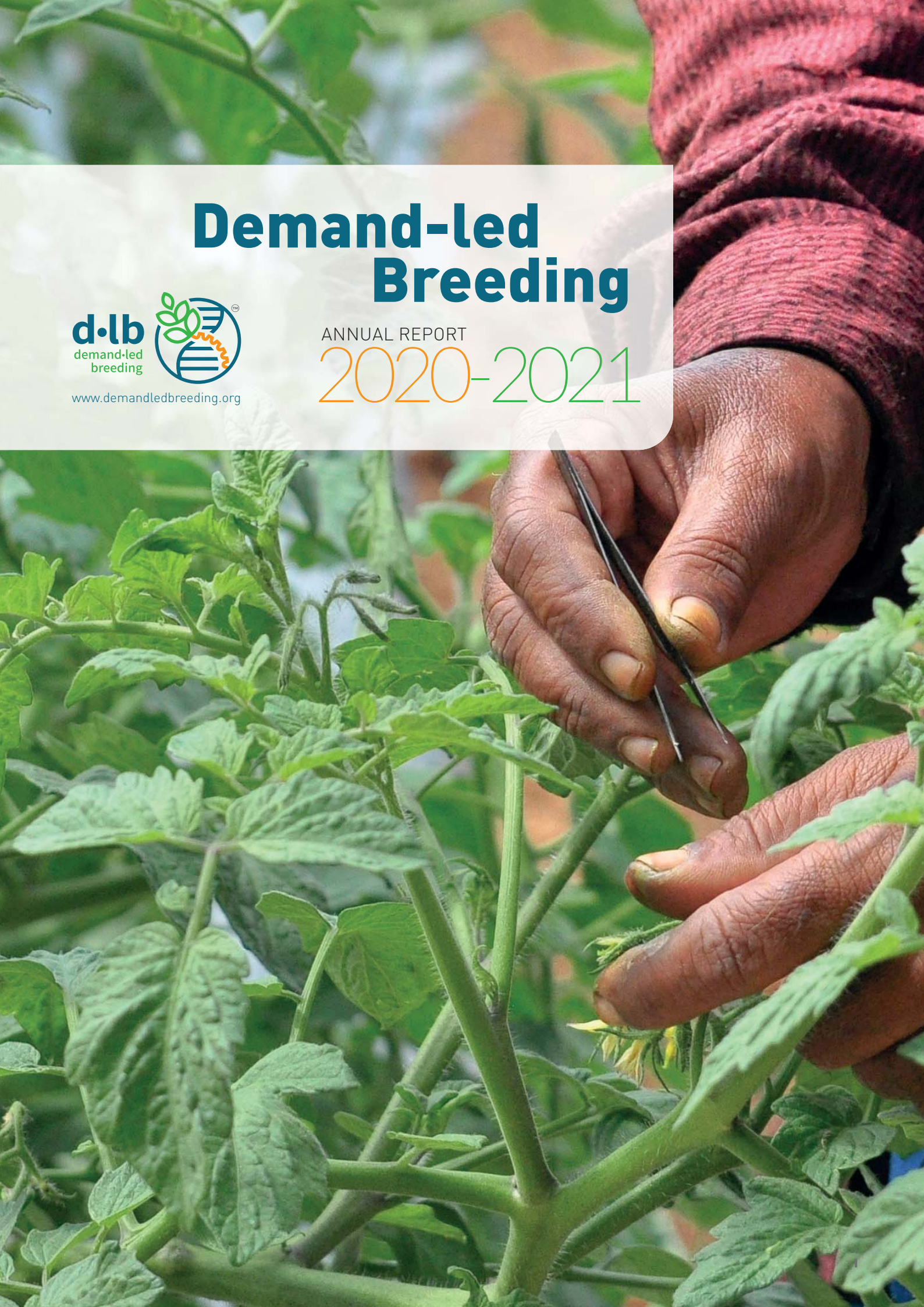

Demand-led Breeding

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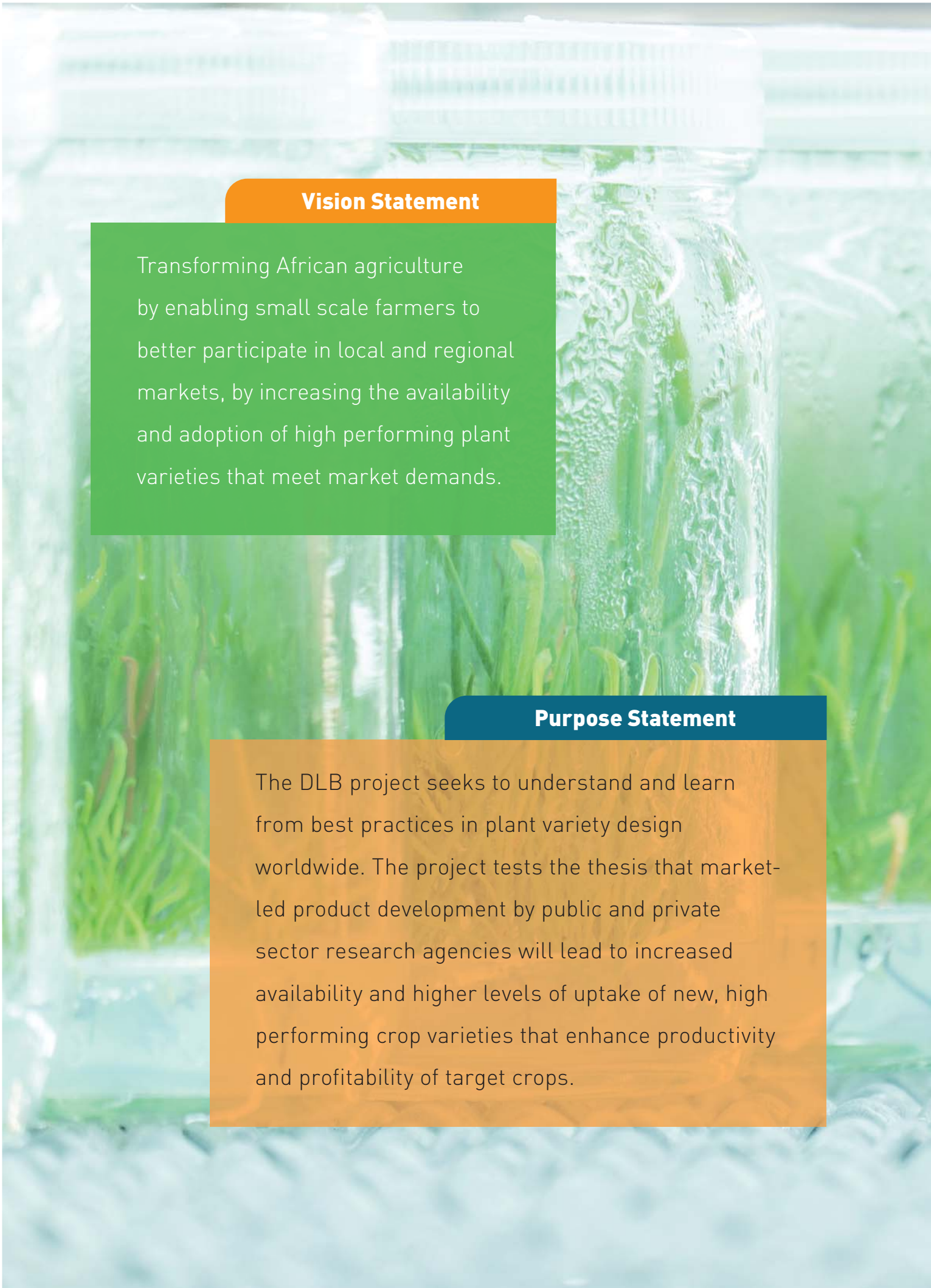
ANNUAL REPORT

2020-2021



Vision Statement

Transforming African agriculture by enabling small scale farmers to better participate in local and regional markets, by increasing the availability and adoption of high performing plant varieties that meet market demands.

Purpose Statement

The DLB project seeks to understand and learn from best practices in plant variety design worldwide. The project tests the thesis that market-led product development by public and private sector research agencies will lead to increased availability and higher levels of uptake of new, high performing crop varieties that enhance productivity and profitability of target crops.

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CONTENTS

1 EXECUTIVE SUMMARY

INTRODUCTION

The aim of the project on *Demand led Plant Variety Design for Emerging Markets in Africa, which commenced in 2015,* is to accelerate uptake and use of new crop varieties that meet farmer needs, consumer preferences and market demand in Africa. These new varieties are designed to meet client needs by connecting plant breeders with crop value chains, seed distribution organizations and encouraging enterprise and entrepreneurship in transforming agriculture in Africa.

Central to the transformation of agriculture in Africa is identifying market demand and developing new products with suitable characteristics to meet market requirements. Such demand can originate from producers, processors, and/or consumers. A more customer focussed approach to plant varietal design will affect public and private sector plant breeding programs. Decisions on determining the preferred traits for which to breed new varieties are paramount for success. Private sector companies have considerable experience worldwide in developing new crop varieties that fit the needs of customers. This experience in plant variety design can add value to public as well as private sector breeding programs in emerging economies. As economies mature and markets expand, it can be expected that the private companies will also become increasingly involved in breeding new high performing varieties (HPVs) to meet customer requirements and market demand in emerging economies.

PROJECT GOAL AND OBJECTIVES

Project goal: To contribute to the transformation of African agriculture by enabling small scale farmers to better participate in local and regional markets, by increasing the availability and adoption of high performing plant varieties that meet market demands.

Objective 1: Best practices in plant variety design: To enable plant breeders to develop new high performing varieties that meet customer requirements and market demand, by having increased access to and ability to implement start-of-the art knowledge, methodologies and best practices from the public and private sectors on demand led plant variety design.

Objective 2: Education and training: To build capacity within plant breeding programs on demand led variety design, through strengthening education and training programs for plant breeders, including through post graduate curriculum development and new professional development programs on demand led plant variety design for plant breeders in Africa.

Objective 3: Policy analysis and advocacy: To provide evidence to support new policy development and investments in plant breeding that will help generate more high performing varieties to meet emerging market demands, with emphasis on Africa.

RESEARCH STRATEGY

The project aims to:

- Encourage *market-led approaches* to determine breeding targets within crop improvement programs, especially in Africa. This will enable research leaders to have access to and interpretation of high-quality data about a range of business drivers and views of stakeholders. These business drivers and stakeholders will influence demand and determine the rate of uptake of new technologies, specifically new varieties of crops grown for food security and/or income generation.
- Develop, disseminate and communicate about a set of *new decision* support tools that will enable R&D programs in Africa to obtain and evaluate information about market demands and use this information to set targets and product specifications within plant breeding programs;
- Expand the use of *innovative approaches to plant breeding* that drive delivery of new seeds, uptake and purchasing of new varieties, technologies, and other inputs by smallholder farmers in Africa.

The project will seek to understand and learn from best practices in plant variety design globally, in the private sector and in leading public research agencies with outstanding track records in uptake of their research outputs. The project will test the thesis that market-led product development by public and private sector research agencies will lead to increased availability and higher levels of uptake of new high performing crop varieties that enhance productivity and profitability of the target crops in selected countries of Africa.

Success in demand-led plant breeding depends on the following factors: Breeding targets and quantitative goals are set; new varieties reach and fulfil client expectations; a development strategy is designed for each new variety; a delivery investment plan is in place; and emphasis is given to the views of both farmers and consumers from rural and urban areas. Success

in demand-led plant breeding will be determined by the adoption and use of the new varieties that meet the market-led demands throughout crop value chains.

The intended **research outcome** is that plant breeders in Africa will adopt more demand-led approaches to plant breeding, including in the design of new plant varieties that respond to the preferences of farmers, consumers, and others along the value chain.

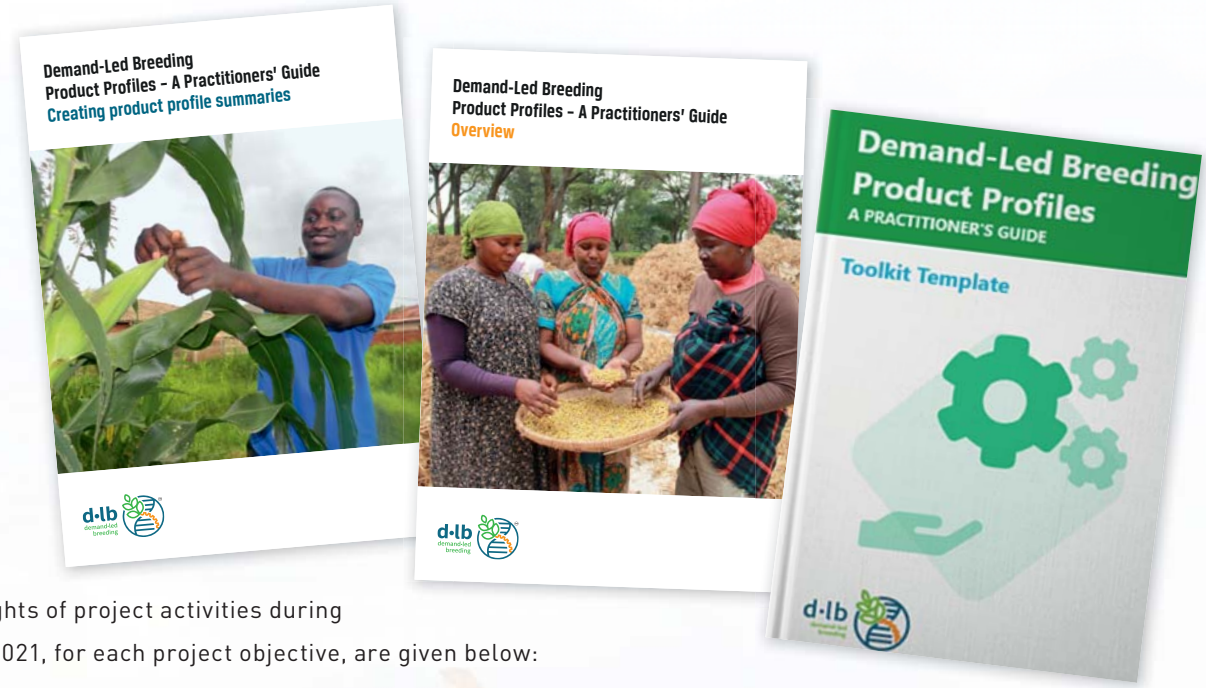
PROGRESS TOWARD OBJECTIVES

The progress towards achieving the project goal and the three project objectives and the activities and outputs achieved are summarised in this Annual Report which covers the period July 1 2020 to June 30 2021. The highlights include the following:

Expanding partnerships with African national agricultural research institutes and universities: The key project partners in Africa include two regional centres of excellence specialising in post graduate education of plant breeders, and an increasing number of partners within national agricultural research systems (NARS), African universities and international organizations. The key partners include the African Centre for Crop Improvement (ACCI) at the University of KwaZulu Natal in southern Africa; the West Africa Crop Improvement Centre (WACCI) at the University of Ghana; the Alliance of Bioversity International and the International Centre for Tropical Agriculture (CIAT) and the Pan African Bean Research Alliance (PABRA); the Ethiopian Institute of Agricultural Research (EIAR); Haramaya University, Ethiopia; the National Agricultural Research Organization (NARO), Uganda; Makerere University, Uganda; and the University of Nairobi, Kenya.

Demand led breeding community of practice developed with plant breeders in Africa: The DLB project has developed a demand-led breeding "community of practice", composed of more than 400 plant breeders working within African national agricultural research systems (NARS) in eastern, southern and West Africa. The members of the DLB community of practice are primarily African plant breeders who first participated in the DLB sponsored education and training workshops, some 24 of which have been held between 2015-2021. These DLB workshops introduced to the African plant breeding community the principles of demand led plant breeding and its applications to crops important for food security and increasing incomes in farming communities throughout Africa. These African plant breeders now constitute a "community of practice" with whom the DLB project team is working to mainstream demand led breeding approaches within national plant breeding programs for a range of crops in the countries of Africa.

The DLB Pan African Coordinator, Dr Nasser Yao, who is based in Nairobi Kenya, is primarily responsible for developing and supporting the DLB community of practice of plant breeders, including making available new education resource materials and establishing regular communication channels and new distance learning opportunities. These virtual educational and professional development activities were initiated in 2019 and have become increasingly important due to the impact of the COVID pandemic through 2020-21. Most countries in Africa, as elsewhere, have restrictions on movement within and between countries, as part of their COVID-19 pandemic control measures.



Highlights of project activities during 2020-2021, for each project objective, are given below:

Objective 1: Best practices in plant variety design

Best practices in demand led breeding include the systematic use of *product profiles* to define the priority traits, as identified through consultations with farmers, consumers, processors, traders, and others in the value chain, for specific crops and countries. The DLB project team have developed and published a set of *Product Profile guidelines*, for use by plant breeders to prepare product profiles for their priority crops in Africa.

Early examples to demonstrate the usefulness of these DLB product profile guidelines have been for the development of product profiles for new bean varieties for countries in eastern Africa (developed by bean breeders working within the EIAR in Ethiopia and the national bean breeding program in Uganda); and new tomato varieties for domestic and export markets in West Africa (developed by plant breeders in tomato breeding programs in Benin and Ghana). These product profile guidelines and tool kit are being used by plant breeders to generate profiles for new varieties in a wide variety of crops in Africa and beyond.

Objective 2: Education and training

A comprehensive education and training program has been developed by the DLB team to build capacity within plant breeding programs in Africa on demand led variety design. This objective is being met by: (i) providing new professional development opportunities for plant breeders in Africa; and (ii) producing and disseminating new education and training materials related to the implementation of demand-led breeding programs.

DLB education and training workshops held in Africa in 2020-21

DLB principles and practices have continued to be introduced to plant breeders in Africa, by means of several workshops hosted by DLB partners in eastern, southern and West Africa during 2020-21. Some of these workshops were face to face meetings while others were virtual events. The teaching and research faculty who planned and led these workshops are all senior African plant breeders who are members of the DLB educators' group.

The DLB educators' group are also co-authors of chapters within the DLB text book published by CABI on "*The Business of Plant Breeding: Market-led Approaches to Plant Variety Design in Africa*" (2017). The textbook continues to provide the core course material for the DLB education and training workshops. Copies of the text book are made available to all workshop participants. The textbook and associated research and educational resource materials are also available to download as open access on the CABI web site at: https://www.cabi.org/products-and-services/about-cabi-books/open-resources/the-business-of-plant-breeding/

Several African universities have now incorporated the demand led breeding approaches, developed through the DLB project, into their formal post graduate teaching programs on plant breeding. These include the post graduate plant breeding courses at the University of Ghana, University of KwaZulu Natal, South Africa, and the University of Nairobi, Kenya.

Developing new education and training materials on demand led breeding

The project is developing additional educational materials during 2020-21, covering three topics: (1) *Creating product profiles; (2) Gender and Diversity in Plant Breeding; and (3) Making the Case for Investing in Demand led breeding.* The product profile publications (1) are now completed, published and are being widely disseminated to plant breeding programs throughout Africa. The new educational materials in the other two areas are in preparation, to be completed during 2021-22.

Product Profiles: Overview and Practitioners' Guide

An important early step in demand led breeding is developing product profiles that identify the priority traits required by various actors along the value chain. A working group of several Africa and international plant breeders met virtually several times during March – July 2020, to address the principles and practice of developing product profiles and to develop guidelines and a methodology for developing and communicating product profiles, which are applicable across a wide range of crops, environments, and markets.

The guidelines for creating product profiles were finalised in mid-2020 and launched in August 2020 at an international webinar, cosponsored by the Syngenta Foundation for Sustainable Agriculture (SFSA) and the DLB project. The launch was attended by some 120 participants worldwide. The DLB series of four publications on Product Profiles cover:

- *Product profiles—A Practitioners Guide: Overview*
- *Product profiles—A Practitioners' Guide: Creating product profile summaries*
- *Product profiles for two new bean varieties in Tanzania and Uganda*
- *Product profiles for two new tomato varieties in Benin and Ghana*

These publications are available on the DLB web site at: www.demandledbreeding.org

Objective 3: Policy and advocacy

Communications

The main DLB communications activities during 2020-21 were focussed on launching and disseminating the *Product Profiles: A Practitioners Guide* and making these guidelines and some early examples of their applications in developing product profiles for specific crops widely available through the DLB Community of practice and to the wider African plant breeding community.

The Africa Centre for Crop Improvement (ACCI) and the DLB team are co-sponsoring a series of webinars during 2021 on "Making the case for investing in demand led breeding in southern Africa". The speakers include a range of business, policy and science leaders throughout southern Africa.

A DLB communications strategy has been developed to guide DLB communications activities through 2021 and beyond. The communications channels will also include new social media channels (Facebook, YouTube, Flickr, Twitter), as well as ensuring that the DLB website is a key site to enable plant breeders in Africa ready access to new publications, teaching materials and other professional development opportunities.

2 SUMMARY OF ACHIEVEMENTS

The purpose of the *"Demand led Breeding"* project is to contribute to the transformation of African agriculture by enabling small scale farmers to participate in local and regional markets, by increasing the availability and adoption of high performing plant varieties that meet market demands. The intended **research outcome** is that plant breeders in Africa will adopt more demand-led approaches to plant breeding to respond to the preferences of farmers, consumers, and others along the value chain. News and educational resource materials can be found on the project website: www.demandledbreeding.org

Forging new Partnerships in Africa, Australia and internationally

The key research and educational institutional partners in Africa are the African Centre for Crop Improvement (ACCI) at the University of KwaZulu Natal South Africa; the Alliance of Bioversity, the International Centre for Tropical Agriculture (CIAT) and the Pan African Bean Research Alliance (PABRA); the West Africa Centre for Crop Improvement (WACCI) at the University of Ghana; the Ethiopian Institute of Agricultural Research(EIAR), Haramaya University, Ethiopia; the Ugandan National Research Organization and Makerere University, Uganda; and the University of Nairobi, Kenya. The project also supports an expanding DLB Community of Practice of some 400 plant breeders working in national agricultural research systems and universities across some 30 countries in Africa. The DLB project is supported by an Alliance for Food Security, formed by ACIAR and the Crawford Fund, Australia and the Syngenta Foundation for Sustainable Agriculture (SFSA), Switzerland. The project is managed by the University of Queensland, on behalf of its co-sponsors.

Product profiles: Overview and Practitioners' Guide

An important early step in demand led breeding is developing product profiles that identify the priority traits required by various actors along the value chain. A working group of several African and international plant breeders was convened in early 2020, to develop guidelines for developing and communicating product profiles. These guidelines are applicable for a range of crops, environments, and markets. The DLB Product profile guidelines and proformas were launched in August 2020, as a DLB series on:

- *Product profiles—A Practitioners Guide: Overview*
- *Product profiles—A Practitioners' Guide: Creating product profile summaries*
- *Product profiles—A Practitioners' summary—Toolkit Template*
- *Product profiles for two new bean varieties in Tanzania and Uganda*
- *Product profiles for two new tomato varieties in Benin and Ghana.*

Demand led breeding community of practice developed with plant breeders in Africa

The DLB project has developed a demand-led breeding "community of practice", composed of more than 400 plant breeders working within African national agricultural research systems (NARS) and universities in eastern, southern and West Africa. The members of the DLB community of practice are primarily African plant breeders who first participated in the DLB sponsored education and training workshops, some 24 of which have been held between 2015-2021. These DLB workshops introduced to the African plant breeding community the principles of demand led plant breeding and its applications to crops important for food security and increasing incomes in farming communities throughout Africa. These African plant breeders now constitute a "community of practice" with whom the DLB project is working to mainstream demand led breeding approaches within national plant breeding programs for a range of crops in the countries of Africa.

The DLB Pan African Coordinator, Dr Nasser Yao, who is based in Nairobi Kenya, is primarily responsible for developing and supporting the DLB community of practice of plant breeders, including making available new education resource materials and establishing regular communication channels and new distance learning opportunities. These virtual educational and professional development activities were initiated in 2019 and have become increasingly important due to the COVID pandemic through 2020-21. Most countries in Africa, as elsewhere, have restrictions on movement within and between countries, as part of their COVID-19 pandemic control measures.

3 IMPACTS

SCIENTIFIC IMPACTS

The intended scientific impact is to ensure greater availability of new, high performing crop varieties that respond to customer needs and market demand, and that this will lead to increased adoption of these new high performing varieties by farmers in Africa, thus contributing to food and nutritional security and income generation.

The DLB project seeks to understand and learn from best practices in plant variety design worldwide. The project tests the thesis that market-led product development by public and private sector research agencies will lead to increased availability and higher levels of uptake of new, high performing crop varieties that enhance productivity and profitability of target crops.

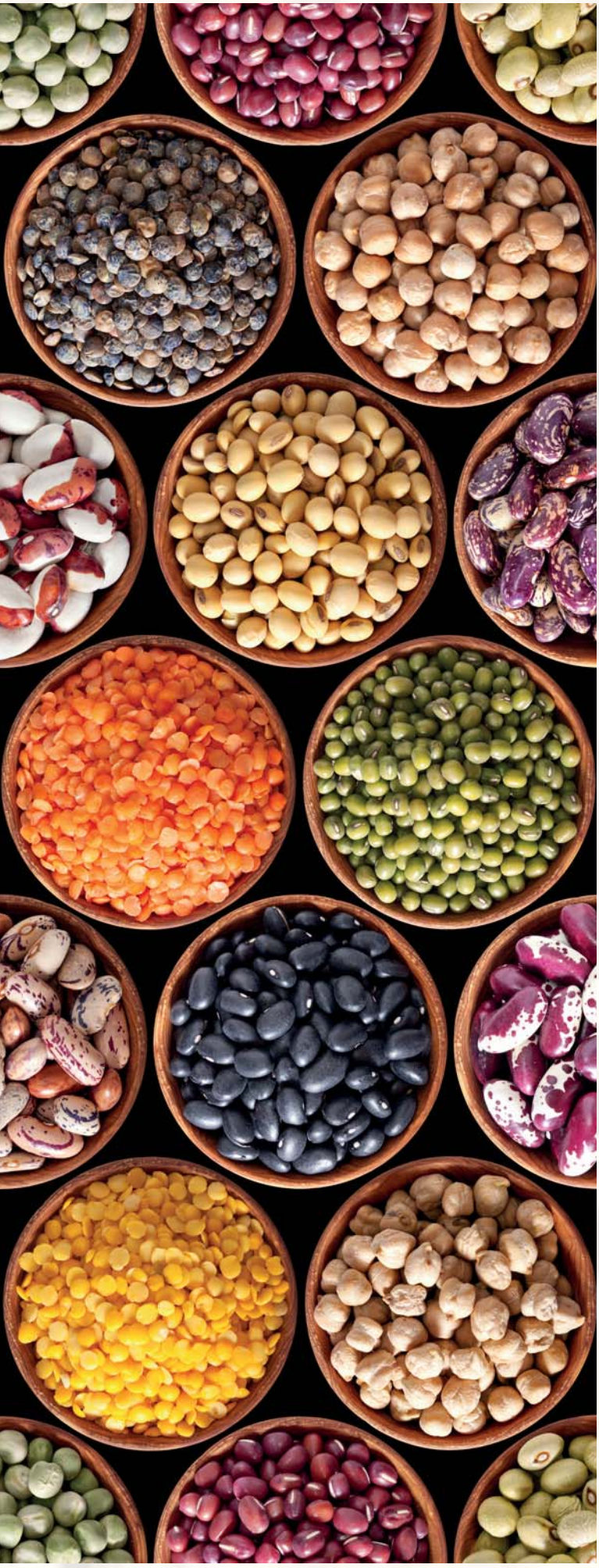
Success in demand-led plant breeding will depend on the development, dissemination, and communication of new decision support tools to the plant breeding community. This will enable R&D programs in Africa to obtain and evaluate information about market demands and use this information to set targets and product specifications within plant breeding programs.

The scientific impacts of this project will be to better integrate all aspects of market demand into the design of new plant varieties. This involves the systematic use of product profiles to define the priority traits identified through consultation with the value chain participants for each crop and country. This approach also includes incorporating demand from farmers (primarily addressing biological constraints), as well as demands from consumers (such taste, colour, quality) and demand from suppliers (e.g., storage quality).

Demand-led approaches to plant breeding are being introduced progressively into regional and national plant breeding programs in Africa by plant breeders who have participated in the DLB project since 2015. For example, demand led approaches to plant variety design are being successfully implemented by project partners for the following crops: Beans in eastern Africa, through PABRA/CIAT and national bean breeding programs in Ethiopia and Uganda; tomato in West Africa, through WACCI, University of Ghana and the Ghanaian national tomato breeding program; rice in Nigeria through the University of Port Harcourt; and Kersting's Groundnut in Benin through the University of Aborney Calavi, Benin.

In the case of the PABRA bean breeding networks across Africa, four years after the first exposure of PABRA bean breeders to DLB principles during phase 1 of the DLB project, many of these bean breeders have made advances on implementing DLB practices into their breeding programs. This includes, for example, by understanding market segmentation and its roles in defining the breeding objectives and engagement of the value chain actors in some stages of germplasm evaluation. Product profile concepts are being mainstreamed with PABRA members in their home countries and national institutions, and by the international bean breeding program led by CIAT, as part of the CGIAR.

In additions, the results from the *market research study on rapid bean cooking time*, commissioned by the DLB project team in Uganda will be shared with bean breeders through the PABRA regional networks in eastern, southern and West Africa to support their utilisation in developing product profiles tailored to their various environments and markets. This data will be used also to develop an investment case for breeding for rapid bean cooking time and other priority traits for farmers and consumers in Uganda.



New scientific partnerships to increase adoption of demand led breeding principles and practice in national and international breeding programs

The DLB project products and tools have been shared with a variety of other national, regional, and international plant breeding programs in Africa. This is exemplified by the CIAT/PABRA Global Breeding lead for Common beans (Dr Clare Mukankusi), who was one of the founding members of the DLB team in Africa in 2015), sharing the DLB website and tools during the PABRA regional steering committee meetings for ECABREN, SABRN and WECABREN, in eastern, southern and West Africa, respectively, and with the Kirkhouse Trust's African Bean Consortium (ABC) during 2020-21.

Africa-Australia research collaboration on rapid bean cooking time: The DLB team is working closely with the University of Western Australia and its new ACIAR funded project on rapid bean cooking time, led by Professor Wallace Cowling at the University of Western Australia. The DLB role is to support this related ACIAR project by facilitating the development of product profiles to target breeding new bean varieties for rapid cooking times in the six project partner countries, and to provide training in DLB approaches to scientists in these countries.

International collaborations: The DLB Pan African coordinator (Dr Nasser Yao) participated in several international meetings during 2020-21, on behalf of the DLB team, and shared the DLB Product Profile suite of publications, including guidelines and a toolkit for preparing product profiles, and examples for use by breeders in preparing product profiles of their target crops.

These international collaborations also included sharing the DLB product profiles tool kit and examples with the SFSA Seeds2B team, for their use in related international programs that SFSA is supporting, particularly *The Accelerated Varietal Improvement and Seed Delivery of Legumes and Cereals in Africa (AVISA).*

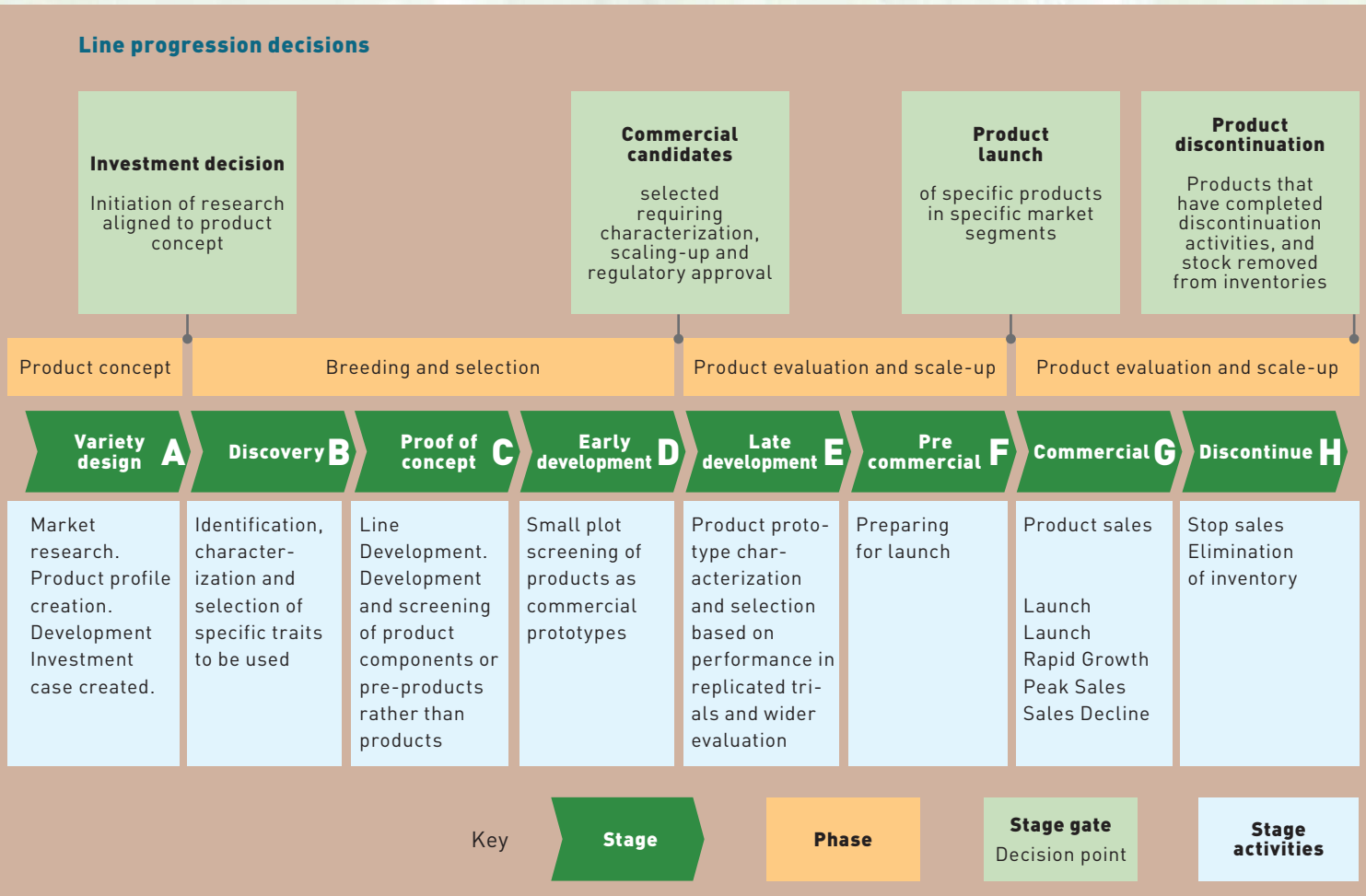
Other international programs with whom the DLB team is sharing its educational resources and expertise include the CGIAR initiatives on Excellence in Breeding (EiB) and Crops to End Hunger (CtEH) and the evolving crop breeding initiatives in One CGIAR. These international programs are all giving increasing emphasis to using product profiles as a means to set targets and determine priorities within and between the crop breeding programs they are supporting.

The DLB approach is to enable crop improvement teams in Africa, including plant breeders and their social science colleagues to work with all actors across the value chain for specific crops, to better understand farmer needs and market opportunities. This knowledge can then be organized into "product profiles", which set targets for plant breeding programs to develop new varieties that have a high chance of adoption by farmers.

The new varieties are designed to reflect farmers' needs, by meeting the biological imperatives of the environments where the crops are to be grown, as well as responding to new market opportunities, especially in regard to consumer preferred traits.

Dr Clare Mukankusi (CIAT/PABRA Uganda) is also the Deputy Lead of the new CGIAR Accelerated Breeding Initiative (together with Dr Michael Quinn, the Excellence in Breeding (EiB) Director as Lead). Based on the relevance and usefulness of the deployment of DLB approaches in PABRA by NARS and the Alliance (Bioversity/CIAT) Bean programs, Dr Mukankusi has introduced the concept of demand led breeding and the DLB guidelines and toolbox for preparing product profiles to the initiative design team (IDT) preparing the Accelerated Breeding Initiative.

A demand led breeding stage plan. Modified version of a Syngenta Seeds stage plan provided by Syngenta. *Acknowledgement: with thanks to Syngenta Seeds, who made this example available to the DLB project via the Syngenta Foundation for Sustainable Agriculture.*



CAPACITY IMPACTS

A comprehensive education and training program has been developed to build capacity within plant breeding programs in Africa on demand led variety design. This objective is being met by: (i) Providing new professional development opportunities for plant breeders in Africa; and (ii) Producing and disseminating new education and training materials related to the implementation of demand-led breeding programs.

Capacity impacts are coming from the project partners working with the teaching and research faculty in African universities and with research scientists and private sector expertise to develop and disseminate new educational materials for introducing new demand led approaches to plant breeding. In addition, there have been new and innovative educational nexus established between Africa and Australia on training of the next generation plant breeders in Africa on demand-led plant breeding approaches.

DLB educational materials incorporated into African university curricula

Several African universities have now incorporated the demand led breeding approaches, developed through the DLB project, into their formal post graduate teaching programs on plant breeding, including the University of Ghana, the University of KwaZulu Natal, South Africa, and the University of Nairobi, Kenya.

Demand led breeding community of practice developed with plant breeders in Africa

The DLB project has developed a demand-led breeding "community of practice", composed of more than 400 plant breeders (120 of whom are women) working within African national agricultural research systems (NARS) and universities in eastern, southern and West Africa. These professionals are working on 31 crops within 28 countries of Africa.

The members of the DLB community of practice are primarily African plant breeders who first participated in the DLB sponsored education and training workshops, some 24 of which have been held between 2015-2021. These DLB workshops introduced to the African plant breeding community the principles of demand led plant breeding and its applications to crops important for food security and increasing incomes in farming communities throughout Africa. These African plant breeders now constitute a "community of practice" with whom the DLB project is working to mainstream demand led breeding approaches within national plant breeding programs for a range of crops in the countries of Africa.

The DLB Pan African Coordinator, Dr Nasser Yao, who is based in Nairobi Kenya, is primarily responsible for developing and supporting the DLB community of practice of plant breeders, including making available new education resource materials and establishing regular communication channels and new distance learning opportunities. These virtual educational and professional development activities were initiated in 2019 and have become increasingly important due to the COVID pandemic through 2020-21.

Most countries in Africa, as elsewhere, have restrictions on movement within and between countries, as part of their COVID-19 control measures. These restrictions are gradually easing and there is more face to face learning at universities and increasing opportunities for safe travel within and between countries in Africa, for example to attend scientific meetings. The African Plant Breeders Association (APBA) intends to meet in Rwanda in October 2021 and DLB will be hosting an event during this annual meeting. Several members of the DLB team in Africa are planning to attend the Rwanda meeting in person.

4 COMMUNICATIONS AND DISSEMINATION

COMMUNICATIONS

The DLB project team and partners in Africa are expanding the DLB communications and advocacy program. A communications strategy has been developed to guide future communications activities during 2021 and beyond. This strategy includes refreshing the DLB web site, as well as using a wider range of communication channels, including social media (e.g. twitter, facebook, youtube, flikr). Expanding these new communications channels is particularly important, when most countries in Africa, as elsewhere, have had restrictions on movement within and between countries, as part of their COVID-19 control measures during 2020-21.

The DLB web site has educational and training materials available as open sourced materials at www.demandledbreeding.org. A refresh of the DLB website is being prepared which will allow greater capability of African partners to update the website on a regular basis with news and add new educational materials, and to host the community of practice working groups on specific crops and breeding topics.

Publications 2020-21

Product profiles: A Practitioners' Guide

A working group of several Africa and international plant breeders was convened under the auspices of the DLB project, to develop guidelines and a methodology for developing and communicating product profiles, which are applicable across a wide range of crops, environments, and markets. These publications were launched at an international webinar, co-sponsored by SFSA and the DLB project, as a DLB series on August 2020, as a DLB series on:

- *Product profiles—A Practitioners' Guide: Overview*
- *Product profiles—A Practitioners' Guide: Creating product profile summaries*
- *Product profiles for two new bean varieties in Tanzania and Uganda*
- *Product profiles for two new tomato varieties in Benin and Ghana*

Other product profiles for a range of crops are being developed by members of the DLB community of practice for their national breeding programs. These are being made available progressively on the DLB web site. Recently prepared product profiles now available include:

- *Product profile for rice variety in Nigeria*
- *Product profile for kersting's groundnut variety in Benin*
- *Product profile for white bean variety in Ethiopia*
- *Product profile for mungbean variety in Ethiopia*
- *Product profile for sugar bean variety in Malawi*

Book chapter

H. Shimelis, E.T. Gwata and M.D. Laing. 2020. Crop improvement for agricultural transformation in southern Africa. In: Richard Sikora, Eugene Terry, Paul Vlek, and Joyce Chitja (Eds.), Transforming Agriculture in Southern Africa: Constraints, Technologies, Policies and Processes. Routledge,Taylor and Francis, London, eBook ISBN978042940170, DOI: https://doi.org/10.4324/9780429401701; pp. 346, https://www.taylorfrancis.com/books/9780429401701

The chapter presents key issues in crop genetic improvement for agricultural transformation in southern Africa. It advocates the need for demand-led variety design in the region for successful variety design, product profiling and market analysis.

DISSEMINATION ACTIVITIES

DLB Virtual Seminars and Presentations during 2020-21

A. DLB sponsored seminars and meetings during 2020-21

Product Profiles – A Practitioners Guide: International Launch and dissemination within Africa of the DLB Product Profiles tool kit and guidelines on product profiling

The primary task of the DLB team in Africa during 2020-21 was to develop and disseminate a Product Profiles "tool kit", with practical guidelines and examples of the usefulness of developing product profiles to guide new variety development, especially within national plant breeding programs. Product profiles are a way to systematically identify priority traits to target when breeding new varieties, which reflect both farmer demands and market preferences. The DLB-led team of African plant breeders continued to work virtually on developing product profile guidelines throughout 2020, including seeking feedback on the emerging guidelines from practicing plant breeders in several countries in eastern, southern and West Africa. The content of the DLB tool kit and suite of publications on Product Profiles - A Practitioners Guide was completed by mid-2020 and preparations made for their launch and dissemination during July – December 2020.

August 27, 2020: International launch of the Demand led Breeding Publications on: *Product Profiles – A Practitioners Guide*

The DLB Product Profile publications were launched at an international webinar, co-hosted by the DLB project team in Africa and SFSA, Switzerland on August 27, 2020. The theme of the launch was: Deployment of Product Profiles and Practitioners' Guide at Research and Educational Organizations in Africa. The launch webinar was attended by some 120 participants from within Africa, including those joining from Benin, Ethiopia, Ghana, Kenya, Mali, Nigeria, Rwanda, Tanzania, and Uganda. There were also additional participants from DLB partners in Australia (ACIAR, University of Queensland and University of Western Australia) and Switzerland (SFSA).

The launch presentations were made by several DLB team members joining the webinar from the DLB partners in eastern, southern and West Africa. These presentations introduced the overall Product Profiles - A Practitioners Guide, a proforma for preparing a new product profile, and examples of the use of the guidelines in developing farmer and market preferred varieties The product profile publications are available at www.demandledbreeding.org

The successful international launch of the DLB Product Profiles tool kit was followed by the DLB team organizing regional webinars, in southern Africa and West Africa. Their purpose was to introduce the Product Profiles tool kit to plant breeders in these regions, especially with those who are members of the DLB Community of Practice.

October 15, 2020: Regional webinar hosted by the DLB Southern Africa node at ACCI

The DLB Product Profiles Webinar for southern Africa was led and hosted by the African Center for Crop Improvement (ACCI) and CIAT Malawi on October 15th, 2020. The webinar was titled "Product Profiling for Plant Variety Design and Commercialisation in Southern Africa". It was attended by approximately 100 participants, coming mainly from Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe. The resources for this webinar can be found at the ACCI website (https://acci.org.za/dlb-workshop-15-October-2020/)

October 23, 2020: Regional webinar hosted by the DLB West Africa node at WACCI

The DLB *Product Profiles* Webinar for West African was led and hosted by the West African Center for Crop improvement (WACCI) on October 23rd 2020. The webinar was titled "Product Profiling: A Practitioners Guide". It attended by 52 participants, mainly plant breeders working in Benin, Mali, Burkina Faso, Ghana, Mali and Nigeria.

B. DLB Policy Webinars 2021: *Making the Case for Investments in Demand led Breeding*

The DLB team in Africa has initiated a series of webinars in 2021, to highlight policy-related issues affecting the successful development of new plant varieties that meet both farmer needs and market preferences. The first of these webinars was hosted by Professor Shimelis Hussein at the African Centre for Crop Improvement (ACCI), University of Kwa Zulu Natal, South Africa in June 2021. The second webinar in the series will be hosted by ACCI in October 2021.

June 29, 2021: DLB Plant variety design for emerging markets in Africa - Policy dialogue in southern Africa

The aim of this online event was to initiate a dialogue amongst policy makers, plant breeders and public and private investors in the agricultural sector, to strengthen plant breeding and to make the case for investing in demand-led plant breeding in southern Africa. There were 230 registered participants, mainly coming from countries across southern Africa. This event involved four keynote speakers (Prof Richar Sikor, Emeritus Professor of the University of Bonn, Germany; Dr Shadrack Moephuli, Chief Executive Officer, Agricultural Research Council, South Africa; Dr Ephrame Kudzaishe Havazvidi, Research Consultant, Seed Co Grp, Zimbabwe; and Dr David Cocharna, Spoor and Firsher, South Africa.

C. DLB Annual core team management meeting 2021

March 9, 2021: DLB Core team meeting

The DLB core team met virtually for its annual management meeting in March 2021. The purpose of the meeting was to review progress towards meeting the project deliverables, and to make any adjustments necessary on the content or timing of the deliverables. There were sixteen participants, including the Pan African Coordinator in Nairobi (Dr Nasser Yao, who convened the meeting), representatives of several African partner organizations in eastern, southern and West Africa, and participants from SFSA in Switzerland and the University of Queensland, Australia.

The DLB team meeting participants reviewed the DLB Phase 2 Workplan for 2019-2021, including the deliverables and milestones. The leadership team considered that most of the deliverables and milestones were on track and those responsible for their delivery expected to meet their due dates for completion.

There were a few deliverables where the responsible parties requested extra time for their completion, mainly to enable additional (virtual) consultations to replace the in person workshops that would normally have taken place to prepare new educational modules, and new methodologies, for example. The deliverables for which the due dates have been extended to December 2021 include:

- Market survey of consumer preferences in bean cooking time in Uganda *(Output 1.2)*
- Completion of educational module on *"Gender and Diversity in Plant Breeding" (Output 2.1)*
- Developing a methodology for creating business cases to support making the case for increasing public and private sector investments in demand led breeding in Africa and applying the methodology to examples in specific crops and countries.

D. DLB invited presentations and participation in other plant breeding events in Africa during 2020-21

November 10-12, 2020, CGIAR Excellence in Breeding (EiB) Virtual Annual Meeting 2020 – *"Sharing Excellence"*

The CGIAR *Excellence in Breeding (EiB)* platform held a Virtual Annual Meeting for 2020. This virtual meeting convened 234 participants from more than 53 countries. The participants interacted virtually through 11 plenary sessions and 11 networking chat rooms.

The DLB team has been engaged with the EiB and particularly its module on *Product design and implementation* since the beginning of the EiB platform in 2018-19. Members of the DLB team participated in the EiB 2020 Annual meeting and contributed to the discussion on Product Profiles during the chat rooms.

December 8-9, 2020: International Mung Bean Improvement Network (IMIN): Market segmentation and Product profiling virtual workshop

The international mungbean improvement network aims to help legume breeders develop product profiles for varieties suited to specific market segments, as identified for mung bean markets in Asia (Myanmar, Bangladesh, Indonesia and India) and Africa (Kenya). The aim of the meeting was to introduce national public breeding organizations in several countries of Asia to the Demand-Led Breeding approach and apply its principles to mung bean in Asia and Africa. This included presentations and discussions with workshop participants on:

- Sharing DLB principles and practice, including examples from a range of crops where DLB approaches have been used in Africa
- Designing new varieties of mung bean using market-led approaches including market segmentation and product profile creation

The DLB Pan Africa coordinator made a keynote presentation on "An overview of the DLB approach: Genesis, Principles of the concept and status. This was then discussed in relation to the relevance of the DLB approach and product profile creation for mung beans in Asia. Several market segments were identified, and one was identified for each country for the further development of a target product profile.

February 18, 2021: University of Cote d'Ivoire Workshop on "The Impact of the DLB Approach on Modern Plant Breeding: Implication and Benefits for Education and Research Institutions"

A workshop was held on February 18, 2021 at the headquarter of the West Africa Virus Epidemiology (WAVE) Centre at the University of the Cote d'Ivoire, Abidjan, Cote d'Ivoire.

The meeting was attended by more than 120 participants, with a combination of in person and online participation. The DLB Pan Africa Coordinator, Dr Yao, attended in person to present the DLB project and to discuss the impact of the DLB approach on modern plant breeding, and the implications and benefits for education and research institutions. The conclusions of the WAVE workshop in relation to DLB were:

- The need for inclusion of DLB approaches to plant breeding in the francophone Africa countries and hence the need for translation of key DLB educational materials and tools into the French language, as soon as possible.
- The WAVE center in Cote d'Ivoire is keen to incorporate the DLB principles and practice into its operations and training programs in West Africa. WAVE would like to become a champion promoting the DLB concept with institutions in Africa, as it expands its network to become a Regional Center of Excellence in plant sciences.

Given that the DLB project has primarily been active in anglophone countries in Africa, a strategic alliance with the emerging WAVE Regional Centre of Excellence in Cote d'Ivoire would be very timely to explore, and the Pan Africa Coordinator is following up on this.

June 15-16, 2021: Joint SFSA/EiB/DLB/PABRA workshop on "Market segmentation and product profile creation best practices"

A meeting was organized in June 2021 by the SFSA Seeds2B team to bring together several breeders and seed system specialists working on AVISA crops (beans, cowpea, groundnut, millet and sorghum) in Africa. The purpose of the workshop was to exchange experiences with the PABRA and DLB teams in the development of product profiles across a range of crops in Africa. The event provided an opportunity to expand the PP concept to other crops and PABRA and DLB teams expressed readiness to support other AVISA crop breeders as they develop product profiles for their target crops. Dr Assefa Mamo Teshale presented an example of Product Profiling for Common bean.

September 7, 2020: Annual Meeting of Rapid Bean Cooking Project (RBCP)

The 2020 annual meeting of the Rapid Bean Cooking Project (RBCP), (which is a complementary project that is also supported by ACIAR), was organized by the Africa-Australia nexus on September 7, 2020. The virtual meeting was convened by UWA and the project partners in Uganda. It was attended by 56 participants from eastern, southern, and central Africa and Australia. The DLB team contributed through making a presentation on: "Demand-Led Variety design in Africa: Implication for the Rapid Bean Cooking Time Project".

The DLB Project educational resources were highlighted, specifically the overview of the product profiles and practitioners' guide; as well as how the DLB community of practice can be of benefit to the RCBP; and how the RCBP can consider gender inclusion through the DLB product profile tool kit. As an outcome from the RCBP meeting, DLB was tasked to support RBCP participants in developing various product profiles for bean in regard to reduce cooking time for the 6 participating countries (Ethiopia, Uganda, Tanzania, Kenya, Rwanda, Burundi) involved in the RCBP. This request from RBCP is being taken forward by the DLB Pan African Coordinator, who is working with the RBCP participants in several countries to assist them in developing product profiles of bean varieties that have reduced cooking times.

DLB core team members attending DLB Phase 2 planning meeting, Addis Ababa Ethiopia April 2019.

E. DLB Presentations at PABRA-sponsored regional network meetings 2020-21

PABRA Regional bean networks—Steering committees' virtual annual meetings 2020

December 8-10, 2020. Southern Africa Bean Research Network (SABRN) Steering committee virtual meeting.
Dr Clare Mukankusi (CIAT/PABRA, Uganda) presented on Common Bean Breeding Updates including the development and deployment of the product profile concept in beans in southern Africa. As result of these interactions, bean breeders in Malawi, Zambia and Zimbabwe have now developed the product profiles for varieties of their major market bean types. The PABRA regional breeding program in southern Africa, led by Dr Rowland Chiara, continues to support the SABRN breeders to mainstream the product profile concept in the national breeding programs. As well as being leaders of PARBA regional networks, both Dr Chiara and Dr Mukankusi are also active members of the DLB team in Africa, including the educators group who are developing and disseminating new tools, such as those on Product profiles.

December 15-17, 2020. WECABREN SC virtual meeting.
Dr Clare Mukankus presented on Common Bean Breeding updates. Members of the West and Central Africa Bean Research Network (WECABRN) SC were exposed to DLB principles including the product profile concept. This approach has allowed the NARS bean breeders in West and Central Africa to make informed choices in germplasm selected for regional exchanges.

January 20-22, 2021. ECABREN SC virtual meeting.
Dr Clare Mukankusi presented on Common Bean Breeding updates. Breeders in most of the countries in eastern Africa have been exposed to DLB principles though the DLB project. Several countries have mainstreamed these DLB approaches, including development and deployment of product profiles. Burundi, Ethiopia, Kenya, Rwanda, Tanzania and Burundi have already produced several product profiles.

February 10, 2021. World Pulse Day PABRA webinar (153 participants/31 countries)
Dr Uwera Annuarite, a Rwanda bean breeder from Rwanda Agriculture Board (RAB) shared her experience in putting the Demand led breeding principles into action in Rwanda. Her session provided insights how DLB principles have been integrated into the RAB bean breeding program. The next step will be to expand the roll out of DLB principles to other RAB crops in Rwanda.

5 TRAINING ACTIVITIES

A comprehensive education and training program has been developed to build capacity within plant breeding programs in Africa on demand led variety design. This objective will be met by: (i) providing new professional development opportunities for plant breeders in Africa; and (ii) producing and disseminating new education and training materials related to the implementation of demand-led breeding programs. There are two target audiences:

- Next generation plant breeders who are undertaking formal post graduate programs.
- Early to mid-career plant breeders working in crop improvement programs in Africa.

Post graduate curriculum development

Several African universities have now formally incorporated the demand led breeding approaches, developed through the DLB project, into their formal post graduate teaching programs on plant breeding. Four African universities included a DLB module within their post graduate teaching programs during 2020-21: University of Ghana; University of KwaZulu Natal, South Africa; Makerere University, Uganda; and University of Nairobi, Kenya.

Developing new education and training materials on demand led breeding

The project is developing additional educational materials to add to the seven DLB educational units currently available online and in the textbook on The Business of Plant Breeding, which were developed as teaching resources during phase 1 of the DLB project. The new educational materials under development cover the following aspects:

- *Gender and Diversity in Plant Breeding (in preparation)*
- *Creating Product Profiles and Technical Data Sheets (completed)*
- *Making the Case for Investing in Demand led Plant Breeding (in preparation)*

DLB education and training workshops 2020-2021

Several DLB education workshops or training events were held during 2020-2021, each led by one of the partner institutions in Africa. Some were face to face learning, while other were a hybrid of face to face interaction and online learning. They included the following:

ACCI, southern Africa: In July 2020, ACCI organised a training workshop for eight postgraduate students at the University of KwaZulu-Natal, South Africa on demand-led plant breeding as part of its post graduate course module on Advanced Plant Breeding.

ACCI, and FAO/IAEA, Namibia: In December 7-11, 2020, ACCI offered a virtual National Training course on Demand-led variety development and cultivar release through Mutation Breeding for 24 staff members of the Ministry of Agriculture, Water and Land Reform, Namibia. This training course successfully dealt with theoretical and practical aspects of demand led variety design and commercialisation The course provided detailed guidelines on product profiles for variety design, development and to enhance marketing and adoption rate on the present research mandate crops (pearl millet, sorghum, cowpea) based on the needs and preferences of the clients and marketplace. This workshop was conducted jointly by ACCI and the FAO/IAEA Vienna joint program on mutation breeding.

Tanzania: DLB and Pan African Bean Research Alliance (PABRA): To strengthen the capacity of young breeders in breeding concepts and methodologies and use of modern breeding tools to hasten varieties release and genetic gain, a seminar series was held in Arusha, as a *"Weekly Seminar for early career breeders under the PABRA program: Contribution from the Demand Led Breeding (DLB) project"*. The DLB Pan Africa Coordinator taught in several of these seminars during the latter half of 2020.

Table 1. Summary of DLB and partners co-organised seminars, webinars, education and training workshops 2020-21

Date	DLB lead host organisation	Topic	Location	Participants
DLB sponsored seminars and webinars 2020-21				
Aug 27, 2020	DLB/SFSA	DLB/SFSA, International webinar Launch of the DLB Product Profile Toolbox and Publications	Africa, Australia and Switzerland	120
Oct 15, 2020	ACCI	ACCI Regional webinar DLB Product Profiles – southern Africa	Southern African countries	100
Oct 23, 2020	WACCI	WACCI Regional webinar DLB Product Profiles – West Africa	West African countries	52
DLB Policy webinars: making the case for investments in demand led plant breeding (DLB)				
Jun 29, 2021	ACCI	ACCI - DLB plant variety design for emerging markets in Africa – Policy dialogue in southern Africa	Southern African countries	230
A. Total participants in DLB sponsored seminars, webinars 2020-21				**502**
DLB Training workshops with post-graduates and "trainers of trainers" in DLB for plant breeders				
Jul 2020	ACCI	DLB Training workshop	University of Kwa Zulu-Natal, S. Africa	8 post graduates
Sep 2020	WACCI	Virtual DLB training workshop	University of Ghana	13 post graduates
Dec 7-11, 2020	ACCI	ACCI, and FAO/IAEA, Namibia. Virtual National training course in DLB	Virtual workshop	24 early to midcareer breeders
Octo 12-15, 2020	EIAR	EIAR Ethiopia – DLB Train the trainers 1	Hawassa, Ethiopia	120 mid-career breeders
Nov 2-5, 2020	EIAR	EIAR Ethiopia – DLB Train the trainers 2	Bahir Dar, Ethiopia	
Nov 25-28, 2020	EIAR	EIAR Ethiopia – Train the trainers 3	Addis Ababa, Ethiopia	
B. Total participants in DLB post graduate training workshops				**165**

Ethiopia: Three "training of trainers" workshops on *"Market led breeding"* were organised by the Ethiopian members of the DLB team during 2020, to introduce new DLB concepts to experienced plant breeders throughout Ethiopia, with the view to their sharing the concepts with their breeding teams in their home institutions. This was part of an ongoing effort commenced by the DLB team in 2019 to mainstream demand led approaches to plant breeding within breeding programs for all of Ethiopia's major food and export crops. These workshops were held from October 12-15, 2020 in Hawassa, from November 2-5, 2020 in Bahir Dar and from November 25-28, 2020 in Addis Ababa, with a total of 120 participants of mid-career Ethiopian plant breeders across the three workshops.

WACCI, West Africa, September 2020: WACCI organized a virtual DLB training workshop in September 2020 at the University for Ghana to 13 PhD students, as part of its post graduate program for plant breeding in West Africa.

A summary of the DLB-led seminars, webinars, education and training workshops that were organised by the DLB team and their partners in Africa during 2020-21 is given in Table 1.

6 CONSTRAINTS AND OPPORTUNITIES

Pandemic induced constraints

COVID-19 has continued to impact project activities due to restrictions on travel within partner countries and internationally and limitations on in person meetings during 2020/2021. Some project activities that depend on field based activities or in person meetings have been delayed, with the outputs now to be delivered by December 2021.

The Master Class for research leaders and policy makers, to be supported by the Crawford Fund is proposed to be conducted as a face to face meeting in Africa during 2022. This will enable greater interactions amongst members of the DLB team in Africa and some international collaborators, including those from Australian partners and SFSA Switzerland and with senior research leaders and policy makers in Africa. The aim of the Master Class is to identify and develop solutions to some of the constraints affecting the successful implementation of demand led breeding by national agricultural research systems in Africa. The goal is to increase the development and adoption of farmer and market preferred crop varieties, which lead to increases in both the productivity.

Future Opportunities

Despite the challenges from COVID-19 pandemic, the project has been progressing well, as demonstrated by the DLB project team working together remotely throughout 2020-21 to finalise a series of new DLB publications on *Product Profiles—A Practitioners' Guide*. The team then implemented a communications strategy and an education and training agenda to promote these *Product Profile* guidelines and tools with the community of plant breeders throughout eastern, southern and West Africa. Virtual meetings promoting the DLB approach have been extensively utilised with several webinars, training workshops and an annual project team meeting organised by the DLB dream team in Africa. This high level of activity by the DLB team in Africa throughout 2021 demonstrates the strong commitment of the DLB project partners in Africa, Australia, and Switzerland to continue their work together to continue to work together through 2021-22 and beyond

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Key African partners

The key project partners in Africa are three regional centres specialising in plant breeding, namely: African Centre for Crop Improvement (ACCI) at the University of KwaZulu Natal in southern Africa; West Africa Crop Improvement Centre (WACCI) at the University of Ghana; and the Alliance of Bioversity International and the International Centre for Tropical Agriculture and the Pan African Bean Research Alliance. In addition to the three centres, other DLB partners include; the Ethiopian Institute of Agricultural Research (EIAR) and Haramaya University, Ethiopia; the Ugandan National Agricultural Research organization (NARO) together with Makerere University, Uganda; and Kenya's University of Nairobi. The project team also works with an extensive Community of Practice of more than 400 plant breeders working in national agricultural research institutes and universities throughout Africa.

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National Agricultural Research organization (NARO)

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