



Adding value to neglected and underutilized crop species: experiences from Kenya, Uganda, Zambia, and Zimbabwe

Photo top: Composite flours produced by the Lower Nyando Community Seed Bank (Kenya).
Credit: Bioversity International/R.Vernooy

Ronnie Vernooy, Gloria Otieno, Alliance of Bioversity International and CIAT

Joyce Adokorach, Plant Genetic Resources Centre-National Agricultural Research Organization (NARO-PGRC)-Uganda

Marceline Fusire, Community Technology Development Organization (CTDO)-Zimbabwe

Graybill Munkombwe, Zambia Agricultural Research Institute (ZARI)

Dalmus Mitei, Dominic Kimani, Seed Savers Network (SNN)-Kenya



A focus on neglected and underutilized crop species

For many rural communities in Africa, neglected and underutilized crop species (NUS) are important for nutrition, food security and income generation throughout the year. NUS are forgotten foods whose roles have been undervalued and their importance neglected by researchers, policy makers and markets. They include cultivated, semi-domesticated, and wild species, and traditional varieties that have been produced and consumed for centuries or even millennia for their food, fiber, fodder, oil, and medicinal properties.

However, relatively little is known about NUS' status, including the number of species, distribution, actual and potential consumption, and health and nutrition benefits. Conserving and further developing NUS would strengthen food and nutrition security across Africa and beyond. In this context, the NUS include indigenous millet and sorghum varieties, which can withstand erratic weather patterns and are highly nutritious. Studying and promoting their sustainable use should provide globally beneficial knowledge.

Between 2021 and 2023, the Alliance of Bioversity International and CIAT coordinated an action-learning project in Kenya, Uganda, Zambia, and Zimbabwe, focused on promoting, conserving and sustainably using NUS (Vernooy 2021). The work was supported by the Dutch Ministry of Agriculture, Nature and Food Quality. In each of the four countries, the project piloted value-chain development work to identify priority NUS, including African leafy vegetables, African rice (*Oriza glaberrima*), African/Shona cabbage (also known as cat's whiskers) (*Cleome gynandra*), finger millet (*Eleusine coracana*), sorghum (*Sorghum bicolor*) and yellow maize (*Zea mays*) (Vernooy et al., 2022). This

novel value-chain development was implemented in a maize-cultivation context. Maize is the main staple crop in the region, and is suffering adverse climate-change impacts across East and Southern Africa (Photo 1). NUS cereals offer great potential to fill the predicted maize-production gap. This brief presents the project's key findings and recommendations.

Overview of the results

Kenya: Vihiga and Nyando

Farmers in western Kenya mainly cultivate the following NUS: cassava, finger millet, pumpkin, sorghum, traditional leafy vegetables, and groundnut.

In Vihiga county, near Kisumu city, the farmers prioritized red sorghum (a local variety known as *ambere amakanyu*), yellow maize (a local variety known as *kipendi*), and (white) amaranth (*Amaranthus cruentus*) for value chain development. The local team was trained in the LINK methodology to be able to develop a viable value-chain strategy (Lundy et al., 2014). The team then trained 85 farmers on value-addition planning and implementation. The LINK approach was used to map value-chains for amaranth, *ambere amakanyu* and *kipendi*. This included mapping the actors in the value chain: producers/farmers, commercial actors, and external influences.



Photo 1: A maize field in western Kenya. Maize is a staple crop in east and Southern Africa but facing challenges due to the impact of climate change.
Credit: Bioversity International/R.Vernooy

The team and farmers elaborated a business canvas model, which describes the rationale of how an individual firm creates, captures, and delivers value. The canvas model is supported by business-model principles for evaluating to what extent small-scale producers are included in any business relationship with formal buyers. The main new NUS added-value product developed is “power *unga* or flour” (named by the farmers) made from cassava, sorghum, and yellow maize, which can be used to make porridge for adults and young children at schools, hospitals, and homesteads. Three types of “power *unga*” have been developed. For the yellow maize, farmers were trained in the technique of nixtamalization, which is a special way of preparing maize, and other grains like sorghum, to enhance the grains’ nutritional value and increase versatility for cooking and baking. The maize is soaked and cooked in an alkaline solution (lime water), washed and hulled (the outer covering of the maize is softened in the process, and it can be washed off the maize). The hulled maize is used to prepare several products, such as “*tortilla*” (a kind of pancake). In addition, the community seedbank in Vihiga acquired an aggregation center with a simple, environmentally-friendly cooler to aggregate vegetables and store them for longer time, and a solar dryer to dry leafy vegetables for the market.

Farmers in Nyando (Kabudi-Agoro Community Seed Bank, and (Lower) Nyando Community Seed Bank), near Kisumu city were also trained in the LINK-methodology.



Photo 2: Amaranth field in Vihiga county (Kenya).
Credit: Bioversity International/R.Vernooy

Based on interactions with private-sector training participants, farmers decided to focus on producing and marketing high-end quality composite flour for porridge and *ugali* (maize meal or pap) to supplement customers’ diets (Photo 3). Farmers in the two

community seed banks in Nyando benefited from two new roller mills which they are currently using to mill small quantities of flour for sale within the local community. The two groups prepared a draft business plan, which will be further improved

and then put into practice and started to prepare small packages of the composite flours, selling them through the community seed banks. The Lower Nyando products are finger millet/cassava/ sorghum flour for porridge and maize/sorghum *ugali*; the Kabudi-Agoro products are amaranth/ cassava/millet/sorghum porridge for adults and for babies, and a porridge type based on fermented flour.

Uganda: Hoima and Masindi

The prioritized varieties in Hoima and Masindi (in the west-central region) included: i) finger millets UNGB 2321 (from Uganda) and TZA 1701 (from Tanzania); ii) (white) *kibani* or *ajua-amy*a and (red) *karibiti* or *amy*a-eka (two local finger millet varieties) (Photos

4-5); iii) *red empwera* and white *kajwenge* sorghum (two local varieties) in Hoima, and iv) *akindi, godo, ondu* and (red) *ondueka* sorghum in Masindi.

Community-seed-bank members of Hoima (established) and of Masindi (named Nyatonzi, inaugurated in September 2023) have been actively involved in all the activities and were trained in the LINK methodology, but encountered some challenges such as problems with on-farm and on-station seed-multiplication (at NARO's BuZARDI station in Hoima) for the selected NUS. Multiplication was constrained by weather-related and crop management issues, and by the unexpected departure of local staff, thus requiring a second

planting cycle to multiply the minimum seed quantities needed. Farmers decided to drop the aforementioned millet varieties UNGB 2321 and TZA 1701 due to insufficient seed availability.

Farmers already have recipes for finger millet/cassava and sorghum/cassava/finger millet composite flour mixtures, and mixtures for porridge and *ugali*, and expressed interest in trying other mixtures combining two millet varieties in the same flour. An initial conversation was held with a new local farmers' marketing enterprise (Ageteraine Farmers' Group) about collaboration with the two community seed banks.



Photo 3: Kabudi composite flour produced by the Kabudi-Agoro Community Seed Bank.
Credit: Bioversity International/R.Vernooy



Photo 4-5: Finger millet grown by Masindi farmers (Uganda).
Credit: Bioversity International/R. Vernooy

Zambia: Kayuni Camp

NUS in Kayuni camp, in the far south of the country near the border with Zimbabwe, have been cultivated for many years, mainly by older women farmers, although this trend has recently changed as young farmers (both male and female) have become interested in NUS and in also becoming seed conservationists. The most important NUS in Kayuni camp are cowpea, groundnut, maize, millet, sesame, and sorghum. Working together through the newly-established community seed bank, farmers were trained in vegetable drying, and started processing and selling small amounts of dried cowpea and pumpkin. Farmers were also trained in using millet and sorghum flours in bakery products (e.g., cakes and cupcakes) and will explore if they can sell these and other products (e.g. flour) at the local market (Photo 6). Additional agribusiness-development training will be needed to strengthen farmers' knowledge and skills.

Zimbabwe: Mudzi and Mutoko districts

The CTDO team compiled a comprehensive NUS catalogue for Zimbabwe. This features crop descriptions and images, which can be used for awareness raising, extension, training, and education. The team also contributed to the "Recipe book Health and Nutrition Technologies," published by the Ministry of Health and Child Care, which promotes the production, processing, and consumption of diverse nutritious and biofortified foods, including those made from NUS.



Photo 6: Baking demonstration in Kayuni (Zambia).
Credit: Bioversity International/R.Vernooy

The team worked on four priority NUS crops identified by farmers in the districts of Mudzi and Mutoko in northern Zimbabwe: African rice, cleome or African/Shona cabbage, finger millet (Photo 7), and Ethiopian rape (*Brassica carinata*). They researched local

production, conservation, and utilization practices. These crops have increasingly gained consumer acceptance, and consumption is increasing in urban areas, driven by a growing health-consciousness. This is despite low production levels and the absence

of formal guidelines on research, development, production, and marketing. Expanding supply, and developing fair and equitable value chains appears promising but there is limited national investment interest. The team proposes to address this in the new project phase, beginning 1 October 2023.

Prospects

A promising start has been made to supporting subsistence farmers in adding value to their NUS. Pilot results demonstrate high potential for boosting household and community seed bank income and livelihoods in the four countries. This will be achieved through targeted and gender-responsive value-addition activities for NUS value-chains, seeds and produce. The goal

is for NUS growers and other stakeholders to become successful agribusiness entrepreneurs beyond agricultural production. In the new project phase, the four country teams will begin to scale the work. This will include: i) training partners and farmers in **product management** according to national quality standards (e.g., as defined by the Kenya/Uganda Bureau of Standards); ii) acquiring **agribusiness certification** to be able to operate as agribusinesses; iii) analyzing the new products to **determine nutrition values**; iv) acquiring **product quality certification**; v) capacity building for **professional processing, packaging and labeling** (including handling tools and equipment, e.g., mills, vacuum packers); vi) setting up **product promotional campaigns**; and vii) Exploring

marketing options (including for export) and building **market linkages**.

Acknowledgements

This activity forms part of the umbrella agreement between Ministry of Agriculture, Nature and Food Quality of the Dutch government and Bioversity International (now the Alliance of Bioversity International and CIAT) to work together on resilient seed systems for climate change adaptation and sustainable livelihoods in Africa. We thank the government of the Netherlands for the support. We thank Grace Ochino Karura for administrative support, and Vincent Johnson of the Bioversity-CIAT Alliance science-writing service for editing support.



Photo 7: Finger millet in Rushinga, Zimbabwe.
Credit: Bioversity International/R.Vernooy

References

Lundy, M.; Amrein, A.; Hurtado, J.J.; Becx, G.; Zamierowski, N.; Rodriguez, F.; Mosquera, E.E. 2014. LINK methodology: a participatory guide to business models that link smallholders to markets. Version 2.0. International Center for Tropical Agriculture, Cali, Colombia.

<https://hdl.handle.net/10568/49606>

Vernooy, R. 2021. Action research on neglected and underutilized species. A methodological guide. Bioversity International, Rome, Italy. <https://cgspace.cgiar.org/handle/10568/116208>

Vernooy, R.; Fusire, M.; Graybill, M.; Kimani, D.; Mitei, D.; Otieno, G.; Recha, T. 2022. Promoting and valuing neglected and underutilized species for sustainable livelihoods and climate change adaptation: insights from Kenya, Uganda, Zambia, and Zimbabwe. Bioversity International, Rome Italy. <https://hdl.handle.net/10568/118375>

Citation: Vernooy, R.; Otieno, G.; Adokorach, J.; Fusire, M.; Munkombwe, G.; Mitei, D.; Kimani, D. 2023. Adding value to neglected and underutilized crop species: experiences from Kenya, Uganda, Zambia, and Zimbabwe. Bioversity International, Rome, Italy.

ISBN: 978-92-9255-307-4

Contacts:

Alliance Headquarters
Via di San Domenico, 1
00153 Rome, Italy
Tel. +39 06 61181

The Alliance of Bioversity International and the International Center for Tropical Agriculture (CIAT) delivers research-based solutions that harness agricultural biodiversity and sustainably transform food systems to improve people's lives. Alliance solutions address the global crises of malnutrition, climate change, biodiversity loss, and environmental degradation.

The Alliance is part of CGIAR, a global research partnership for a food-secure future.

<https://alliancebioversityciat.org>

www.cgiar.org



Photo 8-9: The Kabudi-Agoro community seed bank milling team and room (left). The Lower Nyando community seed bank miller and milling equipment (right).
Credit: Bioversity International/R.Vernooy