

**Challenge Program**  
**on**  
**High-Value Crops - Fruit and Vegetables**

Pre-Proposal

Submitted  
to the  
Consultative Group on International Agricultural Research  
on 9 September 2007

by  
AVRDC - The World Vegetable Center  
on behalf of all the partners, including the Alliance (represented by Bioversity), and other  
international agricultural research centers and universities, as well as representatives  
from the private and public sectors

## Introduction

Global production of fruit and vegetables tripled from 396 million MT in 1961 to 1.34 billion MT in 2003<sup>1</sup>. Within the same period the world's population doubled from 3.2 billion to 6.4 billion<sup>2</sup>. Despite this tripling of output, increasing the production, processing, and marketing of high-value crops still has the potential to enhance dramatically the incomes of small farmers and create employment for rural laborers and some urban poor in the developing world, as well as provide nutritional benefits to poor consumers.

The working group authoring this Pre-Proposal is actively involved in creating new opportunities for the rural and urban poor in all aspects of the commodity chains of high-value crops, from production, through processing, transport and marketing, to consumption. We believe that many existing or potential commodity chains for high-value crops can be vastly expanded and thereby have a greater impact on alleviating poverty if the Consultative Group on International Agricultural Research (CGIAR) invests in research and capacity building.

While there are many high-value crops and products, the scope of this proposed Challenge Program will be limited to the research and promotion of outputs that help the poor to take advantage of the economic and nutritional value of high-value fruit and vegetables for income generation, job creation, food security and health, within a framework which will sustain the environment. Introduction of new methods and technologies will require effective coordination of partners throughout the commodity chains to ensure that supply matches demand and that partners share benefits and risks. Effective adoption of innovations must involve coordination and capacity strengthening within and between relevant sectors.

## Relevance to the Millennium Development Goals and CGIAR Goals and Impacts

The CGIAR and its partners mobilize science to improve the livelihoods of low-income people in developing countries. The proposed Challenge Program will contribute strongly to the mission of the CGIAR: to achieve sustainable food security and reduce poverty in developing countries through scientific research and research-related activities in the fields of agriculture, forestry, fisheries, policy, and environment. Support for this Challenge Program will also improve the balance in the CGIAR's research portfolio for neglected components of a healthy diet.

As stated above, this Challenge Program seeks to increase the incomes, create employment opportunities and improve the nutrition and food security of the poor in developing countries. It will thus contribute substantially to Millennium Development Goals<sup>3</sup> and Targets, especially Goal 1: Eradicate extreme poverty and hunger (Target 1: Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day; Target 2: Halve, between 1990 and 2015, the proportion of people who suffer from hunger), and also, but less directly, to Goals 4, 5 and 6 (Reduce child mortality; improve maternal health; and combat HIV/AIDS, malaria and other diseases). It will also help in the attainment of Goal 7 (Ensure environmental sustainability) by contributing to more sustainable production systems and resource management. Similarly, it will advance

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<sup>1</sup> Weinberger, K., & Lumpkin, T.A. (2007). *Diversification into Horticulture and Poverty Reduction: A Research Agenda*. World Development Vol.35 No.8 pp 1464-1480. <http://www.elsevier.com/copyright>

<sup>2</sup> FAOSTAT, 2007

<sup>3</sup> [www.un.org/millenniumgoals/](http://www.un.org/millenniumgoals/)

Goal 8 (Develop a global partnership for development) by fostering linkages and networking among partners as well as further strengthen the research and capacity development network which is already promoted by the Global Horticulture Initiative<sup>1</sup> (GlobalHort).

### **Alignment with the CGIAR System Priorities**

This Challenge Program will be the principal mechanism for implementation and realization of System Priority 3A as it addresses opportunities to increase incomes and improve livelihoods of the poor through diversification into a range of high-value agricultural crops and products. It proposes a linkage of international sources of expertise on high-value fruit and vegetables that not only expands the network of the CGIAR but also substantially increases the contribution toward attaining its mission, specifically through System Priority 3: Reducing rural poverty through agricultural diversification and emerging opportunities for high-value commodities and products. As proposed under System Priority 3A (Increasing income from fruit and vegetables), this Challenge Program will combine biological, socio-economic and market research, from production to consumption, within an holistic approach to the complexity of development problems affecting these commodity chains. Emphasis will be given to research which addresses globally relevant issues while considering the potential risks, benefits and costs of small-holder production, processing and marketing of fruit and vegetables. Consideration of risks is both technologically and socially necessary since the production of high-value fruit and vegetables is sometimes achieved with inputs and techniques that can compromise human health (e.g. use of contaminated urban waste water, misuse of pesticides). Moreover, micronutrient deficiencies continue to be a major factor preventing the poor from achieving their full mental and physical development potential. Thus, we believe, including this issue strengthens the Challenge Program's contribution towards real and durable poverty alleviation.

The objectives of this Challenge Program (see page 4) are also clearly linked to other System Priorities. For example, Objective 1 is linked to improving resistance to biotic and abiotic stresses (System Priority 2A and B) and to enhancing the germplasm of selected high-value species (System Priority 2D). Objective 2 is closely related to System Priority 5B (making international and domestic markets work for the poor) and System Priority 5C (rural institutions and their governance). Objective 3 is consistent with enhancing nutritional quality and safety (System Priority 2C) and, through its policy dimensions, to System Priority 5A.

### **The Challenges to be Addressed**

The initiation and development of high-value crop commodity chains has been shown to provide a high return on research investment for poverty alleviation by both increasing incomes and creating jobs for the poor in developing countries. Expanding these opportunities, however, presents numerous challenges.

Local, regional and international markets each have their own opportunities and challenges. Within the local and regional markets are traditional fresh markets and emerging supermarkets. Producing and marketing high-value crops for these markets require a range of knowledge, and technology, and it can be labor- and/or capital-

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<sup>1</sup> [www.globalhort.org](http://www.globalhort.org)

intensive depending upon the product and intended market. Capitalizing on the opportunities of regional and global markets requires even greater support in terms of organization and technologies, where there are many inherent risks but also substantial benefits.

For supermarkets, some regional markets and all international markets, product quality is essential. Many fruit and vegetable products are highly perishable, and can require specialized plant protection skills, postharvest handling and/or processing to avoid losses and meet growing quality demands. There are many other potential risks and requirements. Although fruit and vegetable production can create employment, in some locations and seasons labor may be a limiting factor if migration is high or non-farm activities draw labor from agriculture. Quality seed or planting material is often costly or difficult to obtain. Production requires land, reliable access to safe water, appropriate fertilizers and sometimes electricity. Pests<sup>1</sup> are often a major constraint and inappropriate use of pesticides poses a risk to human and environmental health. Market chains are often inefficient, with a highly asymmetric distribution of returns among their participants, favoring those with better access to information at the expense of the poor or less organized participants. Participation in market chains may entail significant risks, particularly related to perishability, with few risk management alternatives. If the accessible market is small, increased production can quickly lead to market saturation and a collapse in price/profits. Therefore a key objective for this Challenge Program will be to understand the diverse constraints, interests and risk management strategies of the poor in allocating scarce time, monetary, physical and natural resources, and how enterprise diversification strategies with high-value crops can be incorporated positively in these livelihoods.

Balancing and addressing such opportunities and challenges is complex, requiring complementary partnerships and expertise. One, or a few, organizations can make a difference in particular locations, for specific groups of the poor in certain crops and associated commodity chains. However, by coordinating and making use of synergies among global, diverse partner organizations and stakeholders, the pay-off to research is more likely to impact a larger number of poor producers, laborers and consumers throughout the developing world.

Besides striving for synergy among its partners and stakeholders, this Challenge Program must complement other current activities, in particular those of the Water and Food Challenge Program that focus on water policy affecting production of high-value fruit and vegetables. Similarly, there must be coordination with the Sub-Saharan Africa Challenge Program, and the appropriate Systemwide and Ecoregional Programs (SWEPs) and other Inter-Center Initiatives.

### ***What is 'high-value' in the context of high-value crops - fruit and vegetables?***

This Challenge Program assumes that any marketable fruit or vegetable crop is appropriate if it can increase income or reduce income instability of the poor, particularly poor farmers. Nevertheless, we recognize that this Challenge Program must be restrained in its selection of commodities in order to focus sufficient resources on research to produce global public goods and deliver impact. We will attain a balance of fruit and vegetable commodities in our research portfolio among globally important crops such as tomato, onion, cabbage, peppers, mango, avocado, dates *etc.*, and other crops with specific potential profitability or substantive nutritional value for the poor in developing countries.

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<sup>1</sup> Pests are defined as any species, strain or biotype of plant, animal, or pathogenic agent injurious to plant or plant products ([http://www.eppo.org/QUARANTINE/ISPM\\_05\\_2006%20Glossary.pdf](http://www.eppo.org/QUARANTINE/ISPM_05_2006%20Glossary.pdf))

These other crops may be assumed to have a high initial rate-of-return on research investment and may include underutilized crops with local geographic or ecological significance such as African plum, some leafy vegetables, jujuba species and some forms of vegetable maize. To attain this balance, initial priority will be given to fruit and vegetable crops that offer some or all of the following opportunities:

- increase the short- and long-term income of small-scale farmers by improving sustainable productivity by raising quality to meet demand, or by adding value in postharvest activities;
- produce relatively quick returns to investments of time, energy, resources, and/or other demands required for their successful production;
- improve the health of farmers and consumers, and environmental quality through new production methods which reduce exposure to pesticides and/or microbial contamination;
- enhance the availability of micronutrients for the poor through promotion of consumer-preferred and nutrient dense fruit and vegetables.

### ***Who are the poor in the context of this Challenge Program?***

The Challenge Program will focus on improving the conditions of four main impoverished groups as defined in the context of this Challenge Program; *i.e.*

- Poor farm households: These are characterized by limited access to land, a crop mix dominated by starchy staples, limited ability to purchase inputs and limited access to credit. Malnutrition can be a significant issue within this group.
- Landless poor: In some countries the landless poor represent a significant share of the rural and urban population. Many landless households will benefit from the increased demand for unskilled labor associated with fruit and vegetable commodity chains.
- Poor postharvest participants in the commodity chain: Horticultural commodity chains typically include a large number of relatively poor small-scale processors, traders and transporters. Many poor postharvest participants will benefit from increased demand for processing and transportation, and from the opportunities to increase added value through improved quality, food safety, shelf-life and convenience.
- Poor consumers: Poor consumers generally allocate a large share of their budgets to food and a large share of their food budget to starchy staples (grains and root crops). They will benefit through increased awareness of the nutritional value of fruit and vegetables and from greater affordability, better availability of fresh and processed products, improved food safety, and higher quality.

Among the four targeted household groups, priority will be given to poor farm households as they represent the greatest proportion of the poor in most developing countries.

### **Challenge Program Objectives and Outputs**

The overall goal of the proposed Challenge Program is to improve the well-being of poor producers and consumers in developing countries through research on high-value fruit and vegetables. There are four specific objectives. The outputs for each objective are both technological (related to improved production, high-quality produce and market chains) and those related to policy and institutional issues:

### **Objective 1**

**To improve the productivity and sustainability of fruit and vegetable production systems that meet market demand.**

This research will address the optimal use of genetic resources<sup>1</sup>, species diversification, spatial and temporal arrangements of plants, appropriate technologies, improved seed systems, suitable propagation techniques and strategies, integrated crop management (including pest management, cultural practices, pollination and fertilizer use) based on agro-ecological processes including a more efficient use of inputs and natural resources, and improved harvest and postharvest management and processing techniques.

#### **Outputs**

- Improved varieties of high-value fruit and vegetables that improve productivity through higher yields and/or greater resistance to biotic and abiotic stresses;
- Better dissemination of existing and improved varieties through timely availability of sufficient, quality planting material;
- New management practices and technologies that lead to more efficient use of inputs, higher yields, safe and better quality produce, lower pesticide residues or other attributes that increase profit;
- Identification of market openings and niche opportunities for some novel underutilized fresh and processed fruit and vegetable products;
- Reduced seasonality and improved year-round availability of fruit and vegetables at affordable prices.

### **Objective 2**

**To improve the efficiency and equity of selected fruit and vegetable market chains through targeted innovations in markets, institutions and policies.**

Research towards this objective will allow impoverished communities to derive increased incomes as producers, processors, transporters or traders while ensuring less expensive, quality products for consumers. Targeted ethnic or exotic markets in both developed and developing countries may also be relevant provided that linkages between poor farmers and these markets are improved.

#### **Outputs**

- Improved market chains and development of new market chains for targeted fruit and vegetables;
- Identification of market openings and niche opportunities for novel, underutilized fresh and processed products of fruit and vegetables;
- Effective public-private partnerships in fruit and vegetable market chains established.

### **Objective 3**

**To improve the quality of fruit and vegetables for traders and consumers and to increase the consumption of fruit and vegetables by the urban and rural poor.**

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<sup>1</sup> Any germplasm movement between countries will adhere to the terms of international agreements such as the International Treaty on Plant Genetic Resources for Food and Agriculture, material transfer agreements and relevant phytosanitary and quarantine regulations.

This research will improve quality determinants as affected by genetic and environmental factors, both during the production process and the postharvest handling and processing. It will include research on the role of fruit and vegetables in consumers' diets, and public awareness campaigns on the nutritional properties of fruit and vegetables. Research and advocacy on policy dimensions of fruit and vegetable commodity chains and consumption will also be key components.

### **Outputs**

- New methods / technologies to monitor, manage and minimize residues of pesticides in line with marketing and certification requirements for food safety;
- New cost-efficient technologies in postharvest processing and storage that add value to fruit and vegetables, extend the marketing season, improve product safety, and avoid harvest glut and spoilage;
- New methods for preserving, packaging, transporting, grading, testing and marketing fruit and vegetables;
- Research results, outreach, and advocacy leading to
  - an improved policy environment related to horticultural production (including policies concerned with irrigation, germplasm, agro-chemicals, and land tenure),
  - more effective institutions supporting horticultural production (including research, extension, market information services, plant health, and farmer associations),
  - improved policies related to horticultural marketing (including postharvest handling, grading, public and private standards, certification, and contract farming), and
  - greater awareness of the importance of fruit and vegetable consumption for health and nutrition.

### **Objective 4**

**To develop new approaches to human capital development that is driven by technology-dependent economic opportunity and entrepreneurship within the horticultural sector of developing countries.**

This objective will be accomplished through a mixture of capacity development approaches and tools, targeted at different sectors in the production and market chain. It will require the development of innovative, effective public-private extension and capacity-development networks. Local capacity to innovate as markets change will be increased and research and development conducted to sustain the profitability of high-value fruit and vegetable production in impoverished communities.

### **Outputs**

- Relevant training courses and materials, such as manuals and technical guidelines for capacity-building;
- Farmers and other market chain participants with new and improved skills, and better access to information;
- An adaptable and relevant system for sharing information, approaches, strategies and methodologies generated by public and private research and extension institutions that directly support the economic development of private fruit and vegetable enterprises;
- An innovative and effective network of farmers and market chain specialists for training and public/private extension activities.

## Outcomes

The achievement of the four objectives and the generation of the described outputs will give rise to the following desired outcomes:

- Increased selection, production and processing of fruits and vegetables that are profitable for growers and environmentally sustainable;
- Adoption of value-adding crop management systems to reduce technical barriers to trade, promote quality of production systems, reduce health risks associated with harmful plant protection products and microbial contamination;
- More efficient and fair market chains that improve product marketability and reduce losses through more efficient processing, transportation, and storage, while addressing demands for quality and safety attributes;
- Sustainable and efficient input supply chains linking smallholder producers and corporate suppliers while taking into consideration equity, gender, and environmental impacts;
- Increase in the number of poor rural households with rising incomes, employment and financial stability through diversification to fruit and vegetable production;
- Greater consumption of fresh fruits and vegetables, particularly those that are dense in micronutrients, to reduce nutrient deficiencies and related illnesses;
- Enhanced access to better knowledge and an increased number of trained individuals who can directly contribute to the economic viability and sustainability of fruit and vegetable enterprises.

## Approach to Facilitate Capacity Building

Capacity-building (through training, experiential learning, research infrastructural enhancement and technical services) in this proposed Challenge Program will have two essential goals. The first goal is to strengthen the capacities of partners to ensure delivery of global public goods in line with the impact pathway. The second goal is to support development of capacity that will ensure sustainability and continuation of the Challenge Program's objectives after its mandate has expired. Enduring linkages will be created and mechanisms established that will enable research and development in high-value fruit and vegetable commodity systems to be mainstreamed in the international agricultural research centers (IARCs), developing country national agricultural research and extension services (NARES), non-governmental organizations (NGOs), commercial enterprises and other partner organizations.

Fruit and vegetable commodity systems are among the most knowledge-intensive and dynamic agricultural systems. Short-term growth and long-term viability are critically dependent on access to technical knowledge, the ability to adapt that knowledge to local conditions and the flexibility to develop new supply systems as market conditions change. Lack of human, institutional and research capacity in support of the developing world slows innovation, technology adoption and the development of solutions to address key constraints in the horticultural industry. Capacity development will train and support and/or establish positions for individuals who will create and provide technical information to private sector enterprises, policy makers, farmer associations, community-based organizations, NARES, and other actors involved in the commodity chains. In addition to training in the technical areas of crop production, integrated pest management (IPM) and postharvest management, there will also be an emphasis on strengthening the capacities of policy-makers to address relevant issues, such as on how to improve farmers' access to markets, to promote fruit and vegetables for reducing malnutrition and to enhance postharvest management to reduce losses. Capacity building will be an integral

part of all activities within the Challenge Program and will also include efforts to reverse the decline in the capacities of horticultural faculties and research institutions in developed countries in relation to their ability to serve the capacity-building needs of the developing world.

The Challenge Program will focus on four principal areas of capacity development:

- 1) development of information management and knowledge sharing systems for horticultural commodity chains;
- 2) development of innovative, effective public-private extension and training/education networks;
- 3) strengthening local technical capacity with a focus on participatory methodologies;
- 4) development of local capacity to innovate as markets change, to conduct advanced research and development, and to assume the role of trainers of extension personnel, private consultants and industry leaders.

Whereas most capacity building conducted by national agricultural research and extension systems, advanced research institutions, the CGIAR and other international organizations has historically focused on the needs of the public sector, the demands of high-value fruit and vegetable commodity systems require that capacity building explicitly target, in addition to the public sector, the technology and human capacity needs of private sector fruit and vegetable enterprises and the public and private institutions that support those enterprises. International legal and other trade standards play a major role in the production of fruit and vegetables for export and are also affecting and influencing regional and local markets. These have resulted in the need for specific training, especially in the area of advanced diagnostics and regulatory compliance skills to ensure that products have adequate quality and traceability to satisfy Sanitary and Phytosanitary (SPS) and other standards required by the targeted markets. Training in these areas will be linked to commodity systems capacity development in pre- and postharvest crop management and handling.

### **Methodological Approaches**

The issues to be addressed by the Challenge Program are complex, especially the global lessons and methods of producing international public goods. Therefore, at this stage, rather than presenting a detailed methodology, it is more realistic to present a methodological approach, describing the types of methods and methodological issues that will be the basis to deliver the outputs.

The Challenge Program will adopt a holistic commodity chain approach, considering the interests of producers, traders, processors and consumers. Important recent methodological advances to analyze commodity chains, such as the participatory market chain approach, will be employed. Given that fruit and vegetable crops and their associated market chains may be unique and location-specific, there is a need to assemble a strategic range of crop species and cultivars, commodity chains and locations relevant to the poor. These should cover multiple situations and conditions from which, through analysis and modeling, robust recommendations can be developed which will be valid across diverse circumstances. These recommendations will include species/cultivars with well-established markets and market chains as well as those with few or limited markets such as neglected or underutilized species. These underutilized crops must demonstrate market potential, whether local, national, regional or global.

The most appropriate, newest and most efficient biological and socio-economic scientific methods will be used to develop appropriate technologies and interventions to increase crop productivity, manage pests, increase product quality and improve the management of natural resources such as water, soil and nutrients. Scoping studies and participatory approaches will be used in the interaction with communities and other stakeholders for diagnosis of circumstances and problems, as well as for the development and evaluation of relevant and appropriate technologies. This effort will also include assessment of the relationships between nutritional qualities, indigenous knowledge, behavioral/consumption patterns, prices, the demand for fruit and vegetables, consumer preferences and their income and price elasticities.

Fruit and vegetables are often consumed with no or minimal processing. Aspects of food safety are therefore paramount and this is emphasized by the various private and legal quality standards already in force. While these are ubiquitous in the international horticultural trade, the development and enforcement of standards for regional and local marketing in the developing world are also becoming more prevalent and stringent. The Challenge Program must concentrate on the development of production and processing systems that minimize the risk of contamination (e.g. pesticides, heavy metal and microbial contamination). This concern is especially relevant to urban and peri-urban production involving the recycling of water for irrigation and washing, and of solid waste in compost. Similarly, development and implementation of sound crop protection methods are also important to ensure compliance with acceptable pesticide residue levels on horticultural produce and to reduce the potential health risks linked to pesticide use for producers, consumers and the environment. Biological control, seed treatment, and protected production will therefore be areas of research; experience has demonstrated high returns on such investments.

The Challenge Program will conduct rigorous impact assessments and derive policy-relevant evidence and lessons. Baseline surveys will be carried out at representative sites, addressing the entire commodity chain, and analyses of impact will be designed to understand the contribution of research under the Challenge Program on poverty reduction and well-being of the poor.

### ***Guidelines for research methodology***

Given the wide range of research topics and disciplines involved in the Challenge Program, it is not feasible in this Pre-Proposal to describe in detail all likely methodological approaches. However, the following are some guidelines to ensure research rigor for the production of global public goods for high-value fruit and vegetable commodity systems:

- **Local consultation:** All research will require prior consultation with policy-makers and other stakeholders, particularly within the countries where the research will be carried out to ensure that the objectives fit with local priorities. Research will also make use of participatory methods to identify perceived constraints and problems of farmers, traders, consumers and others with respect to fruit and vegetable production, marketing and consumption. Where appropriate, scoping studies will supplement consultations.
- **Cultivar development and testing:** Cultivar development will involve traditional plant breeding and selection methods including those assisted by biotechnology approaches (such as marker-assisted selection). We will also utilize other appropriate biotechnology approaches which are socially acceptable and environmentally benign. Varietal testing will include both on-station trials under controlled conditions and farmer-managed on-farm trials to ensure that any new technology is suited to typical farm conditions and local preferences.

- Postharvest technology development: The development of new methods for preserving, packaging, transporting, grading, testing and marketing of fruit and vegetables will take into account the priorities and constraints of potential users.
- Impact evaluation: The impact of new varieties, new technologies, or policy interventions will be subjected to rigorous evaluation, especially cost-benefit analysis.
- Commodity chain analyses: These analyses will combine semi-structured interviews with key informants and formal random-sample surveys of participants. Both qualitative and quantitative methods will be used to provide internal verification of results, including a set of core analyses (such as margin decomposition and market channel mapping) to ensure comparability across studies.
- Methodological standardization: As much as possible standardized methodologies and questionnaires will be adopted for consumer surveys, farm surveys, commodity chain analysis, and other data collection activities. This will reduce the costs of launching surveys, entering data, and analyzing results, allowing quicker turnaround time for the analyses. Standardization will also ensure that results are comparable across commodities and across countries, taking advantage of the synergies to maximize global public goods output.
- Global dissemination: The objectives, methods and results of all research will be made available to the international research and development community.

### ***Geographic and benchmark methodological approaches***

The Challenge Program will specifically target communities with substantive need and where the poor (as defined previously) are capable of transforming their agricultural enterprises through crop diversification with fruit and vegetables. Spill-over effects are expected to impact many other regions beyond the benchmark or pilot research areas as many of the targeted commodities and environments have broad global distribution and thus will permit extrapolation of research results to similar impoverished areas. Modeling will be used to evaluate risks (e.g. those associated with pests, water and soil fertility) and to allow predictions to be made on transferability of outputs from the research sites. To ensure effective spillover to other areas, geographic distribution maps of poverty and target species, together with site similarity methods, will be used to identify project sites which have greater potential for the outputs to be scaled out. Rapid approaches to characterize genotype x environment x management interactions and to improve the management of natural resources such as water, soil and nutrients will be utilized where possible. Biotechnological approaches for mass propagation of healthy planting material, as well as use of molecular approaches to identify important quality and agronomic traits of the targeted fruit and vegetables will be used wherever appropriate.

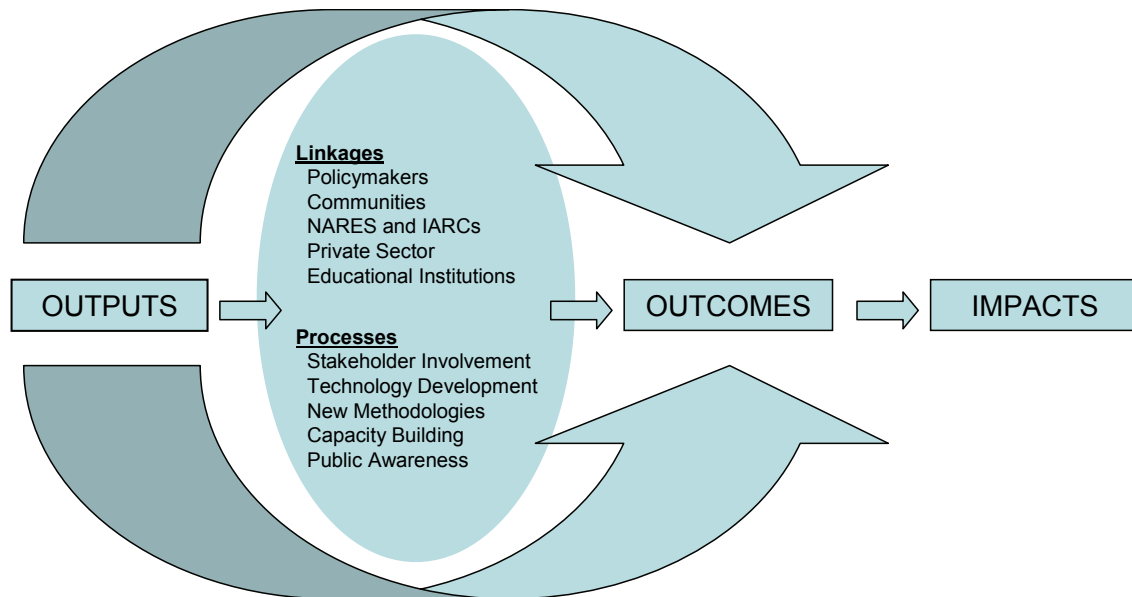
### **Impact Pathway and Mechanisms for the Dissemination of Research Outputs**

For the purposes of clarifying the impact pathways, the Challenge Program will require each funded project to create problem trees and network diagrams during their stakeholder planning meetings. We will then match impact pathway problem trees and network diagrams with appropriate impact pathway analysis within proposed projects.

The pathway from Challenge Program outputs to impacts will involve strategic alliances among various interest groups, as well as use of a variety of processes and instruments to generate the required outcomes, as illustrated in Figure 1. In this regard, the proposed Challenge Program will proactively build participatory approaches, capacity development, public awareness and technology dissemination mechanisms into the total portfolio of activities to ensure that research results are translated directly into actions which address the needs of the poor. This will be done, in part, by making use of all avenues of delivery

and dissemination that are currently active in the respective areas of focus. Partners delivering outputs and impacts must embrace modern extension and information transfer mechanisms. Examples of such mechanisms include the broad-based VASAT (Virtual Academy for the Semi-Arid Tropics) consortium in South Asia, which is providing timely knowledge to farmers through web-based systems directly into their own villages along with real-time question and answer type advisory facilities.

**Figure 1. Pathway showing intermediary linkages and processes to produce impacts and outcomes from the Challenge Program outputs.**



Success in dissemination will depend on the use of a combination of tools. It is therefore important that the partners assess, understand and stay current with advances in modern technology delivery and embrace successful traditional and new extension and information transfer methods (e.g. participatory methods of technology transfer, television and radio programs, mobile-phone text messages, Internet, print media, interactive communication media, and incentive schemes) that will enhance uptake. Additional networks for information dissemination are being developed by GlobalHort, the International Society for Horticultural Science (ISHS), Wageningen UR, CTA and CABI. The Challenge Program will engage with these networks and build new capacity into other existing information dissemination systems operating in the target areas.

### Gender and Equity

High-value fruit and vegetables provide many opportunities for both male and female farmers, but women and other disadvantaged groups (such as the elderly and the handicapped) often dominate in harvesting, processing and sales. Equity mainstreaming will be used as a principle to guide baseline activities in the Challenge Program and where possible proactively help increase the profile of women and other disadvantaged groups

which potentially can make further substantive contributions to community and national economic growth through fruit and vegetable commodity chains.

### **Stakeholder Involvement and Partnerships**

In preparation for this Challenge Program Pre-Proposal, a workshop of interested stakeholders was organized at the World Agroforestry Centre in Nairobi, Kenya 7-8 June 2007. Participants included more than 30 international centers, universities and associations, as well as representatives from the private and public sectors (Table 1). During this meeting preliminary researchable issues for the Challenge Program were identified and these supplement a similar, more comprehensive, compendium of researchable themes identified by the Global Horticultural Assessment<sup>1</sup>. Numerous interactions following this meeting have further extended the global network of partners contributing to this Pre-Proposal.

Results from a questionnaire circulated to the workshop participants showed that both CGIAR and non-CGIAR partners are willing and able to host activities, provide seconded staff and participate in fund-raising activities for this Challenge Program.

The Challenge Program on High-Value Crops - Fruit and Vegetables will require effective partnerships among entities possessing an array of complementary core competencies, especially when considering the complexities and constraints of certain commodity chains. The partnership that collaborated to develop this Pre-Proposal (Table 2) is noteworthy for its range and diversity, including both CGIAR and non-CGIAR IARCs as well as governmental and non-governmental entities, universities and private sector members. Many universities and advanced research institutes have unique research capacity, close ties to the private sector and training skills to offer. For example, research and training knowledge and experience accumulated by the fruit and vegetable commodity systems of the United States, European Union, Australia, Brazil, and Chile as well as from the emerging systems of China, Kenya, and Colombia must be accessed to support this Challenge Program. This range of expertise and experience will bring relevance and balance to the Challenge Program's research and capacity building activities.

Collaboration and linkages with relevant programs and platforms such as GlobalHort, the Global Facilitation Unit on Underutilized Species (GFU) and the CGIAR Inter-Center Initiative 'Urban Harvest' will be explored and facilitated. At the proposal preparation and implementation stages there will continue to be transparent and participatory mechanisms to encourage all interested stakeholders and partners to join the processes of priority setting and project development. The objective of the prioritization process is to target available funding to the needs of the poor as articulated by the Science Council and within the goal and objectives of this Challenge Program. Capacity building along with competitive and tendered funding will be available for the research and development activities of the partners while also mandating inclusion of a broader participatory network with other development partners especially from the South. Capacity-building will support core staffing as well as operational expenses to establish and network the Challenge Program. Through this approach, the best scientific competencies from both within and outside the CGIAR will be mobilized to address the research, development and capacity-building objectives of the Challenge Program.

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<sup>1</sup> [caes.ucdavis.edu/IntProg/GHAPublication2005Web.pdf](http://caes.ucdavis.edu/IntProg/GHAPublication2005Web.pdf)

**Table 1. Participants in the Challenge Program Pre-Proposal Workshop, Nairobi, June 2007<sup>1</sup>.**

Africa Rice Center (WARDA)
Agrifood & Veterinary Authority of Singapore, representing ASEAN-AVRDC Regional Network (AARNET) on Vegetable Research and Development
Asia & Pacific Seed Association (APSA)
AVRDC - The World Vegetable Center
Bioversity International
CABI
Centro Internacional de Agricultura Tropical (CIAT)
Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT)
Centro Internacional de la Papa (CIP)
Centre de cooperation internationale en recherche agronomique pour le développement (CIRAD)
Food and Agriculture Organization (FAO) of the United Nations
Global Horticulture Initiative (GlobalHort)
International Center for Agricultural Research in the Dry Areas (ICARDA)
International Centre of Insect Physiology and Ecology (ICIPE)
International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
International Centre for Underutilized Crops (ICUC)
International Food Policy Research Institute (IFPRI)
International Institute of Tropical Agriculture (IITA)
International Water Management Institute (IWMI)
MIGAL - Galilee Technology Centre
Ministry of Agriculture, Kenya
National Agricultural Research Organizations (NARO) representing Forum on Agricultural Research in Africa (FARA)
Plant Resources of Tropical Africa (PROTA)
System-wide Program - Integrated Pest Management (SP-IPM)
University of California Davis
University of Florida
World Agroforestry Centre

<sup>1</sup> Other partners

Centro Agronómico Tropical de Investigación y Enseñanza (CATIE)  
 Central Science Laboratory (CSL), UK  
 Institut National de la Recherche Agronomique (INRA)  
 Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA)

The Challenge Program will be diligently led and managed to ensure integration and focus of all the partners to address both the geo-political as well as scientific issues. It must be managed so as to enforce defined timelines for outputs and associated monitoring. Timelines and verifiable outputs will facilitate coordination, smooth production of global public goods and identification and strengthening of weak links. A simple and transparent governance mechanism will be used for this Challenge Program drawing on lessons learned from the earlier established Challenge Programs particularly through their reviews (CPEs).

**Exit Strategy**

Given the complexity and importance of the proposed Challenge Program a minimum of 15 years of investment will be required prior to the exercise of a mature exit strategy. The Challenge Program represents only one of a number of activity strands which are designed to generate global public goods that feed into efforts by NARES and development partners to increase the productivity of fruit and vegetables in target countries. An extended period is necessary for the integration of these efforts.

**Table 2. Comparative advantages of some of the current and proposed partners.**

APSA	Seed systems
ASEAN	Trade, indigenous vegetables
AVRDC	Germplasm, vegetable breeding, production, marketing, consumption; health and micronutrient malnutrition
Bioversity	Use of local crop diversity for livelihood improvement, functional use of germplasm especially bananas, and neglected 'minor' species
CABI	Information resources, research, dissemination, training and capacity-building in IPM, biocontrol, phytosanitary measures, good agricultural practices and seed systems.
CATIE	Fruit and vegetable research and development in Central America
CIAT	Fruit production and processing research
CIMMYT	All aspects of research for maize as for use as a vegetable
CIP	All aspects of research on potato and sweet potato as vegetables; urban agriculture
CIRAD	Many aspects of tropical and Mediterranean fruit and vegetables breeding, production, postharvest and commodity chain management (hosting ECART-EEIG <sup>1</sup> )
CORAF/WECARD <sup>2</sup>	Networking in West and Central Africa
CSL	Research (diagnostic and metabolomics); Sanitary and Phytosanitary (SPS) issues and food safety; NR risk modeling
CTA <sup>3</sup>	Capacity development
EMBRAPA	Promotion of research and extension in horticulture in Brazil
FAO	Research and development in horticulture globally
FARA	Fruit and vegetable research in sub-Saharan Africa
GFU <sup>4</sup>	Policy analysis and advice, awareness raising and information sharing on underutilized species
GlobalHort	Networking, promotion, capacity-building and advocacy for development in horticulture
ICARDA	Fruit, vegetables for dry areas and protected agriculture; production, marketing and consumption
ICIMOD <sup>5</sup>	Mountain areas, urban and peri-urban systems, indigenous crops
ICIPE	Integrated pest management, biological control, invasive species, horticulture export/accreditation
ICRISAT	Fruit and vegetables in the semi-arid tropics, genomics and modern ICT / Knowledge Management extension methods
ICUC	Functional use of underutilized germplasm, research and development, capacity building
IFPRI	Policy research on production, marketing and consumption of fruit and vegetables, and impact assessment
IITA	All aspects of research on banana, peri-urban production
INRA	Many aspects of fruit and vegetable breeding, production, postharvest and commodity chain management
IWMI	Water issues involved with horticultural research
KARI (Kenya)	All aspects of fruit and vegetable research in Kenya
MIGAL	Agricultural research and development, particularly fruits
MARD, Israel	Agricultural research and development
NARO (Uganda)	All aspects of fruit and vegetable research in Uganda
NEPAD <sup>6</sup>	Networking and coordination in Africa
PROTA	Horticultural marketing in Africa
SP-IPM	Integrated pest management, biological control, invasive species
University of California/Davis	Research and education in irrigated horticulture
University of Florida	Research and education in tropical horticulture
World Agroforestry Centre	Exploitation of higher value and potentially high-value tree species
Wageningen UR	Research and education in horticulture
Urban Harvest	Inter-Center network with expertise in peri-urban agriculture
Many others	Many additional competencies

<sup>1</sup> European Consortium for Agricultural Research in the Tropics - European Economic Interest Grouping comprises CIRAD, Instituto Agronomico per l'Oltremare (IAO), Instituto de Investigaçao Cientifica Tropical (IICT), Institut de recherche pour le développement (IRD), Natural Resources Institute (NRI) and Wageningen University and Research Centre (Wageningen UR)

<sup>2</sup> Conseil ouest et centre africain pour la recherche et le développement agricole / West and Central African Council for Agricultural Research and Development

<sup>3</sup> Centre Technique de Coopération Agricole et Rurale

<sup>4</sup> Global Facilitation Unit for Underutilized Species

<sup>5</sup> International Centre for Integrated Mountain Development

<sup>6</sup> New Partnership for Africa's Development

Capacity building will be central to the exit strategy but, given the current degraded condition of supporting educational and extension institutions, over a decade will be required to bring about the declared capacity building objectives. Such a time threshold is also justified by social science research designed to promote innovative institutional arrangements to enable integration of research results into experiential learning activities by development partners and appropriate networks. Such efforts can not be brought about, nor assessed, without due time for change to occur and be monitored.

To promote a coherent exit strategy for the Challenge Program and ensure continuity of development activities after termination, research and development partners will be encouraged to develop follow-up action plans and undertake resource mobilization for the generation, testing and sharing of knowledge and technologies on fruit and vegetables within the active lifetime of the Challenge Program.

### **Evidence of Donor Interest and Commitment**

The strategy papers of many donors indicate that crop diversification of rural agricultural enterprises through high-value crops will be an attractive area for support due to the likely benefits which could accrue to a range of poor producers and consumers in these commodity chains. Strong interest in this Challenge Program is already evident. For example, the Canadian International Development Agency (CIDA) has already generously provided support towards the development of this Pre-Proposal. A list of donors who would probably support this Challenge Program includes those who showed strong commitment to the Global Horticulture Initiative, the Global Horticulture Assessment, and fruit and vegetable development projects: the Asian Development Bank (ADB), the Australian Centre for International Agricultural Research (ACIAR), the Bill and Melinda Gates Foundation, the Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (BMZ), the Canadian International Development Agency (CIDA), the European Commission, the French Government, the Gatsby Charitable Foundation, the International Fund for Agricultural Development (IFAD), the Islamic Development Bank (IDB), the Norwegian Agency for Development Cooperation (Norad), the Rockefeller Foundation, the Swedish International Development Cooperation Agency (SIDA), the Swiss Agency for Development and Cooperation (SDC), The Netherlands Foreign Ministry, the United Kingdom Department for International Development (DFID) and the United States Agency for International Development (USAID). As our proposal is highly consistent with the Science Council System Priorities, we expect that strong Science Council enthusiasm will help to attract broad donor interest.