Demand-Led Breeding Product Profiles – A Practitioners' Guide

Overview

d·lb demand·led breeding

Introduction

In these changing times, farmers and plant breeders are facing the challenge to improve the productivity and quality of the food we eat and redress the balance between supply and demand in developing countries. Climate change, rising population, and the need for farming systems to be sustainable for future generations require both innovation and change. Improving new varieties can contribute to this challenge, but the design of new varieties is of paramount importance and can mean the difference between success or failure of new releases. As with most new products it is the inherent benefits provided in variety design that are a key driver of purchasing decisions by farmers, their value chain actors and consumers. Market demand – when complemented by awareness campaigns and access to quality, affordable seed – is the engine for uptake and use of new improved varieties.

This Practitioners' Guide has been developed to support breeders and their breeding teams to conceptualize, describe and communicate the target design of the new varieties they are seeking to deliver from their breeding programs. This overview focuses on the importance of new variety design, the function and position of product profiles (PP) in demand-led plant breeding (DLB) and successful new variety development. The overview contains best practices from both the public and private sectors and addresses the following questions:

- What is a product profile?
- What are product profiles used for, and by whom?
- What is the function and position of product profiles in new variety development?

The PP Practitioners' Guide also contains a separate brief on how to create and communicate quality product profile summaries using a two-page template. The template can be used for product profiles for any crop, use and market combination, and with any consultative process between breeders, scientists, value chains actors, their stakeholders and investors. It follows a three-step process that involves: firstly, assembling a PP multi-discipline design team with client, market, technical and breeding expertise; secondly, identifying the target market, who the variety is being designed for and the crop production system; and thirdly, defining and characterising the attributes and technical specification of traits required for the variety to create demand and market-pull (*Figure 1*). The template is displayed on the last page of this overview.

The PP Practitioners' Guide also contains reference examples of product profiles being developed by plant breeders in Africa to drive their breeding programs in common bean in East Africa and tomato in West Africa.

"A Product Profile is a primary tool for breeders to describe and communicate the design and properties of new varieties they are seeking to develop".

What is a product profile?

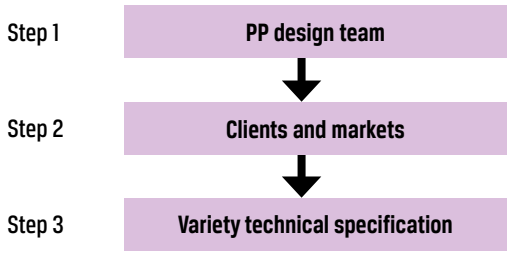
- Product profile is a term that is used ubiquitously within innovation circles. A product profile is a product description.
- Within the business of plant breeding a product profile (PP) describes the technical specification of a new variety that has been designed to serve the needs and preferences of a specified group of clients/customers.
- Product profiles are also sometimes referred to by practitioners as "target product profiles", "variety ideotypes" and "variety profiles".
- A product profile is created for a single variety with a specified set of clients.
- A breeding program that is seeking to deliver a portfolio of new varieties will require multiple product profiles to drive their development and commercialization strategy.
- A specific group of clients may require a range of different varieties for their farming system, off-takers and markets. Each variety will have a different technical design and, therefore, will require a unique product profile.
- A product profile is used not only as an input to drive breeding programs but also as a planning and communication tool to search for suitable varieties from other sources or countries.
- The term product profiling is often used to describe the process used to create product profiles.

What are product profiles used for, and by whom?

Product profiles are useful to breeders, research and development managers, technology transfer managers, crop development managers, investment case managers, investors and donors.

Figure 1

Creating product profile summaries



- **Breeders** – a product profile is a primary tool of breeders using demand-led best practices to describe the design and properties of new varieties they are designing and seeking to deliver from their breeding programs. Breeders and breeding program leaders use PPs:
  1. To communicate the targeted new varieties and their technical performance
  2. As key inputs to create breeding strategies and breeding goals to drive delivery of the new varieties
  3. To determine the traits and germplasm needed from available sources to deliver the target performance (*Figure 1*)
  4. As a tool to validate the assumptions used in the design with value chain actors to ensure demand and support for new varieties to be developed and released.

- **Breeding leads/R&D managers** – need to review multiple product profiles to determine the focus of their institutional breeding programs, priorities and deployment of resources.

- **Technology transfer managers** – will use product profiles to scout for the desired traits, germplasm or specialised processes needed to deliver the new varieties. These may be sourced from potential collaborators or partners. Permissions may be needed to ensure there are no ownership issues that could prevent commercialization of the new varieties (i.e. breeders have "freedom to operate").

- **Crop development managers** – will use product profiles to look for varieties registered in other countries that meet the technical specification. Being a faster way than breeding, farmers can thus more quickly access the benefits.

- **Investment case managers** – will use the performance assumptions in a product profile to estimate market share and pricing of the new variety as part of the analysis needed to create a case for investment.

- **Investors and donors** – use PPs as part of their requirements to invest in breeding programs. Quality product profiles demonstrate to financiers that their investment is carefully targeted to specific beneficiaries with products that will solve problems and address clear business opportunities. This provides transparency and greater confidence for all and a higher likelihood that breeders will satisfy the requirements of investor(s) and obtain investment resources.

Who creates a product profile?

- A leader/champion of a new variety design brings together a multidiscipline team of experts to gather information, create new variety designs and communicate the resulting product profiles to gain support and investment.
- The activities involved in creating product profiles include:
  (i) consulting with clients and stakeholders
  (ii) gathering agricultural statistics, market research information and insights on clients' needs and preferences, various data on scientific, technical, cost, feasibility, and management information
  (iii) deciding the best technical design and the market importance of different traits to meet clients' needs and preferences.
- A range of experts are needed to create product profiles. Each team needs to contain the relevant knowledge and skills to address the business opportunity and/or problem identified.
- Typically, the numbers of people involved can range from 5–9 and may include:
  - Breeder
  - Agricultural economist
  - Market research specialist
  - Farmer representatives
  - Youth and gender expert
  - Value chain representative(s)
  - Private sector processing expert
  - Seeds systems expert (public and/or private sector)
  - Climate change specialist
  - Agronomist
  - Plant pathologist
  - Entomologist
  - Food scientist
  - Public health/nutritionist
  - Expert in management of new variety development
  - Intellectual property expert
  - National country variety release/registration expert.

"A breeding leader/champion brings together a multidiscipline team of experts to create new variety designs".

Position within new variety development

A product profile is one of five core components needed to create a development and commercialization strategy using demand-led best practices that will deliver new improved varieties to farmers (*Figure 2*). The creation of a product profile starts after a market opportunity or problem has been clearly defined. It is then used as one of the key inputs required to create an investment case. Product profiles are also a key driver for initiating trait discovery work and formulating an appropriate breeding strategy for the breeding program as part of the development and commercialization delivery stage plan:

1 **Market opportunity** – Definition of a problem, a market failure or a business opportunity that can be met by creating or finding a new improved variety. This requires critical information to be collected, deep analysis, market research, and foresight and visioning to anticipate future problems and opportunities, such as those occurring with climate change, etc. (*Figures 2 and 3*).

2 **Product profile** – Description of the technical specification of the new variety and the clients/customers it is designed to serve.

3 **Product investment case** – This is the socio-economic business case that contains the benefits and costs of investing in the breeding program. The product profile is not a business case. It is a key input to any new variety investment case. The design provides key technical assumptions about (i) who the variety is suitable for and (ii) how the variety can be used (iii) and its expected performance and benefits compared to other varieties. It is these attributes that are needed to enable market share and pricing assumptions to be generated in order to create the investment case and commercialization strategy.

The positioning and comparative benefits of the new variety are essential inputs required by business/development managers to be able to prepare commercial forecasts on market share and pricing in the investment case.

Figure 2

Product profiles
Function and position in new variety development and commercialization

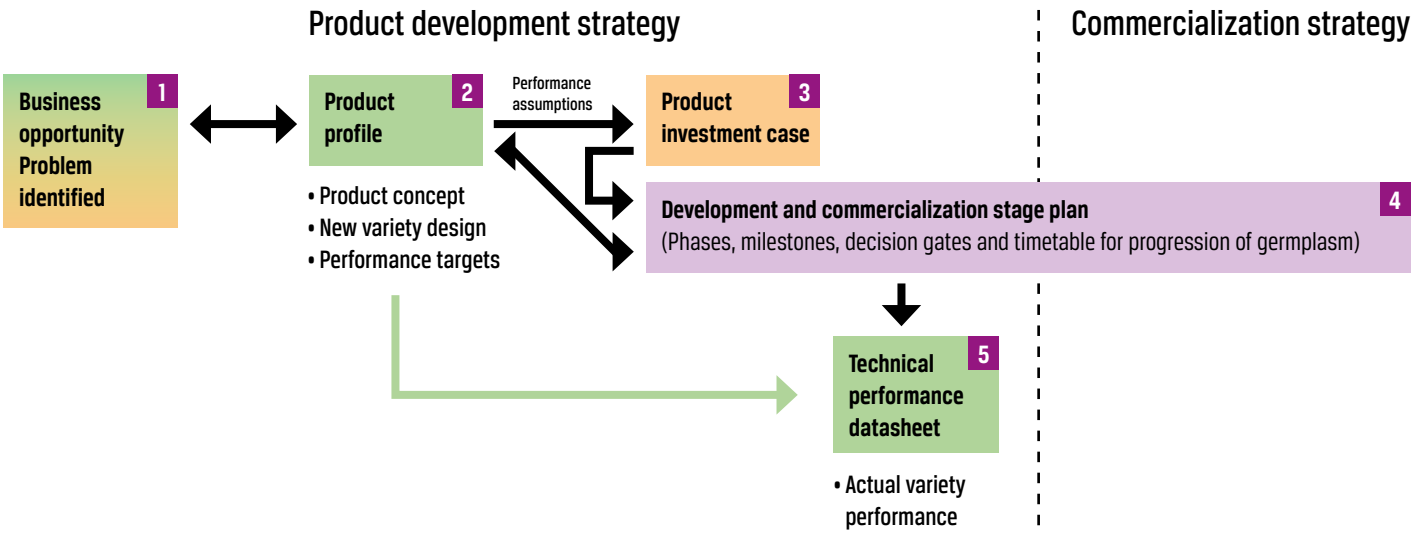
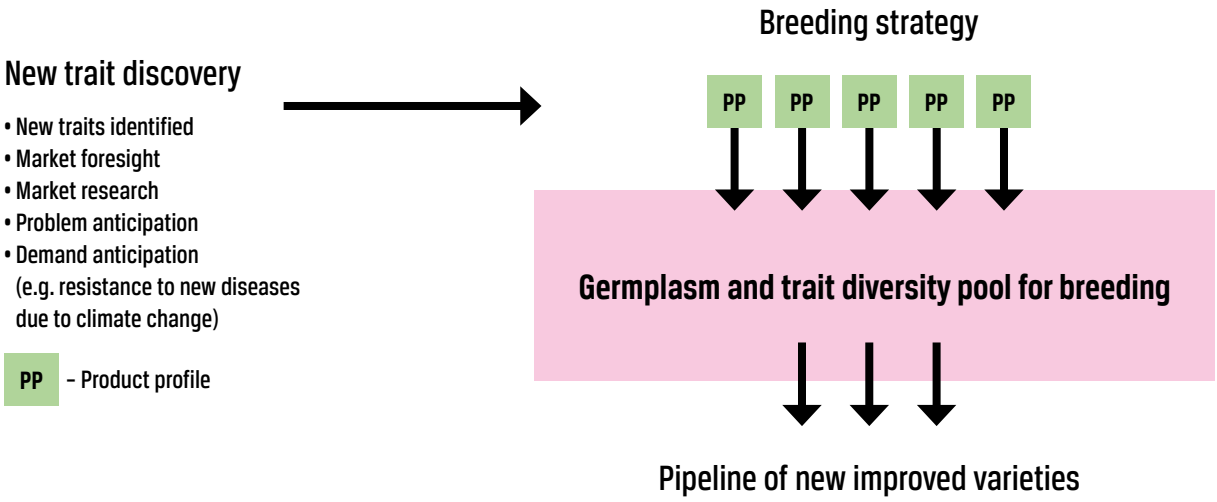


Figure 3

Product profiles
Driver of information inputs and product delivery



4 **Development and commercialization stage plan** – The activity plan required to create, register, scale and distribute the new variety to customers. It is the systematic organisation of the entire work program into defined phases and a timetable for action. Each phase is separated by a decision gate where key managers, scientists and stakeholders confer to decide whether there is enough quality data to make an informed decision on whether specific germplasm should progress to the next stage.

Product profiles are important drivers for the discovery and selection of traits that comprise the breeding strategy and the breeding program that is implemented as part of the stage plan (*Figure 3*).

"A Product Profile is one of five core components needed to create a development and commercialization strategy that will deliver varieties fit for farmers and their markets".

5 **New variety performance technical datasheet** – This is the document that communicates the actual technical performance of the new variety and how it compares with existing varieties and choices available for clients. It communicates actual rather than aspirational targets for performance that are shown in the product profile. There are a range of types of datasheets that contain differing amounts of granularity and emphases that are tailored for different audiences, e.g. seed scalers, farmers, processors and clients in the value chain.

Product profile communication summary

The PP communication summary is comprised of two pages of information that enables the reader to visualise three elements:

1. **Design team:** The leader and experts who create the product profile
2. **Clients and markets:** Who the new variety has been designed for, their markets and farming system
3. **New variety technical specification:** The technical features and comparative advantages of the new variety

The communication summary addresses the following questions:

Clients and their markets

- Who has the PP been designed to serve?
- In which country and region(s) are the clients located?
- What is the crop and how is it used?
- Which market and market segment has the variety been designed for?
- What input, management and cropping system will the variety suit?
- Which variety or landrace is currently grown for this market segment and is targeted for replacement by the new variety?

New variety technical specification

- What is the technical specification of the new variety?
- What are the purchasing drivers for clients?
- Which crop traits in the design respond to these drivers and therefore deliver benefits?
- What are the technical traits and features of the new variety?
- How important is each trait in terms of market demand from different groups of users such as women, men and youth?
- What is the target performance to be achieved for each trait?
- Which variety/land race(s) grown is being targeted for replacement with the new improved variety?

The product profile summary has been prepared as a template that can be used to communicate the output from expert discussions on new variety design. It has been crafted to record the outputs from any process of consultation involved in design of new varieties. The template is available in both Excel and Word to aid sharing and communication of profiles amongst practitioners, managers, collaboration partners, donors and other investors.

Creating product summaries – Practitioners' Guide

A Practitioners' Guide is available as an accompanying document to help product profile leaders/champions prepare quality product profile summaries. The guide provides a working explanation of the contents in each cell in the summary Excel template. The explanations can be accessed in Excel by hovering the mouse over the relevant cell, or viewed in the entire guide. Working examples of product profiles are contained in the Excel template for reference and for use with this overview.

PP design team

Step 1

PP Design Team Lead/Champion	*Name*
	Organization

PP Design Team		
Person	**Area of Expertise**	**Name of organization**
Name 1		
Name 2		
Name 3		
Name 4		
Name 5		
Name 6		

Clients and markets

Step 2

Product profile descriptors	
Product profile name	
Crop	
Country(s)	
Geographic region(s)	
Market segment and positioning	
Name of target variety(s) or landrace to be replaced strengths, weaknesses	
Date PP created (dd.mm.yyyy)	

Target client and use	
Value chain primary clients/customers: farmers, processors, transporters, consumers, etc.	
Market scale: households, local, regional, national and international markets	
Use: food, animal feed, energy, medicinal, clothing, etc.	
Type of processing: none (fresh), dried, cooked, milled, canned, brewed, etc.	
Market class: bean type, wheat quality, etc.	

Target crop producers and production system	
Number of farmers (min–max range)	
% ratio: male to female farmers (min–max range)	
Production system: open field (+/- irrigation), plastic tunnel, glasshouse, hydroponics	
Area of production system (ha)	
Growth habit: e.g. beans, tomatoes, grapes (bush, climbing, etc.)	
Expected level of inputs: low, medium, high (fertilizer, crop protection chemicals)	
Typical yield range of target system (e.g. 0.8–1.5 t/ha)	
Cropping system: continuous monocrop, rotated intercrop, intercrop mixed cropping,	
Mechanization: planting, maintenance and harvesting	
Agroecological zone(s)	
Total seed or vegetative propagation material market (tonnes/numbers)	

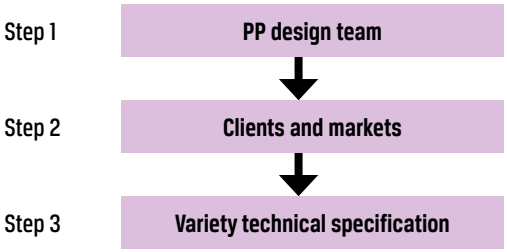
Variety technical specification

Step 3

Client/customer	**Driver**	**Trait category**
Farmer	Productivity	Yield
		Biotic stress resistance
		Abiotic stress tolerance
	Fodder/forage	Biomass
		Animal nutrition
		Animal palatability
		Animal digestibility
	Crop management and harvesting	Plant architecture
	Market value and price	Grain weight
		Crop duration
	Post-harvest storage	Storage-life
Transporter	Durability and cost	Container suitability
		Transportability and storage
Processor	Raw material quality specification	Milling
		Bread-making
		Brewing
		Paste
		Canning
Retailer	Sales and profit	Shelf-life
Consumer	Satisfaction	Taste
		Appearance
		Shelf-life
		Nutrition
		Digestibility
		Food preparation
Seed/vegetative material producer	Scalability and cost	Seed numbers
		Reproductive fertility
		Ease of vegetative propagation
Seed distributors	Variety identification	Unique appearance of plants, grain and produce

Figure 1

Creating product profile summaries



1. **Design team:** The leader, design team and expertise used to create the product profile
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Preference group: Women (W) Men (M) Youth (Y) W+M+Y (All)	**Trait demand classification:** *1 . Essential/"must have" 2. Niche opportunity 3. Added-value 4. Winning trait*	**Target traits**	**Trait description (Quantitative measures)**	**Name of benchmark variety**	**Performance required compared to benchmark variety <,=,> etc.**
		e.g. economic yield			
		e.g. fertiliser efficiency			
		e.g. grain size			
		e.g. fungi, bacteria and viruses			
		e.g. insect pests			
		e.g. nematodes			
		e.g. drought, heat, salinity			
		e.g. total dry biomass			
		e.g. protein content			
		e.g. level of odoriferous compounds			
		e.g. methane production			
		e.g. crop height, pod clearance for mechanical harvesting for bean, chickpea			
		e.g. seed density			
		e.g. early or late maturation			
		e.g. potato sprouting dormancy			
		e.g. mycotoxin production			
		e.g. shape of aubergines for packing crates			
		e.g. mycotoxin production			
		e.g. grain milling efficiency			
		e.g. hagberg falling number			
		e.g. protein content malting barley			
		e.g. tomato brix value			
		e.g. bean grain splitting			
		e.g. days post-harvest			
		e.g. organoleptic properties			
		e.g. fruit shape uniformity			
		e.g. days before fungal decay			
		e.g. protein content, Fe, Zn, etc.			
		e.g. gas production			
		e.g. fast cooking time			
		e.g. number of bean seeds in pods			
		e.g. rice spikelet fertility			
		e.g. propagule storability			
		e.g. phenotypic mark			

Acknowledgements
This overview, the Practitioners' Guide to creating product profiles and associated templates for communicating product profiles have been prepared by a working group of plant breeders, educators and other expert panel members, convened under the auspices of the **Demand-led Breeding Project** (*www.demandledbreeding.org*).

The many contributions of the members of the expert panel to plant breeding in Africa, as well as to the development of these documents, templates and tools to support breeding of successful new varieties that meet future market needs, are gratefully acknowledged and recognized here. The members of the DLB expert panel who developed these materials are:

Walter Alhassan – Biotechnology and Stewardship for Sustainable Agriculture in West Africa (BSSA)
Vivienne Anthony – Syngenta Foundation for Sustainable Agriculture, Switzerland (Convener)
Mathieu Ayenan – WACCI, University of Ghana, Ghana
Rowland Chirwa – Alliance of Bioversity International and CIAT; Pan-Africa Research Alliance (PABRA), Malawi
Wallace Cowling – University of Western Australia, Australia
Richard Edema – University of Makerere
Agyemang Danquah – WACCI, University of Ghana, Ghana
Eric Yirenkyi Danquah – WACCI, University of Ghana, Ghana
Berhanu A. Fenta – EIAR, Melkassa, Ethiopia
Paul Gibson – University of Makerere, Uganda
Karen Harper – University of Queensland
Paul Kimani – University of Nairobi, Kenya
Teshale A. Mamo – Alliance of Bioversity International and CIAT; Pan-Africa Research Alliance (PABRA), Tanzania
Firew Mekbib – Haramaya University, Ethiopia
Clare Mukankusi – Alliance of Bioversity International and CIAT; Pan-Africa Research Alliance (PABRA), Uganda
Stanley Nkalubo – NARO, Uganda
Michael Osei – WACCI University of Ghana, Crops Research Institute, Ghana
Gabrielle Persley – School of Agriculture and Food Sciences, University of Queensland, Australia
Jean Claude Rubyogo – Alliance of Bioversity International and CIAT; Pan-Africa Research Alliance (PABRA), Kenya
Hussein Shimelis – ACCI, University of KwaZulu Natal, South Africa
Herve Thieblemont – Syngenta Foundation for Sustainable Agriculture, Thailand
Pangirayi Tongoona – WACCI, University of Ghana, Ghana
Nathalie Vignaux – Syngenta Foundation for Sustainable Agriculture, Switzerland
Nasser Yao – Demand-led Breeding Project c/o Alliance of Bioversity International and CIAT, Kenya

Additional inputs and review of the product profile templates and supporting documents by Dr Nathalie Vignaux and Dr Herve Thieblemont at SFSA have been most helpful. Also, the contributions towards the development of the product profile communication templates by Tawanda Reginald Mashonganyika, representing Module 1 of the OneCGIAR Excellence in Breeding Platform (EiB), are also gratefully acknowledged.

Demand-led Breeding
The Demand-led Breeding Project is co-financed by the Australian Centre for International Agriculture Research (ACIAR), the Crawford Fund, Australia and the Syngenta Foundation for Sustainable Agriculture (SFSA), Switzerland, through an Alliance for Food Security. The financial support of these funders is gratefully acknowledged. The project is administered by the University of Queensland on behalf of the Alliance. The project is implemented through a wide range of partners in Africa, led by the African Centre for Crop Improvement (ACCI), University of KwaZulu Natal in southern Africa; the Pan Africa Bean Research Alliance (PABRA) and the Alliance of Bioversity and CIAT in eastern Africa; and the West Africa Crop Improvement Centre (WACCI) at the University of Ghana.

Reference
Shimelis, H. (2017) New variety design and product profiling. pp 85–114. In: The Business of Plant Breeding: Market-led approaches to Plant Variety Design in Africa. Eds. Persley, G.J. and Anthony, V.M. CAB International, ISBN-13:9781786393814. https://www.cabi.org/bookshop/book/9781786393814/

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