2014 Publications

HarvestPlus
Better Crops • Better Nutrition

What Is Hidden Hunger?

More than two billion people in the world—roughly one person in three—do not get enough essential vitamins and minerals, such as vitamin A, zinc, and iron, in their daily diets. Their condition is known as "hidden hunger" because those suffering from this type of undernutrition often appear healthy, but are actually more vulnerable to illness and infections. The impact of vitamin and mineral deficiencies is as follows:

Iron Deficiency
- Impairs mental development and learning capacity
- Increases weakness and fatigue
- May increase risk of women dying in childbirth

Vitamin A Deficiency
- Impairs growth
- Causes eye damage leading to blindness
- Increases risk of infections such as diarrheal disease

Zinc Deficiency
- Causes stunting
- Lowers immunity
- Increases risk of diarrheal disease and respiratory infections

Biofortification: Changing the Game

A diverse diet that includes enough fruits, vegetables, and/or animal products usually provides enough vitamins and minerals for good health. However, millions of people—mostly those living in poorer countries—rely on staple foods such as cassava or rice that fill up their stomachs but provide insufficient vitamins and minerals. More nutritious foods are often expensive or simply unavailable. So HarvestPlus and our partners are tackling hidden hunger using familiar foods that people eat every day, through a strategy known as *biofortification*. Using conventional breeding methods, scientists have developed new varieties of productive staple food crops that contain higher amounts of vitamin A, iron, and zinc to improve diets and nutrition.

These nutritious crops have several advantages:

- *Targeted:* They can reach rural communities often missed by other nutrition interventions such as dietary supplementation and fortification.
- *Cost-effective:* Breeding the nutrient into a crop variety takes just one up-front investment. Once the trait is bred in, it is retained in successive crop generations. Through further breeding at low cost, the crops can be adapted to thrive in a range of agroecological zones.
- *Sustainable:* This strategy is centered on staple foods that people already eat regularly. Farmers can save the seeds or cuttings to replant, and share them freely with their neighbors.

HarvestPlus Crops

Bean
Where We Work: DRC, Rwanda, Uganda
Nutritional Benefits: Provides up to 50% of daily iron needs
Farmer Benefits: High yielding, virus resistant, heat and drought tolerant

Maize
Where We Work: Nigeria, Zambia
Nutritional Benefits: Provides up to 25% of daily vitamin A needs
Farmer Benefits: High yielding, disease and virus resistant, drought tolerant

Pearl Millet
Where We Work: India
Nutritional Benefits: Provides up to 80% of daily iron needs
Farmer Benefits: High yielding, mildew resistant, drought tolerant

Wheat
Where We Work: India, Pakistan
Nutritional Benefits: Provides up to 50% of daily zinc needs
Farmer Benefits: High yielding, disease resistant

Cassava
Where We Work: DRC, Nigeria
Nutritional Benefits: Provides up to 40% of daily vitamin A needs
Farmer Benefits: High yielding, virus resistant

Orange Sweet Potato
Where We Work: Uganda
Nutritional Benefits: Provides up to 100% of daily vitamin A needs
Farmer Benefits: High yielding, virus resistant, drought tolerant

Rice
Where We Work: Bangladesh, India
Nutritional Benefits: Provides up to 60% of daily zinc needs
Farmer Benefits: High yielding, disease and pest resistant

Since its inception in 2003, HarvestPlus has conducted or funded scientific research on all aspects of biofortification. Most of this research has been published in peer-reviewed journals, resulting in a substantial body of knowledge on biofortification. This compendium lists all publications from 2014 that were funded, or otherwise supported, by HarvestPlus. They include peer-reviewed journal articles, technical monographs, books/book chapters, conference proceedings, and bulletins by both HarvestPlus team members and our collaborators. A complete listing of these and other publications on biofortification from prior years can be accessed on our website (www.HarvestPlus.org). Key publications are also published as open access.

HarvestPlus also produces and publishes a number of in-house reports, papers and briefs (see below). These are listed in our 2014 annual report and also available on our website for download. A new series of non-technical briefs aimed at policymakers and practitioners will also be launched in 2015.

Technical Monographs

State-of-the-art reviews that help to establish and define HarvestPlus research questions or "gold standard" procedures to be followed in HarvestPlus research.

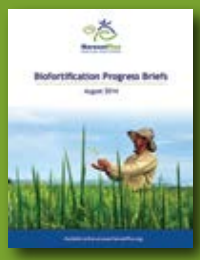
Working Papers

Preliminary material and research results to stimulate discussion and critical comment. Most are eventually printed in peer-reviewed publications.

Research for Action

Literature reviews, descriptive analyses, and other findings generated from HarvestPlus research and program activities that are less technical and more applied in nature.

Progress Briefs



Launched in 2014, present research evidence and progress on development and delivery of biofortified crops.

Crop Development

Journal Articles

- A. Kanatti, K.N. Rai, K. Radhika, M. Govindaraj, K.L. Sahrawat, and A.S. Rao. 2014. **Grain iron and zinc density in pearl millet: combining ability, heterosis and association with grain yield and grain size**. SpringerPlus 2014(3): 763.
- A. Menkir, M. Gedil, S. Tanumihardjo, A. Adepoju, and B. Bossey. 2014. **Carotenoid accumulation and agronomic performance of maize hybrids involving parental combinations from different marker-based groups**. Food Chemistry. 148: 131-137.
- A. Pucher, H. Hogh-Jensen, J. Gondah, C.T. Hash, and B.I.G. Haussmann. 2014. **Micronutrient density and stability in West African pearl millet—potential for biofortification**. Crop Science. 54(4): 1709-1720.
- B. Kyriacou, K.L. Moore, D. Paterson, M.D. de Jonge, D.L. Howard, J. Stangoulis, M. Tester, E. Lombi, and A.A.T. Johnson. 2014. **Localization of iron in rice grain using synchrotron X-ray fluorescence microscopy and high resolution secondary ion mass spectrometry**. Journal of Cereal Science. 59(2): 173-180.
- B.F. Owens, A.E. Lipka, M. Magallanes-Lundback, T. Tiede, C.H. Diepenbrock, C.B. Kandianis, E. Kim, J. Cepela, M. Mateos-Hernandez, C.R. Buell, E.S. Buckler, D. DellaPenna, M.A. Gore, and T. Rocheford. 2014. **A foundation for provitamin A biofortification of maize: Genome-wide association and genomic prediction models of carotenoid levels**. Genetics. 198(4): 1699-1716.
- C. Guzman, A.S. Medina-Larque, G. Velu, H. Gonzalez-Santoyo, R.P. Singh, J. Huerta-Espino, I. Ortiz-Monasterio, and R.J. Pena. 2014. **Use of wheat genetic resources to develop biofortified wheat with enhanced grain zinc and iron concentrations and desirable processing quality**. Journal of Cereal Science. 60(3): 617-622.
- D.N. Njoku, C.N. Egesi, V.E. Gracen, S.K. Offei, I.K. Asante, and E.Y. Danquah. 2014. **Identification of pro-vitamin A cassava (Manihot esculenta Crantz) varieties for adaptation and adoption through participatory research**. Journal of Crop Improvement. 28(3): 361-376.
- E.J. Pereira, L.M.J. Carvalho, G.M. Dellamora-Ortiz, F.S.N. Cardoso, J.L.V. Carvalho, D.S. Viana, S.C. Freitas, and M.M. Rocha. 2014. **Effects of cooking methods on the iron and zinc contents in cowpea (Vigna unguiculata) to combat nutritional deficiencies in Brazil**. Food and Nutrition Research. 58: 20694.
- H. Fan, Z. Zhang, N. Wang, Y. Cui, H. Sun, Y. Liu, H. Wu, S. Zheng, S. Bao, and H-Q. Ling. 2014. **SKB1/PRMT5-mediated histone H4R3 dimethylation of Ib subgroup bHLH genes negatively regulates iron homeostasis in Arabidopsis thaliana**. The Plant Journal. 77(2): 209-221.
- H. Hogh-Jensen, D. Kamalongo, A. Ngwira, and F.A. Myaka. 2014. **Yields and quality of phaseolus bean cultivars under farmers' conditions in eastern and southern Africa**. Experimental Agriculture. 50(2): 178-190.

- H. Kumar, H.K. Dikshit, A. Singh, N. Jain, J. Kumari, A.M. Singh, D. Singh, A. Sarker, and V.P. Kumble. 2014. **Characterization of grain iron and zinc in lentil ('Lens culinaris' Medikus 'culinaris') and analysis of their genetic diversity using SSR markers**. Australian Journal of Crop Science. 8(7): 1005-1012.
- I. Rabbi, M. Hamblin, M. Gedil, P. Kulakow, M. Ferguson, A.S. Ikpan, D. Ly, and J-L. Jannink. 2014. **Genetic mapping using genotyping-by-sequencing in the clonally propagated cassava**. Crop Science. 54(4): 1384–1396.
- J. Srinivasa, B. Arun, V.K. Mishra, G.P. Singh, G. Velu, R. Babu, N.K. Vasistha, and A.K. Joshi. 2014. **Zinc and iron concentration QTL mapped in a Triticum spelta × T. aestivum cross**. 2014. Theoretical and Applied Genetics. 127(7): 1643–1651.
- J. Srinivasa, B. Arun, V.K. Mishra, R. Chand, D. Sharma, S.C. Bhardwaj, and A.K. Joshi. 2014. **Accessing spelt gene pool to develop well-adapted zinc- and iron-rich bread wheat**. Crop Science. 54(5): 2000-2010.
- K.N. Rai, H.T. Patil, O.P. Yadav, M. Govindaraj, I.S. Khairwal, B. Cherian, B.S. Rajpurohit, A.S. Rao, H. Shivade, and M.P. Kulkarni. 2014. **Notification of crop varieties and registration of germplasm: Pearl millet variety 'Dhanashakti'**. Indian Journal of Genetics and Plant Breeding. 74(3): 405 & 406.
- K.N. Rai, H.T. Patil, O.P. Yadav, M. Govindaraj, I.S. Khairwal, B. Cherian, B.S. Rajpurohit, A.S. Rao, and M.P. Kulkarni. 2014. **Dhanashakti: A high-iron pearl millet variety**. Indian Farming. 64(7): 32-34.
- K.T.R. Kiran, K. Radhika, A.A. Kumar, and V. Padma. 2014. **Association studies of grain Fe and Zn concentrations with yield and other agronomic traits using F2 populations of two crosses in sorghum (Sorghum bicolor L. Moench)**. The Journal of Research ANGRAU 42(1): 77-80.
- L.J. Palmer, D.A. Dias, B. Boughton, U. Roessner, R.D. Graham, and J.C.R. Stangoulis. 2014. **Metabolite profiling of wheat (Triticum aestivum L.) phloem exudate**. Plant Methods. 10:27.
- M. Paget, W. Amoros, E. Salas, R. Eyzaguirre, P. Alspach, L. Apiolaza, A. Noble, and M. Bonierbale. 2014. **Genetic evaluation of micronutrient traits in diploid potato from a base population of andean landrace cultivars**. Crop Science. 54(5): 1949-1959.
- N. Oliva, P. Chadha-Mohanty, S. Poletti, E. Abrigo, G. Atienza, L. Torrizo, R. Garcia, C. Dueñas Jr, M. A. Poncio, J. Balindong, M. Manzanilla, F. Montecillo, M. Zaidem, G. Barry, P. Hervé, H. Shou, and I.H. Slamet-Loedin. 2014. **Large-scale production and evaluation of marker-free indica rice IR64 expressing phytoferritin genes**. Molecular Breeding. 33(1): 23-37.
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- S.B. Aciksoz, L. Ozturk, A. Yazici, and I. Cakmak. 2014. **Inclusion of urea in a 59FeEDTA solution stimulated leaf penetration and translocation of 59Fe within wheat plants**. Physiologia Plantarum. 151(3): 348-357.
- T. Dhliwayo, N. Palacios-Rojas, J. Crossa, and K.V. Pixley. 2014. **Effects of S1 recurrent selection for provitamin A carotenoid content for three open-pollinated maize cultivars**. Crop Science. 54(6): 2449-2460.
- T. Sánchez, H. Ceballos, D. Dufour, D. Ortiz, N. Morante, F. Calle, T.Z. Felde, M. Domínguez, and F. Davrieux. 2014. **Prediction of carotenoids, cyanide and dry matter contents in fresh cassava root using NIRS and Hunter Color techniques**. Food Chemistry. 151: 444-451.
- U.J. Ukpabi, S.C. Obasi, P.J. Okporie, and C. Egesi. 2014. **Possible minimal post-processing losses of pro-vitamin A and ascorbic acid in short-term stored wholesome cassava flour**. American Journal of Food Science and Nutrition. 1(1): 12-17.
- W.B. Suwarno, K.V. Pixley, N. Palacios-Rojas, S.M. Kaeppler, and R. Babu. 2014. **Formation of heterotic groups and understanding genetic effects in a provitamin A biofortified maize breeding program**. Crop Science. 54(1): 14-24.
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- Y. Wang, Y. Wei, L. Dong, L. Lu, Y. Feng, J. Zhang, F. Pan, and X. Yang. 2014. **Improved yield and Zn accumulation for rice grain by Zn fertilization and optimized water management**. Journal of Zhejiang University SCIENCE B. 15(4): 365–374.
- Y. Zhang, H. Wu, N. Wang, H. Fan, C. Chen, Y. Cui, H. Liu, and H-Q. Ling. 2014. **Mediator subunit 16 functions in the regulation of iron uptake gene expression in Arabidopsis**. New Phytologist. 203(3): 770-783.
- Z. Yasmine, N. Paltridge, R. Graham, B-L. Huynh, and J. Stangoulis. 2014. **Measuring genotypic variation in wheat seed iron first requires stringent protocols to minimize soil iron contamination**. Crop Science. 54(1): 255-264.

Books

- B.M. Prasanna, R. Babu, S. Nair, K, Semagn, V. Chaikam, J. Cairns, X. Zhang, Y. Xu, and M. Olsen. 2014. **Molecular marker-assisted breeding for tropical maize improvement**. In Wusirika, R; Bohn, M; Lai, J; Kole, C. (Eds). Genetics, Genomics and Breeding of Maize. Chapter 5: 89-119.
- M.S. Andersson, W.H. Pfeiffer, and J. Tohme. 2014. **Enhancing nutritional quality in crops via genomics approaches**. In Tuberosa, R; Graner, A; Frison, E. (Eds). Genomics of Plant Genetic Resources. Volume 2. Chapter 17: 417-429.

Nutrition

Journal Articles

- B. Gannon, C. Kaliwile, S.A. Arscott, S. Schmaelzle, J. Chileshe, N. Kalungwana, M. Mosonda, K. Pixley, C. Masi, and S.A. Tanumihardjo. 2014. **Biofortified orange maize is as efficacious as a vitamin A supplement in Zambian children even in the presence of high liver reserves of vitamin A: A community-based, randomized placebo-controlled trial**. The American Journal of Clinical Nutrition. 100(6): 1541-1550.
- B. Lewis, B. Dyer, W. Siamusantu, R. Klemm, S. Talegawkar, K. Schulze, A. Palmer, and K. West, K. 2014. **Changes in dietary variety scores over six months among 4- to 8-year-old Zambian children**. The FASEB Journal 29(1): 898.20.
- E.K. Heying, J.P. Tanumihardjo, V. Vasic, M. Cook, N. Palacios-Rojas, and S.A. Tanumihardjo. 2014. **Biofortified orange maize enhances b-cryptoxanthin concentrations in egg yolks of laying hens better than tangerine peel fortificant**. Journal of Agricultural and Food Chemistry. 62(49): 11892-11900.
- F.F. De Moura, A.C. Palmer, J.L. Finkelstein, J.D. Haas, L.E. Murray-Kolb, M.J. Wenger, E. Birol, E. Boy, and J.P. Pena-Rosas, JP. 2014. **Are biofortified staple food crops improving vitamin a and iron status in women and children? new evidence from efficacy trials**. Advances in Nutrition. 5(5): 568-570.
- J.E. Arsenault, L. Nikiema, P. Allemand, K.A. Ayassou, H. Lanou, M. Moursi, F.F. De Moura, and Y. Martin-Prevel. 2014. **Seasonal differences in food and nutrient intakes among young children and their mothers in rural Burkina Faso**. Journal of Nutritional Science. 3: e55.
- K. Pillay, M. Siwela, J. Derera, and F.J. Veldman. 2014. **Provitamin A carotenoids in biofortified maize and their retention during processing and preparation of South African maize foods**. Journal of Food Science and Technology. 51(4): 634-644.
- K.A. Bresnahan and S.A. Tanumihardjo. 2014. **Undernutrition, the acute phase response to infection, and its effects on micronutrient status indicators**. Advances in Nutrition. 5(6): 702-711.
- K.A. Bresnahan, J. Chileshe, S. Arscott, E. Nuss, R. Surles, C. Masi, E. Kafwembe, and S.A. Tanumihardjo. 2014. **The acute phase response affected traditional measures of micronutrient status in rural Zambian children during a randomized, controlled feeding trial**. The Journal of Nutrition. 44(6): 972-978.
- K.A. Bresnahana, C.R. Davis, and S.A. Tanumihardjo. 2014. **Relative vitamin A values of 9-cis- and 13-cis-β-carotene do not differ when fed at physiological levels during vitamin A depletion in Mongolian gerbils (Meriones unguiculatus)**. British Journal of Nutrition. British Journal of Nutrition. 112(2): 162-169.
- L. Mugode, B. Ha, A. Kaunda, T. Sikombe, S. Phiri, R. Mutale, C.R. Davis, S.A. Tanumihardjo, and F.F. De Moura. 2014. **Carotenoid retention of biofortified provitamin A maize (Zea mays L.) after Zambian traditional methods of milling, cooking and storage**. Journal of Agricultural and Food Chemistry 62(27): 6317-6325.
- L.M.J. de Carvalho, L.A.S.M. Smiderle, J.L.V. de Carvalho, F.S.N. Cardoso, M.G.B. Koblitz. 2014. **Assessment of carotenoids in pumpkins after different home cooking conditions**. Food Science and Technology (Campinas). 34(2): 365-370.
- M.R. La Frano, F.F. De Moura, E. Boy, B. Lönnerdal, and B.J. Burri. 2014. **Bioavailability of iron, zinc, and provitamin A carotenoids in biofortified staple crops**. Nutrition Reviews. 72(5): 289-307.
- N. Petry, I. Egli, J.B. Gahutu, P.L. Tugirimana, E. Boy, and R. Hurrell. 2014. **Phytic acid concentration influences iron bioavailability from biofortified beans in Rwandese women with low iron status**. The Journal of Nutrition. 144(11): 1681-1687.
- P. Berni, C. Chitchumroonchokchai, S.G. Canniatti-Brazaca, F.F. De Moura, and M.L. Failla. 2014. **Impact of genotype and cooking styles on the content, retention and bioacessibility of β-carotene in biofortified cassava (Manihot esculenta Crantz) conventionally bred in Brazil**. Journal of Agricultural and Food Chemistry. 62(28): 6677-6686.
- S. Schmaelzle, B. Gannon, S. Crawford, S.A. Arscott, S. Goltz, N. Palacios-Rojas, K.V. Pixley, P.W. Simon, and S.A. Tanumihardjo. 2014. **Maize genotype and food matrix affect the provitamin a carotenoid bioefficacy from staple and carrot-fortified feeds in Mongolian gerbils (meriones unguiculatus)**. Journal of Agricultural and Food Chemistry. 62(1): 136-143.
- S.A. Tanumihardjo. 2014. **Usefulness of vitamin A isotope methods for status assessment: from deficiency through excess**. International Journal for Vitamin and Nutrition Research. 84, Suppl. 1: 16–24.
- T. Eagling, A.A. Wawer, P.R. Shewry, F.J. Zhao, and S.J. Fairweather-Tait. 2014. **Iron bioavailability in two commercial cultivars of wheat: Comparison between wholegrain and white flour and the effects of nicotianamine and 2'deoxymugineic acid on iron uptake into caco-2 cells**. Journal of Agricultural and Food Chemistry. 62(42): 10320-10325.

Proceedings

- J. Haas. 2014. **Efficacy of consuming iron-biofortified staple food crops**. In COST Action Project FA 0905 "Mineral-Improved Crop Production for Healthy Food and Feed" Final Conference Proceedings Book. 17-19 March 2014, Ela Quality Resort, Antalya- Belek, Turkey. Sabanci University, Istanbul. ISBN 978-605-4348-72-5: 46-47.
- J. Stangoulis. 2014. **The HarvestPlus update on nutrition studies in biofortified crops**. In COST Action Project FA 0905 "Mineral-Improved Crop Production for Healthy Food and Feed" Final Conference Proceedings Book. 17-19 March 2014, Ela Quality Resort, Antalya-Belek, Turkey. Sabanci University, Istanbul. ISBN 978-605-4348-72-5: 56.

- K.M. Hambidge, L.V. Miller, J.E. Westcott, and N.F. Krebs. 2014. **Zinc requirements from biofortified crops: How important is bioavailability?** In COST Action Project FA 0905 "Mineral-Improved Crop Production for Healthy Food and Feed" Final Conference Proceedings Book. 17-19 March 2014, Ela Quality Resort, Antalya-Belek, Turkey. Sabanci University, Istanbul. ISBN 978-605-4348-72-5: 54-55.
- P. Allemand, L. Nikiema, A.A. Kossivavi, M. Moursi, F.F. De Moura, and Y. Martin-Prevel. 2014. **Statut biologique et ingérés en micronutriments chez des femmes et des jeunes enfants, Burkina Faso**. Revue d'Épidémiologie et de Santé Publique 62(Supplement 5): S247. Special issue on VIe Congrès International d'Épidémiologie, organisé conjointement par l'Association des Épidémiologistes de langue française (Adelf) et par l'Association pour le développement de l'EPIdémiologie de TERrain (EPITER), Nice, 10-12 septembre 2014.

Federation of American Societies for Experimental Biology (FASEB) Journal 28, 1, Supplement

- A. Palmer, J. Chileshe, K. Schulze, W. Siamusantu, R. Klemm, N. Molobeka, M. Barffour, N. Kalungwana, M. Arguello, and K. West. 2014. **Impact of provitamin A biofortified maize on vitamin A status in Zambian children**. The FASEB Journal 28(1): Supplement 646.6.
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- B. Lewis, W. Siamusantu, B. Dyer, S. Talegawkar, R. Klemm, K. Schulze, A. Palmer, and K. West. 2014. **Child dietary intake data by tablet-based 24-hour recall in rural Zambia**. The FASEB Journal 28(1): Supplement 36.3.
- H. Beer, S. Luna, L. Pompano, E. Przybyszewski, S. Udipi, P. Ghugre, and J. Haas. 2014. **Consuming iron-biofortified pearl millet increased hemoglobin concentrations and prevented a decline in energy efficiency in Indian girls**. The FASEB Journal. 28(1): Supplement 646.7.
- J. Haas, S. Luna, M. Lung'aho, F. Ngabo, M. Wenger, L. Murray-Kolb, S. Beebe, J.B. Gahutu, and I. Egli. 2014. **Iron biofortified beans improve iron status in Rwandan University women: results of a feeding trial**. The FASEB Journal. 28(1): Supplement 646.1.
- J. Tanumihardjo, B. Gannon, and S. Tanumihardjo. 2014. **Variation in serum retinol concentrations overtime in Zambian children during an intervention study**. The FASEB Journal 28(1): Supplement 624.27.
- L. Murray-Kolb, M. Wenger, S. Scott, S. Rhoten, M. Lung'aho, J.B. Gahutu, and J. Haas. 2014. **Effects of iron status on attentional functioning in young Rwandan women**. The FASEB Journal 28(1): Supplement 619.5.
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- M. La Frano, C. Zhu, and B. Burri. 2014. **Effects of processing, cooking, and storage on β-carotene retention and bioaccessibility in biofortified cassava (*Manihot esculenta*)**. The FASEB Journal. 28(1): Supplement 646.4.
- M. Wenger, S. Scott, L. Murray-Kolb, E. Cooper, P. Ghugre, S. Udipi, and J. Haas. 2014. **Changes in brain dynamics as a function of changes in body iron status: effects on attentional function in Indian adolescents following consumption of iron-biofortified pearl millet**. The FASEB Journal 28(1): Supplement 389.2
- S. Armah and M. Reddy. 2014. **Adaptation of iron bioavailability with high phytate diet consumption**. The FASEB Journal. 28(1): Supplement 122.6.
- S. Burke, S. Shenvi, D. Killilea, T. Holland, B. Sutherland, E. Kim, M. Shigenaga, and J. King. 2014. **Short-term low zinc intake alters DNA damage and zinc transporter expression without changing plasma zinc**. The FASEB Journal. 28 (1): Supplement 122.2.
- S. Luna, M. Lung'aho, J.B. Gahutu, and J. Haas. 2014. **Relationships between changes in iron status and maximal oxygen uptake (VO2 max) after a 5 month iron-biofortified bean efficacy trial**. The FASEB Journal 28(1): Supplement 646.3.
- S. Rhoten, M. Wenger, L. Murray-Kolb, J.B. Gahutu, M. Lung'aho, and J. Haas. 2014. **Brain dynamics and attentional control as a function of body iron status**. The FASEB Journal 28(1): Supplement 619.4.
- S. Scott, L. Murray-Kolb, M. Wenger, S. Udipi, P. Ghugre, and J. Haas. 2014. **Iron-biofortified pearl millet improves attentional function in Indian adolescents, a 6-month randomized controlled trial**. The FASEB Journal 28(1): Supplement 619.2.
- V. Chen, S. Luna, M. Lung'aho, J.B. Gahutu, and J. Haas, J. 2014. **Unanticipated weight gain during a dietary intervention designed to improve iron status**. The FASEB Journal. 28 (1): Supplement 804.20.

Economics & Policy

Journal Articles

- A. de Brauw and P. Eozenou. 2014. **Measuring risk attitudes among Mozambican farmers**. Journal of Development Economics. 111: 61-74.
- A. Oparinde, A. Banerji, E. Birol, and P. Ilona. 2014. **Information and consumer willingness to pay for biofortified yellow cassava: Evidence from experimental auctions in Nigeria.** HarvestPlus Working Paper 13.
- D.O. Gilligan, N. Kumar, S.C. McNiven, J.V. Meenakshi, and A.R. Quisumbing. 2014. **Bargaining power and biofortification: The role of gender in adoption of orange sweet potato in Uganda**. IFPRI Discussion Paper 01353.
- G.E. Battese, H. Nazli, and M. Smale. 2014. **Productivity and efficiency of farmers growing four popular wheat varieties in Punjab, Pakistan.** HarvestPlus Working Paper 15.
- H. de Groote, Z. Gitonga, M. Smale, D. Asare-Marfo, E. Kasuta, E. Birol, and K. Sonder. 2014. **Smallholder farming and crop variety choice: Maize variety choice in Zambia.** HarvestPlus Research for Action 3.
- H. Nazli, D. Asare-Marfo, M. Smale, S. J. Malik, and E. Birol. 2014. **Smallholder farming and crop variety choice: Wheat variety choice in Pakistan.** HarvestPlus Research for Action 2.
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One seed. Planting and eating it can mean the difference between blindness and sight. Between a child stunted by poor nutrition, and a child growing to reach her true potential. Between a healthy, productive life, and one compromised at every turn.

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HarvestPlus is a leader in the global effort to end hidden hunger caused by the lack of essential vitamins and minerals in the diet, such as vitamin A, zinc, and iron.

We develop these nutrient-rich seeds. We make sure they grow as well, if not better, than the ones farmers currently plant. We understand how they will provide better nutrition when eaten in different ways—and we promote them widely, so farmers and consumers know that these seeds mean a healthier future for their families, communities, and country.

All this requires extraordinary cooperation. With diverse partners in more than 40 countries, we bring extraordinary assets to the table. The 'Plus' in our name doesn't merely refer to nutritious crops. It's a symbol of our tenacity and commitment to bridge the divide between disciplines and sectors in search of robust solutions to hidden hunger. We challenge assumptions, embrace risk, and demonstrate impact—all in the pursuit of a global health revolution.

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HarvestPlus leads a global effort to improve nutrition and public health by developing and deploying staple food crops that are rich in vitamins and minerals. We work with diverse partners in more than 40 countries. HarvestPlus is part of the CGIAR Research Program on Agriculture for Nutrition and Health (A4NH). CGIAR is a global agriculture research partnership for a food secure future. Its science is carried out by its 15 research centers in collaboration with hundreds of partner organizations. The HarvestPlus program is coordinated by two of these centers, the International Center for Tropical Agriculture (CIAT) and the International Food Policy Research Institute (IFPRI).

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