

DLB Product Profile: High yielding, drought tolerant and medium duration dry grain pigeonpea for Eastern Africa



Paul Kimani, University of Nairobi

Design target

High yielding, medium duration maturity, drought tolerant pigeonpea variety with medium to large cream seeds, suitable for dry grain production and consumption by rural and urban households. In eastern Africa

Paul Kimani is a professor of Genetics and Plant Breeding, and leader of the Legume Breeding Research and Seed Program at the University of Nairobi. The program is based in the Department of Plant Science and Crop Protection, Upper Kabete Campus in Nairobi, Kenya. His main interest is on four legumes important in East, Central and Southern Africa: grain and vegetable common bean (*Phaseolus vulgaris* L), pigeonpea (*Cajanus cajan* L. Millsp), runner bean (*Phaseolus coccineus* L) and soybean (*Glycine max*).

He has more than three decades of experience in legume breeding, agronomy, genetics and seed systems. He is one of the pioneers in market-led breeding in Africa and has successfully developed more than 25 commercial varieties for household consumption and processing industry. He has collaborated with most of the bean research programs in Africa, and shared improved germplasm and breeding lines with researchers in all six continents (Africa, Asia, Australia and the Pacific, Europe, North and South America). He holds a PhD in Plant Breeding & Genetics from the University of Wisconsin-Madison, USA.



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Product Profile design team

Step 1

PP Design Team Lead/Champion	Paul Kimani
	Dept of Plant Science and Crop Protection, University of Nairobi, Kenya

PP Design Team		
Person	Area of expertise	Name of organization
Rael Karimi	Breeder	KALRO-Katumani
Paul Kimurto	Agronomist	Egerton University
Arnold Njaimwe	Breeder	KALRO-Katumani
Anthony Gitahi	Pigeonpea specialist/Seed systems	University of Nairobi
Susan Wanderi	Breeder/product development specialist	KALRO- Katumani
Susan Muriithi	Marketing specialist and business development	SUERA LTD, Nyahururu
Veronica K. Moraa	Food scientist	University of Nairobi
Hezekiah Odhiambo	Food scientist	University of Nairobi
Winfred Nyaga	Agricultural economist	University of Nairobi

Clients and markets

Step 2

Product profile descriptors	
Product profile name	Medium-duration pigeonpea
Crop	Pigeonpea (<i>Cajanus cajan</i> L. Millsp.)
Country	Kenya, East African Community, Southern Africa, West and Central Africa
Geographic regions	Arid and semi-arid areas; drought prone regions
Market segment and positioning	Target improved supply between March- June when supplies are low before the main harvest of long duration varieties in July-September. Provide green shelled peas in February to March, and dry grain in April-May. Medium maturity, heavy pod load and long pods are key traits for this category
Name of target variety to be replaced	Kionza (Traditional long duration varieties) Strength: Large, cream seeds Weakness: Low yield, very long duration to maturity (up to 12 months), susceptibility to fusarium wilt, <i>Mycovellosiella</i> leafspot, pod fly, pod borers, bruchids and long cooking time
Date PP created	26.3.2022

Target client and use	
Value chain primary clients/customers	Farmers, traders, hotels, rural and urban households, institutions such as schools and colleges, consumers, dhal processors and exporters
Market scale	Local, national and international markets
Use	Food; livestock feed and food supplements
Type of processing	Cooked, flours for food fortification (samosas, cakes, weaning foods, protein extraction for industrial use)
Market class	White/cream

Contact:

pmkimani@uonbi.ac.ke

Target crop producers and production system	
Number of farmers	600,000 -900,0000
% ratio: male to female farmers	35-45 % male :55- 65% female
Production system	Rainfed (90%); irrigated (10%)
Area of production system	40,000- 80,000 ha
Growth habit	Determinate or non-determinate
Expected level of inputs	Low fertilizer use; limited use crop protection chemicals
Typical yield range of target system	0.3 – 0.5 t/ha
Cropping system	Purestand 30%; 70% intercroops with maize, sorghum, root crops, beans, cowpeas and fruit crops
Mechanization	Mainly manual
Agroecological zone(s)	Low and medium potential semi-arid regions with altitudes 500- 2000masl
Total seed market	3300 tonnes

Variety technical specification

Step 3

Client/customer	Driver	Trait category	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.	
Farmer	Productivity	Yield	All	1	Grain yield	Dry grain weight > 0.8 t/ha	Kionza or traditional variety	>	
		Biotic stress resistance	All	3	Fusarium wilt	Resistant or moderately (on a scale of 1-9, where 1= resistant; 9=susceptible)	Kionza	>	
		Abiotic stress	All	1	Drought tolerant	Tolerant or moderately tolerant (score of 4-6 on a scale of 1-9)	Kionza	=	
	Crop management and harvesting	Plant architecture	All	1	Short (about 1-1.5m tall), compact or semi-spreading	Determinate or indeterminate growth habit	Kionza	<	
		Pods distribution	All	3	Clusters terminally placed on branches	Clusters on the outside of the canopy for ease of harvesting	Kionza	>	
	Market value and price	Seed colour	All	1	white	White or cream seed coat	Kionza	=	
		Seed size	All	4	Large	>15 g per 100 seeds	Kionza	=	
	Post-harvest and storage	Crop duration	Crop duration	All	4	Time to maturity	Medium maturity (less than 200 days)	NPP 670	=
			Storage-life	All	3	Tolerant to bruchids	Score of 6 or less on a 1-9 susceptibility scale	Kionza	=
Processor	Raw material quality specification	dhal quality	All	2	Cooking time (firewood or charcoal)	< 50 minutes to cook in household setting	Kionza	>	
Consumer	Satisfaction	Taste	All	1	Taste	Palatability from sensory evaluation with key consumers	Kionza	=	

		Appearance	All	1	Seed coat and hilum colour	Cream (without coloured hilum)	Kionza	=
		Digestibility	All	1	Flatulence, soft seed coat after cooking	Low gas production	Kionza	=
		Food preparation	All	2	Cooking time (firewood or charcoal)	< 1.5 hours to cook in household setting (whole seeds)	Kionza	=
Seed producer	Scalability and cost	Seed genetic purity	All	1	Seed germination	> 95% viability >99% uniformity	Kionza	>

Grain types



African pigeonpea-
Preferred in ESA



Asian-popular in India and
other Asian countries



Mrs Grace Wanjira Nderitu and Mrs Susan Mureithi
admiring new pigeonpea varieties at Gatundia
PVS site, Laikipia West, 16 Jan 2021

“One consequence of Demand-led breeding and product profiling is a realization that producers will need new varieties that cover the entire growing season. This has led to the three-in-one concept: Growers need early, medium and late maturing varieties to ensure round the year supply to processors, traders and exporters”.