

UNDERUTILISED CROPS

Diversifying the agrifood system by mainstreaming underutilised crops

The increasing demand for food, including inequities in household food and nutrition security, is exerting pressure on the agrifood system, which is already threatened by climate change, environmental degradation and declining agrobiodiversity. Mainstreaming neglected and underutilised crop species could help communities overcome these challenges. So writes Tafadzwanashe Mabhaudhi, Sithabile Hlahla, Moloko Mojapelo, Cliff Dlamini, Baitsi Podisi, Luxon Nhamo, Sylvester Mpandeli, Tshilidzi Madzivhandila and Rob Slotow.



Diversifying the agrifood system and supply chains with neglected and underutilised crop species can increase agricultural income, promote agrobiodiversity, and supply diverse and nutritious food to tackle malnutrition, hidden hunger and food insecurity under climate change. Mainstreaming these crops will promote food and livelihood security and empower vulnerable communities, economically and sustainably, making the agrifood system more inclusive and socially just.

In South Africa, food production is dominated by monocrop agricultural systems which lack agrobiodiversity. The monocrop system is centred around a few major cash crops, such as maize, wheat, sugarcane, potatoes, apples and onions, while excluding

neglected crops such as sorghum, taro, sweet potato, amaranth and Bambara groundnut. While this model of agriculture has been valuable in assuring national food and nutrition security and surplus for export, it has yet to be successful at the household level. There is rising household food and nutrition insecurity and widening insecurities as people cannot afford healthy diets.

Key challenges to the adoption and mainstreaming of neglected and underutilised crops

Neglected and underutilised crops have informal seed systems, also called local, traditional or farmer seed systems, as the farmers access seeds directly from their harvest and disseminate

it through exchange and barter among friends, neighbours, relatives and local markets. The seeds are often of variable quality as they are often landraces and may be heterogeneous (modified through informal breeding and use). In addition, the seed systems of these crops are not regulated by government policies and regulations.

There is a need to recognise and develop a greater understanding of the operation of the informal markets through which neglected and underutilised crops are currently sold and to deploy research for development to scale exemplar crops and support strategies that maximise profitability for farmers selling their produce. Bottlenecks to achieving this are the need to robust and comparable empirical information concerning informal markets and workable models for maximising the value of these crops and scaling them. This, in turn, is a function of an approach to understanding the economy, which regards the informal economy as a deviation from the norm rather than being complementary to formal markets.

There needs to be more policy that recognises the use of neglected and underutilised crops as part of a strategy for sustainable food systems and climate change adaptation, especially in marginalised communities. This acts as a disincentive to developing distribution channels and adopting the post-harvest handling techniques necessary to limit losses and widen the distribution of these crops.

The policies governing the food system reflect a favourable environment for big businesses and have made it conducive for a few players to dominate the food system. Many policymakers favour the commercial agenda because its actors have shown that it is productive, improving national food security, reducing unemployment, and contributing to the national gross domestic product (GDP). However, the profit-environmental harm and inequitable distribution, which results in household food and nutrition insecurity.

The potential of neglected and underutilised crops under climate change

Climate change will affect crop yields and quality, food supply, and ultimately cause an increase in food prices, highlighting the importance of supporting traditional crops and farming systems. A change in the observed climate will affect the growth of crops through multiple mechanisms, including changing phenology, heat stress, water stress, waterlogging, and increases or reductions in pests and diseases.

Several neglected and underutilised crops (e.g. Bambara groundnut, cowpeas, amaranth, millets, and wild mustard) are nutrient dense. Their ability to adapt to harsh conditions suggests that they can be deployed to champion climate change adaptation. This can improve food systems' resilience to climate shocks while transforming healthier, more equitable, and inclusive diets.

Furthermore, there will be environmental co-benefits, as neglected and underutilised crops are typically adapted to marginal environmental: they require less landscape modification, are more tolerant to stresses (e.g. drought, heat, salinity), and need fewer external inputs (e.g. fertiliser,

water pesticides). Hence, diversifying the food system by incentivising such crop production and consumption can be pivotal in adequately addressing food insecurity, micronutrient deficiencies, vulnerability to climate change, and environmental degradation.

Benefits of including neglected and underutilised crops in the climate change agenda

Millions of people in the global South rely on neglected and underutilised crops as a primary food source. Research has shown that these crops are highly nutritious, containing several micro- and macro-nutrients that are essential for health, more so than some of common major crops. For example, several traditional cereals, legumes, and vegetable crop species contain high proportions of vitamins, calcium, iron, potassium, magnesium and zinc, and some neglected and underutilised fruits and vegetables contain more vitamin C and pro-vitamin A than major crop species and their staple counterparts such as maize.

Certain neglected and underutilised crops have been reported to have certain health protection and medicinal properties and can have protective effects against major chronic diseases. For example, finger millet has a low glycaemic index (GI) and can be digested slowly, making it popular among diabetic patients.

Neglected and underutilised crops are important for conserving agricultural biodiversity and agroecosystems, critical for the long-term sustainability of food and agricultural production. In addition, adopting these crops could contribute towards reducing greenhouse gas (GHG) emissions. Research shows that worldwide adoption of a more plant-based diet could reduce food-related GHG emissions by up to 70% by 2050.



Crops such as sorghum have been found to be suited for drought and heat-stress-prone areas such as KwaZulu-Natal, Eastern Cape and Limpopo provinces, where most agricultural and rural households reside.



The demand for agriculture that supports a healthier diet, which is less dependent on monocultural systems and external inputs and is better suited to marginal and semi-arid environments, has revived interest in diverse traditional systems.

Neglected and underutilised crops can also reduce the contribution of environmental contaminants by agriculture, which can tolerate pests and diseases, grow in low-quality soils and require lower levels of inputs such as pesticides fertilisers.

Climate-socio-economic co-benefits of neglected and underutilised crops

Neglected and underutilised crops can provide and improve income for people experiencing poverty, especially women and youth, who generate income from agricultural activities, creating job opportunities through agro-processing and value-adding, particularly in rural areas. The crops require low inputs such as pesticides and fertilisers, reducing farmers' inputs costs.

They are also resistant to pests and diseases and tolerant to environmental extremes and less favourable weather conditions, unlike major crops, meaning the farmers' income sources will not be disrupted. Within communities, neglected and underutilised crops can offer cross-cutting solutions to multiple constraints. For instance, sorghum, millet, Bambara groundnut, lentils, and cowpeas are recommended food choices under nutritional and water-limited conditions.

In this regard, they can benefit low-income producers and consumers of food who are limited in their capacity to adapt to increasing climatic risks. Therefore, the promotion and inclusion (i.e. mainstreaming) of these crops could contribute towards addressing Sustainable Development Goals related to social and economic issues.

The suitability of neglected and underutilised crops to harsh environments

Changes in rainfall and temperature due to climate change will affect land suitability. Several neglected and underutilised crops are drought and heat-stress-tolerant, making them ideal for de-risking cropping systems in drought-prone areas. However, owing to their status, current crop suitability maps do not include them as part of the crop choices. Knowing these crops' spatial and temporal suitability is important for fitting them into marginal production areas and cropping systems under climate change.

It has been found that approximately 70% of South Africa's



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land is categorised as unsuitable for rain-fed crop production due to poor rainfall distribution and soils with low fertility. Yet, neglected and underutilised crops, such as sorghum, taro, amaranth, and cowpea, are naturally suitable in marginal areas. However, there were variations in the magnitude of suitability for each of the crops investigated. For example, sorghum and cowpea were suited for drought and heat-stress-prone areas such as KwaZulu-Natal, Eastern Cape and Limpopo provinces, where most agricultural and rural households reside.

These crop species are well adapted to high climate risk and can be produced under water-limited and extremely hot (33–38°C) conditions. Amaranth is highly suitable across most cropping lands in South Africa, and this is because the crop has a short growing period and low water requirement. The suitability of taro in KwaZulu-Natal and Mpumalanga provinces is consistent with the observed length of the growing period. Specifically, taro takes up to 300 days to mature and has a high water use (651–1 701 mm). In this regard, the areas suitable for taro production in South Africa have been found to be low and mostly confined to subtropical areas receiving high rainfall. The crop's mild drought tolerance and adaptation to waterlogging suggests it may be more suited to high rainfall areas that experience mid-season dry spells and are prone to flash flooding.

Therefore, neglected and underutilised crops can be introduced as part of sustainable intensification approaches for climate change adaptation, as they could use land unsuitable for growing cash crops. This option offers a complementary crop rather than a substitution production scenario. However, the information on suitability needs to be complemented with information on "better bet" agronomic management to realise the full potential of the crops in question.

Cowpea, sorghum, and amaranths are highly suitable in areas which receive more than 500 mm per season and most of these areas are highly urbanised (i.e. Gauteng province). Therefore, the land value near urban areas might affect the opportunity cost of promoting NUS near urban areas. Peri-urban farmers prefer high-valued horticultural crops and dairy production with higher market demands.

Promoting neglected and underutilised crops within marginal

production areas can create new and sustainable economic pathways and improve the availability and access to nutrient-dense foods. The importance of smallholder farmers to sustainable food systems and their participation in local food systems must be emphasised. Moreover, there is a need to create an enabling environment for all participating stakeholders.

This can be achieved if there is a harmonisation of existing policies that speak to land, environment, agriculture and health, and new land-use policies are co-designed based on evidence. Policies such as the National Environmental Management: Biodiversity Act of 2004, National Food and Nutrition Security Policy and Draft Policy on Preservation and Development of Agricultural Land Bill 2015 could foster the co-development of NUS technologies and aid in addressing challenges in the land, environment, agriculture and health domains.

The potential of neglected and underutilised crops to contribute to diverse socio-economical goals

The demand for agriculture that supports a healthier diet, which is less dependent on monocultural systems and external inputs and is better suited to marginal and semi-arid environments, has revived interest in diverse traditional systems. Neglected and underutilised crops can offer new opportunities to address malnutrition and food insecurity, exacerbated by the rapidly increasing global population, the reduction in arable land, and the changing climate.

In this regard, they offer opportunities to co-evolve, hence transform socio-ecological landscapes, in response to changing socio-economic and bio-physical factors and the need for healthier diets. Including these crops as part of transformative

adaptation allows for adapting to the climatic, ecological, and natural limits in which resource-poor farmers, in particular, reside. Therefore, neglected and underutilised crops can offer opportunities for 'fitting to' or 'fitting with' the socio-ecological environment while sustaining the natural products or processes needed for sustainable food systems.

What is needed

The current South African food system is centred around a few cash crops and needs to fully recognise the value of neglected and underutilised crops. Diversification of the food system and supply chain with these crops can increase farmers' food supply and agricultural income, promote agrobiodiversity (crop diversity), and tackle malnutrition, hidden hunger, and food insecurity in the face of climate change and environmental challenges.

Crop diversification can also increase the South African food basket and reduce reliance on food imports. Therefore, creating a value chain for these crops is imperative. The value chain must be promoted from production, post-harvest and processing, and consumer marketing. Creating an enabling environment for promoting neglected and underutilised crop production, marketing, and consumption will require governments to acknowledge their potential while ensuring broader stakeholder participation from inception. This will promote integrating indigenous and expert knowledge into the process and contribute to gaining stakeholder commitment and developing the necessary capacities and structures for holistically integrating these crops into the food system.

Mainstreaming neglected and underutilised crop species

