ANNEX 1

HarvestPlus 1st CPER Panel Composition and Biodata

CHAIR
Ricardo Uauy
Institute of Nutrition and Food Technology
University of Chile
Casilla 138-111
Santiago, Chile
Tel: +56-2-221-4105
Fax: +56-2-221-4030
Email: Ricardo.Uauy@lshtm.ac.uk

MEMBERS
Markus A. Palenberg
Global Public Policy Institute
Reinhardtstr. 15, 10117 Berlin, Germany
General: +49-3-2759 5975 - 0
Direct: +49-(3)-2759 5975 – 112
Mobile: +49 177 7815 204
Fax: +49-30-6908 8200
Email: mpalenberg@gppi.net
Web: http://www.gppi.net

A. Hamid Zakri
UNU Institute of Advanced Studies
6F International Organizations Center
Pacifico-Yokohama, 1-1-1 Minato Mirai
Nishi-ku, Yokohama, Japan 220-0012
Tel: +81 (045)221-2300
Fax: +81 (045)221-2302
E-mail: Zakri@ias.unu.edu

UAUY, Ricardo (Chile)
Position: Currently, Professor of Public Health Nutrition, London School of Hygiene & Tropical, Medicine, University of London, UK
Expertise: Nutrition, biochemistry, child health, malnutrition, public health nutrition
Education: Ph.D. Nutritional Biochemistry and Metabolism, International Nutrition, Massachusetts Institute of Technology. Board certified in USA in Pediatrics and in Neonatal-Perinatal Medicine.
Experience: 2002-to date: Professor and Chair, Public Health Nutrition, London School of Hygiene and Tropical Medicine, University of London. 2002 - 2005: UN University Regional Coordinator for Latin America, Food and Nutrition Program. 1994 - 2002: Director, Institute of Nutrition and Food Technology (INTA), University of Chile. Dr Uauy has directed INTA's training programs, the Clinical Research Center, the Division of Human Nutrition and Medical Sciences and was resident-coordinator for UN University activities at INTA. From 1985 to 1990 he was Associate Professor of Nutrition and Pediatrics at the Center for Human Nutrition University of Texas Southwestern Medical Center at Dallas. Dr Uauy has been involved as advisor for the UN, WHO and FAO from 1981 to 2001. He was elected President of the International Union of Nutritional Sciences and received the Presidential Award (Chile) in Science for his research into the effects of essential fatty acids on gene expression

during retinal and brain development. He has also served as President of the Chilean Nutrition Society and is a member of the Scientific Advisory of the Novartis Foundation. Dr Uauy has over 250 scientific publications on various aspects of human nutritional needs in health and disease with an emphasis on neonatal nutrition. He received the McCollum award presented by the American Society for Nutritional Sciences (USA) in 2000.

PALENBERG, Markus (Germany)
Position: Currently since 2005: Managing Director of the Global Public Policy Institute (GPPi), Germany
Expertise: governance & management, program evaluation, research in theoretical physics
Education: Massachusetts Institute of Technology, USA, 1998-2000. PhD, RWTH Aachen University, Germany, 1994-1998. Doctoral thesis in theoretical physics. Graduation with "summa cum laude" and award of the "Borchert medal" for academic excellence. Diploma in theoretical physics, RWTH Aachen,Germany, 1988-1994.
Experience: 2004-2005: Corporate Projects Manager for three business units, leading and driving top-level projects and taking on interim management roles on board and director level, SCOUT24 GMBH, Munich, Baar, Switzerland. 2000-2004: Team leader of up to 5 consultants and 20 client team members on projects in Germany, France, Italy and Portugal, reporting directly to board-level client management. Focus on strategy development (market research and benchmarking-based) and overall project management, McKinsey & Company Inc., Paris, Cologne, Munich. Other part time professional activities include: Business Consultant for Etnoka.com, Paris, 2004; Part-time teaching assistant, RWTH Aachen and Laser-Laboratorium Göttingen e.V, (1990-98) and freelance research consultant, (1993-2000). Dr Palenberg is member of the McKinsey Alumnus, non-profit alumni association; the MIT alumnus association and member of the ICAN career advisor network.

ZAKRI, A. Hamid (Malaysia)
Position: Currently, Director of United Nations University/Institute of Advanced Studies (UNU/IAS), Tokyo
Expertise: Genetics/breeding of rice and soybean for Malaysian conditions, genetic variation of Malaysian timber, biodiversity and biotechnology policies in developing countries
Education: Ph.D, Crop Science(Plant Breeding), Michigan State University, USA, 1974-1976. M.S, Crop Science (Plant Breeding), Michigan State University, USA, 1972-1974. B.S. Crop Science, Louisiana State University, USA, 1970-1972.
Experience: Dr Zakri is currently the Director of UNU/IAS in Tokyo. He is also the Co-Chair of the Millennium Ecosystem Assessment Board, a four-year undertaking launched by the UN Secretary–General in 2001 to assess the state-of-health of the world's ecosystems. He is a Council member of the Third World Academy of Sciences, member of the Board of Trustees of the Institute for Global Environmental Strategies. Dr Zakri served as the Secretary–General of the Society for the Advancement of Breeding Researches in Asia and Oceania (SABRAO) from 1981-89 and the Chair of the Subsidiary Body on Scientific,Technical and Technological Advice (SBSTTA) of the Convention on Biological Diversity from 1997 to 99. He was a Deputy Vice–Chancellor of the University of Kebangsaan in Malaysia from 1992 to 2000 and the Founding President (1994-2000) of the Genetics Society of Malaysia. In 1998, he received the Langkawi Award, a national laureate for outstanding contribution in the field of environment in Malaysia. Three new species known to science are named after him: a beetle (*Paleosepharia zakrii*); a cicada (*Pomponia zakrii*), and a pitcher plant (*Nepenthes curtisii ssp. zakriana*).

ANNEX 2

CGIAR Challenge Program External Reviews (CPER) Guidelines

CGIAR
CHALLENGE PROGRAM EXTERNAL REVIEWS (CPER)
GUIDELINES

Background

Challenge Programs (CPs) are time-bound, independently-governed programs of high-impact research that target CGIAR research goals and priorities and require partnerships with a wide range of organizations. CPs are meant to improve the CGIAR's relevance and impact, better target and integrate existing activities, achieve greater efficiency and cohesion among CGIAR Centers, widen and improve their partnerships with non-CGIAR research partners and mobilize more stable and long term financing.

Three CPs were approved for implementation beginning in 2003: Water and Food (W&F); HarvestPlus (HP+); and Generation (GCP). At AGM04, the Sub-Saharan Africa Challenge Program (SSA CP) was approved in principle for an 18-month inception phase. ExCo 6 (May 2004) requested the SC and the CGIAR Secretariat to synthesize some lessons learned from the three pilot CPs. One of the recommendations of the ensuing 2004 report was that "the current CPs be evaluated by an external panel after five years from start to assess the value added provided by the CP structure in terms of the effectiveness of partnerships and generation of outputs, evidence of adoption and impact of research, cost effectiveness of operations and sustained donor interest".

At the AGM 2005, the Group endorsed a set of 20 System Priorities to enhance the focus and cohesion of the CGIAR's research agenda. CPs may be an important option for the implementation of priority research and need to be reviewed also in this context to ensure that their rationale is validated by experience.

The guidelines for the CPERs have been prepared to address the particular characteristics of the programs that make their operations and governance distinctly different from those of the CGIAR Centers, and anticipating that CPs of different nature and duration will increasingly be used to implement a part of the CGIAR's research agenda, and help the CGIAR leverage external research capacities.

Issues

These guidelines provide the general principles that guide all CPERs. For each individual review, the specific Terms of Reference (TOR) will include both the generic issues listed below and a set of strategic issues identified through consultation with stakeholders, including the SC and the CGIAR Secretariat.

The CPER is aimed at informing the CGIAR members, stakeholders and other investors about the relevance of the program, and that the investment is sound, or recommend measures to make it so. It will advise the program and its partners about the efficiency and

effectiveness of their work and the appropriateness of their internal monitoring and evaluation, and make recommendations for improvements.

The CPER should address the overall scientific quality of the program, the program's effectiveness in reaching its research goals and the appropriateness of management and governance. The CPER should focus on the extent to which the key defining characteristics of a CP have been met: high-impact research; targets the CGIAR goals in relation to complex issues of overwhelming global and/or regional significance; requires partnerships among a wide range of institutions in order to deliver its products; is time-bound; and is independently-governed.

The individual CPERs are expected to provide inputs to a broader assessment or analysis of the extent to which the CP model is fulfilling its objectives, i.e. the purposes for which it was conceptualized and adopted.

The issues that the CPER needs to address can be clustered in two main categories:

Programmatic issues:

1. Is it likely that the CP research will eventually have a high impact based upon the conduct of the program to date? Has the CP clearly identified its direct and final beneficiaries? Were the CP's key assumptions/expected impact pathways concerning critical scientific and technological constraints, socioeconomic conditions, adoption, markets, researchers' motivation and donors' interests appropriate? Is there any evidence of progress along these pathways? Are there changes required to help increase the chances of success and the extent of impacts?
2. What has been the added scientific value from the CP; in particular, by the partnerships represented by the CP? What has been achieved by the CP that could not have been achieved without it, through Center activities or SWEPs? Is there any evidence of synergies and/or new modes of operation of the Centers involved in the CP? Can these synergies be improved?
3. Is the science in the CP overall and in the different components of high quality and are the scientific outputs recognised by peers? Does the CP, including all its partners, follow a clear policy of best practices regarding ethics and intellectual property?
4. Was the international public goods nature of the planned outputs clear at the outset and has this been reinforced from the conduct of the program?
5. To what extent have the objectives of the CP been achieved? Has the CP been effective in delivering outputs? Is there already evidence of adoption and other outcomes among the intended users? If there was a technology exchange process, how effective and efficient was it?
6. Is the CP cohesive, allocating a critical mass of resources to research with a clear set of goals in terms of outputs, outcomes, and impacts that can be monitored to measure collective progress at a system level? Was an appropriate M&E system included in the design of the CP and has it been implemented (including, inter alia, baseline data and

outcome monitoring) in order to be in a position to generate, disseminate and use credible and timely evidence concerning program impact?
7. In what ways has the CP contributed to capacity building of partners? Is capacity building included in the business plan and appropriately integrated into the program?

Management/governance/partnership issues:

1. Is there a clear, balanced, and formal governance structure involving research partners? Does it provide effective and adequate oversight, including financial oversight? Are there any perceived or real conflicts of interest in the governing body? Is there a clear and effective M&E system in place? What are the constraints and benefits for the CP (in terms of research, synergies, financial arrangements, etc) that result from the arrangements with the host institution?
2. What is the relationship between CP governance systems and the Boards of the Centers leading or participating in them?
3. Is the breadth of the CP in terms of partners optimal for reaching the objectives? Is there clarity of roles and responsibilities of all partners? Is there an effective system for internal knowledge sharing and communication across regions and research sites? Are the transaction costs in partnering well-managed?
4. What internal / external audit arrangements are in place, and do these cover site operations? For commissioned research, are the rules and mechanisms transparent? Is there a well-established, clearly defined and transparent internal control environment on implementing competitive grants?
5. How is the program's multi-year funding ensured? Is financial support diversified enough to avoid funding risks? How much is the deviation (if any) between budget and actual expenditures? What is the percentage of unidentified funding in budget at time of approval by the CP governing body? What is the proportion of transaction costs to expenditure/budget/funding?

The purpose and objectives of the CPER are to learn and to assess; hence the following general principles guide the conduct of the review:

- The Panel should take into account assessments made of the CP and available information such as MTP reviews, *ex ante* project reviews, reports to donors and any other information from internal monitoring and evaluation mechanisms.
- The Panel should identify key program assumptions, particularly those having implications for costs, benefits, outcomes and impact, indicating which items are expected to be included as costs or benefits, their expected magnitudes and time profiles.
- The Program needs to ensure that critical data on performance, benchmarks and context are available at the time of the CPER.
- The Panel needs to document any unexpected costs and benefits of the CP, including spillovers.
- The review process should involve adequate communication of the CPER with the CP both during the review and after it, and the results should be communicated using various approaches, preferably electronic means, reaching also external audiences.

Implementation

The CPERs are commissioned by the SC on behalf of the Group. They are organized jointly by the SC and the CGIAR Secretariat and their implementation is coordinated by the SC Secretariat. They complement the other elements of the CGIAR's Monitoring and Evaluation systems, namely the annual MTP review by the SC and the Performance Measurement System, which will be adjusted also to accommodate the CPs.

An external review panel of at least two, maximum three members will be assembled. The Panel Chair should have demonstrated experience and skills in research management as well as in scientific research. The profile of the Panel Chair would also depend on the nature of the CP's research as well as the stage that the CP is in, in its life cycle. S/he would have an understanding of international agricultural research for development; have excellent analytical capability, and excellent command of English. S/he should have experience in reviewing complex research programs and demonstrated capacity to lead an independent external review. The Panel member responsible for the governance, management and partnership component of the review should have expertise in program governance, management of multi-partner consortia and program funding.

The review team may include 1-2 consultants to cover specific aspects corresponding to the complexity of the concerned program in which the Panel requires *ad hoc* expertise. Thus, the review Panel will have more flexibility to deal with issues that may not require an expert to be on board for the full period of the review. In consultation with the SC and the CGIAR Secretariat the Panel will determine if there is a need for consultants, who subsequently are selected through a standard Panel selection process led by the SC. The TOR of these consultants should include time for consultations upfront and towards the end of the review process.

All Panel members and consultants participate in the review in their personal capacity and should have no conflict of interest with the CP. Causes of potential conflict include: current employment with a CGIAR Center or CP; previous employment or consultancy with the CP; employment with any of the CP partners; participation or consultancy in planning of the CP or its components; representative of a donor to the CP with any responsibility related to the program funding.

In addition to the generic questions presented in this document, additional review questions will be included in the TOR for each CPER. These would reflect the specific nature and focus of the CP and its research and review history. The CPER should provide information to guide decisions about continuing the program's activities.

The review will include one visit to the host institution of the CP and also a visit to at least one CP partner. It is essential that the CPER reviews the efficiency of the partnerships and captures both the internal partners' and external stakeholders' perceptions.

The report should be clear and succinct. It should explicitly address all the points of the TOR with sufficient analysis to support the conclusions; and present clear and explicit recommendations for improvement, or for bringing the CP to closure. The report should be brief and concise (not to exceed 60 pages), and should include a short Executive Summary (not more than 2 pages). Any supplementary evidence and/or tables could be included in an annex, but the text should be self-contained.

The CP will prepare a response to the Panel report. The SC and CGIAR Secretariats will prepare a commentary to the report prior to its submission to the ExCo and to the Group. The SC and the CGIAR Secretariat will monitor the follow-up of the CPER through the MTP and report their assessment to ExCo.

Background Documents that the CPER Panel is expected to use

1. CP specific Terms of Reference
2. CP full project proposal
3. SC commentary on CP full proposal
4. CP final Business plan
5. CP Annual reports
6. CP MTPs, including annual work plans
7. SC commentaries of CP MTPs
8. CP annual budgets
9. Description of competitive grants process
10. Major funding applications
11. Reports to donors
12. Donor assessments
13. Description of internal monitoring and evaluation processes
14. Internal monitoring and evaluation reports
15. List of program publications by category (to be decided)
16. List of program partners, the specific contribution to the research and the associated budget share
17. CGIAR documents of lessons learned from CPs (e.g. 2004)
18. Selected peer reviewed papers/books produced by the CP

ANNEX 3
List of Strategic Issues for the 1st HarvestPlus CPER

Background

HarvestPlus , the Biofortification Challenge Program (CP) of the CGIAR began operations in January 2004. The Challenge Program External Review (CPER) evaluates the progress of the CP as it is coming towards the end of its first phase. The review will be conducted following the **CPER Guidelines,** a companion document to this TOR and available at www.sciencecouncil.cgiar.org.

For **logistics** please see the "Implementation" section of the CPER Guidelines. It is expected that this review will take up to a total of 30 working days. The schedule for the review as well as contract details will be specified in the appointment note to panel members.

Topics to be covered

The main topics to be covered by the CPER are:

1. The seven (7) programmatic issues as described in pg. 2 of the CPER Guidelines.

2. The four (4) management, governance and partnerships issues as described in pg. 3 of the CPER Guidelines.

In addition, while addressing these issues, the Panel is asked to comment on the following specific items:

3. Are HarvestPlus resources best employed to help reduce micronutrient malnutrition globally? To what extent has the promise of HarvestPlus of adding significant amounts of bioavailable nutrients such as iron, zinc and vitamin A to key staples that also have excellent agronomic qualities been achieved? Is significant progress likely in the CP's time frame?
4. To what extent have health and nutritional benefits of biofortified staples been demonstrated in humans, either under controlled conditions (efficacy) or under program conditions (effectiveness)? Are plans in place for assessments of these benefits in humans reasonable?
5. HarvestPlus has biofortication country programs in Africa, Latin America and Asia (China and India). Are there spillovers from the country programs to other sites and as IPGs?
6. Transgenic methods may provide the best approach for biofortification as compared to conventional breeding (e.g beta-carotene for rice and cassava). To what extent should biotechnology and nutritional genomics take the lead in identifying specific genes as compared to traditional breeding? What is the recommendation for research on transgenics to improve nutritional value?
7. For reasons of transparency towards the public, HarvestPlus' positioning vis-à-vis the GMO debate may deserve more attention. Has HarvestPlus developed plans for transgenic outputs involving NARS for which compliance with the appropriate local regulatory and biosafety guidelines will be necessary for field release?
8. To what extent should resources be applied to completing the work with Phase I crops vs. expanding to Phase II?
9. To what extent and when should NARS be involved in adaptive and participatory breeding activities of the promising varieties?
10. To what extent is the current process of nomination of the Program Advisory Committee members conducive to including diverse and novel perspectives from outside the CGIAR system?

11. Does the program ensure effective buy-in and feedback from external stakeholders? To what extent are the program's financial and management processes considered transparent and fair by the partners?

ANNEX 4
Itinerary of the CPER Panel (Schedule of visits to the Program)

26 April- 1 May 2007	Visit to HarvestPlus at IFPRI, Washington D.C.
13 - 14 July 2007	The Panel meets in Paris to work on the draft
30 July – 3 August 2007	Visit to HarvestPlus at CIAT, Cali, Colombia

ANNEX 5
People contacted/ interviewed by the Panel

Donors
Lawrence Kent, Senior Program officer Global Development, Bill and Melinda Gates Foundation
Katharine Kreis, Senior Program officer nutrition/health, Bill and Melinda Gates Foundation
Eija Pehu Science and Technology adviser, The World Bank
Rob Bertram (agriculture), United States Agency for International Development (USAID)
Cheryl Jackson (nutrition), USAID
Frances Davidson, Nutrition Team Leader, USAID
Larry Beach, Biotechnology Advisor for Africa, USAID
Giusette Lamb, USAID
Jonathan Wadsworth , U.K. Department for International Development (DFID)
Finn Christensen, Royal Danish Ministry of Foreign Affairs (DANIDA)
Hanna Carus, DANIDA
Staffan Wiktelius , Swedish International Development Agency (SIDA)
Jacques Jeugmans , Asian Development Bank (ADB)
Canadian International Development Agency (CIDA)
International Life Sciences Institute (ILSI)
Austrian Ministry of Finance

Partners
Ross M. Welch, Plant Physiologist & Lead Scientist, USDA/ARS, U.S. Plant, Soil and Nutrition Laboratory, Department of Crop & Soil Sciences, Cornell University
James Stangoulis, Research Fellow, Plant and Food Science Department, University of Adelaide, Australia
Jan Low, CIP, Nairobi Kenya
Paul Van Jaarsveld, MRC Nutrition Research Unit, Cape Town, South Africa Penelope Nestel, University of Southampton, UK
Timothy Johns, Bioversity International, Rome, Italy
Barbara Burlingame Nutrition, FAO, Rome)
MS Swaminathan (Chennai, India and Bioversity International, Rome, Italy)
Jorge Dubcovsky, USDA National Research Initiative Plant Genome Program, UC Davis California, USA).

HarvestPlus Management
Howarth Bouis, Program Director
Bonnie McClafferty, Communications and Donor Relations Coordinator
Christine Hotz, Nutrition Coordinator
J.V. Meenakshi, Impact and Policy Coordinator
Wolfgang Pfeiffer, Breeding Coordinator
Joe Tohme, Biotechnology Coordinator
Kwasi Ampofo, Reaching End User Program Coordinator

Program Advisory Committee (PAC) members
Maria Jose Amstalden Sampaio , PAC, EMBRAPA, Brazil
Barbara Underwood , PAC Vice Chair, Ret. Columbia University, USA
Yves Savidan, PAC, CIAT Board Chair, France
Patrick J. Murphy, PAC Audit Chair, USA
Michael Lipton, University of Sussex, UK

Zhang Qifa, Professor and Director, National Key Laboratory of Crop Genetic Improvement, Huazhong Agricultural University, China
Mark Wahlqvist, Monash University, Australia
Joachim von Braun, IFPRI, Director General
David Governey, Director of Finance and Administration, IFPRI
Albin Hübscher, Deputy Director General for Corporate Services, CIAT (informal PAC member)
Mohamed Ait-Kadi, PAC Audit, Conseil Général du Développement, Rabat, Morocco
Estrella Alabastro, Government of the Philippines, Philippines
Richard Flavell, Ceres Inc., USA
David Miron, PAC Audit, USA
Ruth Oniang'o , Editor-in-Chief, African Journal of Food, Agriculture, Nutrition and Development (AJFAND), Kenya
Peter Sandoe, The Royal Veterinary & Agricultural University, Denmark
Suttilak Smitasiri, Mahidol University, Thailand
Peter McPherson , PAC Chair, National Association of Universities and Land Grand Colleges (NASULGC), USA

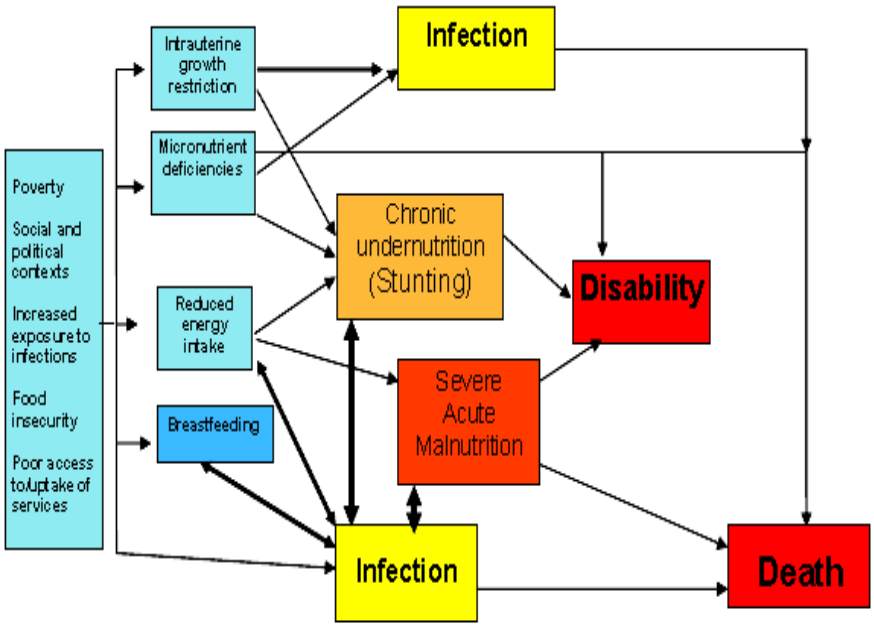
CIAT Laboratories and field site visits
Joachim Voss, CIAT Director General
Douglas Pachico, Deputy Director General for Research
Albin Hubscher, Director of Administration
Steve Beebe, CIAT, Senior Researcher Bean Breeding Program
Helena Pachon, CIAT, AgroSalud Nutritionist
Juan Carlos Perez Asóciate Researcher
Paul Chavarriaga, Yuca genetic transformation
Jesús Alonso Beltrot, Yuca genetic transformation
Teresa Sanchez, Cassava laboratories
Cesar Martinez, Senior Researcher Agro Salud Rice Leader
Lucia Chavez, Biochemistry laboratory
Mathew Blair, Plant biotechnologist/breeder
Luis Sanint, CIAT Finance Department, Colombia
Wolfgang Pfeiffer, CIAT, Colombia

CGIAR Secretariat, Washington D.C
Namita Datta, Chief- Governance Advisor
Manny Lantin, Science Advisor
Loriza Dagdag, Financial Officer

ANNEX 6
List of main documents reviewed by the Panel

HarvestPlus Governance and Management Handbook (May 2005)
IFPRI CIAT Agreement
CGIAR Challenge Program External Reviews (CPER) Guidelines
Phase I Program Review Document
PAC minutes 2003-2005
PAC members, November 2006
PAC Audit Committee minutes, 2005-2006
HarvestPlus MTPs 2005-2007; 2006-2008; 2007-2009; 2008-2010
Science Council Commentary to the MTPs and Center's Responses
HarvestPlus Biofortification Proposal
Reaching End Users Proposal
Letters of Support to the HarvestPlus CP
HarvestPlus Annual Reports 2004, 2005, 2006
Gates Foundation Reports for HarvestPlus Phase I: 2004, 2005
Gates Foundation Report for Reaching End Users
Donors contact information
Executive Council Annual Reports 2005 & 2006
Funding of collaborators for Phase I and Phase II
Internal Review of contracts for Breeding, REU, Impact and Nutritional Genomics
HarvestPlus Planning 2007 Time Allocation Assessment
HarvestPlus PMT Time Allocation Task Ranking
Report on an Audit of the HarvestPlus Challenge Program CIAT Component, Nov. 2006
Work Plan Budget template, 2006
IFPRI HP Supplemental Schedule 2006
IFPRI Contracting System
IFPRI Audited Financial Statements 2005
IFPRI HarvestPlus Supplemental Schedule 2006
HarvestPlus Contract Template
Funding projections
CIAT-Audited Financial Statements 2005
CIAT HarvestPlus Supplemental Schedule 2006
2003-2006 Consolidated Budget
List of publications by HarvestPlus Alliance Members & PMT
Survey of publications referring to HarvestPlus
Letter of Inquiry HarvestPlus Phase II
CGIAR Secretariat Commentary on the Governance, Management and Finance Aspects of the Annual Reports (2005) of Challenge Programs
Synthesis of Lessons Learnt from Initial Implementation of CGIAR Challenge Programs, 2004
Funding projection table (2006-2010)
Budget and expenditure tables (include contractee)
Explanation of contracting system
Description of fundraising plan

ANNEX 7
Relevant information on Micronutrient deficiencies
(Vit A, Fe, and Zn) modified from Lancet 2007 (in press)
Model to consider multicausality of Death and Disability from Malnutrition



Vitamin A, zinc, iron and iodine deficiencies and the anthropometric measures as risk factors are largely independent, but there is still overlap in their risk, e.g. diarrhea for vitamin A, zinc, and stunting. In addition to simple multi-causality, about half of the effect of zinc deficiency is mediated through stunting; the rest is a direct effect on morbidity and mortality, probably as a result of reduced immune function. Therefore, an analysis was done to account for joint effects. Collectively, the anthropometric and micronutrient deficiencies examined in this analysis are responsible for about 30% of deaths and disease burden in children less than 5 years old and 9% of disease burden in all ages globally. This constitutes a very large attributable burden for this set of conditions.

The risk related to sub-optimal breastfeeding may in part be due to micro nutrient deficiencies resulted from inadequate dietary intake, but is more importantly due to avoidance of infection. The disease burden attributed to sub-optimal breastfeeding cannot be added to that from undernutrition risk factors without further consideration of their joint effects, which was beyond the scope of the analyses; however, it is appropriate to consider breastfeeding practices to be important risk factors for infectious disease burden in their own right.

1. Effective interventions are available to reduce stunting, micronutrient deficiencies and child deaths. If implemented at scale, they would reduce the DALYs (all child deaths) by about a quarter in the short term.
2. Among the interventions reviewed, breastfeeding counseling and vitamin A and zinc fortification/supplementation have the greatest potential to reduce the burden of child morbidity and mortality.
3. Improving complementary feeding through strategies such as nutrition counseling for food secure populations and nutrition counseling, food supplements and/or conditional cash transfers in food insecure populations could substantially reduce stunting.

4. Maternal nutrition interventions (iron folate supplements and targeted balanced energy protein supplementation) can make a difference to maternal health and birth outcomes, but relatively few have been evaluated at scale in health systems.
5. Although available interventions can make a difference in the short term, elimination of stunting will require long term investments to improve education, economic status and empowerment of women. Maternal short stature and anemia may increase the risk of death of the mother at delivery

Global deaths and disability adjusted life years (DALYs) in children under five years of age attributed to micronutrient deficiencies in 2004

Condition	Deaths	Percentage of <5y Deaths	Disease Burden (1000 DALYs)	Percentage of <5y DALYs
Vitamin A def	773,529	7.5	26,221	6.0
Zinc deficiency	665,347	6.4	23,991	5.5
Iron deficiency	20,854	0.2	2,156	0.5
Iodine deficiency	3,619	0.03	2,614	0.6

Global deaths and disease burden measured in disability-adjusted life years (DALYs) in children under five years of age attributed to nutritional status measures in 2004

Measure	Deaths	Percentage of <5y Deaths	Disease Burden (1000 DALYs)	Percentage of <5y DALYs
Underweight*	1,957,530	19.0	81,358	18.7
Stunting	1,491,188	14.5	54,912	12.6
Wasting*	1,505,236	14.6	64,566	14.8
(Severe wasting*)†	(449,160)	(4.4)	(25,929)	(6.0)
IUGR-low birth weight	337,047	3.3	13,536	3.1
Total of stunting, severe wasting and IUGR-low birth weight**	2,184,973	21.4	90,962	21.2

*Deaths (138,739) and DALYs (14,486,400) directly attributed to "protein energy malnutrition" included.
†Included in wasting
‡Total takes into account the joint distribution of stunting and severe wasting

- More than 3 million deaths and 30% of the disease burden in children less than 5 years old can be attributed to maternal and child undernutrition.
- The more than 20% of global deaths and DALYs in children less than 5 years old attributed to stunting, severe wasting and intrauterine growth restriction is the largest percentage for risk factors in this age group.
- Of the micronutrients, vitamin A and zinc deficiencies, by far have the largest remaining disease burden.
- 1.4 million deaths and 10% of the disease burden in children <5y can be attributed to sub-optimal breastfeeding, especially non-exclusive breastfeeding in the first 6 months of life.

ANNEX 8

Costs and contributions of bio-fortified foods

Proposals for NutriRice™ label and costs

Héctor Cori

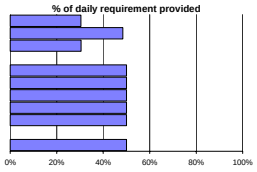
Nutrition Improvement Program

DSM Nutritional Products

Label

200 grams of rice fortified with Nutririce® provide:

Nutrient	Value	Reference Value	% Reference
Macronutrients		**	
Calories (kcal)	730	2404	30%
Carbohydrates (g)	160	331	48%
Protein	14	46	30%
Vitamins		*	
Vitamin A (µg)	250	500	50%
Vitamin B_1 (mg)	0.55	1.10	50%
Folate (µg)	200	400	50%
Niacin (mg)	7.0	14.0	50%
Vitamin B_{12} (µg)	1.2	2.4	50%
Minerals		*	
Iron (mg) (10%RBV)	14.7	29.4	50%



* Reccomended Nutrient Intakes, as per WHO 2004.

** Dietary Reference Intakes, IOM, FNB, 2005.

DSM Nutritional Products

China 1: Extruder amortization

Scenario Details			
Extruder Capacity		315	Kg/hour
Shifts per day		2	
Price of broken rice	USD	0.30	/Kg
Selling price of rice	USD	0.50	/Kg
Extruder Cost	USD	2.00	mio
Rice consumption		200	g/person/day

Cost Impact		
Cost per Kg rice	USD	0.008
Impact in price of rice		1.7%
Cost/person/year	USD	0.62

DSM Nutritional Products

China 2: No extruder amortization

Scenario Details			
Extruder Capacity		315	Kg/hour
Shifts per day		2	
Price of broken rice	USD	0.30	/Kg
Selling price of rice	USD	0.50	/Kg
Extruder Cost	USD	0.00	mio
Rice consumption		200	g/person/day

Cost Impact		
Cost per Kg rice	USD	0.005
Impact in price of rice		0.9%
Cost/person/year	USD	0.35

DSM Nutritional Products

India 1: Extruder amortization

Scenario Details			
Extruder Capacity		315	Kg/hour
Shifts per day		2	
Price of broken rice	USD	0.13	/Kg
Selling price of rice	USD	0.22	/Kg
Extruder Cost	USD	2.00	mio
Rice consumption		200	g/person/day

Cost Impact		
Cost per Kg rice	USD	0.010
Impact in price of rice		4.3%
Cost/person/year	USD	0.70

DSM Nutritional Products

India 2: No extruder amortization

Scenario Details			
Extruder Capacity		315	Kg/hour
Shifts per day		2	
Price of broken rice	USD	0.13	/Kg
Selling price of rice	USD	0.22	/Kg
Extruder Cost	USD	0.00	mio
Rice consumption		200	g/person/day

Cost Impact		
Cost per Kg rice	USD	0.006
Impact in price of rice		2.7%
Cost/person/year	USD	0.43

DSM Nutritional Products

COST AND CONTRIBUTION

Fortification Formulas (Averages of Addition)

OIL

Micronutrients	Fortificants	Average= 7 g/day			Category[1]= ≤ 10		Average= 15 g/day			Category= 11–19		Average= 30 g/day			Category= ≥ 20	
		Population Distribution =2-25 g/day					Population Distribution =5-40 g/day					Population Distribution =10-60 g/day				
		Content (mg/kg)	Intake[2] (mg/day)	EAR[3] (%)	Abs. Cost (US$/MT)	Person cost (US$/year)	Content (mg/kg)	Intake (mg/day)	EAR (%)	Abs. Cost (US$/MT)	Person cost (US$/year)	Content (mg/kg)	Intake (mg/day)	EAR (%)	Abs. Cost (US$/MT)	Person cost (US$/year)
Vit. A (RE)[a]	Retinyl Palmitate- 1.7 m IU/g (oil)	35.0	0.159	45	6.86	0.018	25.0	0.244	68	4.90	0.027	20.0	0.390	109	3.92	0.043

SUGAR

Micronutrients	Fortificants	Average= 15 g/day			Category= ≤ 25		Average= 35 g/day			Category= 26–47		Average= 60 g/day			Category= ≥ 48	
		Population Distribution =5-80 g/day					Population Distribution =20-120 g/day					Population Distribution =50-180 g/day				
		Content (mg/kg)	Intake (mg/day)	EAR (%)	Abs. Cost (US$/MT)	Person cost (US$/year)	Content (mg/kg)	Intake (mg/day)	EAR (%)	Abs. Cost (US$/MT)	Person cost (US$/year)	Content (mg/kg)	Intake (mg/day)	EAR (%)	Abs. Cost (US$/MT)	Person cost (US$/year)
Vit. A[a]	Retinyl Palmitate-250,000 IU/g (dry)	20.0	0.180	50	10.67	0.042	15.0	0.315	88	8.00	0.102	7.5	0.270	76	4.00	0.088

SALT

Micronutrients	Fortificants	Average= 3 g/day			Category= ≤ 5		Average= 6 g/day			Category= > 5		Average= No applicable				
		Population Distribution =1-10 g/day					Population Distribution =3-15 g/day					Population Distribution =No applicable				
		Content (mg/kg)	Intake (mg/day)	EAR (%)	Abs. Cost (US$/MT)	Person cost (US$/year)	Content (mg/kg)	Intake (mg/day)	EAR (%)	Abs. Cost (US$/MT)	Person cost (US$/year)	Content (mg/kg)	Intake (mg/day)	EAR (%)	Abs. Cost (US$/MT)	Person cost (US$/year)
Iodine[c]	Potassium iodate (raw and refined)	60.0	0.153	143	2.03	0.002	40.0	0.204	190	1.36	0.003	N.A.				
	Potassium iodide (refined salt)	60.0	0.135	126	0.95	0.001	40.0	0.180	168	0.63	0.001	N.A.				

Notes:

[1] Categorization of the country based on the per capita intake (g/day).

[2] Considering losses of the micronutrient during the marketing life of the food and the food preparation.

[3] For women of reproductive age.

[4] Based on the micronutrient that shows the minimum contribution in term of EAR.

[a] RE = Retinol equivalents; 1μg retinol = 1 μg RE; 1 μg β-carotene = 0.167 μg RE; 1 μg other pro-vitamin A carotenoids = 0.084μg RE.

[c] Sections highlighted in blue present several alternatives of the same micronutrient to choice from.

Omar Dary

25-May-07

COST AND CONTRIBUTION

Fortification Formulas (Averages of Addition)

REFINED WHEAT FLOUR

Micronutrients	Fortificants	Average= 50 g/day			Category[1]= ≤ 75		Average= 100 g/day			Category= 76–149		Average= 200 g/day			Category= ≥ 150	
		Population Distribution =10-200 g/day					Population Distribution =25-350 g/day					Population Distribution =50-600 g/day				
		Content (mg/kg)	Intake[2] (mg/day)	EAR[3] (%)	Abs. Cost (US$/MT)	Person cost (US$/year)	Content (mg/kg)	Intake (mg/day)	EAR (%)	Abs. Cost (US$/MT)	Person cost (US$/year)	Content (mg/kg)	Intake (mg/day)	EAR (%)	Abs. Cost (US$/MT)	Person cost (US$/year)
Vit. A[a]	Retinyl Palmitate-250,000 IU/g (dry)	4.0	0.130	36	2.13	0.039	2.0	0.130	36	1.07	0.039	1.5	0.195	55	0.80	0.058
Vit. B-1	Thiamin mononitrate	6.0	0.203	22	0.19	0.003	6.0	0.405	44	0.19	0.007	4.5	0.608	66	0.14	0.010
Vit. B-2	Riboflavin	5.0	0.213	23	0.19	0.003	5.0	0.425	46	0.19	0.007	4.0	0.680	74	0.15	0.011
Vit. B-3 (Niacin)	Niacinamide	60.0	2.550	24	0.61	0.011	60.0	5.100	47	0.61	0.022	40.0	6.800	63	0.40	0.029
Vit. B-6	Pyridoxine	6.0	0.233	21	0.23	0.004	6.0	0.465	43	0.23	0.008	5.0	0.775	72	0.19	0.014
Vit. B-9 (folate)(DFE)[b]	Folic Acid	4.0	0.130	69	0.36	0.007	2.0	0.130	69	0.18	0.007	1.5	0.195	104	0.14	0.010
Vit. B-12	Vit. B-12 0.1% WS	0.020	0.001	85	0.84	0.015	0.010	0.001	85	0.42	0.015	0.005	0.001	85	0.21	0.015
Iron[c]	Ferrous sulfate dried	25.0	1.250	9	0.20	0.004	25.0	2.500	19	0.20	0.007	25.0	5.000	38	0.20	0.015
	Electrolytic iron	60.0	3.000	15	0.28	0.005	60.0	6.000	30	0.28	0.010	60.0	11.000	59	0.28	0.020
	Ferrous fumarate	45.0	2.250	17	0.99	0.018	45.0	4.500	34	0.99	0.036	45.0	9.000	68	0.99	0.072
Zinc	Zinc oxide	30.0	1.500	37	0.13	0.002	30.0	3.000	73	0.13	0.005	15.0	3.000	73	0.06	0.004

WHOLE WHEAT FLOUR

Micronutrients	Fortificants	Average= 50 g/day			Category= ≤ 75		Average= 100 g/day			Category= 76–149		Average= 200 g/day			Category= ≥ 150	
		Population Distribution =10-200 g/day					Population Distribution =25-350 g/day					Population Distribution =50-600 g/day				
		Content (mg/kg)	Intake[2] (mg/day)	EAR[3] (%)	Abs. Cost (US$/MT)	Person cost (US$/year)	Content (mg/kg)	Intake (mg/day)	EAR (%)	Abs. Cost (US$/MT)	Person cost (US$/year)	Content (mg/kg)	Intake (mg/day)	EAR (%)	Abs. Cost (US$/MT)	Person cost (US$/year)
Vit. A[a]	Retinyl Palmitate-250,000 IU/g (dry)	4.0	0.130	36	2.13	0.039	2.0	0.130	36	1.07	0.039	1.5	0.195	55	0.80	0.058
Vit. B-1	Thiamin mononitrate	2.0	0.068	7	0.06	0.001	2.0	0.135	15	0.06	0.002	2.0	0.270	29	0.06	0.004
Vit. B-2	Riboflavin	4.0	0.170	19	0.15	0.003	4.0	0.340	37	0.15	0.005	3.0	0.510	56	0.11	0.008
Vit. B-3 (Niacin)	Niacinamide	15.0	0.638	6	0.15	0.003	15.0	1.275	12	0.15	0.005	5.0	0.850	8	0.05	0.004
Vit. B-6	Pyridoxine	5.0	0.194	18	0.19	0.003	5.0	0.388	36	0.19	0.007	2.0	0.310	29	0.08	0.006
Vit. B-9 (folate)(DFE)[b]	Folic Acid	4.0	0.130	69	0.36	0.007	2.0	0.130	69	0.18	0.007	1.5	0.195	104	0.14	0.010
Vit. B-12	Vit. B-12 0.1% WS	0.020	0.001	85	0.84	0.015	0.010	0.001	85	0.42	0.015	0.005	0.001	85	0.21	0.015
Iron[c]	Electrolytic iron	30.0	1.500	4	0.14	0.003	30.0	3.000	7	0.14	0.005	30.0	8.000	15	0.14	0.010
	Ferrous fumarate	30.0	1.500	6	0.55	0.010	30.0	3.000	11	0.55	0.020	30.0	6.000	23	0.55	0.040
	NaFeEDTA[g]	20.0	1.000	8	1.00	0.018	20.0	2.000	15	1.00	0.037	20.0	4.000	30	1.00	0.073
Zinc	Zinc oxide	20.0	1.000	12	0.08	0.001	20.0	2.000	24	0.08	0.003	10.0	2.000	24	0.04	0.003

Notes:

[1] Categorization of the country based on the per capita intake (g/day).

[2] Considering losses of the micronutrient during the marketing life of the food and the food preparation.

[3] For women of reproductive age.

[a] RE = Retinol equivalents; 1μg retinol = 1 μg RE; 1 μg β-carotene = 0.167 μg RE; 1 μg other pro-vitamin A carotenoids = 0.084μg RE.

[b] DFE = Dietary Folate Equivalents; 1μg folic acid = 1.7 μg DFE. Table shows amounts as folic acid.

[c] Sections highlighted in blue present several alternatives of the same micronutrient to choice from.

Omar Dary

25-May-07

COST AND CONTRIBUTION

Fortification Formulas (Averages of Addition)

MASA-MAIZE FLOUR

Micronutrients	Fortificants	Average= 50 g/day			Category[1]= ≤ 75		Average= 100 g/day			Category= 76–149		Average= 200 g/day			Category= ≥ 150	
		Population Distribution =10-200 g/day					Population Distribution =25-350 g/day					Population Distribution =50-600 g/day				
		Content (mg/kg)	Intake[2] (mg/day)	EAR [3] (%)	Abs. Cost (US$/MT)	Person cost (US$/year)	Content (mg/kg)	Intake (mg/day)	EAR (%)	Abs. Cost (US$/MT)	Person cost (US$/year)	Content (mg/kg)	Intake (mg/day)	EAR (%)	Abs. Cost (US$/MT)	Person cost (US$/year)
Vit. A[a]	Retinyl Palmitate-250,000 IU/g (dry)	4.0	0.130	36	2.13	0.039	2.0	0.130	36	1.07	0.039	1.5	0.195	55	0.80	0.058
Vit. B-1	Thiamin mononitrate	5.0	0.169	18	0.15	0.003	4.0	0.270	29	0.12	0.004	3.0	0.405	44	0.09	0.007
Vit. B-2	Riboflavin	5.0	0.213	23	0.19	0.003	5.0	0.425	46	0.19	0.007	4.0	0.680	74	0.15	0.011
Vit. B-3 (Niacin)	Niacinamide	35.0	1.488	14	0.35	0.006	25.0	2.125	20	0.25	0.009	15.0	2.550	24	0.15	0.011
Vit. B-9 (folate)(DFE)[b]	Folic Acid	4.0	0.130	69	0.36	0.007	2.0	0.130	69	0.18	0.007	1.5	0.195	104	0.14	0.010
Vit. B-12	Vit. B-12 0.1% WS	0.020	0.001	85	0.84	0.015	0.010	0.001	85	0.42	0.015	0.005	0.001	85	0.21	0.015
Iron[c]	Ferrous fumarate	20.0	1.000	4	0.44	0.008	20.0	2.000	8	0.44	0.016	20.0	4.000	15	0.44	0.032
	NaFeEDTA[g]	15.0	0.750	6	0.75	0.014	15.0	1.500	11	0.75	0.027	15.0	3.000	23	0.75	0.055
Zinc	Zinc oxide	30.0	1.500	18	0.13	0.002	30.0	3.000	37	0.13	0.005	20.0	4.000	49	0.08	0.006

Notes:

[1] Categorization of the country based on the per capita intake (g/day).

[2] Considering losses of the micronutrient during the marketing life of the food and the food preparation.

[3] For women of reproductive age.

[4] Based on the micronutrient that shows the minimum contribution in term of EAR.

[a] RE = Retinol equivalents; 1μg retinol = 1 μg RE; 1 μg β-carotene = 0.167 μg RE; 1 μg other pro-vitamin A carotenoids = 0.084μg RE.

[b] DFE = Dietary Folate Equivalents; 1μg folic acid = 1.7 μg DFE. Table shows amounts as folic acid.

[c] Sections highlighted in blue present several alternatives of the same micronutrient to choice from.

Omar Dary

25-May-07

Additional explanations to the table on costs of fortification

1. The cells highlighted in yellow correspond to categories of countries classified according to their national per capita intake of the food being fortified. These values are not the Population Distribution that corresponds to the range of expected consumption patterns in the same population.

2. The fortification formulas are defined by consumption level at the 95 centile for the corresponding food, and not by per capita intake; in the absence of this information and for cost estimations you can use the specified country categorization.

3. The column of EAR (estimated average requirement) provides the best index of requirement to estimate the nutritional contribution of the fortified food; with the exception of iron in foods other than in refined wheat flour, food fortification is able to provide significant amounts of the key micronutrients. EAR and not (RDA or RNI) is the best index to assess sufficiency of population nutrient intakes.

4. The cost per person is correlated with the proportion of EAR that is supplied, and not to the absolute cost of the fortification per metric ton. Obviously, the absolute cost per metric ton is in function of the selected micronutrient content, but it does not make sense to compare the cost of the fortification programs based on the absolute cost or the price of the premix. The comparative costs should be done based on the annual investment per person per year, and if possible in terms of the proportion of EAR that is provided.

5. The last column presents the relative comparison of cost of all the micronutrients based on providing 100% EAR for women of reproductive age. You can see that given vitamin A through oil is 1/3 of the cost of given that vitamin through sugar or wheat flour. Nevertheless, it is important to keep adding vitamin A to sugar and wheat flour, because for most populations the consumption of fortified oil will only cover part of the needs.

6. The last column clearly illustrated that vitamin A is not more expensive than iron. It is also important to point out that this is a theoretical calculation favors iron, because we are assuming that we can provide 100% EAR of the nutrient through food fortification, this is not always the case. On the contrary, we can easily provide good amounts of vitamin A through food fortification.

ANNEX 9

Principal HarvestPlus collaborators (based on 2003-2007 budgeting documentation)

Chinese Academy of Agricultural Sciences
Chinese Academy of Sciences
CIAT
CIMMYT
CIP
Crop Science Institute
Danish Institute of Agricultural Sciences
EMBRAPA
ETH, Zurich
Freiburg University
Fundação de Apoio da Universidade Federal do Rio Grande do Sul
ICARDA
ICRISAT
IFPRI
IITA
INIBAP
International Center for Control of Diarrheal Disease, Bangladesh
Iowa State University
IRRI
Michgian State
Michigan State University
National Maize Improvement Center of China, China Agricultural University
Ohio State University
Pioneer Corporation
PRAPACE (African Root and Tuber Network)
Purdue University
Royal Veterninary and Agricultural University
Sabanci University
Tufts University
University of Adelaide
University of California at Davis
University of Colorado
University of Greenwich
University of Illinois
University of Natural Resources and Applied Life Science (BOKU)
University of Otago, New Zealand
University of Rhode Island
University of Tokyo
University of Wisconsin
USDA-ARS
Wageningen University
WARDA
World Vision
Xaivier University, Philippines
Yale University
Zheijiang University, Hangzhou

ANNEX 10
Survey Respondents and Analysis of Survey Answers

Survey Respondents

"Management Group"
- Howarth Bouis, Program Director
- Christine Hotz, Nutrition Research Coordinator
- Bonnie McClafferty, Communications and Donor Relations Coordinator
- J.V. Meenakshi, Impact and Policy Coordinator
- Wolfgang Pfeiffer, Coordinator
- Joe Tohme, Biotechnology Coordinator

"PAC Group"
- Estrella Alabastro, PAC Member
- Michael Lipton, PAC member
- Peter McPherson, PAC Chair
- David Miron CIAT Board Audit Committee Chair, CIAT Board member, PAC Audit Committee member
- Patrick Murphy, PAC Audit Committee Chair
- Ruth Oniang'o, PAC member
- Maria Jose Amstalden Sampaio, PAC member
- Yves Savidan, CIAT Board Chair, PAC member
- Suttilak Smitasiri, IFPRI Board Vice Chair, former PAC member
- Barbara Underwood, PAC Vice Chair
- Michele Veeman, IFPRI Board member, PAC member
- Mark Wahlqvist, PAC member

Analysis of Survey Answers

Recipient and response info

- The online survey was started by means of an email by Howdy Bouis on May 23, 2007, giving basic information and providing the link to the online survey website
- The survey was closed on June 11, 2007 after an extension of the deadline
- For the response statistics please refer to the tabular below
- The survey has been sent to a total of 27 individuals that were grouped into a
    - "PAC" group of 20 individuals:
        - 15 out of 17 current PAC members[30] (3 incoming members were not targeted, but apparently 1 incoming member has received the link and has responded and has also been included in the analysis)
        - 2 Audit Committee members (the audit committee chair is included as PAC member in the number above)
        - 2 Finance Directors (CIAT and IFPRI)
        - 1 former PAC member
    - A "Management" group of 7 management team members
- Complete survey responses were received from 18 individuals (12 individuals from the "PAC" group and 6 individuals from the "Management" group)

[30] Current PAC membership as indicated in documentation for the HPlus PAC meeting on June 14-15, 2007 in Washington DC

Analysis	Number of respondents	Number of recipients	% of recipients responding
PAC	12	20	60%
Management	6	7	86%
All	18	27	73%

Questions and answer statistics

1. How satisfied are you with the overall program performance?

Analysis	Highly satisfied	Satisfied	Slightly unsatisfied	Highly unsatisfied
PAC	5	7	0	0
	42%	58%	0%	0%
Management	6	0	0	0
	100%	0%	0%	0%
All	11	7	0	0
	61%	39%	0%	0%
Total respondents	18	100%	Respondents	

2. Please comment on question 1. *(Comments have been omitted for confidentiality)*

3. In your view, will the program be able to reach its stated objectives within the planned time frame?

Analysis	Yes, certainly	Probably yes	Probably not	No, impossible
PAC	0	11	1	0
	0%	92%	8%	0%
Management	1	5	0	0
	17%	83%	0%	0%
All	1	16	1	0
	6%	89%	6%	0%
Total respondents	18	100%	Respondents	

4. Please comment on question 3. *(Comments have been omitted for confidentiality)*

5. How important is achieving development impact (nutrition and wellbeing of populations) in addition to research results for HarvestPlus?

Analysis	Research results more important	Equally important	Development impact more important
PAC	1	5	6
	8%	42%	50%
Management	1	3	2
	17%	50%	33%
All	2	8	8
	11%	44%	44%
Total respondents	18	100%	

6. Please comment on question 5. *(Comments have been omitted for confidentiality)*

7. Does the program have the right partners, e.g. for research and implementation?

Analysis	Yes, partner mix is good	No, important partners are missing or quality is low
PAC	11	1
	92%	8%
Management	5	1
	83%	17%
All	16	2
	89%	11%
Total respondents	18	100%
		respondents

8. Please comment on question 7. *(Comments have been omitted for confidentiality)*

9. Does the program have the right balance between directly commissioning program activities versus allocating funds through competitive mechanisms?

Analysis	Yes. The balance is right	No there is too much activity directly commissioned,	No there are too many funds allocated though competitive mechanisms
PAC	6	3	0
	67%	33%	0%
Management	5	1	0
	83%	17%	0%
All	11	4	0
	73%	27%	0%
Total respondents	15	83%	respondents

10. Please comment on question 9. *(Comments have been omitted for confidentiality)*

11. Please indicate your satisfaction with the quality of HarvestPlus Governance and Management along the dimensions listed below. Please tick one option for each area.

Legitimacy. To what extend do the governance and management structures permit and facilitate the effective participation and voice of the different categories of stakeholders in the major governance and management decisions, taking into account their respective roles and relative importance?

Analysis	Highly unsatisfied	Slightly unsatisfied	Slightly satisfied	Highly satisfied
PAC	0	2	4	6
	0%	17%	33%	50%
Management	0	0	3	3
	0%	0%	50%	50%
All	0	2	7	9
	0%	11%	39%	50%
Total respondents	18	100%	respondents	

Accountability. To what extent is accountability defined, accepted, and exercised along the chain of command and control, starting with the PAC and the participating center's boards and going down to the program coordinator, the program management team, functional and crop leaders, and implementers?

Analysis	Highly unsatisfied	Slightly unsatisfied	Slightly satisfied	Highly satisfied
PAC	0	0	4	8
	0%	0%	33%	67%
Management	0	0	1	5
	0%	0%	17%	83%
All	0	0	5	13
	0%	0%	28%	72%
Total respondents	18	100%	respondents	

Responsibility to others. To what extent does the program accept and exercise responsibility to stakeholders who are not directly involved in the governance of the program and who are not part of the direct chain of accountability in the implementation of the program?

Analysis	Highly unsatisfied	Slightly unsatisfied	Slightly satisfied	Highly satisfied
PAC	0	1	5	6
	0%	8%	42%	50%
Management	0	0	0	6
	0%	0%	0%	100%
All	0	1	5	12
	0%	6%	28%	67%
Total respondents	18	100%	respondents	

Fairness. To what extent do partners and participants, similarly situated, have equal opportunity to influence the program and to receive benefits from the program (e.g. absence of barriers in terms of structure, process, language, technical or legal information)?

Analysis	Highly unsatisfied	Slightly unsatisfied	Slightly satisfied	Highly satisfied
PAC	0	0	4	6
	0%	0%	40%	60%
Management	0	0	4	2
	0%	0%	67%	33%
All	0	0	8	8
	0%	0%	50%	50%
Total respondents	16	89%	respondents	

Transparency. To what extent are the program's decision-making, reporting, and evaluation processes open and freely available to the general public?

Analysis	Highly unsatisfied	Slightly unsatisfied	Slightly satisfied	Highly satisfied
PAC	0	0	7	5
	0%	0%	58%	42%
Management	0	0	4	2
	0%	0%	67%	33%
All	0	0	11	7
	0%	0%	61%	39%
Total respondents	18	100%	respondents	

Efficiency. To what extent do the governance and management structures enhance efficiency or cost-effectiveness in the allocation and use of the program's resources?

Analysis	Highly unsatisfied	Slightly unsatisfied	Slightly satisfied	Highly satisfied
PAC	0	0	4	8
	0%	0%	33%	67%
Management	0	0	1	4
	0%	0%	20%	80%
All	0	0	5	12
	0%	0%	29%	71%
Total respondents	17	94%	respondents	

Probity. To what extent do all persons in leadership positions adhere to high standards of ethics and professional conduct over and above compliance with the rules and regulations governing the operation of the program?

Analysis	Highly unsatisfied	Slightly unsatisfied	Slightly satisfied	Highly satisfied
PAC	0	0	1	11
	0%	0%	8%	92%
Management	0	0	0	6
	0%	0%	0%	100%
All	0	0	1	17
	0%	0%	6%	94%
Total respondents	18	100%	respondents	

12. Follow-up to question 11: Please provide comments/suggestions and/or specific examples illustrating your choices in question 11 above. *(Comments have been omitted for confidentiality)*

13. Please indicate your satisfaction with the performance of the Program Advisory Committee (PAC) in terms of the following functions: Please tick one option for each area.

Giving strategic direction
(e.g., exercising effective leadership that optimizes the use of the financial, human, social, and technological resources of the program. Establishing a vision or a mission for the program, reviewing and approving strategic documents, and establishing operational policies and guidelines. Continually monitoring the effectiveness of the program's governance arrangements and making changes as needed.)

Analysis	Highly unsatisfied	Slightly unsatisfied	Slightly satisfied	Highly satisfied
PAC	0	0	1	10
	0%	0%	9%	91%
Management	0	0	1	5
	0%	0%	17%	83%
All	0	0	2	15
	0%	0%	12%	88%
Total respondents	17	94%	respondents	

Exercising management oversight
(e.g., monitoring managerial performance and program implementation, appointing key personnel, approving annual budgets and business plans, and overseeing major capital expenditures. Promoting high performance and efficient processes by establishing an appropriate balance between control by the governing body and entrepreneurship by the management unit. Monitoring compliance with all applicable laws and regulations, and with the regulations and procedures of the host organization, as the case may be.)

Analysis	Highly unsatisfied	Slightly unsatisfied	Slightly satisfied	Highly satisfied
PAC	0	1	2	8
	0%	9%	18%	73%
Management	0	0	0	6
	0%	0%	0%	100%
All	0	1	2	14
	0%	6%	12%	82%
Total respondents	17	94%	respondents	

Fostering stakeholder participation
(e.g., establishing policies for inclusion of stakeholders in programmatic activities. Ensuring adequate consultation, communication, transparency, and disclosure in relation to program stakeholders that are not represented on the governing bodies of the program.)

Analysis	Highly unsatisfied	Slightly unsatisfied	Slightly satisfied	Highly satisfied
PAC	0	1	6	4
	0%	9%	55%	36%
Management	0	0	5	1
	0%	0%	83%	17%
All	0	1	11	5
	0%	6%	65%	29%
Total respondents	17	94%	respondents	

Risk management
(e.g., establishing a policy for managing risks and monitoring the implementation of the policy. Ensuring that the volume of financial resources is commensurate with the program's needs and that the sources of finance are adequately diversified to mitigate financial shocks.)

Analysis	Highly unsatisfied	Slightly unsatisfied	Slightly satisfied	Highly satisfied
PAC	0	1	3	7
	0%	9%	27%	64%
Management	0	0	2	4
	0%	0%	33%	67%
All	0	1	5	11
	0%	6%	29%	65%
Total respondents	17	94%	respondents	

Conflict management
(e.g., monitoring and managing the potential conflicts of interest of members of the governing body and staff of the management unit. Monitoring and managing conflicting interests among program partners and participants, especially those that arise during the process of program implementation.)

Analysis	Highly unsatisfied	Slightly unsatisfied	Slightly satisfied	Highly satisfied
PAC	0	0	5	6
	0%	0%	45%	55%
Management	0	0	3	3
	0%	0%	50%	50%
All	0	0	8	9
	0%	0%	47%	53%
Total respondents	17	94%	respondents	

Audit and evaluation
(e.g., ensuring the integrity of the program's accounting and financial reporting systems, including independent audits. Setting evaluation policy, commissioning evaluations in a timely way, and overseeing management uptake and implementation of accepted recommendations. Ensuring that evaluations lead to learning and programmatic enhancement.)

Analysis	Highly unsatisfied	Slightly unsatisfied	Slightly satisfied	Highly satisfied
PAC	1	0	1	9
	9%	0%	9%	82%
Management	0	0	0	6
	0%	0%	0%	100%
All	1	0	1	15
	6%	0%	6%	88%
Total respondents	17	94%	respondents	

14. Follow-up to question 8. Please provide comments/suggestions and/or specific examples illustrating your choices in question 8 above. *(Comments have been omitted for confidentiality)*

15. How much do you agree / disagree with the following statements:

"The PAC is representing the program's interests in a balanced way"

Analysis	Strongly disagree	Slightly disagree	Slightly agree	Strongly agree
PAC	0	1	2	9
	0%	8%	17%	75%
Management	0	0	0	6
	0%	0%	0%	100%
All	0	1	2	15
	0%	6%	11%	83%
Total respondents	18	100%	respondents	

"The presence of IFPRI and CIAT representatives on the PAC introduces some institutional interests into PAC recommendations/decisions"

Analysis	Strongly disagree	Slightly disagree	Slightly agree	Strongly agree
PAC	0	1	6	5
	0%	8%	50%	42%
Management	2	2	2	0
	33%	33%	33%	0%
All	2	3	8	5
	11%	17%	44%	28%
Total respondents	18	100%	respondents	

"The PAC is an advisory body without decision-making power"

Analysis	Strongly disagree	Slightly disagree	Slightly agree	Strongly agree
PAC	6	2	0	4
	50%	17%	0%	33%
Management	4	2	0	0
	67%	33%	0%	0%
All	10	4	0	4
	56%	22%	0%	22%
Total respondents	18	100%	respondents	

"De facto the PAC is a program steering committee with decision-making power"

Analysis	Strongly disagree	Slightly disagree	Slightly agree	Strongly agree
PAC	2	1	2	7
	17%	8%	17%	58%
Management	0	0	1	4
	0%	0%	20%	80%
All	2	1	3	11
	12%	6%	18%	65%
Total respondents	17	94%	respondents	

"De facto the PAC is an independent governance body"

Analysis	Strongly disagree	Slightly disagree	Slightly agree	Strongly agree
PAC	2	0	8	2
	17%	0%	67%	17%
Management	1	0	2	3
	17%	0%	33%	50%
All	3	0	10	5
	17%	0%	56%	28%
Total respondents	18	100%	respondents	

"Individual PAC membership should be limited to a couple of years"

Analysis	Strongly disagree	Slightly disagree	Slightly agree	Strongly agree
PAC	4	5	1	2
	33%	42%	8%	17%
Management	0	2	3	1
	0%	33%	50%	17%
All	4	7	4	3
	22%	39%	22%	17%
Total respondents	18	100%	respondents	

"The PAC should be smaller"

Analysis	Strongly disagree	Slightly disagree	Slightly agree	Strongly agree
PAC	5	6	1	0
	42%	50%	8%	0%
Management	1	1	2	2
	17%	17%	33%	33%
All	6	7	3	2
	33%	39%	17%	11%
Total respondents	18	100%	respondents	

"The PAC should meet more often"

Analysis	Strongly disagree	Slightly disagree	Slightly agree	Strongly agree
PAC	5	5	0	1
	45%	45%	0%	9%
Management	6	0	0	0
	100%	0%	0%	0%
All	11	5	0	1
	65%	29%	0%	6%
Total respondents	17	94%	respondents	

"The current PAC composition should be changed"

Analysis	Strongly disagree	Slightly disagree	Slightly agree	Strongly agree
PAC	3	5	4	0
	25%	42%	33%	0%
Management	2	2	2	0
	33%	33%	33%	0%
All	5	7	6	0
	28%	39%	33%	0%
Total respondents	18	100%	respondents	

"The overall governance setup should be changed"

Analysis	Strongly disagree	Slightly disagree	Slightly agree	Strongly agree
PAC	8	3	1	0
	67%	25%	8%	0%
Management	6	0	0	0
	100%	0%	0%	0%
All	14	3	1	0
	78%	17%	6%	0%
Total respondents	18	100%	respondents	

16. Follow-up to question 15:Please provide comments/suggestions and/or specific examples illustrating your choices in question 15 above. *(Comments have been omitted for confidentiality)*

17. Please indicate your satisfaction with the performance of the Program Management in terms of the following functions: Please tick one option for each area.

Program implementation
(e.g., managing financial and human resources. Reviewing proposals for inclusion in the portfolio of activities and allocating financial resources among activities. Supervising the implementation of activities. Contracting with implementing or executing agencies to implement individual activities. Ensuring that these agencies are self-monitoring and reporting their progress in a timely way.)

Analysis	Highly unsatisfied	Slightly unsatisfied	Slightly satisfied	Highly satisfied
PAC	0	0	3	9
	0%	0%	25%	75%
Management	0	0	1	4
	0%	0%	20%	80%
All	0	0	4	13
	0%	0%	24%	76%
Total respondents	17	94%	respondents	

Regulatory compliance
(e.g., ensuring compliance with all applicable laws and regulations at the international, national, and institutional levels, including the regulations and procedures of the host organization, as the case may be. Being aware of and adhering to these requirements and standards on a day to-day basis.)

Analysis	Highly unsatisfied	Slightly unsatisfied	Slightly satisfied	Highly satisfied
PAC	0	0	2	9
	0%	0%	18%	82%
Management	0	0	1	4
	0%	0%	20%	80%
All	0	0	3	13
	0%	0%	19%	81%
Total respondents	16	89%	respondents	

Reviewing and reporting
(e.g., taking stock of the overall performance of the portfolio in relation to the program's objectives and strategies. Reporting progress to the governing body, including any adverse effects of the program's activities. Serving the needs of the governing body by preparing strategies, policy statements, etc.)

Analysis	Highly unsatisfied	Slightly unsatisfied	Slightly satisfied	Highly satisfied
PAC	0	1	1	10
	0%	8%	8%	83%
Management	0	0	1	4
	0%	0%	20%	80%
All	0	1	2	14
	0%	6%	12%	82%
Total respondents	17	94%	respondents	

Administrative efficiency
(e.g., maintaining a lean administrative cost structure (while recognizing that administrative costs tend to be higher during the launch period of a global partnership program). Proposing ways to maintain high performance while reducing costs to increase operational effectiveness.)

Analysis	Highly unsatisfied	Slightly unsatisfied	Slightly satisfied	Highly satisfied
PAC	0	0	2	10
	0%	0%	17%	83%
Management	0	0	2	3
	0%	0%	40%	60%
All	0	0	4	13
	0%	0%	24%	76%
Total respondents	17	94%	respondents	

Stakeholder communication

(e.g., implementing board-approved policies for stakeholder inclusion in programmatic activities. Finding ways to increase the effectiveness of stakeholder participation in all aspects of the program.)

Analysis	Highly unsatisfied	Slightly unsatisfied	Slightly satisfied	Highly satisfied
PAC	1	2	3	6
	8%	17%	25%	50%
Management	0	1	1	2
	0%	25%	25%	50%
All	1	3	4	8
	6%	19%	25%	50%
Total respondents	16	89%	respondents	

Fostering learning

(e.g., distilling and discerning lessons from the implementation of activities across the portfolio. Transmitting these lessons to both governing partners and beneficiaries in order to inform policy making and to enhance implementation of activities.)

Analysis	Highly unsatisfied	Slightly unsatisfied	Slightly satisfied	Highly satisfied
PAC	0	3	2	6
	0%	27%	18%	55%
Management	0	0	3	2
	0%	0%	60%	40%
All	0	3	5	8
	0%	19%	31%	50%
Total respondents	16	89%	respondents	

Performance assessment
(e.g., reviewing the performance of operational staff on a regular basis, as well as the performance of consultants at the end of their assignments.)

Analysis	Highly unsatisfied	Slightly unsatisfied	Slightly satisfied	Highly satisfied
PAC	0	1	4	6
	0%	9%	36%	55%
Management	0	0	1	4
	0%	0%	20%	80%
All	0	1	5	10
	0%	6%	31%	63%
Total respondents	16	89%	respondents	

18. Follow-up to question 12: Please provide comments/suggestions and/or specific examples illustrating your choices in question 12 above: *(Comments have been omitted for confidentiality)*

19. The Challenge program has a hosting arrangement with the International Food Policy Institute (IFPRI) and is based on a Joint Venture Agreement with both IFPRI and the International Center for Tropical Agriculture (CIAT).
To what extent do these agreements lead to a "two masters problem", i.e. to a situation of unclear or overlapping responsibilities of program management towards the PAC on the one hand and IFPRI/CIAT management on the other hand? Please tick one option for:

The Program Coordinator?

Analysis	100% responsible towards IFPRI/CIAT	Mainly responsible towards IFPRI/CIAT	Responsibility evenly distributed towards IFPRI/CIAT and PAC	Mainly responsible towards PAC	100% responsible towards PAC
PAC	0	1	5	4	1
	0%	9%	45%	36%	9%
Management	0	0	2	3	1
	0%	0%	33%	50%	17%
All	0	1	7	7	2
	0%	6%	41%	41%	12%
Total respondents	17	94%	respondents		

The Program Management Team?

Analysis	100% responsible towards IFPRI/CIAT	Mainly responsible towards IFPRI/CIAT	Responsibility evenly distributed towards IFPRI/CIAT and PAC	Mainly responsible towards PAC	100% responsible towards PAC
PAC	0	3	3	4	1
	0%	27%	27%	36%	9%
Management	0	0	0	5	1
	0%	0%	0%	83%	17%
All	0	3	3	9	2
	0%	18%	18%	53%	12%
Total respondents	17	94%	respondents		

The Program Secretariat?

Analysis	100% responsible towards IFPRI/CIAT	Mainly responsible towards IFPRI/CIAT	Responsibility evenly distributed towards IFPRI/CIAT and PAC	Mainly responsible towards PAC	100% responsible towards PAC
PAC	2	2	3	2	2
	18%	18%	27%	18%	18%
Management	0	0	1	0	0
	0%	0%	100%	0%	0%
All	2	2	4	2	2
	17%	17%	33%	17%	17%
Total respondents	12	67%	respondents		

20. Do you feel any need for the current situation as mentioned in the above question to be improved?

Analysis	Yes	No
PAC	1	11
	8%	92%
Management	1	5
	17%	83%
All	2	16
	11%	89%
Total respondents	18	100%
		Respondents

21. If you answered yes to question 20, please comment. *(Comments have been omitted for confidentiality)*

22. Please comment on the advantages and disadvantages of the current hosting and joint venture arrangements. *(Comments have been omitted for confidentiality)*

23. Please add any additional suggestions, comments or feedback you might have. *(Comments have been omitted for confidentiality)*

ANNEX 11
Project 8003 Contractual and Progress Reporting Documentation

Project 8003 Amendment: No. 4 Date: June 30, 2006
Title: PSNL In vitro/animal model bioavailability & optimize breeding objectives
Contract Value shall increase by US$ 567,919 from US$ 1,169,737 to US$ 1,737,656

To reach the goals of the project the following tasks will be carried out:

- The effects of whole wheat grain milling on Fe, Zn, phytate and polyphenol levels and on bioavailable Fe using an in vitro Caco-2 cell model will be studied. **This relates to methods to assess bioavailability of nutrients**.
- Parental lines of maize, wheat and beans will be screened for bioavailable Fe to identify those genes affecting Fe bioavailability using the in vitro Caco-2 cell model. **This relates to evaluating genes responsible for bioavailability of nutrients, but work is unrelated to breeding methods**
- Specific hypothesis testing will be conducted using the in vitro digestion/Caco-2 model on the effects of promoters (e.g., phytoferritin) and inhibitors (polyphenols and phytate) and diet composition on Fe bioavailability. **This relates to methods to enhance bioavailability of nutrients**
- Test validity of Caco-2 cell model using pig model. Fe bioavailability from white and red beans will be tested in piglets using intrinsically stable isotope labeled (58Fe and 70Zn) beans. Refine in vitro model to include hind gut microbial activity for testing Fe bioavailability. **This relates to methods to assess bioavailability of nutrients**
- More detailed studies of inulin promotion of Fe bioavailability and reduction of the inhibitory effects of bean phytate on Fe bioavailability will be carried out using a pig model and a wheat study using wheat lines, high and low in inulin, will be carried out to determine effects of intrinsic inulin on Fe bioavailability using a pig model. **This relates to methods to assess bioavailability of nutrients**
- The effects of the MAL trait in cereal grains on vitamin and mineral accumulation in the grain will be studied. **This relates to methods to assess bioavailability of nutrients**
- Attempts will continue to be made to identify Fe bioavailability promoter compounds in white bean seed coats and in OFSP lines, and polyphenol inhibitors in colored bean seed coats. **This relates to methods to assess compounds that regulate the bioavailability of nutrients**

Achievements of the Breeding Objectives Subprogram
Publication Progress Report- Summary of PSNL and Adelaide Breeding Objectives Research

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ANNEX 12
Acronyms

CGIAR	Consultative Group on International Agricultural Research
CIAT	International Center for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
CIP	International Potato Center
CP	Challenge Program
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária
ETH, Zurich	Swiss Federal Institute of Technology Zurich
FAO	Food and Agriculture Organization of the United Nations
Fe	Iron
ICARDA	International Center for Agricultural Research in Dry Areas
ICRISAT	International Crops Research Institute for the Semi Arid Tropics
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
INIBAP	The International Network for Improvement of Banana and Plantain
IPG	International Public Good
IPGRI	International Plant Genetic Resources Institute now Bioversity International
IPR	Intellectual Property Rights
IRRI	International Rice Research Institute
MAS	Marker Assisted Selection
NARS	National Agricultural Research System
NIRS	Near-Infrared Spectrometry
OFSP	Orange fleshed sweet potatoes
PAC	Program Advisory Committee
PMT	Program Management Team
PRAPACE	Regional Potato and Sweetpotato Improvement Network in Eastern and Central Africa
QPM	Quality Protein Maize
QTL	Quantitative Trait Loci
USAID	United States Agency for International Development
USDA, ARS	United States Department of Agriculture, Agricultural Research Service
WARDA	Africa Rice Center
WB	The World Bank
WHO	World Health Organization
Zn	Zinc