looking for high yielding varieties, which are also resistant to pest and disease. And at the same time, they have to have the right market characteristics," he says.

"This is the Uyole 03 bean variety," he notes, lifting a handful out of the batch. "They are high yielding compared to local varieties, they cope well with pests – and importantly, they are bound for the South African market, which means they bring in a good income too."

His interest in breeding comes from knowing that farmers – especially women – won't be disappointed. They will be able to make money after their hard work. "That's what makes me happy at the end of the day. I have decided to work with smallholders, so I know they will get the best varieties we can find, which will bring them the best income and food for the table."



Stories from the field

2 0 1 6





BEAN RESEARCHERS IN *Ethiopia* WIN HIGHEST ACCOLADE

The Ethiopia Bean Research Programme led by the **Ethiopian Institute of Agricultural Research (EIAR)** won the country's highest scientific award – the Gold medal and Cup – for the impact of its bean research in 2016, which has transformed the lives of millions of farmers.

The National Common Bean Research Team of EIAR, based at Melkassa Agricultural Research Center was awarded the Gold Medal and Cup at the 7th Science, Technology and Innovation awards organized by the Ministry of Science and Technology of Ethiopia.

The award, presented by Ethiopian Prime Minister H.E. Hailemariam Desalegn, was given for outstanding research in common bean production, productivity and marketing through generation and promotion of common bean varieties for food security and export to the international market.

Dr. Berhanu Amsalu Fenta, Coordinator of the National Lowland Pulses Research Program who accepted the award on behalf of the Ethiopian Bean Research Programme, thanked CIAT, PABRA and the **Tropical Legumes projects (II and III)** led by CGIAR center **ICRISAT**.

In addition, he thanked the **Bill & Melinda Gates Foundation** and other long term donors such as the **Swiss Agency for Development and Cooperation, USAID** and **Global Affairs Canada**, for their technical and financial support to facilitate bean improvement and promotion.

The commitment of the Ethiopian government to support the national bean programme was key to enhancing bean research in the country, he said, without which, “we couldn’t reach this stage. Thus, I would like to say this award is for all of us.” He noted that the award will drive momentum to promote bean research to a higher level.

Dr. Robin Buruchara, Director of PABRA, of which the Ethiopian Bean Research Programme is a member, congratulated the researchers and said that the relationships between farmers, researchers, exporters and other valuable members of the bean value chain in Ethiopia ensure that high-quality bean varieties are available for farmers to grow and consume, and companies to export.

Ethiopia’s researchers have **transformed the white pea bean** from a neglected staple into a cash crop in Ethiopia – boosting exports from around \$8 million in 2004 to more than \$120 million in 2015. Since 2004, access to quality seed of improved varieties has risen from 20 percent of farmers to 75 percent in 2014, supporting around 2 million smallholder farmers.



The 7th Science, Technology and Innovation Awards

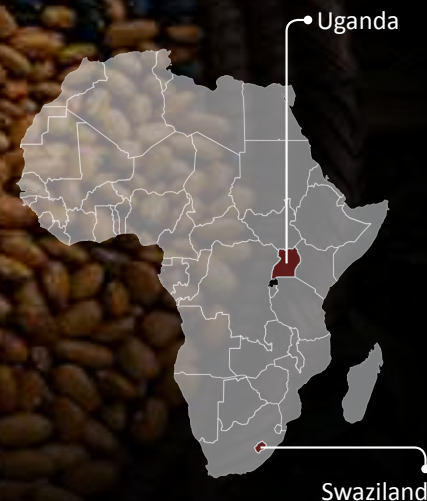
The awards took place on November 19th, 2016 in Addis Ababa. Dr. Berhanu, who received the award on behalf of EIAR, is a former PhD student supported by CIAT.

“The relationships between farmers, researchers, exporters and other valuable members of the bean value chain in Ethiopia ensure that high-quality bean varieties are available for farmers to grow and consume, and companies to export.”

Dr. Robin Buruchara,
Director of PABRA

SNACK BARS

WITH A WINNING *twist.*



BEANS IN THE INTERNATIONAL SPOTLIGHT

When Harriet Aber entered the global LovePulses Showcase competition with her special bean-amaranth energy bar, she never imagined it would take her from Uganda to Chicago.

Yet her novel and nutritious snack won her second place in the competition, presented at one of the world's biggest food expo events, at the Institute of Food Technologists, Chicago in early 2016.

Harriet – a nutritionist at Uganda's National Agricultural Research Organization (NARO) and Makerere University – is among the hundreds of dedicated bean researchers in Uganda and across Africa, who have worked to draw attention to the importance of beans in contributing to better, more nutritious diets in Africa, during the 2016 International Year of Pulses.

For Harriet and the community of pulse researchers working on the vitally important common bean, consumed by over 400 million people a year as part of their regular diet, the year was about celebrating beans – and making them more available to consumers.

Clare Mukankusi, a Regional Bean Breeder, said the role that beans can play in meeting the Sustainable Development Goals is vital, contributing to sustainable food production, climate mitigation and adaptation, nutrition and income generating goals.

“If we’re going to continue to reduce hunger and improve nutrition in Africa, the common bean can help us do it,”

“That’s why this is just the start – we’re building on research to improve more beans for more people.”

*Dr. Clare Mukankusi,
Regional Bean Breeder*

Research has already shown that investment in bean genetic improvement is paying handsome dividends. For example, households growing improved varieties in Rwanda and Uganda, have increased yields by 53 and 60 percent respectively. The beans are becoming increasingly popular in other major bean producing countries like Ethiopia, Tanzania, and Kenya.

Improved beans have strong, positive impacts on food security in East Africa. For example, CIAT studies indicated that food insecurity would be 2 and 16 percent higher in Uganda and Rwanda respectively without the improved varieties.



The LovePulses Showcase Competition

Harriet Aber from Uganda wins second place for her special bean amaranth energy bar.

What next?

- Investing in the PABRA network enhances shared data, to accelerate learning, and fast-track the development of better beans in national programs.
- The International Year of Pulses in 2016 raised global awareness of the importance of beans in our diets, but sustained efforts are needed to make beans accessible, affordable and nutritious for the public.

Harriet's Bean Amaranth Energy bar, containing popped amaranth and honey – and Jane Tsela's Bean Jam entry from Swaziland which came third in the same competition – are examples of the innovative approaches bean researchers and the private sector have already used to ensure quality, affordable and nutritious beans reach more people – achievements they will build upon in coming years.



NEW STUDY CALLS FOR SHIFT TO *Pre-pregnancy Nutrition,* TO DRIVE DOWN STUNTING IN RWANDAN CHILDREN UNDER TWO-YEARS-OLD



A scientific report released in 2016 calls for a shift in interventions to tackle malnutrition in children under the age of two in Rwanda. Among recommendations, authors urge renewed focus to “fast-track” pre-pregnancy nutrition. Adolescent nutrition before pregnancy, they say, has a bigger impact on stunting in children than previously thought.

The ‘Nutrition, Markets and Gender: An integrated approach towards alleviating malnutrition among vulnerable populations in Rwanda’ survey, was supported by United Nations agencies including the World Health Organization, the United Nations Children’s Fund, World Food Program and the Food and Agriculture Organization. It makes a series of recommendations to drive down stunting and malnutrition in the country.

“For the first time, we can clearly see that waiting until a woman is pregnant before intervening in her/their diet is often too late for tackling stunting.”

“Focusing on the established 1000-day nutrition target – from the start of a woman’s pregnancy until her child’s second birthday – is not enough. We need to target undernourished adolescent girls with more nutritious food, fast-tracking nutrition well before pregnancy.”

*Co-author Mercy Lung’aho,
a Nutritionist with PABRA and CIAT.*

The study also points to other drivers of stunting and malnutrition, which in turn pinpoint sociological, financial and agricultural factors fueling the problem.

While Rwanda has made significant gains in reducing hunger and undernutrition, a third of children are stunted, the report shows.

What’s next?

- This study’s methodology can be expanded to other geographic areas, to determine drivers of malnutrition in other countries.
- Interventions could improve the impact of community health workers in social behavioral change communication and maternal and child health extension services.
- Adolescent health and nutrition could be enhanced by improving the quality of school meals.

Accelerated progress is needed if the government is to reach its target of reducing child stunting to 18 percent by 2018, or the United Nation’s Sustainable Development Goals to end all forms of malnutrition by 2030.

Dr. Louis Butare, co-author and then Director General of the Rwanda Agriculture Board (RAB) said that in 2012, Rwanda’s Gross Domestic Product would have been 11.5 percent higher had stunted growth in children been tackled.

“A multi-faceted response needs to be launched on all fronts to tackle this problem in line with findings of this study.”

*Dr. Louis Butare, co-author and
Director General of RAB*

The findings of the report suggest that no single sector is able to address malnutrition alone – in part because no single drivers can be attributed to its cause. Improved coordination among health and agricultural sectors as an approach, the study suggests, offers the best opportunity towards linking agriculture to nutrition, and driving down stunting.

This study was led by RAB in partnership with CIAT, through PABRA. The work was supported by the Rwandan Ministry of Health, and UN partners WHO, UNICEF, WFP, FAO, as well as CIDA and SDC. The Women Empowerment in Agriculture Index was developed by IFPRI.



Five new bean varieties bred to contain more iron, and to be resilient to the impacts of drought were released in 2016 in Uganda for the first time.

The varieties – co-developed by the National Crops Resources Research Institute (NACRRI), the Rwandan Agricultural Board (RAB) and CIAT through PABRA and HarvestPlus - were released as part of the government's strategy to tackle malnutrition and reduce anemia in the country, especially in children and expectant mothers.

Dr. Stanley Nkalubo, the breeder and leader of the Legumes Research Program at NACRRI, which evaluated and released the varieties on Friday 22nd July 2016, said the biofortified beans will provide a cheap source of nutrition among poorer communities.

"The varieties, also known as NAROBAN 1, 2, 3 4C and 5C, are an excellent source of iron. Instead of buying expensive supplements, communities can now buy and grow these beans as a way of boosting nutrition and reducing anemia – a major health concern in Uganda – also knowing they will get yield despite drought."

Dr. Stanley Nkalubo, Breeder and Leader of the Legumes Research Program at NACRRI

"This is particularly good news for millions of women across Africa, because these beans can tackle iron deficiency and anemia, key health concerns in women, and boost their incomes through improved yields."

These beans have been bred conventionally over many years, combining iron sources from our CIAT genebank in Colombia with locally adapted germplasm.

It is a long process to track down varieties with higher iron content, and then ensure that they can also tolerate harsh conditions in our environment, like drought.

Dr. Wolfgang Pfeiffer, Global Director of Product Development and Commercialization at HarvestPlus

"In our work with farmers who have grown the high iron beans, mothers have observed that their children are more active and their performance in school has improved."

Sylvia Magezi, Uganda Country Manager for HarvestPlus

An unusually strong El Niño weather cycle and record high temperatures devastated crops across southern and eastern Africa in 2016.

What next?

- Biofortified beans could be bred to contain additional characteristics such as resistance to disease, and adaptation to poor soils.
- By investing in PABRA, education and training to include biofortified beans and other nutritious crops as part of a healthy, balanced 'food basket' is ongoing.

Dr. Clare Mukankusi, a regional breeder based at Uganda's National Agricultural Research Organization, said:

"These beans have to go through decades of breeding hurdles to get to the stage of being released into the community. The varieties will not only give farmers better yields, but they are vital for smallholder farmers and communities who rely on rain-fed agriculture."

Dr. Clare Mukankusi, Regional Breeder

Despite efforts to curb iron deficiency through supplements and fortified foods, the condition affects an estimated 2 billion people worldwide.

The breeding effort was made possible with support from IFPRI, CIAT, HarvestPlus, with principal donors including the UK Government; the Bill & Melinda Gates Foundation; the U.S. Government's Feed the Future initiative; the European Commission; and donors to the CGIAR Research Program on Agriculture for Nutrition and Health, of which HarvestPlus is a part.



NUTRITIOUS MEALS FOR CASH-STRAPPED AND *Busy mothers* LAUNCHED IN KENYA

Fast-cooking beans and nutritious bean snacks have hit supermarket shelves in Western Kenya. The products target women who may need to prepare meals in a short period of time for the whole family.

The fast-cooking beans have been pre-cooked, and only need to be boiled for 15 minutes. They contain all the nutrition and appearance of regular dry beans and others come in a packet like peanuts and can be eaten right away.

Regular dry beans can take around three hours to cook, requiring more firewood or charcoal. Fetching firewood or buying charcoal take up time, energy and money, mostly impacting women and girls, who are in charge of preparing meals and collecting firewood, and who may also have another job.

Developed together with the private sector company Lasting Solutions Ltd., the pre-cooked beans and snacks are labeled “quick-cook” or “ready to eat”, and have been industrially pre-cooked, using water but no preservatives or additives.

A team of PABRA researchers tested 47 bean varieties to establish which ones can cook faster while still retaining their taste, color, shortlisting 12.



Jemimah Njuki, Senior Programme Specialist at the International Development Research Centre, said:

“This innovative partnership combines research and private sector expertise to move a product into the market, responding directly to our objective to have impact at scale. These will save women’s time and improve nutrition. What we like about working with this type of partnership is that they make products more easily available for low- and middle-income households – especially women.”

The products are also good news for farmers like Nancy Adhiambo. Already a bean grower, she struggled to find a good market and price for her beans. Then, through local charity Caritas Internationalis, she found out about two of the 12 varieties sought by Lasting Solutions.

The development of precooked beans and bean snack products use the Commodity Corridor approach, which brings together partners in bean production, distribution, and consumption hubs.

The US\$2.5 million, three-year project, is funded under the Cultivate Africa’s Future Fund, a program of Canada’s IDRC and the Australian Centre for International Agricultural Research (ACIAR). The pre-cooked beans project is led by KALRO in Kenya, and in Uganda by NARO, with CIAT through PABRA.

Joab Ouma, Director of Lasting Solutions, a partner in the development of both products, said:

“This partnership combines knowledge about beans, with the needs of consumers.”

When Lasting Solutions reaches full capacity, it expects that ten percent of customers across Kenya who currently buy dry beans, will switch to pre-cooked beans.

Kenya Agriculture and Livestock Research Organization (KALRO)’s National Coordinator for Grain Legumes, David Karanja, said the products will also help Kenya plug a 60 percent gap in local consumer demand, while building capacity of local industries to generate income.



Drought-beating Beans

TRIPLE YIELDS

George Oketch Achola is a farmer on the banks of Lake Victoria, Western Kenya, earns 70 percent of his income from beans. He supplies Lasting Solutions Ltd. with improved bean varieties.

He has more than tripled his production using new varieties, which he discovered through PABRA members including the local charity Caritas Internationalis.

“These new beans are drought resilient and higher yielding.”

George Oketch Achola

Now, from 2 kilograms of seed, he produces 90 kilograms of beans to sell – compared with the 20 kilograms possible with local varieties. He can put more nutritious meals on the table, and invest the profit back into his home and family.



FINDING Buyers TO BOOST Returns

For years, Nancy Adhiambo, a farmer in Western Kenya, had struggled to find a good market and price for her beans. Then, through local charity Caritas Internationalis, she found out about two new varieties, which could fetch a good price from a local private company - Lasting Solutions Ltd.

“These new beans mature faster and demand is higher”

Nancy Adhiambo

She added that more local customers are buying them too, helping her boost her income.

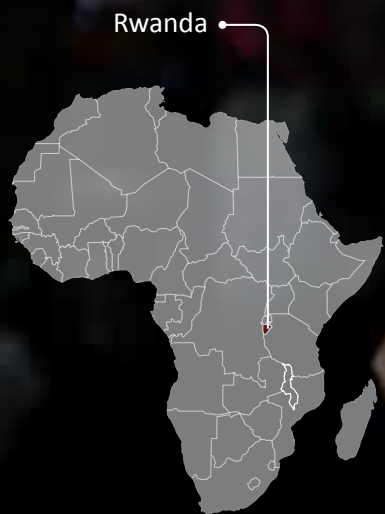
What next?

- PABRA's Commodity Corridor approach requires investment to inform policymakers about where to prioritize infrastructure support bean to improve bean trade.
- Investing in CIAT's public-private partnerships ensures that farmers can better access improved and certified seeds on local markets.
- Our research supports continued breeding and development of new bean varieties which stay ahead of new challenges and respond to market demands.

NEW STUDY SHOWS

Eating high-iron beans

REDUCES IRON DEFICIENCY IN MONTHS



This study shows that eating specially-bred, high-iron beans twice-a-day for just four-and-a-half months reduced iron deficiency and anaemia in young women in Rwanda.

Iron deficiency is the world's leading nutritional ailment, particularly in developing countries. It can impair cognitive and physical development in children, while anemia, often caused by iron deficiency, increases risks to women during childbirth. Despite efforts to curb iron deficiency through supplements and fortified foods, it continues to affect an estimated 2 billion people worldwide.

The findings, published in The Journal of Nutrition, are the result of an 18-week study involving iron-deficient women in Rwanda. It is the first of its kind to show that eating "biofortified" beans bred to contain more iron has a significant impact on iron levels in the blood.

Mercy Lung'aho, a nutritionist at PABRA and CIAT, and co-author of the study said:

"It really breaks my heart as a woman, as a mother and as a daughter of this continent, to see women and children suffering from malnutrition."

These results are tremendously exciting because they show for the first time that these beans are an excellent vehicle for delivering long-term, low-cost solutions to a major health problem. This has profound implications for global nutrition, and public health policy.

Mercy Lung'aho, a Nutritionist at PABRA and CIAT

The beans were developed through HarvestPlus, a joint initiative of the International Food Policy Research Institute (IFPRI), and CIAT. Using native American beans conserved in the CIAT genebank that are naturally high in iron, scientists crossbred them to adapt them to tropical environments and to ensure acceptable grain color, among other traits, and sent to Rwanda.

"In this study we see a significant reduction in iron deficiency and also an increase in hemoglobin levels of women who ate iron beans."

All consumers have to do is to replace the common variety of beans with more nutritious biofortified varieties.

Lead Scientist Jere Haas, of Cornell University

While previous studies have shown that staple crops like rice and pearl millet bred to contain more iron can have a positive effect on iron levels in the body, the new study shows the most impressive increases in iron uptake of all the crops studied so far, say authors.

The new findings are not just good news for Rwanda, which has one of the highest per-capita rates of bean consumption in the world, but also bean-producing countries across Africa, and Latin America, where iron deficiency is also widespread.

What's next?

- Efforts are required to further improve the biofortified bean yields beyond those of standard beans to include traits such as disease resistance or adaptation to poor soils.
- Biofortified beans need to reach farmers in the form of seed for planting, and creative mechanisms are needed to achieve this on a broad scale in different regions of the world.
- Biofortified beans must be part of public health policies to address malnutrition. Nutritional education is needed to constitute a healthy diet and balanced 'food basket'.



Magic beans IN MALAWI



In 2016, Malawi suffered the worst drought in 30 years, attributed to a particularly severe El Niño weather cycle. It left the country's central and southern maize-growing areas in ruin. But while the maize withered, some beans developed by CIAT and partners through PABRA were bucking the trend. Weathering the drought, the pods were plump and ready for harvest.

“As a result, local farmers started calling them ‘magic beans’.

said Rowland Chirwa, Regional Breeder and Coordinator of SABRN

The beans had bred to mature early – in around 60 days instead of the usual 90 or so. It's an escape mechanism against the crippling effects of drought. The beans also have longer roots, helping them reach water deeper in the soil. Mesoamerica, the area from Central Mexico down to northern Central America, is the ancestral home to the magic beans. Their ancestors were collected and conserved in the CIAT genebank in Colombia, and screened for interesting traits.

That's where they were found to have the potential to withstand drought. They were crossed and selected for drought tolerance by bean scientists at CIAT headquarters and then sent to Malawi. Next followed research station trials, and then field trials with farmers, via CIAT-led PABRA, together with the Malawi's Department of Agricultural Research Services.

These helped researchers pinpoint the two most promising varieties. More recently, the team in Malawi has been testing the beans with different combinations of chemical fertilizer and manure, as well as intercropping them with maize. Seeing the success of the trials from the roadside, other farmers have started asking where they can get the seeds. CIAT scientists hope the beans will be commercially released soon, offering farmers a safety net when the rains fail.

Initial trials of the “magic beans” in Malawi were supported by Germany's Federal Ministry of Economic Cooperation and Development (BMZ). Subsequent work was part of the Africa RISING project, a multi-donor, multi-partner effort led by Michigan State University and funded by USAID.



What's next?

The performance of “magic beans” could be further enhanced through research to:

- Incorporate other desirable attributes in drought-resilient bean materials, such as larger seed size and shorter cooking times.
- Determine optimum plant density in a maize-bean cropping system to maximize yields.
- Combine traits for drought resilience with heat resilience as well, since drought-affected areas in Southern Africa are also associated with higher temperatures.



Ruben Otsyula, a KALRO Breeder with Jonathan Mayer of Bubayi Products Ltd. Photo by Jean-Claude Rubyogo.

The catalyst for change came from catastrophe in Kenya, when farmers in the western part of the country had their maize harvest wiped out by disease in 2012.

Jacinta Majimbo, a bean farmer from Bungoma district in Western Kenya, often ended up with plants that only had a few pods. Then she discovered bean KK-8.

Now she can find the large, red mottled bean on a shop shelf in clear packaging with labelled credentials: an early-maturing, high-yielding, quick-cooking seed, that is resistant to root rot.

For **Jacinta**, the advantages of harvesting an additional 35 kilograms of beans each season are obvious.

"It provides more food, and I can sell some to pay for school fees and other expenses, KK-8 has made a big difference."

Jacinta Majimbo

Yet until a few years ago, she had never heard of it – or been able to find it at the market.

During the time that Kenya's maize was hit by disease, **Jonathan Mayer**, joint-owner of Bubayi Products Ltd – a family-run seed business in Kenya's North Rift region – saw a big gap in the market.

"I saw what disease was doing to maize. It was wiping out entire harvests. Farmers needed access to alternative crops that weren't available at their local agro-dealer,"

Jonathan Mayer

Bubayi had the necessary infrastructure, land and skills to produce "quality seed" of a high standard for farmers. And unlike other companies, they were also willing to take the risk and invest their own money.

Joining forces with the Kenya Agriculture and Livestock Research Organization (KALRO) and One Acre Fund – with a ready market of 167,000 potential customers with a growing interest in bean seed – they took the risk.

Supported by the Syngenta Foundation for Sustainable Agriculture, through PABRA, Bubayi, One Acre Fund and KALRO made KK-8 and other improved beans available to farmers.

For example, 80 grams of the high-performing bean, CAL194, were supplied to Bubayi Seed Company in late 2014. Two years later, 7,550 kilograms of breeder seeds were ready for the market. "That's the power of the private sector," said seed systems specialist and Coordinator of the East and Central Africa Bean Research Network (ECABREN), Jean-Claude Rubyogo.

George Osure, Regional Director for the SFSA in East Africa, added: "Partnerships have transformed bean markets in Rwanda, Burundi and Kenya – successes which can be replicated in other countries."

Farmers like Jacinta are already realizing that with a minimal investment in higher quality, certified seeds they can triple their yields and avoid disappointment at harvest.



What's next?

- Further investment could lead to better partnerships in Tanzania, Uganda, Malawi, Zimbabwe and Zambia to register varieties and issue licenses.
- Policy makers could invest in cataloguing standards, to spur cross-border trade and speed up new varieties releases.

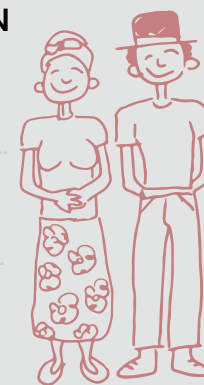


US\$1 MILLION donor investment has generated more than US\$3 million in revenue

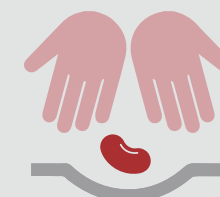
146,000 FARMERS in Rwanda, Burundi and Kenya now have access to improved varieties.



On average, **15KG** per farmer



Potential income per kilogram of improved beans planted:
US\$16



More farmers are producing certified seed, disseminated in smaller packs through agro-dealer networks



This has reduced the distance farmers need to travel from **200 TO JUST 2 KM**

30-50%

In Tanzania, private sector partnerships show that bundling improved bean seed with a seed dressing chemical – which can increase bean profitability by 30-50 percent – has led to doubled yields for some farmers.

Finger ON THE PULSE OF A drought resilient FUTURE

Against a hilly backdrop, Daud Bukuku and his wife Neema Obeti examine a handful of red speckled beans from a large basket. The open fields behind them have just been harvested. But they're lucky to have had a harvest at all – the beans they proudly shows us didn't bring a harvest for everyone.

Even they had a lucky escape. Working together with the Agricultural Research Institute Uyole in the Southern Highlands of Tanzania, Daud made a call to find out from researchers there which beans could be planted to beat the drought and maintain high yields.

He found out about Uyole 03 – an improved, drought-resilient sugar bean variety being tested – and decided to invest in it, planting some local varieties as well, just in case.

Impressed with the hardier Uyole 03 beans, Daud and his wife now plant these on a regular basis. From one acre, this season they harvested 700 kilograms of beans – compared to the 150 kilograms they got when planting local varieties.

“Others who grew local varieties harvested nothing.”

Daud Bukuku



In addition, at least 95 percent of the improved beans germinated, while none of the local beans did.

Researchers at ARI Uyole are also linking bean farmer groups, mostly women who dominate the bean retail sector - with the private sector to ensure they have a fixed minimum price, when they harvest.

Daud now supplies 295 farmers with seed, up from nine when he first started three years ago. He also sells commercial bean grain to a private company, Raphael Group Limited, for export.

“When I grew only maize I wasn't getting any profit.”

“The yield from beans wasn't that good – 120 kilograms wasn't enough to make money.”

Now, he and his wife keep cattle and pigs, have started a project to grow improved avocados, and have invested in a bio-gas plant.

“We'd like to ask the researchers to keep us informed of improved varieties, and which markets we can aim for.”

This research is funded in the framework of the Tropical Legume III project by the Government of Tanzania through the Bill & Melinda Gates Foundation (BMGF), and jointly implemented by ARI-Uyole and the International Center for Tropical Agriculture (CIAT).

What's next?

- Through PABRA, cheaper packs of inputs including seeds for improved varieties and fertilizers can be replicated at scale to provide more beans over a larger area.
- By investing in private sector partnerships, more farmers can have access to improved varieties and markets for their product.



Zimbabwe

TRANSFORMING a Landscape AND DOUBLING INCOMES

In Zimbabwe, nutritional deficiencies and chronic malnutrition persist in some areas. Yet while beans have the potential to diversify diets and boost nutrition, in areas like Manicaland province, farmers either do not produce common beans, or producing very little, and are skeptical about new varieties.

The new common bean variety, NUA45, released in 2010 by the Crop Breeding Institute of the Department of Research and Specialist Services in Zimbabwe, was not spared by the adoption challenges. The NUA45 bean, despite being rich in proteins, minerals and fiber, was released into the community and yet farmers were reluctant to take it up.

To solve the impasse, the CIAT-PABRA Bean Production Support Initiative, supported by the Swiss Agency for Development and Cooperation

(SDC) and in partnership with the Department of Research and Specialist Services, launched a well-coordinated forum, bringing bean farmers and all stakeholders along the value chain, to discuss strategic actions for enhancing uptake of the bean.

The approach, known as the Innovation Platform for Technology Adoption, led to a remarkable transformation in the attitudes of the farmers participating in the forum.

“Farmers actually wanted to own the new improved bean varieties; to be part of the success in seeing them spreading across the landscape.”

Gutsa Freeman, Principal Research Economist at the Harare Research Station.

Since 2010, the number of farmers growing the beans within a pilot area has increased from 11 to 79 percent. Yields have doubled, from 0.9 to 1.8 tons per hectare. Despite drought, which has severely affected yields, returns from NUA45 bean sales per farmer have risen from an average of US\$90 to US\$252.

“We now develop new varieties together with the farmers.”

“The new approach allows us to hear the voices of the people who will grow and earn an income from the beans. Farmers need to profit from their hard work, and with this new approach, we are working together to find varieties that are high yielding, high in nutritious qualities, and earn farmers a higher income too.”

Gutsa Freeman, Principal Research Economist at the Harare Research Station.



MORE NUTRITIOUS *Flour* FOR URBAN CONSUMERS- AND A BETTER PRICE FOR FARMERS

When **Tei Mukunya**, Director of Azuri Health, prepared meals for her 112 year old grandmother, she had a realization.

“It wasn’t easy to find a good range of nutritious, easily digestible foods that she liked.

Most flour was made from maize, and having a range of vegetables and nutritious crops in flour wasn’t a possibility.

Tei Mukunya, Director of Azuri Health

So she and her family, working with women's groups, started making a nutri-porridge flour that contained other nutritious crops like beans and amaranth.

“My grandmother really noticed the difference, and felt much better. It showed me that nutritious food can have such a big impact on people’s lives.

With experience in marketing, she decided to shift her focus to producing and distributing nutritious flour and dried fruits for urban consumers.

“People are busy, and convenient foods are not always nutritious. Our products are aimed at those who want an affordable, healthy product, that doesn’t take much time to prepare.

Since she started her company Azuri Health in 2010, production of dried fruits, sweet potato flour, and bean porridge, has jumped from 300 kilograms to 4 tons a year today. Her products are available across Kenya – 90 percent of her market is major retail outlets, but she also supplies to smaller urban shops.

She has her sights set on exporting as well. She’s already received calls from interested buyers, and is in the process of setting up the rigorous standards required to enter the European market.

She’s testing the first of eight solar-powered “bubble” driers to be installed in Kenya and Uganda, as part of a project supported by Germany’s Federal Ministry of Economic Cooperation and Development, to fight malnutrition among 50,000 rural and urban consumers.

During harvest time, all too often rain can damage crops as they dry. The driers retain bean quality and commercial value, while retaining all the nutritious qualities before they are turned into a porridge flour.

The project partnership includes the Kenya Agriculture and Livestock Research Organization, supplying farmers with improved, nutritious and higher yielding bean varieties, which Azuri Health will then buy.

Farmers are excited by this prospect. Joseph Kamoing, a member of the SATEWA group - an acronym merging the names of three villages - of 500 farmers growing the improved beans, says he can earn almost double the price he is currently earning with local varieties through the new partnership.

“With these improved beans, ‘Chelalang’, we can get 7-8 bags for beans, compared with 2-3 bags using local bean varieties,

Usually we sell one bag for US\$34 but Azuri Ltd. have promised US\$58. The extra income will help buy fertilizer for next season and pay school fees.

As part of the project, scientists will also study malnutrition levels, where families source food, and how much they pay for it. This will generate a deeper understanding of which nutrients are a priority for adding to the porridge and how to best price the product for target consumers.

This work is part of the project “Making Value Chains Work for Food and Nutrition Security of Vulnerable Populations in East Africa” supported by Federal Ministry of Economic Cooperation and Development (BMZ), the German Society for International Cooperation (GIZ), and the CGIAR Research Program on Agriculture for Nutrition and Health (A4NH).

The project is led by the International Center for Tropical Agriculture (CIAT), in collaboration with the University of Hohenheim (UHOH), University of Göttingen (UGOE), Kenya Agriculture and Livestock Research Organization (KALRO) and Ugandan National Agricultural Research Organization (NARO).

What’s next?

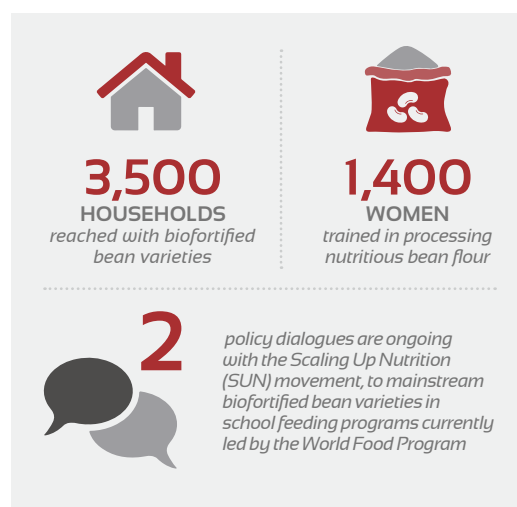
- Further research is needed to investigate consumer behavior, to improve diet choices.
- Farmers can benefit from bulking their produce to sell to companies like Azuri Health, but often they are skeptical. Good examples of success like this are needed to deepen trust, and can be used in other areas to improve incomes and nutrition for consumers.



Burundi

BUILDING Partnerships TO FIGHT MALNUTRITION

In spite of its fragile state, Burundi saw much progress in nutrition in 2016. A strong partnership between the Ministry of Health (PRONIANUT) and the Ministry of Agriculture (ISABU) has led to 11 farmer cooperatives receiving training on how to produce nutritious bean flour for the market and household consumption. A community crèche has been set up for mothers, accepting 351 children two to five years old. Two community members take turns caring for the children while the other mothers are out farming. A bean-based porridge is prepared for the children at the crèche.



SETTING HER Sights HIGH

Christella Ndayishimiye started her business TOTOHARA in 2009 with just a few bags of bean flour for friends. Today, she now sells four metric tons of flour a month and is struggling to keep up with demand. Her new product add value to beans, fetching better prices for her and the farmers who supply her business, while also nurturing consumers.

"I saw that older and younger people needed more nutritious food. But the flour sold at the market was not of high quality or nutritious, so I started making it for my family, neighbors and friends. It was really popular and soon they convinced me to start making it for others as well."

Christella got the idea for making the flour from a training session she attended, facilitated through PABRA. Glancing over at the neat rows of bean flour she has on the shelves of her shop, she reflects on her progress.

"Now I have bought a bicycle to transport the bean flour bags to small markets to supply different customers in Bujumbura. My family has relied on the income from this factory – now I can send my children to school and I have also adopted one child. My hope for TOTOHARA is to expand to other countries, so we can even export," she said.

What's next?

- Development projects providing free composite flour for pregnant women are distorting the market and research is needed to train others about the benefits of partnering with private sector entrepreneurs like Christella Ndayishimiye.
- Further dialogue is needed among the agriculture and nutrition sectors to evaluate the sustainability of investments, to ensure a sustainable, food secure, future.



MULTIPLYING Nutritious beans TO TACKLE MALNUTRITION

Richard Hatungimana works with PABRA through the Institut des Sciences Agronomique du Burundi (ISABU), to multiply high quality beans for more farmers in Burundi. Since he started growing high-iron climbing beans in 2012 on just one hectare of land, he has bought another seven hectares. He used the income from the extra yield to reinvest around US\$17,000 back into his farm in the last five years. He now also has livestock and grows other crops on his farm.

STORIES FROM THE FIELD



VILLAGE OF *nutrition*

The “Village of Nutrition” is an initiative in Madagascar by PABRA and local partners to fight malnutrition.

The initiative has two objectives: first, to improve the nutritional status of vulnerable groups, with a focus on pregnant women and nursing mothers; children under five years of age; and school children or unschooled children between six and 14 years of age. Second, to improve household food security in Masindray Village.

Masindray village, located 19 kilometers from the capital Antananarivo, was selected by partners as a vulnerable site, where 95 percent of the community are farmers and chronic malnutrition affects half of the population.

To tackle malnutrition, activities included culinary demonstrations and the planting vegetable gardens in community centers and schools. A focus on school nutrition included bean based porridge in school feeding programs, among other activities.

Between January and June 2016, the prevalence underweight in children fell by five percent. From this experience, it is clear that in low income countries, the health and agricultural sectors must join forces and promote initiatives together to fight malnutrition.





FARMERS IN *Uganda* TEAM UP WITH SCIENTISTS TO FIND *better beans*



Sunny Mbeeta Abwooli knows how to whip up a delicious meal, especially when it involves one of her favorite ingredients: beans. “We have many varieties of beans,” says Sunny, pointing to a colorful basket of different bean types.

“They are different in color, taste; how they grow. They are all important in my home because they’re easy to grow; to keep during times when food is scarce – even easy to cook and prepare.”

Sunny Mbeeta Abwooli

But since witnessing the severe impact of drought on her bean yields, she’s done more than just prepare them for the table. In recent years, as chairwoman of the Kyamaleera Woman’s Handicraft Association, Sunny and more than 300 other farmers in western Uganda – more than half of them women – joined forces with scientists.

Between 2012 and 2013, the farmers in western Uganda were given 15 different bean varieties to test on their plots. Over three seasons, the farmers – together with researchers from the National Crops Research Resources Institute (NACRRI) in Uganda and CIAT – tracked height, yield; number of pods per plant and disease resilience of each.

Pointing to a small, round, black variety from the northern part of Uganda, Sunny offers up a nugget of information that emerged during her participation in the research. These small black varieties did best during her trials – and those of many others. But this bean was not selected by farmers as their favorite choice. Why? Although they were found to beat drought and survive excessive rainfall better than some local yellow and red varieties, these beans are not a traditional part of the diet in Western Uganda.

Dr. Clare Mukankusi, regional bean breeder with PABRA, explains:

“We wanted to see if farmers would make trade-offs depending on the weather – to see which varieties they would select and why.”

When farmers saw that NABE2 – the black variety – could withstand flooding and drought, they said they would grow it in those weather conditions. But in reality, farmers are looking for income at market first – they will grow varieties they are already familiar with.


Dr. Clare Mukankusi, Regional Bean Breeder

Yet the research also found that women were more inclined to make trade-offs between climate adaptability and marketability.

“That’s probably because women worry more about nutrition security in the home, and putting food on the table,”

What the results show us as breeders, is that while growing different bean varieties can ‘buffer’ farmers against the impacts of climate change, we need to keep market demand in mind, at the same time as yield performance, or resilience to drought and excessive rainfall conditions.

That’s why the participation of local farmers in selecting best varieties is key.

A woman with dark hair, wearing a blue denim jacket, is smiling and looking at a tablet computer she is holding. The background is a blurred outdoor setting with trees and a bright sky. The text 'THE Open Data Kit LAUNCHED' is overlaid on the bottom left of the image.

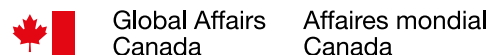
THE *Open Data Kit* LAUNCHED

Launched by PABRA in early 2016, the Open Data Kit is a mobile-based platform which allows field data to be collected offline, and then loaded into a central database later when an internet connection is established, making it smarter than previous versions. The data is sent to a central database, instantly accessible to anyone else in the PABRA team by smartphone.

To date, the Kit has been used by researchers to monitor improvements in yield of specific bean varieties for example. It also collects important information about bean producers and bean plot soil samples, as well as seed amount sown, harvested, sold and the location of participating shops and markets selling farmers fertilizer and other inputs. This helps us to understand how well PABRA interventions are being received by farmers, to better target expansion of new varieties for example, into new areas. The tool can also be used to help researchers answer questions, by prompting requests for specific data.

Members of the network have already started using the tool, and are in the process of establishing standard procedures for data collection with support from a Monitoring and Evaluation team. Virtual training has also been organized, and PABRA members in Uganda, Malawi, Zimbabwe and Burundi have already started using the Kit to capture field data.

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