10 de November de 2000 **flash ...** No. 20E

Research Results from the Department of Policy Analysis
MARD-Directorate of Economics*

Orange-Flesh Sweet Potato: Promising Partnerships for Assuring the Integration of Nutritional Concerns into Agricultural Research and Extension

*Jan Low, Rafael Uaiene, Maria Isabel Andrade, and Julie Howard***

Since 1994, Mozambique has made considerable progress in reducing its dependence on imported basic foodstuffs, raising agricultural production while macro-economic conditions have improved impressively. However, the majority of the rural populace continues to be poor, depending principally on semi-subsistence agriculture to survive. While land access is still relatively good, there is little use of improved varieties, purchased inputs, and labor-saving mechanization technologies to increase agriculture productivity. Widespread poverty and inadequate health care are the principle determinants of the high levels of chronic malnutrition (stunting) found among children under five years of age in rural areas of Mozambique. (44% falling below the cut-off point of -2 Z-scores for height-for-age (DPDS et al. 1998)).

In response, the government has recently approved various strategies to tackle poverty and assure adequate food security and the nutritional well-being of its population. In 1998, the government adopted a new framework for developing the agricultural sector, PROAGRI, which has as its principal goal the development of agricultural activities in the family sector. In planning exercises to date, PROAGRI has focused on strategies for improving availability and access to food, through improvement of market infra-structure and liberal marketing policies, as well as intensification and increased commercialization of agricultural production. Availability and access are two of the pillars of the National Food Security Strategy (ESAN) adopted in December 1998. However, awareness is increasing that increasing yields and incomes alone cannot resolve the enormous malnutrition problem in the country. More attention must be paid to the third pillar of ESAN, utilization**.** Utilization deals more with the issue of diet **quality** than quantity, recognizing that to be healthy, a person can not thrive on calories alone. To achieve the major food security objective of PROAGRI, extension personnel will need to promote interventions that will address all three aspects – **availability, access,** and **utilization** among the 3 million smallholder households targeted under this scheme.

The Nutrition Division of the Ministry of Health has played a strong role in promoting the integration of food security and nutritional concerns into national agendas. In July 1999, the government approved its Strategy for Combating Micronutrient Deficiencies, emphasizing both short- and longer-term approaches for reducing iodine, iron and vitamin A deficiencies. The strategy for reduction of vitamin A deficiency argues forcefully for complementary approaches: the distribution of vitamin A capsules, and interventions to improve diet **quality**, while at the same time increasing the amount of calories consumed. In addition, the Plan of Action for the Reduction of Absolute Poverty 2000-2004 specifically mentions increasing the consumption of foods rich in vitamin A as one the key activities to be undertaken to combat malnutrition, with yield trials and the introduction of orange flesh sweet potatoes planned for the years 2000 and 2001. Clearly, food based approaches for attacking the malnutrition problem require close collaboration between researchers and extensions in agriculture and nutrition.

Interest in integrating nutritional concerns into agricultural research and extension is increasing at the regional level as well. At an FAO sponsored conference for Southern Africa in April 1999, the National Institute for Agronomic Research (INIA), together with representatives from the Ministries of Health, Agriculture and Fisheries and Planning and Finance, presented the orange flesh sweet potato, rich in pro-vitamin A, as the prime example of how INIA and the Ministry of Agriculture would initiate the integration of nutritional concerns into its research and extension programs.

Strategies based on the use of foods to attack vitamin A deficiency are gaining more attention. Experiences to date in different African countries will be shared in an Africa-wide conference to be conducted in Capetown in November 2000.

This document summarizes the rationale for why orange flesh sweet potato is the ideal candidate for combating

* The views expressed here are those of the authors and do not necessarily reflect the official position of the Ministry of Agriculture and Rural Development.

** Low and Howard are faculty members in the Department of Agricultural Economics, MSU. Uaiene is the Director of the National Institute for Agronomic Investigation, Mozambique. Andrade is the representative of the Southern Africa Roots and Tubers Network in Mozambique.

food insecurity and vitamin A deficiency in many areas of Mozambique, describing progress achieved to date in program implementation, and concluding with several recommendations to strengthen agricultural policies and existing inter-sectoral mechanisms for addressing malnutrition.

PRODUCTION AND CONSUMPTION OF SWEET POTATO IN MOZAMBIQUE: Sweet potato is already widely grown in many parts of Mozambique on a small scale, where it serves the role of a classic food security crop (Minde and Jumbe 1997). That is, it is ideal for filling gaps in food availability from other sources because once mature, sweet potato is often harvested "piecemeal" over a period of several months. In Mozambique, women control the production and sale of sweet potato and in some areas, it serves a source of timely income which women use to pay for salt, sugar, medicines, and other basic household needs (Bias et al. 1999).

Sweet potato vines were massively distributed at the end of the war in parts of Mozambique to provide an easily cultivable source of calories and greens to re-establishing households (Minde and Jumbe 1997). While "traditional" varieties of sweet potato take 8 to 10 months to mature and demonstrate average root yields of 2-5 tons/hectare, the improved varieties distributed in the early 1990s yield 9-11 tons per hectare on farmer fields and typically mature in 4-6 months (early maturing).

The FAO average estimate for annual sweet potato root production for Mozambique for 1995-97 at 57,333 metric tons, or approximately 3.5 kilograms per capita. While provincial level production figures are not available, levels of consumption vary considerably by province. Recent figures (Table 1) indicate that sweet potato is widely consumed in all Central provinces, in Niassa in the North, and in Gaza and Maputo provinces in the South. Unlike in most of Eastern Africa, sweet potato leaves are widely consumed by people in many parts of Mozambique. **Nationally, 23% of the population eats sweet potato roots or leaves at least once a week.**

Early maturing sweet potato varieties yield higher amounts of edible energy per unit area per unit of time than all other major food staples (Table 2). Moreover, sweet potato is widely adapted and is capable of yielding in marginal conditions (Woolfe 1992).

While sweet potatoes grown in Mozambique are playing an important role in assuring adequate caloric intake, most of the varieties currently growing in the country are white-fleshed. White-fleshed varieties lack β-carotene, the plant precursor of Vitamin A, an essential component of all human diets. Orange-flesh varieties, on the other hand, are outstanding sources of β-carotene. Regular intakes (100 grams per day or half-cup) of orange-fleshed sweet potato roots provide the recommended daily amount of vitamin A for children under five years of age (400 µg Retinol Equivalents [RE]) (Tsou and Hong 1992).

As families would only be making a **marginal** change in their dietary habits, there is high potential that the cultivation and appropriate use of this important pro-vitamin A rich food can become permanent, sustainable practices in rural Mozambican households.

Table 1. Percent of Households Consuming Sweet Potato Roots or Leaves During the Week Prior to the Survey Date by Province
(National Household Sample Survey, 1996/97)

PROVINCE		RURAL	URBAN
North:	Niassa	18	18
	Cabo Delgado	3	0
	Nampula	7	5
Center:	Zambézia	41	16
	Tete	27	19
	Manica	35	48
	Sofala	47	44
South:	Inhambane	3	7
	Gaza	20	45
	Maputo	39	10
Capital City: Maputo		n.a.	12

* Calculated from nationally representative data collected throughout the year to control for seasonality.

WHY FOCUS ON VITAMIN A?: While people are generally quite aware when their calorie consumption is inadequate, the opposite is true for diets deficient in trace nutrients (micronutrients). Hence, the problem of poor diet quality is often referred to as **hidden hunger**. One of these micronutrients, vitamin A, is needed in small amounts to assure the normal functioning of the immune system, the visual system, and proper growth and development (WHO 1995). Most people associate vitamin A deficiency with blindness, however damage to body functions can be occurring because of low stores of Vitamin A in the body – even without seeing any signs of eyesight damage. **"Improving the vitamin A status of deficient children aged 6 months to 6 years dramatically increases their chance of survival.** Risk of mortality from measles is reduced by ~50%, from diarrhea by ~40%, and overall mortality by 25-35%**"** (Vitamin A Global Initiative 1998). Given Mozambique's high child mortality rate, 199 per 1000 births (MISAU et al., 1998) and evidence of inadequate intake of foods rich in vitamin A (Rose et. al. 1999), improving young child vitamin A intake and status is an imperative.

There are two principle causes of Vitamin A deficiency — inadequate intake and high levels of infection. High levels of infection affect all of the developing world, but the supply of available Vitamin A per capita is particularly inadequate (<550 µg RE) in Eastern and Southern Africa and in South and South East Asia. The supply situation is better in Central and West Africa primarily due to the widespread use of palm oil, an excellent source of pro-vitamin A (WHO 1995). The orange flesh sweet potato is the only other **plant** source of pro-vitamin A that is an excellent source of calories as well as pro-vitamin A.

THE MOZAMBICAN EXPERIENCE: PUBLIC SECTOR-NGOS- PRODUCER ASSOCIATIONS FOR PROMOTING THE PRODUCTION AND CONSUMPTION OF ORANGE FLESH SWEET POTATO: INIA, in collaborative partnership with the Southern African Root Crops Network (SARRNET), received 38 orange-flesh varieties in 1997 for testing at the central national research station, Umbeluzi. In 1999, additional funds from Helen Keller International (HKI) enabled adaptive varietal testing to be undertaken for the first time **at the provincial level**. From the outset, the approach has been undertaken emphasizing partnerships: a member of either the national or provincial nutrition office working alongside an agronomist; INIA/SARRNET working in close collaboration with non-governmental organizations (NGOs) operating at the provincial level to increase the number of trial sites and logistic support; researchers involving local farmers near the research sites in the evaluation of varietal performance; and a multi-disciplinary team conducting qualitative research on child feeding practices, agronomic practices regarding sweet potatoes, and marketing and processing practices.

The number of partners involved in the multiplication and distribution of sweet potatoes expanded rapidly in response to the devastating floods that affected southern and central Mozambique in March 2000. Strong collaboration emerged between the Roots and Tubers Program of INIA, SARRNET (financed by USAID), Rural Extension (DNER), the Nutrition Division (Ministry of Health), the Department of Policy Analysis (DAP), and many non-governmental organizations (World Vision, Food for the Hungry, Action Aid, World Relief, Save the Children, Helvetas, Casa de Gaiato, ATAP, Lutheran World Federation, e ANSA) with substantial financial and moral support from OXFAM and Helen Keller International. Six rapid multiplication sites were established in Maputo, Gaza, e Sofala provinces between May and June, which were expanded into 47 hectares of conventional multiplication between August and September 2000. Planting material (vines) will be distributed to an estimated 91,000 families in Maputo and Gaza, 15,000 families in Sofala, and 2,000 families in Inhambane in the main growing season of 2000/2001. A nutritional campaign will take place concurrent with the vine distribution utilizing several promotion techniques (community theater, *capulanas* [cloths with designs and slogans worn by women], educational posters, radio) to promote the diversified use of sweet potato. The theme of the campaign is **"O Doce que Dá Saúde"** (The Sweet that Gives Health).

POTENTIAL FOR THE FUTURE: SWEET POTATO AS AN EXAMPLE OF HOW TO INTEGRATE NUTRITIONAL CONCERNS INTO AGRICULTURAL RESEARCH AND EXTENSION: If the ultimate goal is to reduce malnutrition, obviously increasing crop output is a necessary but not sufficient condition for achieving the overall objective. In this respect, greater attention needs to be paid to understanding characteristics besides yield that may be relevant for farmers cultivating under marginal conditions or in isolated areas without easy market access: drought resistance, ease of processing by hand, potential to store a crop several months without rotting, taste, etc. If an introduced crop has desired nutritional characteristics, inter-sectoral coordination is essential, especially among staff in agriculture, nutrition, and social communication. The integration of nutritional concerns into the design and implementation of agricultural research and extension programs no doubt will entail significant additional costs. In the majority of cases, these interventions will require long term commitment and financing by the public sector in collaboration with non-governmental organizations.

In this section, various key reasons are presented explaining why the promotion of orange flesh sweet potato in an integrated manner is worth the additional cost. Experiences in other African countries with the introduction of new technologies and partnership approaches based on the sweet potato provide specific lessons for the future design of activities to improve the production and consumption of less-commercialized crops in Mozambique. The evidence can be divided into five main categories: agronomic, nutritional, improvement of women's access to technologies, commercial, and institutional.

AGRONOMIC: The introduction of improved, higher yielding germplasm into an agricultural system is the equivalent of raising family incomes in semi-subsistence households. However, often the improved planting material requires significant purchased input use and greater labor use than required by the traditional variety. However, results from 14 sites in 7 provinces indicate that 8 of the 19 orange-fleshed sweet potato varieties tested during the major planting season in 1999 exhibited widespread adaptability and had higher average yields (15-18 tons per hectare) than local "check" varieties (3-11 tons per hectare) without any application of fertilizer or additional labor time (Andrade e Ricardo 1999).

In many environments, sweet potato can be successfully established over a wide range of time without massive

yield loss and are usually harvested "piecemeal" as needed by the family. This flexibility in the timing of labor input will be increasingly important with the reduction in adult labor availability in the agricultural sector that is a likely consequence of the expanding AIDS epidemic (Brown 1996).

NUTRITIONAL: Since two harvests per year of these early maturing varieties is feasible in many areas of Mozambique, particularly in the central and northern provinces, widespread adoption will help reduce seasonal fluctuations in calorie availability particularly in isolated communities with limited market access. Market survey results indicate that **orange flesh sweet potato roots would be the cheapest dietary source of vitamin A** in all but one of the 14 sites studied (Gani e Mucavele 1999).

While improved agricultural technologies (in this case, varietal improvement) are essential for increasing agricultural incomes, higher family income does not guarantee that malnutrition among young children will decline. Experience in Western Kenya indicates that efforts to improve child feeding practices, both in terms of increased frequency of feeding of young children and developing appropriate weaning foods, should accompany the introduction of orange flesh sweet potatoes to ensure a significant impact on child vitamin A intake (Low et al. 1996, Hagenimana et al. 1999**).** The availability of orange-fleshed sweet potato within the household provides women with a productive, low cost source of pro-vitamin A as a base for preparing weaning foods of higher nutritional value.

Improving vitamin A intake among older children and adults is much simpler, as most of the tested varieties are acceptable to consumers in terms of taste and appearance (Andrade e Ricardo 1999). The common practice for root preparation is simply to boil or steam the roots. However, the vitamin A content of products such as bread, chapatis, and fried doughnuts was vastly enhanced through the replacement of just one-third of the wheat flour ingredient in these products produced in Uganda and Kenya (Hagenimana et al. 1999).

IMPROVING WOMEN'S ACCESS: Agricultural intensification of many crops often demands increased labor input, particularly that of women in planting, weeding, harvesting, and processing activities. However, often women do not receive a significant share of the proceeds of cash crop sales, yet are still expected to produce adequate food to meet their households consumption needs (Quisumbing et al. 1998). Providing them access to improved sweet potato planting material reduces the amount of land and labor needed to produce sufficient household calories and consequently, helps reduce the labor burden of women.

COMMERCIAL: Sweet potato sales are an important source of timely income for rural women. As large urban markets develop for the product, men are also likely to become more involved in larger-scale sweet potato production, as is the case in Western Kenya (Low 1995). Sweet potato is playing an ever increasing role as a commercial crop aimed at feeding the urban poor in countries such as Malawi, Kenya, and Uganda.

Targeting any sweet potato processed product development at women enhances their ability to improve diet quality within the home and obtain additional value-added income from selling vitamin A enriched food products to consumers outside the home. The East African experience indicates that profitable sweet potato products can be successfully marketed in small urban centers (Hagenimana et al.1999).

In the longer-run there is significant potential to use "excess" sweet potato production for animal feed. China, the world's largest sweet potato producer, heavily exploits the roots as an excellent pig feed in addition to producing sweet potato noodles and starch for human consumption. Leaves can also be used for animal feed, particularly for dairy cattle and goats.

INSTITUTIONAL: Both public and private sector input distribution systems are still in their infancy in Mozambique. While 90% of the population owns land, only 1.8% used fertilizers or pesticides in 1996/97 (DPDS et al. 1998). Unlike maize, sweet potato is vegetatively propagated; that is, segments of sweet potato vine are the principal planting material for farmers. Therefore, once established, farmers' have their own continuous supply of sweet potato "seed" and farmer-to-farmer varietal transmission is typically the predominant mechanism for varietal distribution within a community. In practical terms this means that improved planting material only has to be provided once within a given area, eliminating the need for an annual "seed" distribution system.

Moreover, sweet potato can grow on soils of limited fertility, is relatively drought tolerant, provides good ground cover, and is usually cultivated without fertilizer or pesticide (Ewell 1990). While sweet potato benefits from being inter-cropped with fertilized crops such as maize, obtaining improved yields in the short to medium term does NOT depend on the successful establishment of a purchased input distribution system.

Finally, with adequate financial support and good collaboration between government and non-government institutions, extensive dissemination of improved planting material is possible within a relatively short time frame. This can have a massive impact on diet diversification, improved household food security, and vitamin A intake. Such a program was launched in Malawi in 1991/92 with impressive results in terms of varietal dissemination (Minde and Jumbe 1997 and Moyo et al. 1999). By

1997/98, sweet potato had emerged as a major food staple alongside maize in Malawi, with an annual per capita consumption of sweet potato of 79 kgs. Unfortunately, no beta-carotene rich varieties were included in this distribution effort. Mozambique clearly has an opportunity to perfect the Malawian model. The promotion of orange-flesh sweet potato will enhance diet diversity and lead to substantial increases of both caloric and vitamin A intake in the daily Mozambican diet.

IMPLICATIONS FOR AGRICULTURAL AND NUTRITION POLICY IN MOZAMBIQUE: The careful integration of nutritional concerns into agricultural research and extension systems can significantly contribute to the reduction of child malnutrition and mortality and improve food security for all household members. This necessarily implies the establishment of strong collaborative arrangements between nutritionists and agronomists, researchers and extension agents, as well as finding secure funding over the medium term.

As sweet potato is a vegetatively propagated crop, the private sector never will have great interest in developing and marketing improved sweet potato planting material. The public sector must lead efforts such as these on crops like sweet potato which typically benefit the poorest in society (especially women and children) by helping to assure their nutritional well-being. Moreover, the public sector needs to support the development of agro-processing activities that utilize crops produced by the family sector to enhance rural incomes and reduce the labor burden associated with traditional agro-processing methods.

The government has already created the Technical Secretariat for Food Security and Nutrition (SETSAN), based in the National Directorate of Agriculture (DINA), that meets two times a month to monitor progress in the implementation of the National Food Security and Nutrition Strategy. SETSANs at the provincial level are in the process of being established and will have the responsibility to design interventions appropriate for their communities. The SETSAN sub-committee for research is an body which needs to be strengthened and operationalized to effectively assist with the integration of nutritional concerns into agricultural research programs.

We recommend that the SETSAN committee be designated to resolve three constraints identified through the work done to date on orange flesh sweet potato:

1. The government and the majority of donors design and finance programs **by sector** which complicates the design and efficient implementation of inter-sectoral programs. From time to time, nutritional activities are placed in the health sector; rarely are they put in the agricultural sector. The lack of simple mechanisms for financing inter-sectoral programs results in delays raising funds and more complex management arrangements for these interventions than required to accomplish the task at hand.

2. The lack of a sufficient number of nutritionists to accelerate the implementation of activities with nutrition components and the level of awareness about nutrition in the country is a major constraint. While food security and nutrition modules are being integrated into the course curriculum of medium-level technical staff of the Agrarian Institutes, there is still need to train agricultural and other types of extensionists (at both the basic and medium level) in the essential aspects of nutritional interventions. In the context of PROAGRI, the nutritional component needs to be integrated into the annual planning process of Rural Extension. The proposal to create a bachelor's degree in nutrition at the Universidade Eduardo Mondlane (the major university in the country) should be supported.

3. Programs for genetic improvement and varietal selection of food crops should include the participation of nutritionists at every step to ensure nutritional concerns are not ignored. This implies improved collaboration between nutritionists and agriculturalists in the design and prioritization of specific activities in agricultural research.

REFERENCES:

Andrade, Maria Isabel, and José Ricardo, e o Instituto Nacional de Investigação Agronómica (INIA). 1999. *Results of First Round Provincial Trials on the Evaluation of Nineteen Orange-flesed Sweetpotato Clones Across Fourteen Different Environments in Mozambique*, Relatório Preliminar do Instituto Nacional de Investigação Agronómica e o Southern Africa Root Crops Research Network: Maputo, December.

Bias, Calisto, Jorge Mabay Tembe, and Maria Isabel Andrade. 1999. *Práticas Culturais, Processamento, Utilização e Mercado de Mandioca e Batata Doce em Moçambique.* Relatório do Instituto Nacional de Investigação Agronómica: Maputo, Novembro.

Brown, Lynn R. 1996. *The Potential Impact of AIDS on Population and Economic Growth Rates*. Food, Agriculture, and the Environment Discussion Paper No. 15. Washington D.C.: International Food Policy Research Institute.

Department of Population and Social Development, Ministry of Planning and Finance (DPDS), Universidade Eduardo Mondlane, and the International Food Policy Research Institute. 1998. Understanding Poverty and Well-Being in Mozambique: The First National Assessment (1996-97). Maputo, Mozambique.

Ewell, P.T. 1990. Sweet Potatoes in Eastern and Southern Africa. Paper presented at the Workshop on Sweet Potatoes in the Food Systems of Eastern and Southern Africa, Nairobi, Kenya.

FAOSTAT Production database February 1999. Rome.

Gani, Armanda, and Sebastião Mucavele. 1999. *Results of the First Round Provincial Trials on Market Assessment, Seasonal Production Patterns, Cultural Attitudes, Practices, and Beliefs Concerning Child Feeding and Food Preparation.* Relatório Preliminar do Instituto Nacional de Investigação Agronómica e a Repartição de Nutrição: Maputo, December, 27.

Hagenimana, Vital, Mary Anyango Oyunga, Jan Low, S.M. Njoroge, Simon Gichuki, and Jackson Kabira 1999. *The Effects of Women Farmer's Adoption of Orange-Fleshed Sweet Potatoes: Raising Vitamin A Intake in Kenya*. International Center for Research on Women, ICRW/OMNI Research Program, Research Report No. 3. Washington, D.C.

Low, Jan W. 1995. Determinants of Sweetpotato Commercialization in South Nyanza, Kenya. Paper Presented at the Sixth Triennial Symposium of the International Society for Tropical Root Crops–Africa Branch, 22-28 October. Lilongwe, Malawi.

Low, Jan, Peter Kinyae, Simon Gichuki, Mary Anyango Oyunga, Vital Hagenimana, and Jackson Kabira. 1997. Combating Vitamin A Deficiency through the Use of Sweetpotato: Results from Phase I of an Action Research Project in South Nyanza, Kenya. International Potato Center in collaboration with the Kenya Agricultural Research Institute: Lima, Peru.

Minde, I.J., and C.B.L. Jumbe 1997. *Situation Analysis and Outlook of Cassava and Sweet Potato in SADC Countries*. Technical Report No. 5. A Study Report Prepared for SADC/IITA/SARRNET, SARRNET.

Ministério de Saúde (MISAU), Instituto Nacional de Estatística (INE), and Macro International, Inc. 1998. Inquérito Demográfico e de Saúde, Maputo, Mozambique.

Ministério de Saúde, Repartição de Nutrição 1998. Resultados Preliminares: Inquérito sobre Micronutrientes em Quatro Províncias.

Moyo, C.C., I.R.M. Benesi, V.S. Sandifolo, and J.M. Teri. 1999. Current Status of Cassava and Sweetpotato Production and Utilization in Malawi. In *Food Security and Crop Diversification in SADC Countries: the Role of Cassava and Sweetpotato*. Proceedings of the scientific workshop of the Southern African Root Crops Research Network (SARRNET), 17-19 August 1998. Held at Pamodzi Hote, Lusaka, Zambia: Ibadan. February 51-68.

Rose, Donald, Paul Strasberg, José Jaime Jeje, and David Tschirley. 1999. *Household Food Consumption in Mozambique: A Case Study in Three Northern Districts*, MSU Food Security Project Research Report No. 33. East Lansing: Michigan State University.

Sommer, Alfred, and Keith P. West, Jr. 1996. *Vitamin A Deficiency: Health, Survival, and Vision.* New York: Oxford University Press.

Tsou, S.C.S. and T.L. Hong. 1992. The Nutrition and Utilization of Sweet Potato, Section 4. In *Sweet Potato Technology for the Twenty-first Century*, ed. Walter A. Hill, Conrad K. Bonsi, and Philip A. Loretan. Tuskegee: Tuskeegee University Press.

Vitamin A Global Initiative. 1998. A Strategy for Acceleration of Progress in Combating Vitamin A Deficiency, Consensus of an Informal Technical Consultation. New York: UNICEF.

Woolfe, Jennifer A. 1992. *Sweet Potato: An Untapped Food Resource.* Cambridge: Cambridge University Press.

World Health Organization. 1995. *Global Prevalence of Vitamin A Deficiency*. Micronutrient Deficiency Information System Working Paper No. 2. Geneva: World Health Organization.