# Phase 1 Technical Meeting Report for the Vision for Adapted Crops and Soils (VACS) August 21, 2023

African Union

Food and Agriculture Organization of the United Nations

# Foreword

FAO is pleased to be part of the Vision for Adapted Crops and Soils (VACS), to be part of its Steering Committee, and to host the Phase 1 Technical Workshop held in Rome in May 2023.

VACs is a fantastic initiative for Africa. Its major objectives of identifying the most nutritious crops in each of the African Union's five regions, assessing the expected challenge posed to those crops by climate change, and seeking to boost public and private investments to adapt those crops to anticipate effects of climate change, are fully aligned with the African Union's Agenda 2063 aspirations, making a concrete, tangible contribution towards sustainable food systems transformation in the region. For FAO, it is a living example of three of the four pillars of our Strategic Framework 2022-2031, prioritizing actions for better production, better nutrition, better environment, with high potential to contribute also to the fourth, a better life for farmers and food systems workers in Africa.

The two-day workshop reported here brought together experts on climate adaptation, plant breeding and other areas of agriculture, and nutrition and food composition. It provided an opportunity for VACS to consolidate its grounding in science, knowledge, politics, innovation, and engagement, and to set the right ambition and balance for VACS among those five pillars.

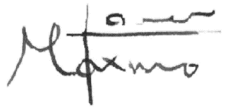
In the run-up to the workshop, VACS already made important contributions highlighting gaps and opportunities for data and evidence. Food composition data, for example, were not readily available for almost 30% of the identified potential crops. Robust evidence of consumption patterns for foods made from most of the potential crop was

similarly unavailable. Moving forward, VACS can contribute to filling these and many other data and evidence gaps identified.

As highlighted in the 2021 Food System Summit and many follow up activities, comprehensive food systems transformation is urgently needed to ensure healthy diets are available and affordable to all now and in the future in sustainable agrifood systems. In Africa, rural transformation is also needed to ensure equitable livelihoods for rural workers. No single initiative can solve these challenges, but VACS can make a critical contribution in the right direction.

The Phase 1 Technical Workshop was just the start of a journey for VACS. Ultimately, the success on the investments in prioritized crops will depend on actions across the value chain. Soils have already been prioritized as part of VACS, but other investments and actions will need to be linked and leveraged including seed systems, processing, and reduction of food losses, supporting, and fostering farmer and consumer uptake, among others. The Phase 1 Technical Workshop was a major milestone for VACS, one of many steps still needed to realize the potential of the prioritized crops to contribute to healthy diets in Africa, and to select the right metrics and benchmarks to demonstrate that contribution.

Investment in identifying and adapting crops for healthy diets and climate resilience is needed in all regions of the world. We hope that VACS generally, and this report specifically will help spark further momentum to realize the potential of nutritious crops for Africa and beyond.



Maximo Torero, Chief Economist, Food and Agriculture Organization of the UN

# Introduction

Africa has been and will continue to be the region in the world most adversely affected by climate change. The UN estimates that the world population will be 9.7 billion by 2050, with three quarters of that population increase occurring in Africa. It is estimated that by 2050, up to an additional 80 million people on the continent could be at risk of hunger, two hundred fifty million people could face high water stress, and up to 700 million people could be displaced due to climate change and variability.[1]

Agricultural adaptation can and must help the African continent to avoid these projected worst-case scenarios. Building more resilient food systems begins with growing crops that can withstand more heat, less moisture, greater pest and disease pressure, and extreme weather events like droughts and floods. African diets often focus on calorie-dense, staple crops—like maize, rice, yam, and cassava—without providing the micronutrients and macronutrients needed for a healthy and active life. Importantly, there are many indigenous and traditional food crops (ITFCs) —many of which are highly nutritious—that are eaten daily in rural Africa. Many ITFCs may be better suited to tolerate hot and dry conditions, since they have been adapting to the local environment for thousands of years [2]. Yet, most IFTCS in Africa have received little to no funding to improve their resilience, yield, and marketability. Moreover,

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[1] Trisos, C.H., I.O. Adelekan, E. Totin, A. Ayanlade, J. Efitre, A. Gemeda, K. Kalaba, C. Lennard, C. Masao, Y. Mgaya,G. Ngaruiya, D. Olago, N.P. Simpson, and S. Zakieldeen, 2022: Africa. In: Climate Change 2022: Impacts, Adaptationand Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panelon Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig,S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 1285–1455, doi:10.1017/9781009325844.011.

[2] Rudebjer, P. G., Meldrum, G., Padulosi, S., Hall, R., & Hermanowicz, E. (2014). Realizing the promise of neglected and underutilized species: Policy Brief. Rudebjer, P. G., Meldrum, G., Padulosi, S., Hall, R., & Hermanowicz, E. (2014). Realizing the promise of neglected and underutilized species: Policy Brief.

agricultural policies have generally favored a select few crops to the detriment of this diversity.

Historically, plant breeding investments at the global scale have been highly concentrated in cash crops and in three major staple crops: maize, wheat, and rice. Together, these three commodities provide about half of global calories, while 80-90% of global energy intake is sourced from just 12-20 species.[3] But a healthy diet – one that meets nutrient requirements and prevents deficiencies and excesses related to a variety of diseases - depends on consumption of a diversity of nutritious foods, including whole grains, legumes, roots and tubers, nuts, seeds, fruits, vegetables, and animal source foods.

Some of the most nutritious crops, like legumes, seeds, fruits, and vegetables, receive the least plant breeding investment. Yet, we have already begun to see the effects of climate change in Africa on all forms of malnutrition, including those caused by undernutrition as well as overweight and obesity, due to inadequate and inconsistent economic and physical access to nutritious foods. Climate change directly reduces the production of ITFCs and staple crops, threatening global nutritional security. Additionally, increased levels of $CO_2$ in the atmosphere are expected to affect the nutrient composition of staple crops adversely—reducing up to 10% of their zinc, 5% of their iron, and 8% of their protein content, thus limiting their potential to contribute to healthy diets.[4]

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[3] Chivenge, P., Mabhaudhi, T., Modi, A. T., & Mafongoya, P. (2015). The potential role of neglected and underutilised crop species as future crops under water scarce conditions in Sub-Saharan Africa. International journal of environmental research and public health, 12(6), 5685-5711.

[4] Smith, M. R., & Myers, S. S. (2018). Impact of anthropogenic CO2 emissions on global human nutrition. *Nature Climate Change*, *8*(9), 834-839.

Unfortunately, IFTCs have never benefited from the investments that could make them successful for growers and in the marketplace. Some species are threatened by abiotic and biotic stresses, have acquired tastes [5], low yields, high labor requirements, or are difficult to process into their consumable form.[6] The need for nutritious, climate-adapted crops in Africa that are competitive in markets and acceptable for consumers can be effectively addressed through targeted investments in plant breeding and value chains, minimal processing, and other value chain interventions, especially given recent technological advances in breeding and food processing.

Preparing Africa's food systems to deliver food security and nutrition in the face of climate change will require a dedicated political and scientific effort. To meet these challenges, the U.S. Department of State, in collaboration with USAID, and in partnership with the African Union (AU) and the Food and Agriculture Organization (FAO), launched the Vision for Adapted Crops and Soils, a multi-phase initiative. First, Phase 1 aims to identify the most important crops for nutrition in Africa through a consultative process involving a broad array of experts primarily based on the continent. Phase 2 will assess how those crops will fare under climate change through the year 2050 across the five regions in Africa. Phase 3 seeks to mobilize resources to accelerate research and development for these crops. Ultimately, Phase 3 will deliver high-yielding, locally adapted varieties to farmers and consumers in an effort to improve food and nutrition security on the continent.

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[5] Uusiku, N. P., Oelofse, A., Duodu, K. G., Bester, M. J., & Faber, M. (2010). Nutritional value of leafy vegetables of sub-Saharan Africa and their potential contribution to human health: A review. Journal of food composition and analysis, 23(6), 499-509.

[6] Dawson, I. K., Powell, W., Hendre, P., Bančič, J., Hickey, J. M., Kindt, R., Hoad, S., Hale, I. & Jamnadass, R. (2019). The role of genetics in mainstreaming the production of new and orphan crops to diversify food systems and support human nutrition. New Phytologist, 224(1), 37-54.

Investment in adaptation of nutritious crops is well-aligned with the policy objectives of the African Union. According to the African Union Common Position on Food Systems, which arose from the 2021 UN Food Systems Summit:

> "expanding Africa's food basket will serve both nutrition and resilience objectives. In this regard, there must be intentional investments towards increased productivity and production in traditional and indigenous crops. These are normally low-cost but nutritionally important in food systems. They are often managed by women and include vegetables, grain legumes, root crops and climate resilient crops such as sorghums, millets and cassava, all of which have for a long time suffered from massive under-investment."[7]

This report describes the VACS initiative and presents the findings of Phase 1. On May 18-19, 2023, approximately 40 experts from diverse organizations and geographic backgrounds convened at the FAO in Rome for the VACS Phase 1 Technical Workshop. Over the course of two days, workshop participants narrowed down a list of 150 traditional and indigenous crops in Africa to a list of 60 priority crops based on a defined set of criteria, with an emphasis on their contribution to nutrition. The following sections describe the selection process and present its results. The full crop list that resulted from this process can be found in Annex 1.

[7] "Africa Common Position on Food Systems: Regional Submission to the UN Food Systems Summit." (2021). African Union, AUDA-NEPAD.

# VACS Structure and Partners

Designated staff from the U.S. Department of State, African Union, and Food and Agriculture Organization of the UN comprise the VACS Steering Committee. Beyond the Steering Committee, VACS has several key partners involved in its core activities. These include The Rockefeller Foundation, which is generously financially supporting activities in Phases 1 and 2 of VACS and providing technical guidance throughout the initiative, and the African Orphan Crops Consortium, which has worked with indigenous African crops for over a decade and is providing key subject-matter expertise, data, resources, and connections to stakeholders. VACS also has two technical partners, HavosAi and AgMIP, which are contributing research inputs to Phases 1 and 2; additionally, FAO compiled food composition data to inform the crop selection process. In addition to these partners, VACS has a network of key stakeholders who have been consulted throughout the process, and technical experts who participated in the Phase 1 workshop.

# Methodology

## Initial Review

Over the years, there have been a number of efforts to promote the expanded development and use of what proponents have termed neglected, forgotten, underutilized, minor or orphan crops. While each of these terms has some validity, each is problematic in some way. For VACS, we have adopted the designation of the African Union, as indigenous and traditional food crops. The VACS effort builds upon the substantial work done by others that includes efforts to identify, prioritize and promote such crops, some of which are described below.

First, we created a master list, pulling largely from four existing lists of these traditional, or underutilized crops. In 2020, Akinola et al. published a comprehensive review of 61 ITFCs, organized by four categories of contributions: nutritional, environmental, economic, and socio-cultural. We included all 101 crops determined by a complex, multi-stakeholder survey conducted by the African Orphan Crops Consortium and endorsed by the African Union.[8] The third list we considered focused on 126 African vegetable crops compiled in a review by van Zonneveld et al. (2020).[9] The fourth list comprised 138 crops and modeled by van Zonneveld et al. in their 2023 publication, "Forgotten food crops in sub-Saharan Africa for healthy diets in a changing climate."[10] The authors ultimately prioritized 58 of these 138 crops, all of which were included in the preliminary list. A small number of individual crops that were not present in any of these reviews were added based on expert consultation.

The master list of ITFC's pulled from the four primary lists of crops described above. After excluding duplicates, this resulted in over 300 crops. We then filtered crops by the inclusion/exclusion criteria (i.e. removing fodder, inedible or non-nutritious crops, non-indigenous or traditional crops, or exported cash crops) and consulted with several plant breeding experts to narrow down the list, resulting in a final selection of 150 crops that served as the starting point for the Phase 1 workshop discussions.

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[8] The African Orphan Crops Consortium https:/africanorphancrops.org/meet-the-crops/

[9] van Zonneveld, M., Kindt, R., Solberg, S. Ø., N'Danikou, S., & Dawson, I. K. (2021). Diversity and conservation of traditional African vegetables: Priorities for action. Diversity and Distributions, 27(2), 216-232.

[10] van Zonneveld, M., Kindt, R., McMullin, S., Achigan-Dako, E. G., N'Danikou, S., Hsieh, W. H., ... & Dawson, I. K. (2023). Forgotten food crops in sub-Saharan Africa for healthy diets in a changing climate. Proceedings of the National Academy of Sciences, 120(14), e2205794120.

## Figure 1: The VACS Crop Selection Process - Akinola et al. (2020):

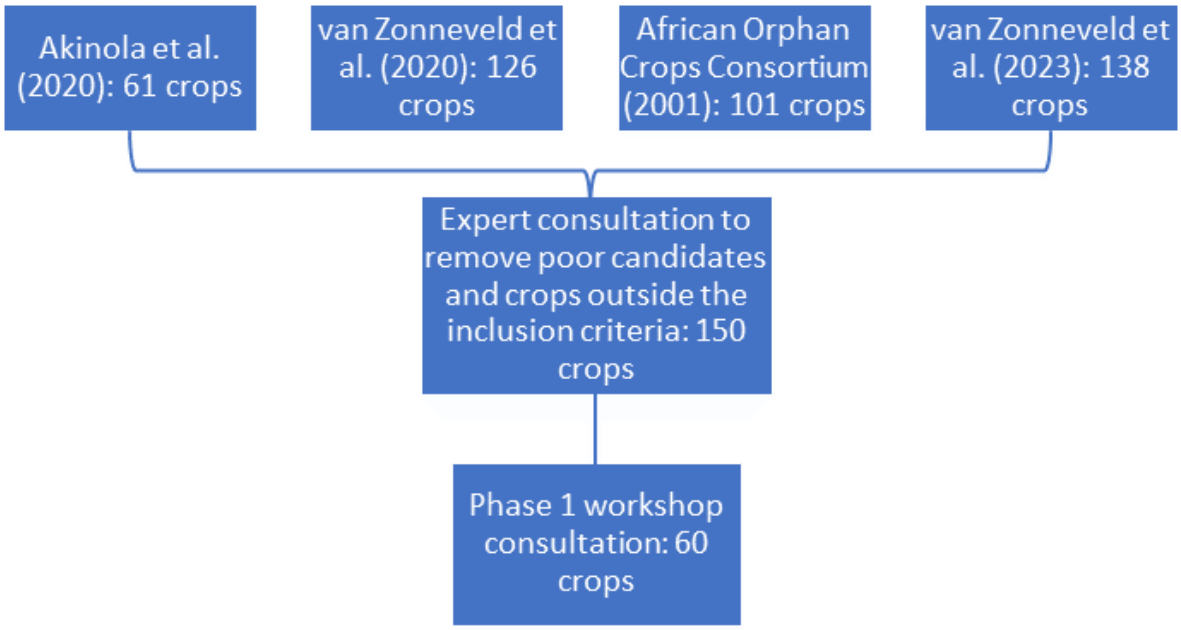



**Figure 1 Caption:** The VACS Crop Selection Process - Akinola et al. (2020) - 61 crops; van Zonneveld et al. (2020): 126 crops; African Orphan Crops Consortium (2001): 101 crops; van Zonneveld et al. (2023): 138 crops. These four lists feed into: expert consultation to remove poor candidates and crops outside the inclusion criteria: 150 crops. This list fed into: Phase 1 workshop consultation: 60 crops.

## Phase 1 Meeting Process

The primary objectives of the Phase 1 workshop were:

1. Determine a prioritized set of the most important crops for nutrition across six crop categories for each of the five African Union regions.

2. Determine a prioritized set of 15-25 crops for AgMIP's crop modeling in Phase 2 to show how a diverse and indicative subset of crops will fare under climate change by the year 2050.

Workshop participants represented a diverse range of scientific and geographic backgrounds, including plant breeders, nutritionists, climate modelers and economists,

with representation from all five regions of the African Union (see Annex 2 for the full list of participants). Participants were asked to review the preliminary crop list, food composition data, and criteria in advance of the meeting. If there were crops that participants did not see on the original list that they felt were important, they were invited to propose them during the meeting.

Participants were guided through the crop selection in a facilitated discussion. Although there was no set formula for determining selections, a set of guiding criteria (described in more detail below) included: nutrition potential, geographic coverage, food group, consumption/marketing (to date and potential), breeding potential, and contribution to soils.

Crops were selected under each of the five regions in Africa for the following food groups: cereals, roots/tubers, fruits, vegetables, legumes, and nuts/seeds/oilseeds. Crops that are strictly used for animal fodder, inedible or non-nutritious crops, or primarily export cash crops (e.g., coffee, tea, sugar, cocoa, tobacco) were excluded.

On day one of the workshop, the facilitator went through each of the six food groups to have participants nominate crops for consideration for the development of the Phase 1 indicative crop list. On day two, the facilitator raised each of the crops mentioned on day one to allow time for discussion, and to score its potential (low, medium, or high) within each of the five geographic regions of Africa, based on subjective expert opinion of those in the room as to the relevance of the crop for the region.

## Criteria for Selection

### 1. Nutrition Potential

In preparation for the Phase 1 meeting, FAO collated food composition data for the 150 crops on the preliminary list based on available data in selected published food composition tables (FCTs). Considering the time frame for Phase 1, the data were compiled from three selected FCTs: the FAO/INFOODS Food Composition Table for Western Africa (2019); Kenya Food Composition Tables (2018); and Priority Food Tree and Crop Food Composition Database (2019). Data were compiled for energy, proximate composition (9 components), 3 minerals (calcium, iron and zinc) and 2 vitamins (vitamin A and folate). An approximate compilation of food composition data for 191 food items (based on 100 crops for which there were data in the selected FCTs) was prepared. A file containing the compiled data was circulated prior to the meeting and presented to participants during the meeting. Some limitations of the data were also highlighted.

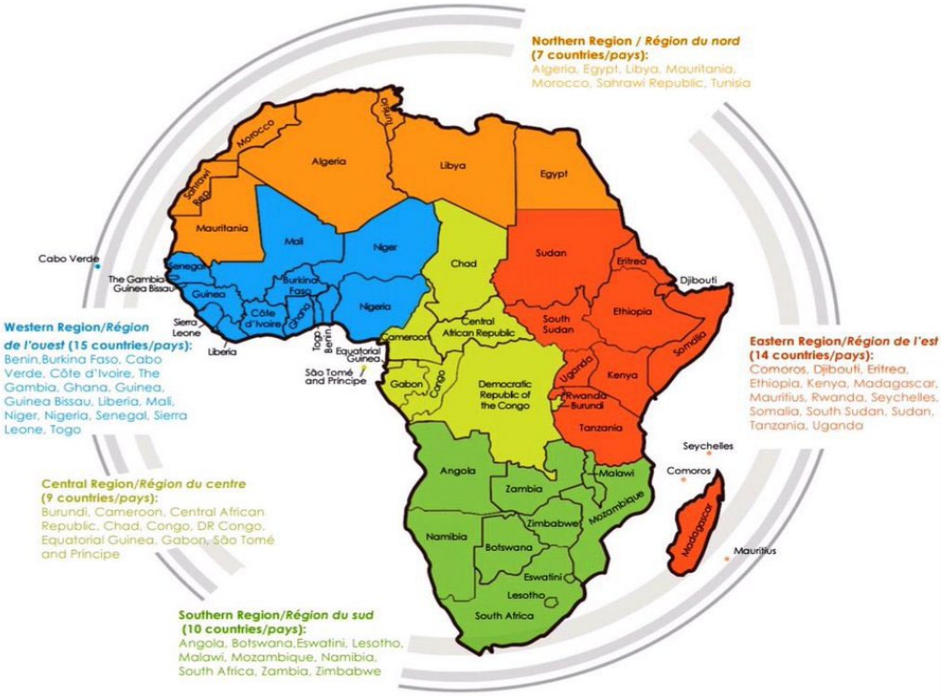
Workshop participants used these data, as well as their knowledge about the past, current and future potential food consumption patterns of the 150 crops, to guide their decision making. For example, participants chose to exclude crops that are primarily grown for alcohol (like marula and malting barley), that are primarily used for industrial purposes (like gums/resins), and that are primarily consumed in sugar-sweetened or non-nutritious forms.

### 2. Geographic Coverage

The African Union is divided into five regions, including: East, West, Central, North, and South (see Figure 2). In the selection process, we conducted the prioritization

exercise based on the importance of crops in each region. For many crops, there was substantial overlap across regions.

## Figure 2. The Five Regions of the African Union [11]




## Table for figure 2: Countries in Five African Union Regions

| African Union Region | Countries |
|---|---|
| Northern Region (7 countries) | Algeria, Egypt, Libya, Mauritania, Morocco, Sahrawi Republic, & Tunisia |
| Western Region (15 Countries) | Benin, Burkina Faso, Cabo Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo |
| Central Region (9 Countries) | Burundi, Cameroon, Central African Republic, Chad, Congo, DR Congo, Equatorial Guinea, Gabon, Sâo Tomé and Principe |
| Southern Region (10 Countries) | Angola, Botswana, Eswatini, Lesotho, Malawi, Mozambique, Namibia, South Africa, Zambia, Zimbabwe |
| Eastern Region (14 Countries) | Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Mauritius, Rwanda, Seychelles, Somalia, South Sudan, Sudan, Tanzania, Uganda |

[11] Image source: African Union Mission to the UN on Twitter: https://twitter.com/AfricanUnionUN/status/1187019468469350401/photo/1

## 3. Food Groups

Historically, plant breeding research has focused on cereal grains, which has led to the prioritization of calorie-rich staples over foods of high nutritional quality. By design, VACS emphasizes nutrition at its core by selecting crops across six diverse food groups. One exception is that we do not include animal source foods or fodder, since this initiative focuses on nutritious food crops for direct human consumption. While we recognize the critical importance of animal source foods for micronutrient intake—especially for specific populations like women and children—animal source foods are outside of the scope of this project.

In each of the five focal regions, we selected crops across six food groups:

a) cereal grains,
b) roots and tubers,
c) fruits,
d) vegetables,
e) legumes, and
f) nuts/seeds/oilseeds.

Although these food groups are informed by food-based dietary guidelines, only nine countries on the African continent have published their guidelines to date. However, the core principles across different dietary guidelines are often similar and evidence-based, varying by cultural considerations, locally available foods, and dietary patterns.

## 4. Breeding Potential

Crops were also selected based on the potential for and presence of plant breeding programs to generate significant progress in key nutrition- , agronomic- or market-

driven varieties. This criterion included: the potential for domestication of previously undomesticated crops; consideration of the availability and accessibility of plant genetic resources from gene bank; collections of local populations, landraces and crop wild relatives; and existing or promising plant breeding research capacity.

Participants also made the decision to exclude crops for which there is already substantial investment and ongoing research, based on the premise that VACS can make a much greater impact on crops that have received minimal investment. For example, maize and soybean were discussed as critically important to diets and incomes in Africa; however, participants chose to leave them off the priority list due to the significant volume of ongoing work for these crops. Crops that were thought to have limited potential for breeding were excluded, as were crops that were deemed to have risk for invasiveness.

## 5. Consumption/Marketing

To select foods that are socially and culturally relevant, we only considered crops that are already cultivated and consumed as part of the diet in each region. When a crop is already part of diets, it implies that crop has social, cultural, and economic importance for a population. Having workshop participants who were from or worked extensively in each region was invaluable for evaluating which of the crops on the proposed list were most important in each of the contexts. Crops that were evaluated as being a low priority across all five regions were excluded. Some of the selected crops are only be grown in some countries or areas rather than the full region, but are still extremely important in diets (e.g. teff). Foods that were deemed to have significant current or future market potential were prioritized for the final list. Some trees, legumes, tubers, and cool-season crops were included based on

their importance to the seasonality of cultivation in order to promote nutrition throughout the year.

### 6. Contribution to Soils

Although soil was not a predefined criterion before the workshop, it was proposed during the workshop as a key factor to consider in the selection process due to the importance of healthy soils for nutritious, resilient agri-food systems. Nutritional content in a crop is directly dependent on the nutrient profile and health of the soil, and African soils have been mined to a depleted state for decades. Thus, crops that could contribute positively to soil health were given extra weight. Moreover, the synergies between adapted crops and soil health improvements, both integral to VACS, were viewed as reinforcing factors for the overall initiative.

## Results and Conclusions

This report summarized the background, process, and findings of the VACS Phase 1 Technical Workshop. The workshop was both a qualitative and a quantitative exercise used to develop an indicative, interim, annotated crop list to inform Phases 2 and 3 of VACS. The crop list that resulted from this exercise is listed in Annex 1. Through ongoing consultation with the workshop participants virtually (including a follow-up online survey and workshop), VACS will develop a list of 25 crops that will be carried forward into the Phase 2 modeling exercise. However, this does not mean only 25 crops will be prioritized in Phase 3 of VACS. To streamline the modeling process, Phase 2 will prioritize 25 crops that may have been ranked more highly based on the stated criteria, or crops that can stand in as proxies for similar crops in the model.

There is no perfect process, dataset, or expert group to conduct this exercise. The result of this workshop was a consensus-driven product that balanced the priorities of many different scientific disciplines, stakeholder interests, and geographies. We acknowledge there are crops that others might have excluded or included.

This interim list represents the first step in a multi-stage, collaborative process and may have been one of the first efforts to bring together nutritionists, plant breeders, climate modelers, and economists to focus crop adaptation for climate change resilience and nutrition security. We expect and hope this effort will spur broader discussion and appropriate action.

# Acknowledgements

Agricultural Model Intercomparison and Improvement Project(AgMIP) provided climate change and crop modeling expertise. Havos.Ai provided an expert assessment of published and grey literature for underutilized crops using data science & artificial intelligence. The African Orphan Crops Consortium (AOCC) provided scientific background for breeding of traditional and indigenous crops in Africa. The Rockefeller Foundation provided grant funding for activities in Phases 1 and 2. The findings and conclusions contained within are those of the authors and do not necessarily reflect positions or policies of The Rockefeller Foundation.

**Supported by:**

# Annex 1: Indicative, Interim Crop List from the VACS Phase 1 Technical Workshop*

***Note:*** *Many ITFCs have numerous uses, including amaranth, cowpea, sweet potato, cassava, pumpkin, baobab, African eggplant, and others, with multiple parts of the plant consumed across several of the six food groups listed above. Although all crops have been categorized based on their perceived primary food group in many contexts, we acknowledge that many of these crops do not fit neatly into one category.*

## Annex 1 Table 1: Cereals - Potential in Each African Union Region

| **Scientific Name** | **Crop** | **North** | **Central** | **East** | **Southern** | **West** |
|---|---|---|---|---|---|---|
| *Eragrostis tef* | Tef | Low | Low | High | Low | Low |
| *Digitaria exilis* | Fonio | Low | Low | Low | Low | High |
| *Cenchrus americanus/ Pennisetum glaucum* | Pearl Millet | Low | Medium | Low | Medium | High |
| *Eleusine coracana* | Finger Millet | Low | Low | High | High | Low |
| *Avena sativa* | Oats | High | Low | High | Medium | Low |
| *Sorghum bicolor* | Sorghum | Low | Low | High | High | High |
| *Hordeum vulgare* | Barley | High | Low | High | High | Low |
| *Oryza glaberrima* | African Rice | Medium | High | Low | Medium | High |

## Annex 1 Table 2: Roots/Tubers - Potential in Each African Union Region

| Scientific Name | Crop | North Africa | Central Africa | East Africa | Southern Africa | West Africa |
|---|---|---|---|---|---|---|
| *Ensete ventricosum* | Enset | Low | Low | High | Low | Low |
| *Xanthosoma sagittifolium* | Cocoyam/elephant ear | Low | High | Low | Low | High |
| *Dioscorea spp.* | Yams | Low | Medium | Medium | Medium | High |
| *Manihot esculenta* | Cassava | Low | High | High | Medium | High |
| *Colocasia esculenta* | Taro (Colocasia) | Low | High | Medium | High | High |
| *Ipomoea batatas* | Sweet potato | Medium | High | High | High | High |

## Annex 1 Table 3: Fruits - Potential in Each African Union Region

| Scientific Name | Crop | North Africa | Central Africa | East Africa | Southern Africa | West Africa |
|---|---|---|---|---|---|---|
| *Parkia biglobosa* | African locust bean | Low | Low | Low | Low | High |
| *Annona senegalensis/squamosa* | African custard apple | Low | Medium | Low | Low | Medium |
| *Synsepalum dulcificum* | Miracle berry | Low | Medium | Low | Low | Medium |
| *Balanites aegyptiaca* | Desert date | Medium | Medium | Low | Low | Medium |
| *Uapaca kirkiana* | Wild loquat | Low | Medium | Low | High | Low |
| *Artocarpus altilis* | Breadfruit | Low | Medium | Medium | Medium | Low |
| *Artocarpus heterophyllus* | Jackfruit | Low | Medium | Medium | Medium | Low |
| *Ziziphus jujuba/ mauritania* | African jujube | Medium | Low | Medium | Medium | Medium |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Musa × paradisiaca* | Cooking banana | Low | Medium | High | Low | Medium |
| *Irvingia gabonensis* | Bushmango | Low | High | Low | Low | High |
| *Musa balbisiana* | Plantain | Low | High | Medium | Low | High |
| *Adansonia digitata* | Baobab | Low | High | Medium | Medium | High |

## Annex 1 Table 4: Vegetables - Potential in Each African Union Region

**Note**: *Potential for Citrullus lanatus/mucosospermus (watermelon/egusi) in the table below is reported after the workshop based on consultations.*

| **Scientific Name** | **Crop** | **North Africa** | **Central Africa** | **East Africa** | **Southern Africa** | **West Africa** |
|---|---|---|---|---|---|---|
| *Bidens pilosa* | Black jack | Low | Low | Medium | Medium | Medium |
| *Cucurbita spp.* (gourds) | Gourd species (bottle, luffah, bitter) | Low | Medium | Low | Low | High |
| *Brassica carinata* | Ethiopian mustard | Low | Low | High | High | Low |
| *Gynandropsis gynandra* | Spider plant | Low | Low | High | High | High |
| *Moringa oleifera* | Moringa/drumstick tree | Medium | Medium | Medium | Low | Medium |
| *Solanum spp.* | African nightshade/gboma | Low | High | High | Medium | Medium |
| *Corchorus olitorius* | Jute mallow | Medium | Low | High | Medium | High |
| *Solanum aethiopicum* | African eggplant | Low | High | High | Medium | High |
| *Amaranthus spp.* | Amaranth | Medium | High | High | High | High |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Cucurbita maxima/ C. moschata / C. pepo* | Pumpkin | Medium | High | High | High | High |
| *Abelmoschus esculentus /caillei* | Okra | High | High | High | High | High |
| *Citrullus lanatus/ mucosospermus* | Watermelon/egusi | See note above the table | See note above the table | See note above the table | See note above the table | See note above the table |

## Annex 1 Table 5: Legumes - Potential in Each African Union Region

| **Scientific Name** | **Crop** | **North Africa** | **Central Africa** | **East Africa** | **Southern Africa** | **West Africa** |
|---|---|---|---|---|---|---|
| *Sphenostylis stenocarpa* | African yam bean | Low | Low | Low | Low | Medium |
| *Macrotyloma geocarpum* | Kersting's groundnut | Low | Low | Low | Low | High |
| *Lupinus albus* | Lupin | Medium | Low | Medium | Low | Low |
| *Lablab purpureus* | Lablab | Low | Low | High | Low | Low |
| *Trigonella foenum-graecum* | Fenugreek | High | Low | Medium | Low | Low |
| *Vicia faba* | Fava bean | High | Low | High | Low | Low |
| *Lathyrus sativus* | Grass pea | High | Low | High | Low | Low |
| *Lens culinaris* | Lentils | High | Low | High | Medium | Low |
| *Vigna radiata* | Mung bean/green gram | Low | Low | High | Medium | High |
| *Cicer arietinum* | Chickpea | High | Low | High | Medium | Low |
| *Pisum sativum* | Peas | High | Low | High | Medium | Low |
| *Vigna subterranea* | Bambara groundnut | Low | High | Low | High | High |

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| *Cajanus cajan* | Pigeon pea | Low | Low | High | High | High |
| *Vigna unguiculata* | Cowpea | Medium | High | High | High | High |

## Annex 1 Table 6: Nuts/Seeds/Oilseeds

| **Scientific Name** | **Crop** | **North Africa** | **Central Africa** | **East Africa** | **Southern Africa** | **West Africa** |
|---|---|---|---|---|---|---|
| *Carthamus tinctorius* | Safflower | Medium | Low | Medium | Low | Low |
| *Linum usitatissimum* | Flax | Medium | Low | Medium | Low | Low |
| *Macadamia ternifolia* | Macadamia | Low | Low | High | Low | Low |
| *Vitellaria paradoxa* | Shea | Medium | Low | Medium | Low | High |
| *Allanblackia floribunda* | Allanblackia/tallow tree | Low | Medium | Medium | Medium | Medium |
| *Sesamum indicum* | Sesame | Low | Low | High | Low | High |
| *Anacardium occidentale* | Cashew | Low | Low | High | High | High |
| *Arachis hypogaea* | Groundnut | Medium | High | High | High | High |

# Annex 2 – Phase 1 Technical Workshop Participants

## Annex 2 Table 1: Technical Workshop Participants

| **Name** | **Surname** | **Affiliation** | **Title** |
|---|---|---|---|
| Gbenato Enoch | Achigan Dako | University of Abomey-Calavi, Faculty of Agronomic Sciences | Professor, Genetics and Plant Breeding |
| Moez | Amri | Mohammed VI Polytechnic University (UM6P) | Professor, Genetics and Plant Breeding |
| Godfrey | Bahiigwa | African Union Commission (AU) | Director of Agriculture and Rural Development |

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|---|---|---|---|
| Robert | Bertram | United States Agency for International Development (USAID) | Chief Scientist |
| George | Bigirwa | Alliance for a Green Revolution in Africa (AGRA) | Deputy Vice President |
| Namukolo | Covic | International Livestock Research Institute (ILRI) | Director General's Representative to Ethiopia |
| Eric Yirenkyi | Danquah | University of Ghana, West Africa Centre for Crop Improvement (WACCI) | Professor and Founding Director |
| Fekadu Fufa | Dinssa | World Vegetable Center Eastern and Southern Africa (AVRDC) | Vegetable Breeder |
| Cary | Fowler | United States Department of State (DoS) | Special Envoy for Global Food Security |
| Michel Edmond | Ghanem | CIRAD, UMR AGAP Institute | Senior Scientist |
| Luigi | Guarino | Global Crop Diversity Trust (Crop Trust) | Chief Scientist |
| Bridget | Holmes | Food and Agriculture Organization (FAO) | Nutrition and Food Systems Officer, Food and Nutrition Division |
| Ramni | Jamnadass | World Agroforestry (ICRAF) | Principal Scientist and Theme Leader |
| David | Laborde | Food and Agriculture Organization (FAO) | Director, Agrifood Economics Division |
| Tafadzwanashe | Mabhaudhi | University of KwaZulu-Natal | Honorary/Research Associate Professor |
| Dilys Sefakor | MacCarthy | University of Ghana, Soil and Irrigation Research Centre | Associate Professor, Plant Nutrition |

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|---|---|---|---|
| Busisiwe | Maziya-Dixon | The International Institute of Tropical Agriculture (IITA) | Nutrition and Health Programme Lead |
| Richard | Mkandawire | Alliance for African Partnership (AAP) | Africa Director |
| Giulia | Muir | Food and Agriculture Organization (FAO) | Forestry Consultant |
| Andrew | Mushita | Community Technology Development Trust/Organization | Executive Director |
| Lynnette | Neufeld | Food and Agriculture Organization (FAO) | Director, Food and Nutrition Division |
| Simone | Passarelli | United States Department of State (DoS) | Policy Advisor |
| Jaron | Porciello | University of Notre Dame | Associate Professor of the Practice (Information & Data Science) |
| Vieshnavi | Rattehalli | United States Department of State (DoS) | Foreign Affairs Officer |
| Cynthia | Rosenzweig | NASA Goddard Institute for Space Studies | Senior Research Scientist |
| Lindiwe Majele | Sibanda | CGIAR System Organization | System Board Chair |
| Julia | Sibiya | University of KwaZulu-Natal, School of Agricultural, Earth & Environmental Sciences | Professor, Plant Breeding |
| Mphumuzi | Sukati | FAO Regional Office for Africa (FAO-RAF) | Senior Food and Nutrition Officer |
| Zerihun | Tadele | University of Bern, Institute of Plant Sciences | Professor |
| Máximo | Torero-Cullen | Food and Agriculture Organization (FAO) | Chief Economist |

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|---|---|---|---|
| Tom | van Mourik | Hellen Keller International (HKI) | Global Advisor, Food Systems |
| Maarten | van Zonneveld | World Vegetable Center (Headquarters) (WorldVeg) | Genebank Manager |
| Hailu | Wordofa | United States Agency for International Development (USAID) | Agriculture Development Officer |
| Jingyuan | Xia | Food and Agriculture Organization (FAO) | Director, Plant Production and Protection Division |
| Kevin | Karl | Columbia Climate School/NASA | Research Associate, Center for Climate Systems Research |
| Emily | Fredenberg | The Rockefeller Foundation, Food Initiative | Project Manager |
| Catherine | Bertini | The Rockefeller Foundation, Food Initiative | Managing Director |
| Robert | Asiedu | International Institute of Tropical Agriculture (IITA) | Emeritus Director |
| Betty | Kibaara | The Rockefeller Foundation, African Region Office | Director, Food Initiative |
| Carine | Temegne Nono | University of Yaounde 1, Faculty of Science | Senior Lecturer |
| John | Ulimwengu | International Food Policy Research Institute (IFPRI) | Senior Research Fellow |
| Fernanda | Grande | Food and Agriculture Organization (FAO) | Nutrition and Food Systems Officer (Food composition), Food and Nutrition Division |
| Doris | Rittenschober | Food and Agriculture Organization (FAO) | Food composition consultant, Food and Nutrition Division |