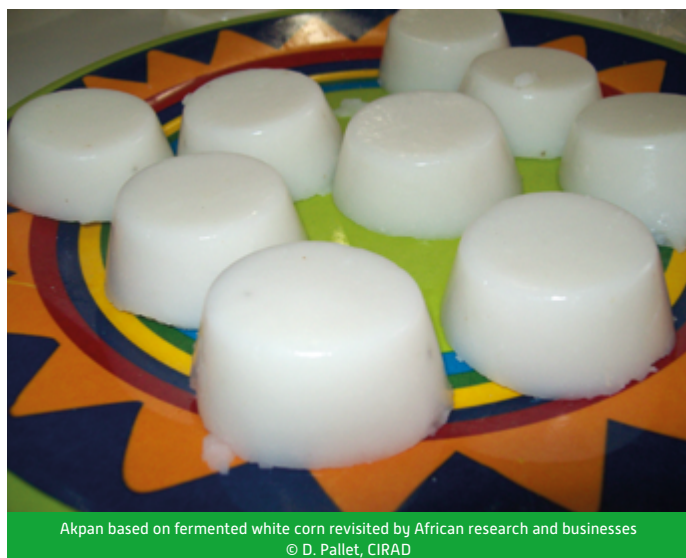


Developing and improving nutrition in traditional African food: the creation of functional foods



Traditional African foods should be advocated to help food systems provide better nutrition to local populations while being inclusive, innovative, and sustainable. Previous projects making use of new technology have helped improve the nutritional quality of traditional African products, leading to the creation of functional foods with the aim of reducing obesity. A new project, FAMA, aims to provide evidence of the role of traditional African foods in improving nutrition and gut microbiota of South African people.

Traditional African foodstuffs can contribute to nutritional intake, for example:

- Grain-legume combinations (e.g., fonio and beans) for a more balanced amino acid intake,
- Leaves (bred, baobab, okra, etc.) rich in micronutrients,
- Whole grains providing iron, calcium, vitamins, and fibre.

Fermented foods (akpan, nunu - fermented milk, etc.) are also staple or essential foods. They are rich in probiotics, which can benefit the gut.

Excess weight and obesity are on the rise in urban areas of the Global South, leading to an increase in metabolic diseases such as cardiovascular disease and type 2 diabetes. Traditional foods may form part of the solution. For example, a unique CIRAD innovation has been the development of non-dairy functional foods based on fermented cereals (inspired by traditional African foods) enriched with bioactive compounds.

In South Africa, CIRAD and its partners are working to strengthen agri-food systems to provide traditional, affordable and nutritious African foods benefitting gut microbiota and general health.

Projects involved

- The AFTER (African Traditional Foods Revisited by Research) project, funded by the European Union and coordinated by CIRAD, has modernized processing of traditional African foods while respecting their heritage and authenticity. These foods are the result of age-old sustainable practices, adapted to the climatic and cultural conditions of local populations and which have the potential to meet their nutritional requirements.
- The PROMET (PRObiotic-METabolic) project is developing a probiotic, plant-based functional food that could help prevent and reduce metabolic syndrome. It is a vegan alternative to the functional products already available in both northern and southern African countries. This food improves lipid and carbohydrate metabolism in vivo while supporting intestinal microbiota.
- The FAMA (Food And Microbiota in Africa) project, supported by the French Ministry of Foreign Affairs and coordinated by CIRAD, is being implemented through partners in South Africa and Senegal. In response to the triple burden of malnutrition (undernutrition, micronutrient deficiencies, excess weight/obesity) and inadequate intestinal microbiota, the project is focusing on alternative food systems based on traditional African foods. It aims to better understand the role of traditional foods on the intestinal microbiome and to promote agroecological production, processing, distribution and consumption.

Work carried out by the projects

- The AFTER project carried out R&D to promote highly nutritious traditional African foods based on knowledge transfer between Africa and Europe.
- The PROMET project helped design a probiotic cereal food and tested it in vivo in animals. The synergistic effects of the bioactive and probiotic compounds in the food led to a reduction in metabolic syndrome; it acted on insulin resistance and dyslipidemia, and helped restore a healthy intestinal microbiota balance.
- The FAMA project is generating knowledge on traditional African foods by focusing on the link between these foods and the human microbiome. In partnership with stakeholders in the food system, pilot schemes are currently underway to increase the supply of these foods whilst keeping them at an affordable price, through the creation and transfer of agroecological innovations and the development of processing methods ensuring high nutritional and health standards. The project is also raising awareness among policymakers about the importance of traditional African foods.

Recommendations to policy makers

- The increase in urban population and the ever more widespread consumption of high-calorie, easy-to-prepare, but often overly fatty/sweet/salty foods low in micronutrients mean that traditional foods are often neglected by today's urban consumers. It is therefore necessary to improve the production, processing and public image of these products to better meet consumer needs without losing any of their heritage or authenticity.
- Decision makers, particularly in urban areas, must make food and nutrition part of their public policies, e.g. by offering a range of traditional African foods in urban consumer environments.
- Fermented plant products represent a vast and vibrant area ripe for innovation. Exploring these products could open new avenues in nutrition, health, sustainability, and food innovation. Research and development in this sector is essential to maximize the benefits of fermentation while meeting the growing health and sustainability needs of consumers. Fermentation is also a traditional and energy-efficient food preservation process that can overcome seasonality, preserve the nutritional and health benefits of food, thus reducing losses and waste.
- Traditional food producers facing frequent droughts and increasing soil salinity must be supported through assistance and training in food processing, post-harvest handling, and packaging.

Find out more



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Two biofortification processes to increase food micronutrient content



Participatory varietal evaluation with members of the farmers' organisation VFTV-FIFATA in the commune of Manandona, Madagascar. © S. Castro Pacheco, 2023

Biofortification is a process by which foods are fortified with micronutrients. At CIRAD this is done via two methods: varietal improvement of conventionally-grown plants (without GMOs) and the use of agroecological farming to provide plants with minerals that accumulate in their edible parts

In addition to nutritional qualities, these crops are adaptable, productive, healthy and possess excellent sensory qualities, and have been accepted by producers and consumers.

Micronutrient deficiencies, also known as “hidden hunger,” is a form of malnutrition affecting more than 1.5 billion people worldwide, in both rural and urban areas. One way to combat this is to produce foods rich in micronutrients. Biofortification produces micronutrient-enriched cereals, legumes, roots, and tubers. These biofortified foods do not require any additional processing and are available to producers and consumers at market stalls.

Work carried out by the projects

- Rice varieties naturally rich in micronutrients (e.g. zinc) are being identified, created, or developed through producer - consumer partnerships (Colombia, Bolivia, Madagascar).
- Naturally micronutrient-rich varieties of cowpea, orange-fleshed sweet potato (Senegal), and teff (Ethiopia) have been enriched with iron, zinc, and vitamin A through a combination of organic fertilization and the use of soil microorganisms (beneficial indigenous microorganisms and mycorrhizae).

Projects involved

- HarvestPlus – a CGIAR research project on Agriculture for Nutrition and Health (A4NH)
- Or4Food – Organic residual products for biofortified food for Africa, funded by the African Union Commission and the European Commission.



Lessons learned from the projects

Both biofortification methods, varietal improvement of plants (without GMOs) and application of organic fertilizer combined with beneficial microorganisms, have demonstrated their ability to increase micronutrient content in different foods (cereals, legumes, tubers, etc.). They have also demonstrated that biofortification, whether using varietal or agroecological techniques, is fully compatible with agroecological production.

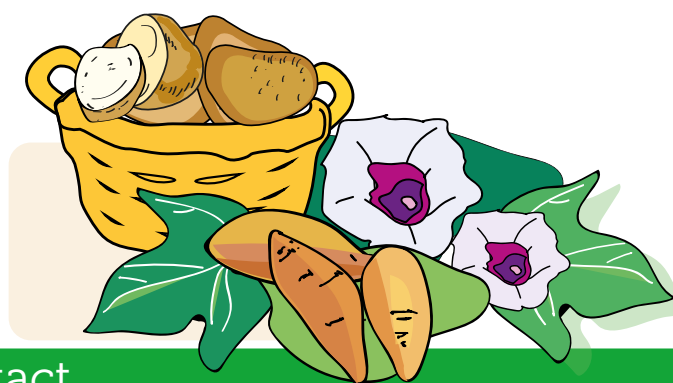


Harvesting a biofortified orange-fleshed sweet potato © E. Noumsi Foamouhoue

Recommendations to policy makers

- These two methods of biofortification should be combined to maximise their impact and improve the nutritional status of macronutrient-deficient populations.
- Public bodies must promote agroecological production and varietal selection of micronutrient-rich plants. This should be combined with recycling of local organic waste and the use of effective endogenous microorganisms for better soil health, thus ensuring agroecological biofortification in agricultural production.
- Biofortification, whether varietal and/or agronomic, in no way precludes dietary diversification, a desirable and overarching objective. These two approaches should be complementary over time. Biofortification provides a rapid, though imperfect, response to nutritional and human health needs, while diversification represents a more holistic approach addressing challenges in the food production system. This remains a major issue in many regions of the world where certain physical factors are highly limiting (access to water, land, extreme climate, etc.) and require a long-term territorial approach.

Find out more



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Providing healthy, high-quality, locally-produced and sustainable school meals



Teams of parents take turns preparing meals at a public primary school in the Ambositra district © H. David-Benz, CIRAD

School meals are a useful mechanism to assist in the territorialisation and greening of food systems. On the one hand, they influence the eating habits and nutritional education of many young people and, on the other hand, strengthen the supply of healthy, sustainable, and high-quality local products. At the territorial level, they help drive strategies and cooperation between public and private players in education, health, agriculture, and development.

CIRAD and its partners are conducting research in contrasting island contexts, in the Antilles and the Indian Ocean, where malnutrition is seen in its different forms.

School meals are widespread only in the French Overseas Territories (DROMs). In other Indian Ocean islands, catering is limited to highly vulnerable populations or pilot projects in areas where food supply is particularly challenging. But in all these places, the challenge is to improve the diversity of children's diets, use a greater quantity of quality locally-sourced products, particularly fresh produce.

Projects involved

- **RESTOMART** - Barriers and levers to locally-sourced food in mass catering in Martinique (2021-2022). This project aims to identify players in mass catering and to analyze their activities and interactions on the island of Martinique. It also aims to understand the constraints facing stakeholders, particularly in their purchasing decisions, forced upon them by the nature and origin of foods, as well as to identify, discuss, and propose mechanisms for improving the supply of locally-sourced food.
- **TERRITOIRES DURABLES 2** (Martinique Ambition, 2025-2027). This local project supports stakeholders in their efforts to increase supplies to school catering of fruits and vegetables from low-pesticide production areas, or from certified organic farming or other standards promoting sustainable practices, compatible with the EGAlim law.
- **ITALIQ** - Technological and organizational innovations for quality food (2023-2026). This project is designed to improve food security in the Indian Ocean by improving the availability of varied, healthy foods in local and regional markets. It provides a fresh perspective and new initiatives for Indian Ocean countries for sourcing locally-produced foods for school meals.
- **SADUR** - Sustainable food systems in an island environment (2023-2026). This project aims to strengthen the sustainability and sovereignty of the food system on Reunion Island, via agroecological transition, to provide healthy, sustainable, locally-sourced and accessible food for all. In particular, the project analyzes how best to organise procurement structures between suppliers, school catering managers and support players to simplify the purchasing of quality local products, as well as promoting the benefits public policy can play.



Lessons learned from the projects

- In Martinique, as in Réunion, local produce is limited, seasonal, and subject to significant climatic hazards. Competition from imported products, complex public procurement procedures, and unattractive payment terms for producers all serve to hamper local sourcing. However, professional and inter-professional organizations as well as the use of facilitators between local suppliers and caterers are helping to increase use of local products. Combined with awareness-raising, these initiatives are also helping to change students' attitudes toward fresh local produce and vegetarian dishes.
- In Madagascar, the World Food Programme is backing a new school meal supply model. This model is based on a combination of imported staple foods (rice, oil, pulses), cash transfers to purchase fresh local produce, and parental contributions through meal preparation and agricultural production on community plots. It has resulted in diversification of diets and has generated positive community dynamics connecting the areas of education, nutrition, and agriculture.



Mealtime at a public elementary school in the Ambositra district (Madagascar). The refectory has been damaged by bad weather, and the children are eating in their classroom
© H. David-Benz, CIRAD

Recommendations to policy makers

- Increase local legume production. Diversifying school meals requires a highly diverse local agriculture, particularly fresh produce. This includes the fruits and vegetables, but also legumes, essential for a balanced and inexpensive protein intake and for soil fertility. In French Overseas Territories (DROMs), legumes are widely used in traditional recipes, but are rarely locally produced.
- Simplify administrative procedures for public procurement in the DROMs to make them accessible to as many producers as possible.
- Promote organizations that facilitate coordination between local supply and demand for school meals (professional organizations, purchasing groups, etc.).
- Develop school meal programs with local producers and schemes promoting diversified agriculture and agroecological practices.

Find out more



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Creating new urban food environments through partnerships



Citizen Food Assembly in Montpellier, September 2023 © N. Bricas, CIRAD

Influencing people's eating habits requires more than just education, raising awareness, and informing consumers. We must also influence their food environments: location of food stores, health regulations, prices, advertising, and so on. This requires easy access, both physically and financially, to safe, healthy, and nutritious food from equitable and sustainable food systems. This requires the involvement of stakeholders from every sector of the system.

In recent years, cities have become key players in food policy creation. They aim to confront the health and nutritional challenges of their populations whilst promoting job creation and sustainable production and consumption in food systems. Through multi-stakeholder governance and the participation of residents, they are able to influence their food environments.



Projects involved

- Agroecological and food policies of Montpellier 
- Foodscapes: the effects of food landscapes on the eating habits of Montpellier residents 
- AfriFOODlinks: an action-research project aiming to transform urban food systems in Africa. 
- WECCO: A partnership with the Council of Rufisque (Senegal) on school meal policies.
- TerrAsol: Solidarity in Food Territories. Solidarity between residents of Montpellier and its food-producing regions.

Results

- An interdisciplinary research project (Foodscapes) led by CIRAD and INRAE, based in the Montpellier Metropolitan Area, aimed to identify food landscapes and their effects on behaviour. It led to the development of a city-wide food policy.
- For 10 years, CIRAD has lent its support to Montpellier's "My Different Canteen" project, a scheme with 25 initiatives: promoting organic and local products, meat-free meals, waste reduction, etc.
- With CIRAD's support, knowledge gained from the scheme in Montpellier has been shared with various networks and projects: Milan Urban Food Policy Pact, AfriFOODlinks, and WECCO.
- AfriFOODlinks is carrying out 25 pilot initiatives on food environments in 15 African cities.
- Montpellier is piloting a food democracy scheme, with a Citizen Food Committee managing a common food fund and an agreement for points of sale.



Recommendations to policy makers

- With three-quarters of the global population experiencing moderate and severe food insecurity living in cities, food policies must further take on board urban issues and consider cities as key players in these policies.
- Addressing the health and nutrition challenges faced by city dwellers must necessarily involve transforming their food environments to improve access to healthy and nutritious food, rather than simply the use of awareness campaigns.
- From the outset, action on food environments must involve all stakeholders, including "informal" players and, if possible, residents, to ensure long-term relevance, replicability and sustainability.
- It is essential to supporting urban groups involved in the transformation of food systems in order to influence national and international food policy.

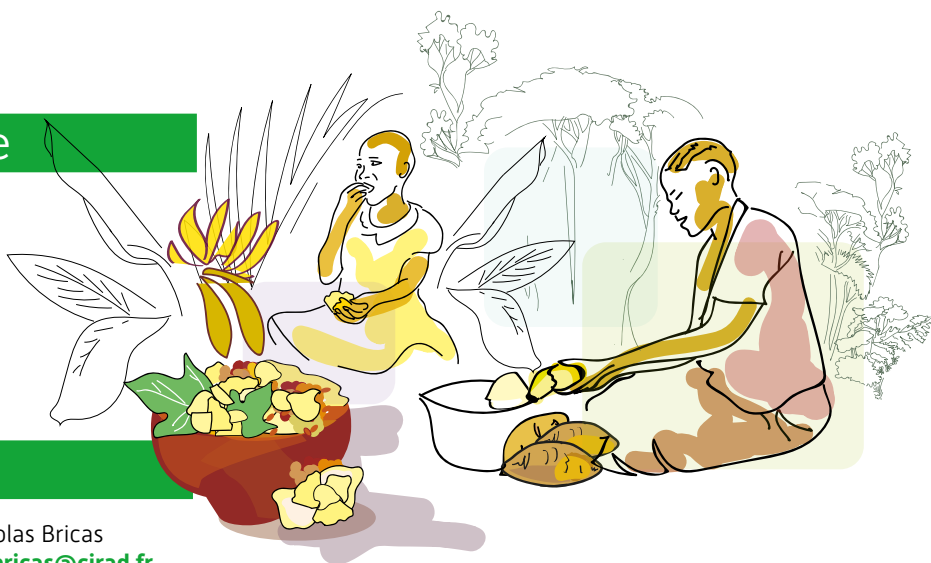
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Promoting agroecological food systems to improve nutritional intake and consumer health



Micro-gardening on tables in the Patte d'Oie district of Dakar, Senegal © N. Sirdey, CIRAD

Agroecology can help improve the nutritional intake and health of both rural and urban consumers, through a variety of mechanisms that go beyond the simple consumption of agroecological products. Agroecology is a holistic approach comprising the production of diverse and healthy local foods, connectivity to markets, management of natural resources such as water and timber, transfer of resources and knowledge between farmers, and empowering vulnerable local groups. Agroecology must therefore be supported at every level and in a territory-specific manner, to allow nutritious, inclusive and sustainable food systems to grow and flourish.

Malnutrition, in all its forms, is a major issue in the Global South, both in rural and urban areas. The cause is often a diet that is too undiversified and/or too rich in fat, salt, and sugar. Food systems need be redesigned fundamentally, both at social and institutional levels, to provide more diverse diets and healthier food. Agroecology can be a powerful mechanism to transform food systems to provide improved nutrition, inclusively and sustainably.

Projects involved

- **NSAE – Nutrition Sensitive Agro Ecology:** Funded by the European Union as part of the Nutrition Research Facility (NRF) initiative and managed by CIRAD and its Laotian partners, the NSAE project combines scientific and local knowledge to explore ways of improving women and children's diets through agroecological practices in Laos.
- **NRF Agroecology and Nutrition in Senegal Study:** This study, part of the NRF initiative by Cornell University, LATES-IFAN/UCAD and CIRAD, focuses on the mechanisms by which agroecology-based food systems can improve the diet of women in low-income neighbourhoods in the Dakar area, in Senegal.
- **RELAX – Promoting the resilience of rural African households:** Food systems at a crossroads: The Relax project explores ways to improve the food resilience of rural households in Burkina Faso through areas such as nutrition, economics, agronomy, sociology and political science.
- **FAMA – Food and Microbiota in Africa:** Backed by the French Ministry for Europe and Foreign Affairs, the project is managed by CIRAD and its partners in South Africa and Senegal. In response to the triple burden of malnutrition (undernutrition, micronutrient deficiencies, excess weight, and obesity) and impairment of intestinal microbiota, FAMA focuses on alternative food systems inspired by traditional African foods. It aims to understand the role of these foods on intestinal microbiota and to promote production using agroecological practices, as well as sustainable processing, distribution and consumption.



Lessons learned from the projects

- Agroecology can improve the diets of rural populations by improving agricultural biodiversity and thus the diversity of home-consumed foods. According to NSAE, the main barriers to fruit and vegetable consumption in the Xiengkhouang Province in northern Laos are slow growth of fruit trees at high altitudes and maintaining vegetable gardens during the dry season. Since fruit is rarely purchased, its consumption depends first and foremost on local production and self-supply; hence the importance of promoting agroecological production.
- Agroecology, often seen as solely agricultural, also includes aspects such as market connectivity and natural resource management. The RELAX project in Burkina Faso has shown that self-supply, market purchases, and wild harvesting are complementary, providing access to different foods in different seasons.
- Agroecological market initiatives in low-income neighbourhoods in the Dakar area in Senegal, show that the purchase of agroecological products is primarily driven by health concerns and contributes to the dietary diversity of local families. Agroecological produce markets are also ideal places for consumers and producers/vendors to meet and to raise awareness of health, food, and environmental issues affecting them.
- In South Africa, agroecological food systems promote traditional African foods such as fermented sorghum products, which are highly nutritious and support human microbiota. They are an alternative to the food systems responsible for obesity and diet-related non-communicable diseases.

Recommendations to policy makers

- Promote agroecology in rural areas to support the production and consumption of healthy, diverse food, raise incomes and resilience to shocks and crises, reduce the impact of agriculture on the environment and biodiversity, and encourage equity in food systems.
- Support the development of local agroecological sectors and markets to provide a regular, diversified, and accessible supply of agroecological produce, particularly traditional African products, to the poorest urban populations.
- Integrate agroecology into urban food policies to create dedicated production areas and extend food markets in deprived neighbourhoods.
- Increase the supply of agroecological produce in public procurement, particularly for mass catering (schools, universities, company restaurants, hospitals, etc.).

Find out more



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Using peanut varietal diversity as a mechanism to improve protein and energy intake in populations with severe acute malnutrition



Peanut diversity © P. Teres, CIRAD

Peanuts are a basic raw material used in manufacturing Ready-to-Use Therapeutic Foods (RUTF) used to treat acute malnutrition in children. There is a wide disparity in nutritional quality (mainly proteins and lipids) between different peanut varieties. Varietal diversity is used in improvement programs to provide local West African RUTF manufacturing companies with highly nutritious peanut seeds that meet international standards [Codex Alimentarius].

Severe acute malnutrition (SAM) is a major cause of child mortality. Treatment for SAM relies largely on Ready-to-Use Therapeutic Foods (RUTF), typically in the form of peanut-based paste. Recent changes in international standards regarding the fatty acid and protein content of RUTF are rendering traditional peanut varieties obsolete. This has had the effect of limiting the amount of quality peanut seeds African producers are able to supply to local factories. Current research is using different peanut varieties of to create new, more nutritious varieties which are well-adapted to African agrosystems.



Projects involved

- ABEE: Strengthening networks and institutional capacities in plant improvement for the development of resilient crops for the benefit of small producers in West Africa [Desira-UE]
- Enhancing Peanut productivity in West-Africa [UGA-USAID]
- Selection of peanut varieties based on essential amino acid content [TSARA: Cirad/INRAE]
- Greenut [INRAE, Cirad et Nutriset]

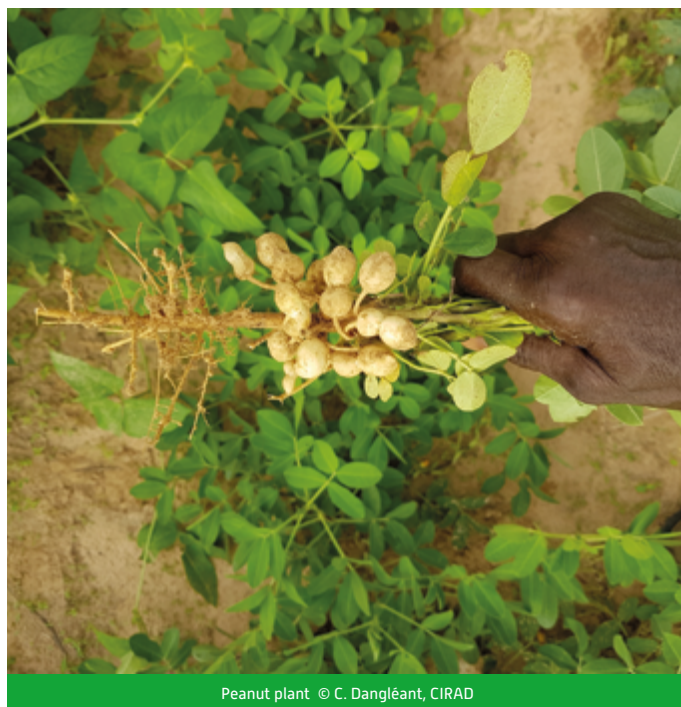


Work carried out by the projects

- Over 1,000 peanut varieties have been collected. This represents the entire peanut diversity cultivated in Africa and has been used in various varietal improvement programs and studies. These peanut varieties were selected based on their adaptation to different environments, their resistance to disease and the nutritional quality of their seeds, including lipid, protein, fatty acid, sugar, iron, and zinc content. The best varieties were redistributed to 15 countries in Western, Eastern, and Southern Africa, including Madagascar.
- Elite varieties are used in crossbreeding programs to combine their nutritional properties with the adaptability of other varieties, creating new peanut varieties. A current doctoral thesis aims to describe the amino acid profile and protein digestibility of several varieties of peanuts with high nutritional value.
- This has been done in partnership with producers to test varieties within the private sector (Nutriset, BASAN Group) to bring peanut production and processing together in the manufacture of RUTF.

Recommendations to policy makers

- Regulatory changes impact ability to source local high-quality raw materials for RUTF production. Supporting public-private partnerships through research funds will improve innovation systems and adapt more quickly to change.
- Agrobiodiversity will enable systems to adapt to changing environments and to diversify and improve consumer nutrition and diet. With this in mind, grain legumes will play a role in the transition to more sustainable and nutritionally rich food systems.
- South-South and North-South partnerships are crucial for mobilizing diversities, knowledge and skills, as well as to strengthen the scope of research and economic players.



Peanut plant © C. Dangleant, CIRAD

Find out more



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Peanut producer in southern Senegal © D. Fonceka, CIRAD