

# Community-based agricultural interventions in the context of food and nutrition security in South Africa

<sup>a</sup>Faber M, <sup>a</sup>Witten C, <sup>b</sup>Drimie S

<sup>a</sup>Nutritional Intervention Research Unit, Medical Research Council

<sup>b</sup>Regional Coordinator, RENEWAL, International Food Policy Research Institute

Correspondence to: Mieke Faber, e-mail: [mieke.faber@mrc.ac.za](mailto:mieke.faber@mrc.ac.za)

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## Abstract

Despite South Africa being a food-secure country in terms of aggregate food availability, it is listed by the World Health Organization as one of 36 high-burden countries, home to large numbers of stunted children. Recent findings, in the context of both over- and under-nutrition, have indicated that adult and child malnutrition rates have deteriorated in South Africa. The complementarities and synergies between food availability, access and utilisation need to be aligned in interventions used to address and strengthen food and nutrition security. This is particularly pertinent in the context of the widespread AIDS epidemic which interacts with food insecurity in complex ways.

It is against this backdrop that home-grown or small-scale food production is explored as a feasible contributor to food and nutrition security for the rural poor with particular emphasis on contextual and technical factors. By illustrating a few successful models of home gardening, the evidence for addressing micronutrient deficiencies in these types of interventions is presented. The challenges to establish sustainable home gardening practices and the efforts needed to address gender-distinctive issues are discussed. The case is made for community-based agricultural interventions as a critical component of the various interventions used to address food and nutrition security at the household level.

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## Introduction

South Africa has a malnutrition challenge of public health significance is listed by the World Health Organization (WHO) as one of the 36 high-burden countries.<sup>1</sup> As one of the 189 United Nations member states, South Africa has committed to the Millennium Development Goals (MDGs), the first of which (“eradicate extreme poverty and hunger”) is directly related to food and nutrition security. In addition, many of the MDGs, such as improving education, reducing child mortality, improving maternal health and combating HIV/AIDS, malaria and other diseases, require good nutritional status if they are to be achieved effectively.<sup>2</sup> Nutrition security should thus be high on South Africa’s development agenda.

In 1995, when the South African Department of Health initiated the Integrated Nutrition Programme to address and prevent malnutrition with the vision of optimal nutrition for all, it did so through a comprehensive approach to address the underlying causes of malnutrition.<sup>3</sup> Direct nutrition interventions included food provision, nutrition education and promotion, micronutrient supplementation, food fortification and disease-specific nutrition counselling and support, while indirect interventions involved the provision of health care services, improved access to food, parasite control and the provision of clean and safe water.

Despite various national nutrition and primary health care interventions emerging in South Africa under the auspices of the Integrated Nutrition Programme, recent findings, in the context of both over- and undernutrition, have indicated that adult and child malnutrition rates have increased and hence health has deteriorated.<sup>4,5</sup> Poor dietary intake, food insecurity and poor quality of basic services prevail within the context of an HIV/AIDS pandemic, further burdening an already overstretched health system.<sup>6</sup>

To be food secure, households need access to sufficient, safe and nutritious food.<sup>7</sup> However, nutrition is intrinsically multisectoral and food production alone will have a limited impact on nutritional outcomes. Strategies are therefore needed to maximise the potential impact of agriculture in nutrition. The challenge is to translate increased food production into increased household consumption and individual intakes. This can only be achieved through integrated agricultural-nutrition interventions.<sup>8</sup>

In this paper, homegrown or small-scale food production is explored as a feasible contributor to food and nutrition security for the rural poor in South Africa, with particular emphasis on contextual and technical factors. By illustrating a few successful home gardening models, the evidence for addressing micronutrient deficiencies in these types of intervention is presented. The challenges in establishing sustainable home gardening practices and the efforts needed to address gender-distinctive issues are discussed.

## Food and nutrition security in South Africa: an overview

The World Food Summit of 1996 defined food security as a state in which “all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preference for an active and healthy life”.<sup>7</sup> Underpinning food security is the sustainable and stable availability of, access to, and utilisation of food. Although South Africa is food secure at the national level, a large proportion of the population is food insecure, a stark reality of widespread poverty that underpins hunger. With a Gini coefficient of 0.72, household income in South Africa is among the most unequal in the world. Ten per cent of the population earns more than 50% of household income in the country; conversely, the poorest 40% of the population receives less than 7% of household income.<sup>9</sup>

Given the difficulty in collecting large-scale data on food consumption and food expenditure to give accurate accounts of food and nutrition security, simple dietary diversity scores are increasingly being used as measures of food security and as proxies for nutrient adequacy.<sup>10</sup> A variety of foods is needed in the diet to ensure an adequate intake of essential nutrients. For that reason, scores of dietary diversity can be used at the individual level as a proxy measure of the nutritional quality of the diet.<sup>11</sup> This is captured in the food-based dietary guideline, “Enjoy a variety of foods”. However, the poor may lack the resources to obtain a variety of foods.

As an example of these measures, Faber et al<sup>12</sup> demonstrated that in Sekhukhune, one of the poorest districts in the Limpopo Province, low household dietary diversity scores were associated with households who had fewer assets, who experienced more food shortages, and who had a higher household food insecurity and access scale. Also noteworthy was that a smaller percentage of households with a low dietary diversity score had a bank account compared to households with a higher diversity score (35.7% versus 60.3%, *p*-value < 0.001). This correlated with other studies in that poor households often cope with poverty by adopting monotonous diets that are based mainly on starchy staples, with little or no animal products and few vegetables and fruit.

In South Africa, vegetable and fruit consumption is generally low.<sup>13</sup> Analysis of household availability of different foods showed that 196 g of vegetables and fruit were available per person per day at the household level.<sup>14</sup> This is about half of the recommendation of the WHO of a daily intake of more than 400 g of vegetables and fruit per person to protect against cardiovascular disease and certain cancers.<sup>15</sup> As a result of low consumption of animal foods, vegetables and fruit, the diet of the South African population is low in a number of micronutrients.<sup>13</sup>

The 2005 National Food Consumption Survey-Fortification Baseline (NFCS-FB) showed that 64% of one-to-nine-year-old South African children were vitamin A deficient, 28% were anaemic, 13% had

a poor iron status and 45% had a low zinc status.<sup>5</sup> Findings from the 1999 National Food Consumption Survey (NFCS)<sup>13</sup> and the 2005 NFCS-FB<sup>5</sup> reported that the rural and urban poor bear the burden of poor health, as reflected in a greater proportion of these groups having high levels of stunting and underweight children. At the national level, stunting and underweight affect one out of five children, and almost one out of 10 children, respectively. Moreover, 10% of the children were classified as overweight and 4% as obese.

The NFCS-FB provided nutritional indicators for women of childbearing age, defined as women 16–35 years of age. NFCS-FB data regarding women’s body mass index (BMI) were very similar to data obtained in the 2003 National Demographic and Health Survey.<sup>16</sup> The more recent 2005 NFCS-FB national prevalence of chronic energy deficiency among women, as defined by BMI < 18.5 kg/m<sup>2</sup> was 4.6%, with the highest provincial prevalence in the Northern Cape at 16.7%, followed by Limpopo Province at 7.9%. The NFCS-FB national combined prevalence of overweight and obesity among women was 51.5%, with the highest provincial prevalence in the Western Cape (58.7%).

These figures may be attributable to the “nutrition transition”<sup>17</sup> underway in South Africa, as a greater number of the population consume more energy, more processed foods, including refined grains, and foods higher in saturated fat, sugar and salt. The move away from unprocessed foods to relatively cheaper, more accessible foods has contributed to a rise in overweight and nutrition-related chronic diseases, even as undernutrition remains high. Expenditure on food is thus an important aspect of food and nutrition security in South Africa.

## Food expenditure

Using data from the 2005/2006 Income and Expenditure Survey, Aliber demonstrated that in contrast to their urban counterparts, poor rural households spend a larger share of their total expenditure on food, but in absolute rand terms, poor rural households spend 15% less on each household member than their urban counterparts.<sup>18</sup> Altman et al<sup>19</sup> speculate that the lower food expenditure per adult equivalent for rural households could be explained by a higher number of people per rural household and/or contribution of own production or household farming. The authors have further underscored the significance of the contribution of small-scale, largely subsistence agricultural production to an estimated value of R2 billion, which by their analysis, would result in an annual saving of R750 per annum or R62.50 per month in poor households.

In recent years, several attempts have been made to express the nutrient gap by means of food cost and food expenditure analysis.<sup>20,21</sup> However, food security for the rural poor has also been shown to be compromised when it comes to food choices, with price and availability being barriers to a healthier diet.<sup>22</sup> Rural and urban women in KwaZulu-Natal and the Western Cape considered affordability, and to a lesser extent availability, as major constraints

to the consumption of vegetables and fruit.<sup>23</sup> In a rural village in KwaZulu-Natal, where vitamin A-rich vegetables were not available in the local shops, unavailability was reported as the main reason for not consuming these vegetables.<sup>24</sup>

As in many other countries facing an obesity epidemic, in South Africa, refined cereals and low-cost energy-dense foods are easier for the poor to come by than the more nutrient-dense foods such as fish, lean meat, vegetables and fruit.<sup>21,22,25</sup> There is emerging evidence that obesity in developing countries is in some cases a result of moderately food-insecure households relying on cheaper, high-fat, high-energy, less nutritious food.<sup>26</sup> The globalisation of food production and supply and modern food systems plays an important role in nutrition transition, which results in the double burden of both under- and overnutrition in the same country.<sup>27</sup> Changes in local production systems include a shift away from subsistence agriculture in the classic sense and an increasing orientation towards markets for both income and food purchase. Globally, food production and supply are characterised by large-scale commercial farming, processing and packaging of food products, corporate concentration in retailing and distribution (e.g. brand names and large supermarkets) and the growth of the urban population, who rely almost completely on purchased food.<sup>28</sup> A household's food security status is dynamic because of people's vulnerability to the risks to which they are exposed, and their ability to cope with those risks.

Vulnerability to food insecurity can be triggered by a number of factors such as, in recent times, rising food prices and the global economic downturn, household disruptions such as illness or the death of a wage-earner, and/or risky crop production as a result of climate, or water scarcity. Block et al,<sup>29</sup> in the context of the financial crisis in Asia, showed that a reduction in non-staple food consumption was associated with increased prevalence of anaemia, demonstrating that food price and economic crises have a considerable impact on the nutritional status of the poor, particularly women and children. Earlier, Torlesse et al<sup>30</sup> showed that poor households in Bangladesh spent more on non-rice foods as their rice expenditure declined, while non-rice expenditure per capita was negatively correlated with the percentage of underweight children. Their findings suggested that the percentage of underweight children declined when rice expenditure fell because households were able to spend more on non-rice foods and thereby increase the quantity and quality of their diet. West and Mehra<sup>31</sup> argued that "strengthening homestead food production is an important future element in attenuating the shocks of market-based, national or global food price fluctuations".

It is against this backdrop that homegrown food or small-scale food production is explored as a possible contributor to food and nutrition security for the rural poor in South Africa. Aliber and Hart<sup>32</sup> estimated that in South Africa, approximately 3-million small-scale farmers produce food primarily for household consumption and that the vast majority of these farmers are women. Furthermore, in the South African context, for many households, subsistence farming is

a fallback activity from which they can seek benefit when it suits them and when they are able to, but when it is unnecessary or inconvenient, households readily abandon farming. The data also indicate that farming as a main source of food is a sign of extreme poverty. The study also shows that in some contexts, particularly where there is access to input and output markets and to extension services, and where there is a high quality of natural resources, home production can address food insecurity and result in a "low incidence of hunger".<sup>32</sup>

The paper now turns to consider agricultural activities that may be appropriate for food and nutrition security in South Africa and the factors that are required to achieve these outcomes and to ensure sustainability.

### Community-based agricultural activities for food and nutrition security

There is a large body of evidence from the Asia-Pacific region supporting the role of homestead food production in improving dietary intake, decreasing micronutrient deficiencies, increasing household earnings and improving women's involvement in household decision making.<sup>33</sup> The Helen Keller International (HKI) Homestead Food Production Programme addresses some of the underlying determinants of child undernutrition, including poor maternal knowledge and education, lack of women's empowerment, inadequate community support and inadequate access to quality food, while concurrently focusing on addressing the direct causes of child undernutrition, namely inadequate food and nutrient intake and poor health.

The programme emphasises gardens that have year-round production with more varieties of vegetables and fruit grown, using a fixed plot of land. In contrast, traditional gardens in the Asia-Pacific region are seasonal and are often maintained on scattered plots of land with a few traditional fruits and vegetables being grown.<sup>34</sup> HKI-intervention households that had access to a developed homestead garden were shown to have more varieties and higher quantities of vegetables available for consumption, and children living in those households consumed a median of 13 types of vegetable in the week prior to the survey, compared to a median of four types of vegetable consumed by children in households with traditional gardens during the same period.<sup>33</sup> Although the HKI experience has important lessons for South Africa, particularly in terms of how own production can improve dietary diversity, it is important to bear in mind the sociocultural and geophysical differences between the Asia-Pacific region and South Africa. Generally speaking, compared to Africans, Asians have a distinctive plant-based diet that can be provided for by means of a garden. Also, the Asia-Pacific region does not face the same degree of water scarcity as do some drought-stricken parts of southern Africa. Nonetheless, HKI is looking to replicate this approach and adapt it for Zambia, which indicates a belief in the suitability of the approach for southern Africa.

## Crops to be planted and promoted

Consideration of the most appropriate crops for interventions encouraging own production is important, particularly as a factor underpinning nutrition security. An understanding of food security emphasises the nutritional adequacy of the diet. It focuses on the need for dietary diversity and quality, including the importance of micronutrients. Mono-crop production of low nutrient content crops will not translate into food and nutrition security. It is important to diversify the crops to be planted, including both warm- and cool-weather crops, as this will help to ensure year-round availability of food, largely through vegetables. As a result, households will have access to a greater variety of foods, which could potentially increase dietary variety and ultimately improve the nutritional adequacy of the diet.<sup>11</sup> From an agronomic point of view, planting a variety of crops will help to improve soil fertility and protect against plant pests and diseases, thereby reducing the risk of crop failure.<sup>35</sup>

The nutrient content of foods, and their potential contribution towards the nutritional requirements of the target population, are predominant considerations in the selection of crops to be planted, with the focus on nutrients that are limited in the diet. For that reason, community-based agricultural interventions often focus on provitamin A-rich crops, such as carrots, orange-fleshed sweet potatoes, butternut, pumpkin, mangoes, papayas and dark-green leafy vegetables, such as spinach and wild-growing leaves. Although the bio-efficacy of provitamin A carotenoids in plant foods is less than previously thought,<sup>36</sup> consumption of cooked sweet potato,<sup>37-38</sup> carrots<sup>39</sup> and green leafy vegetables<sup>37,39-40</sup> has been shown to improve vitamin A status, providing evidence supporting the use of provitamin A-rich crops in agricultural interventions to address vitamin A deficiency.

Orange-fleshed sweet potato varieties offer one of the highest sources of naturally occurring  $\beta$ -carotene. A randomised controlled trial conducted in South Africa showed that orange-fleshed sweet potato was well accepted by primary school children and improved their vitamin A status when given as part of the school meal.<sup>38</sup> The colour of the sweet potato is directly related to the  $\beta$ -carotene content, and colour intensity (cream, yellow, yellow-orange and dark orange) may therefore be used as an indicator of provitamin A value.<sup>41</sup> Vegetable garden projects in South Africa use varieties with an orange to dark-orange colour and are supported by a breeding programme for orange-fleshed sweet potato at the Agricultural Research Council (ARC) Roodeplaats Vegetable and Ornamental Plant Institute that focuses on developing sweet potato cultivars with high  $\beta$ -carotene content, good yield, good taste, drought tolerance and resistance to major diseases.<sup>42</sup> Focusing on gardening projects pivoting on provitamin A-rich vegetables and fruit within a diversified production regime, the following sections detail key lessons for South Africa and demonstrate how a focused intervention, based on both production and consumption, can have a significant influence on the diet of nutritionally-at-risk populations. As such, important issues emerge for similar programmes and indeed policy in the country.

## Gardening projects in South Africa: lessons for policy and praxis

### Medical Research Council/Agricultural Research Council crop-based approach to address vitamin A deficiency

Nutritionists from the Medical Research Council (MRC) and agriculturists from the ARC have been working on a crop-based approach with the aim to improve the vitamin A status of nutritionally-at-risk populations through production and consumption of provitamin A-rich vegetables and fruit.<sup>43</sup> Integral to this approach is the fact that agricultural interventions for improved nutrition should have a well-designed agricultural component, as well as a well-designed nutritional component, both of which should be mutually reinforcing.<sup>44</sup> Within the MRC/ARC approach, households are encouraged to plant provitamin A-rich vegetables in addition to other existing crops.

A crop rotation system is recommended for soil improvement and pest control. Staggered planting, which entails small, regular plantings at intervals during the planting season, is promoted to lengthen the period of availability of individual provitamin A-rich vegetables.<sup>43</sup> Two projects, Ndunakazi and Lusikisiki, are examined in this article to draw out key issues.

#### *Ndunakazi project*

The foundation for the crop-based approach supported by the MRC/ARC was laid by the Ndunakazi project. Existing community-based growth monitoring activities<sup>45</sup> were used as a platform for the promotion and implementation of home gardening. A high coverage of 90% of children aged five years and younger and average monthly attendance ratio of 71% was achieved,<sup>46</sup> which provided a suitable platform to reach large numbers of mothers for nutrition education and agricultural training activities given during the growth monitoring sessions.

Demonstration gardens, which served as training centres for planting provitamin A-rich vegetables, were established at each growth monitoring site. During the monthly growth monitoring sessions, household production and daily consumption of provitamin A-rich vegetables and fruit were promoted through: education on vitamin A nutrition; provision of cooked locally produced provitamin A-rich vegetables to the children, and demonstrations of the planting process. Many of the mothers were not familiar with the provitamin A-rich vegetables. Providing the cooked vegetables to the children on growth monitoring days introduced the mothers and children to these vegetables, taught the mothers various ways of preparation and gave them the opportunity to observe their children eat and enjoy these vegetables. This served as motivation for mothers to plant these vegetables and to prepare them at home. The nutrition education component of the gardening project focused on, among others, optimal food preparation methods to optimise the bioavailability of provitamin A carotenoids.

The effect of the gardening project on maternal knowledge, dietary intake and the vitamin A status of children two-to-five years old was evaluated through two cross-sectional surveys, one at baseline and

a follow-up survey 20 months later. A neighbouring village that had similar community-based growth monitoring activities, but no home gardening project, served as the control village. Within 20 months, most of the mothers in Ndunakazi could name at least three food sources of vitamin A (Ndunakazi 71%, control village 18%); could name the colours (yellow/orange and dark-green) of vitamin A-rich vegetables (Ndunakazi 82%, control village 15%); and could name at least one symptom related to vitamin A deficiency (Ndunakazi 74%, control village 27%).<sup>47</sup>

Before implementation of the gardening project, the children consumed a cereal-based diet, with staple foods being a thick maize meal porridge, bread and rice. The intake of vitamin A-rich foods was low, resulting in a median vitamin A intake of 35% of the required amount.<sup>48</sup> The home gardening project added variety to the diet and did not replace a major component of the fruits and vegetables previously consumed, which were mostly cabbage, banana and orange. The intake of yellow/orange-fleshed and dark-green leafy vegetables increased, and as a result the intake of vitamin A increased, with at least 85% of the vitamin A intake being from provitamin A-rich fruit and vegetables.<sup>49</sup>

The prevalence of vitamin A deficiency decreased from 58% at baseline to 34% in Ndunakazi. Ndunakazi children from households with vitamin A-rich vegetable gardens had a significantly higher mean serum retinol concentration (0.84  $\mu\text{mol/L}$ ) than Ndunakazi children without a vitamin A-rich vegetable garden (0.72  $\mu\text{mol/L}$ ,  $p$ -value = 0.0197) and children from the control village (0.73  $\mu\text{mol/L}$ ,  $p$ -value = 0.005).<sup>47</sup> During the two weeks prior to the follow-up survey, children in Ndunakazi suffered less from diarrhoea than children in the control village (10% versus 22%).<sup>50</sup>

Seasonal variation in the consumption of provitamin A-rich vegetables was observed.<sup>51</sup> Butternut, pumpkin and orange-fleshed sweet potato were consumed mostly during the first quarter/half of the year and spinach and carrots mostly during the second half of the year.<sup>24</sup> It was also shown that traditional leafy vegetables were consumed mostly during the first and last quarter of the year and spinach, mostly Swiss chard, during the third quarter.<sup>52</sup> This highlights the importance of promoting the consumption of both conventional spinach and traditional leafy vegetables. There are indications that provitamin A-rich vegetables and fruit can sustain an adequate vitamin A intake throughout the year for the majority of the population.<sup>24</sup>

Clearly the impact of the intervention has been significant. A qualitative assessment using focus group discussions showed that the community had gained a sense of empowerment through a better understanding of what makes its children healthy (through the nutrition education), how to check this (through the growth monitoring) and how to produce food to achieve this (through the training in gardening activities).<sup>53</sup> The mothers' understanding of the underlying factors of poor growth and health of their children, which was obtained through monthly growth monitoring and nutrition education, contributed towards the success of the home gardening

project. A recent assessment showed that the gardening activities have been sustained after withdrawal of the research team.<sup>54</sup>

### **Lusikisiki project**

The Ndunakazi project had high input from the research team and was closely monitored. To reduce this input as an important variable, the focus of the Lusikisiki project was on technology transfer, mobilisation of the local community and involvement of the local governmental departments of health and agriculture. Central to the initiative was the need to learn key lessons as to how the measured successes of Ndunakazi could be replicated and sustained by other agencies, in particular those of the state. Agricultural extension officers served as agricultural advisors for the project and as the link between the researchers and community members involved in the project. Using the "training of trainers" principle, trained project health volunteers were responsible for cultivating and promoting provitamin A-rich vegetables with the support of the agricultural extension officers, for providing nutrition education and for monitoring the growth of children one-to-five years old with the support of the Department of Health. Through the use of existing state 'infrastructure', key aspects of Ndunakazi were replicated.

The project built on existing structures and activities, namely decision making, problem solving and promotion activities that were linked with existing monthly farmer forum meetings, growth monitoring and awareness creation were added mostly to crèche activities, and demonstration gardens were established using existing gardens that were already fenced, saving these costs. Orange-fleshed sweet potato field nurseries were established to ensure a continuous supply of cuttings. Training in gardening activities was done at both the demonstration gardens and the field nurseries, while the homesteads at these sites were used to demonstrate the preparation and processing of orange-fleshed sweet potato.

Overall, the impacts of the project were positive. The project activities had a favourable effect on the caregivers' knowledge of vitamin A nutrition, morbidity of children one-to-five years old, and consumption and cultivation of provitamin A-rich vegetables.<sup>55</sup> A limitation of this project was the lack of quantitative baseline data. For this reason, observed differences between participating and non-participating households were not conclusive. However, a number of key lessons have been derived from the project, particularly around the contribution of provitamin A-rich plants as part of a diversified diet, the use of natural resources as part of this diversification strategy, entry points for similar projects and therefore for replication, markets for sustainability, gender dynamics and a number of challenges that might undermine similar initiatives. The analysis makes a strong argument about the contribution of community-led production, hinged on nutrition, in terms of engaging food and nutrition insecurity in South Africa.

### **Contribution of provitamin A-rich vegetables and fruit towards dietary intake of nutrients other than vitamin A**

An important criticism of an approach focusing on provitamin A-rich crops is that people need a range of nutrients, not only vitamin A. As

such, micronutrient deficiency would not be addressed by focusing on a product that provided vitamin A alone. However, production of provitamin A-rich crops was shown to improve dietary intake of not only vitamin A, but also of some other micronutrients.<sup>49</sup> These vegetables and fruit were shown to contribute significantly towards dietary intake of nutrients such as calcium, iron, magnesium, riboflavin and vitamin C.<sup>24</sup> This is a significant additional benefit, more so as these nutrients were all shown to be deficient in the diets of South African children.<sup>13</sup> Maunder and Meaker,<sup>56</sup> citing findings of secondary data analysis of the NFCS data, showed that children one-to-three years old from households with homestead food production (without targeting specific foods) had higher intakes for energy and certain micronutrients compared to children from households without homestead food production, although the median intakes were still below the recommended nutrient requirements.

An additional benefit of provitamin A-rich vegetables and fruit is that food carotenoids are credited with other beneficial effects on health, independent of their vitamin A activity, such as the reduction of the risk of degenerative diseases, certain types of cancer and cardiovascular disease.<sup>57</sup> Increasing the intake of vegetables and fruit in general could also have a large impact on reducing non-communicable diseases.<sup>58</sup>

### Natural resources

As a complement to own production, households should also be encouraged to utilise indigenous or wild vegetables. Consumption of, and reliance on natural resources, is well documented as a food security strategy<sup>59-60</sup> and a coping mechanism to mitigate food insecurity.<sup>32,61</sup> The World Declaration and Plan of Action for Nutrition adopted at the 1992 International Conference on Nutrition promotes the use of locally available nutrient-rich indigenous and traditional foods as a critical strategy against food and nutrition insecurity.<sup>62</sup> The potential value for food security and rural development of gathering wild foods, growing locally adapted varieties and eating from the local ecosystem is recognised by the Convention of Biological Diversity.<sup>63</sup> Smith and Eyzaguirre argued that in sub-Saharan African countries, African leafy vegetables could play an important role in the WHO global initiative on increased consumption of vegetables and fruit.<sup>64</sup> Labadarios and Steyn proposed that indigenous vegetables should be considered in relation to fulfilling the food-based dietary guideline, *Eat plenty of vegetables and fruit*.<sup>65</sup>

In South Africa, dark green leafy vegetables are commonly consumed, particularly in rural areas, and can potentially make a significant contribution to dietary intake.<sup>52</sup> However, African leafy vegetables are often regarded as a poor person's food<sup>66-67</sup> and as a poor choice of food.<sup>32</sup> In addressing affordability, the term "cheap" should therefore be avoided, or used carefully during promotion, to avoid these misconceptions. The emphasis should rather be on the potential nutritional and hence health benefits that the consumption of these vegetables could offer.

To achieve sustainable food security, it is critical to make the best use of environmental goods and services, while not damaging these assets.<sup>68</sup> But as researchers warn, traditional home farming and wild food gathering are done under relatively harsh conditions in which rainfall is unpredictable and soil fertility is declining.

Various agro-ecological conditions, combined with negative social conditions, are resulting in the deterioration of natural resources. In this light, it would be prudent for government and agricultural networks concerned with food and environmental sustainability to invest in and support appropriate and optimal home food production strategies.<sup>32</sup>

### Entry points

Various entry points can be used as platforms for community-based agricultural interventions. The Ndunakazi and Lusikisiki projects both used community-based growth monitoring as platform to promote the production and consumption of provitamin A-rich vegetables and fruit. Other entry points that can potentially be used include school, clinic, crèche and community gardens and institutional programmes such as sustainable land use programmes or agricultural assistance programmes.<sup>69</sup> School-based interventions can be used to: promote consumption of fruit and vegetables; teach learners how to establish and maintain home gardens; introduce learners to food preparation and storage techniques; provide nutrition information and thereby encourage learners to adopt more healthy dietary habits; and stimulate the interest of learners in agriculture and nutrition.<sup>70</sup>

In 2004, the Department of Education took over full responsibility for the National School Nutrition Programme (NSNP). One of the three subprogrammes of the NSNP is Sustainable Food Production in Schools (SFPS), which promotes the implementation of sustainable food production initiatives in order to transfer skills to learners and school communities and thus improve household food security.<sup>71</sup> By 2007/8, nationally a total of 6 503 schools had school-based food gardens, which is a steady increase from the 3 058 gardens in 2004/5.<sup>72</sup>

The Mdantsane for Vitamin A Project, which essentially was a social marketing project to improve the uptake of vitamin A supplementation at clinics among children six to 59 months old, integrated the promotion of vitamin A-rich foods and home gardening. This project is an example of how integration of home gardening was used to improve health-seeking behaviour, namely attendance at clinics for vitamin A supplementation for children six to 59 months old. At the time, vitamin A supplementation was a new primary health care programme and both health service providers and caregivers were foreign to the idea of providing "drugs" to keep children healthy, especially "drugs to improve nutrition", in contrast to "drugs that cure disease".

The promotion of provitamin A-rich vegetables and home gardening were familiar concepts and activities with which to tie and link the clinic-based vitamin A supplementation programme. The

promotion of provitamin A-rich vegetables, particularly the orange-fleshed sweet potato, together with the vitamin A supplementation programme, was an effective strategy to improve vitamin A intake, both through diet and adherence to the vitamin A supplementation schedule for children six to 59 months as provided by the clinic.<sup>73</sup> Evaluation of the integrated project showed a 77% increase in the number of children who received vitamin A supplementation and a 45% increase in knowledge of vitamin A nutrition and health among caregivers. In addition, an increase in the cultivation and consumption of orange-fleshed sweet potato was observed.<sup>74</sup>

### Challenges

Access to a secure water supply for irrigation is probably one of the biggest challenges to overcome when implementing community-based gardening activities.<sup>54</sup> A survey that was conducted by the Public Service Commission in the Limpopo and Eastern Cape provinces showed that although several schools had vegetable gardens, most of these gardens were dysfunctional because of drought.<sup>75</sup>

Vegetable gardens are often not fenced properly, while the lack of fencing often results in animals destroying the crops.<sup>54</sup> Aliber and Hart reported in their Limpopo case study that fertiliser and fencing costs were significant barriers to small-scale village farming.<sup>32</sup> It has been recommended that homestead food production interventions to address vitamin A deficiency include not only local production of provitamin A-rich plant foods, but also local production of animal foods that are rich in vitamin A, such as keeping poultry for eggs and cows and goats for milk and meat.<sup>76</sup> The practicality in terms of the animals destroying the vegetable gardens should be taken into consideration when implementing food-based projects.

Easy access to a regular supply of quality seed and seedlings, and to virus-free plant cuttings at an affordable price is critical for the success and long-term sustainability of gardening activities. A study in the Eastern Cape showed that buying seeds constituted most of the capital expenditure of home gardening.<sup>77</sup> Other challenges include pests and diseases and lack of funds to buy agricultural supplies.<sup>54</sup> To some extent, many of these challenges can be overcome. The involvement of agriculturists in the implementation of gardening projects to address food and nutrition security is critical to address these challenges.

### Gender

Because homestead food production is community based and traditionally targets women, it is culturally acceptable as an activity for women and aimed at women. In South Africa, women make up 61% of all those who are involved in farming.<sup>19</sup> Women also outnumber men as subsistence farmers. As pointed out by Aliber and Hart, the high prevalence of women in and dependent on agriculture requires an increased focus from government on this particular group and in particular, on the specific and often gender-determined constraints faced by women.<sup>32</sup>

Similar to other developing countries, in South Africa, gender-specific constraints in agriculture include access to and control of land, finances, markets and the women's time.<sup>78</sup> Women are at the frontline of caring and providing for their families, providing and preparing food, taking care of the children, the sick and the elderly, and performing many other household chores. It is therefore imperative that community-based home gardening projects be gender sensitive and gender responsive in order to enable women to participate and succeed in such projects. Reducing gender disparities in key areas, particularly in education and health, and empowering women are essential for reducing poverty and hunger.

The International Fund for Agricultural Development defined three pillars to achieve gender equality, namely:

- Economic empowerment, through improved access to income-earning opportunities and productive assets for women;
- Decision making, through increased women's input in community affairs and the strengthening of women producers' organizations; and
- Well-being, through improved access of rural people, in particular women, to basic services and infrastructure.<sup>79</sup>

### Markets

Although the focus of homestead food production is on producing food for household consumption, there is the potential for income generation, provided that households produce a surplus and that they have easy access to markets (formal or informal) to sell their produce.<sup>80</sup> Infrastructure such as roads and transport is needed for access to markets, and for households to be able to sell surplus produce, they need access to agricultural inputs, information and technology, reduction of transaction cost, and adequate storage to minimise losses.<sup>81</sup>

Economically viable post-harvest products could further enhance market possibilities for locally produced crops.<sup>82</sup> Using a variety of post-harvest products could create a greater demand for, among others, orange-fleshed sweet potato, which, in turn, could potentially enhance the sustainability of local production thereof. For example, when baking bread, part of the wheat flour can be substituted with boiled orange-fleshed sweet potato, and to the extent that this practice becomes more common, it could result in a sustained market demand. However, it is important that the dark-orange varieties be used to ensure that the baked bread provides adequate amounts of vitamin A.<sup>82</sup>

Although not directly related to the analysis of Lusikisiki and Ndunakazi, a final issue deserves discussion when considering the contribution of home-grown or community-based agriculture to food and nutrition security in South Africa: the vicious cycle of HIV/AIDS and food insecurity. Without taking this into consideration, community-based interventions may be undermined at the start.

## HIV/AIDS and food and nutrition security

It is now well recognised that HIV/AIDS and food and nutrition security are complex phenomena entwined in a vicious cycle. Food insecurity increases susceptibility to HIV exposure and infection, while HIV/AIDS exacerbates vulnerability to food and nutrition insecurity.<sup>83</sup> Sub-Saharan Africa is the region most heavily affected by HIV/AIDS, with South Africa representing a quarter of the burden of HIV infection in the region, with an estimated 5.3 million people living with HIV/AIDS in 2008.<sup>84</sup> In this region, women are more vulnerable to HIV infection than men and account for approximately 60% of HIV infections.<sup>85</sup>

Subsistence farmers are particularly vulnerable to the impact of HIV/AIDS. The disease reduces available labour due to sickness, premature death or caring for the ill. Additionally, less money is available and assets are sold because of medical and funeral costs. This reduces the household's ability to buy food. In addition, households affected by HIV/AIDS often switch to a low-labour-intensive monocrop system, producing only one crop, rather than a variety of crops, or shift from labour-intensive crops, such as vegetables, to less labour-intensive crops, such as roots. As a result, the household has less access to a variety of nutritious foods. The long-term effects of HIV/AIDS decrease the household's resilience to other shocks, thereby increasing the household's vulnerability to food insecurity.<sup>83</sup> Home gardening can be part of a sustainable long-term strategy that complements household food security, nutrition education, supplementation and food fortification interventions to address the food and nutrition needs of HIV-infected populations.<sup>86-88</sup>

As it was recognised with micronutrient deficiency control programmes that the various interventions to address the deficiency should be used in combination because they each serve a particular target group, and none of them provides 100% coverage,<sup>76</sup> so too does it hold true for interventions targeting the food and nutrition needs of HIV-infected populations. In the South African context, the Integrated Food Security Strategy,<sup>89</sup> through two of its key stakeholders, namely the Food Security Directorate of the National Department of Agriculture and the Nutrition Directorate of the National Department of Health, has implemented food-based approaches to address the food and nutrition security of vulnerable groups such as households with malnourished children and households with an HIV-infected member. However, despite the vast amount of resources invested in these programmes, these programmes are yet to be critically evaluated to ascertain the impact and value of backyard and community gardens, and to better understand the challenges facing them, with particular reference to HIV/AIDS and nutrition.<sup>90</sup>

## Conclusion

Through an analysis of home gardening in South Africa, a clear case is made for the contribution of this type of production to food and nutrition security for the rural poor. The evidence for addressing micronutrient deficiencies in these types of intervention is compelling despite the challenges associated with sustainability and gender dynamics. The case is made for community-based agricultural interventions as a critical component of a comprehensive approach to address food and nutrition security at the household level.

Interventions to strengthen food and nutrition security must ensure the complementarities and synergies between food availability, access and utilisation. These interventions should therefore focus on actions to improve households' physical, economic, social and physiological access to food. In particular, it is recognised that home gardening projects that aim to produce particularly provitamin A-rich foods for household consumption will not eliminate vitamin A deficiency, but can help to reduce the risk of vitamin A deficiency by increased consumption of home-grown provitamin A-rich vegetables.<sup>76</sup>

Although not all households will opt to grow their own vegetables, non-gardening households can potentially benefit from community-based agricultural interventions. Vegetable gardens are visible, and nutrition education and promotion usually target gardening and non-gardening households. For example, an increased vitamin A intake was observed for both participating and non-participating households in the Ndunakazi home gardening project.<sup>49</sup> Although some mothers opted not to have a project garden, many of them realised the nutritional benefits of these vegetables and negotiated with other community members to obtain some of these vegetables. However, the increased vitamin A intake in non-participating households was not sufficient to improve the vitamin A status of their children, underpinning the importance of regular and continuous availability of vitamin A-rich vegetables at the household level as provided by home gardening.<sup>47</sup>

The prospects for nutrition improvements through agricultural interventions are increased if the interventions invest in social, natural, physical, financial and especially human capital.<sup>91</sup> It is imperative that the agricultural component of the intervention be integrated with a comprehensive nutrition education and behaviour change component,<sup>92</sup> as the two components work synergistically to increase household consumption of micronutrient-rich foods. Furthermore, individuals need access to sufficient, safe and nutritious food, and also need access to safe water, hygiene and sanitation, access to quality health care services, and sound household and community practices in child care, food hygiene and preparation, and environmental health.<sup>93</sup>

## References

1. Nishida C, Shrimpton R, Darnton-Hill I. Landscape analysis on countries' readiness to accelerate action in nutrition. *SCN News*. 2009;37:4-9 [homepage on the Internet]. c2011. Available from: <http://www.unscn.org/layout/modules/resources/files/scnnews37.pdf>
2. UN Millennium Project. Investing in development: a practical plan to achieve the Millennium Development Goals. New York: United Nations Development Programme; 2005 [homepage on the Internet]. c2010. Available from: <http://www.unmillenniumproject.org/reports/index.htm>
3. Department of Health. Integrated Nutrition Programme. A foundation for life. Issue 5. Pretoria: South African Department of Health; 2008.
4. Steyn NP, Bradshaw D, Norman R, Joubert JD, et al. Dietary changes and the health transition in South Africa: implications for health policy. Cape Town: South African Medical Research Council; 2006. homepage on the Internet]. c2011. Available from: <http://www.sahealthinfo.org/lifestyle/dietaccess.pdf>
5. Labadarios D, ed. National Food Consumption Survey: Fortification Baseline (NFCS-FB): South Africa, 2005. Pretoria: South African Department of Health; 2007.
6. Chopra M, Witten C, Drimmie S. GAIN working paper series no 1: combating malnutrition in South Africa. Global Alliance for Improved Nutrition, 2009. [homepage on the Internet]. c2010. Available from: <http://www.gainhealth.org/reports/gain-working-paper-series-no-1-combating-malnutrition-south-africa>
7. Food and Agricultural Organization (FAO). World Food Summit, Rome: FAO; 1996. [homepage on the Internet]. c2010. Available from <http://www.fao.org/docrep/003/w3613e/w3613e00.htm>
8. The World Bank. From agriculture to nutrition. Pathways, synergies, and outcomes. Washington, DC: The International Bank for Reconstruction and Development/The World Bank; 2007. [homepage on the Internet]. c2010. Available from: <http://www.worldbank.org/rural>



9. Statistics South Africa. 2008. Income and expenditure of households 2005/2006. [homepage on the Internet]. c2010. Available from: [www.sarpn.org.za/documents/d0003023/Income\\_expenditure\\_StatsSA\\_2005-06.pdf](http://www.sarpn.org.za/documents/d0003023/Income_expenditure_StatsSA_2005-06.pdf)
10. Thorne-Lyman AL, Valpiani N, Sun K, et al. Household dietary diversity and food expenditures are closely linked in rural Bangladesh, increasing the risk of malnutrition due to the financial crisis. *J Nutr*. 2009;140(Suppl):182-85.
11. Steyn NP, Nel JH, Nantel G, et al. Food variety and dietary diversity scores in children: are they good indicators of dietary adequacy? *Public Health Nutr*. 2006;9:644-650.
12. Faber M, Schwabe C, Drimie S. Dietary diversity in relation to other household food security indicators. *Int J Food Safety Nutr Public Health*. 2009;2(1):1-15.
13. Labadarios D, Steyn N, Maunder E, et al. National Food Consumption Survey of one-to-nine year-old children in South Africa, 1999. Pretoria: South African Department of Health, Directorate of Nutrition; 2000.
14. Rose D, Bourne L, Bradshaw D. Food and nutrient availability in South African households. Development of a nationally representative database. Parow: Medical Research Council; 2002. [homepage on the Internet]. c2010. Available from: <http://www.mrc.ac.za/bod/foodnutrientavail.pdf>
15. World Health Organization (WHO). Diet, nutrition and the prevention of chronic diseases: report of WHO study group. WHO technical series report no 797. Geneva: WHO; 1990. [homepage on the Internet]. c2010. Available from: [http://www.who.int/hpr/NPH/docs/who\\_fao\\_expert\\_report.pdf](http://www.who.int/hpr/NPH/docs/who_fao_expert_report.pdf)
16. Department of Health. South Africa Demographic and Health Survey 2003. Pretoria: South African Department of Health; 2007. [homepage on the Internet]. c2010. Available from: <http://www.measuredhs.com/pubs/pdf/FR206/FR206.pdf>
17. Garrett J, Ruel M. Stunted child-overweight mother pairs: prevalence and association with economic development and urbanization. *Food Nutr Bull*. 2005;26:209-221.
18. Aliber M. Exploring Statistics South Africa's national household surveys as sources of information about household-level food security. *Agrekon*. 2010;48(4):384-409.
19. Altman M, Hart TGB, Jacobs P. Household food security status in South Africa. *Agrekon* 2010;48(4):345-361.
20. Jacobs P. The status of household food security targets in South Africa. *Agrekon*. 2010;48(4):410-433.
21. Temple NJ, Steyn NP. Food prices and energy density as barriers to healthy food patterns in Cape Town, South Africa. *J Hunger Environ Nutr*. 2009;4:201-213.
22. Temple NJ, Steyn NP, Fourie J, De Villiers A. Price and availability of healthy food: a study in rural South Africa. *Nutrition* 2010;27(1): 55-58.
23. Love P, Maunder E, Green M, Ross F, et al. South African food-based dietary guidelines. Testing of the preliminary guidelines among women in KwaZulu-Natal and the Western Cape. *S Afr J Clin Nutr*. 2001;14:9-19.
24. Faber M, Laubscher R. Seasonal availability and dietary intake of  $\beta$ -carotene-rich vegetables and fruit of two-year-old to five-year-old children in a rural South African setting growing these crops at household level. *Int J Food Sci Nutr*. 2008;59:46-60.
25. Puoane T, Steyn K, Bradshaw D, et al. Obesity in South Africa: the South African demographic and health survey. *Obes Res*. 2002;10:1038-1048.
26. Benson T. Improving nutrition as development priority. Addressing undernutrition in national policy process in sub-Saharan Africa. Research report 156. Washington DC: International Food Policy Research Institute; 2008. [homepage on the Internet]. c2010. Available from: [http://pdf.usaid.gov/pdf\\_docs/PNADL364.pdf](http://pdf.usaid.gov/pdf_docs/PNADL364.pdf)
27. Food and Agricultural Organization. The state of food insecurity in the world. High food prices and food security: threats and opportunities. Rome: Food and Agricultural Organization; 2008. [homepage on the Internet]. c 2010. Available from: <ftp://ftp.fao.org/docrep/fao/011/i0291e/i0291e00a.pdf>
28. Ericksen PJ. Conceptualising food systems for global environmental change research. *Global Environ Change*. 2008;18:234-1245.
29. Block SA, Kiess L, Webb P, et al. Macro shocks and micro outcomes: child nutrition during Indonesia crisis. *Econ Hum Biol*. 2004;2(1):21-44.
30. Torlesse H, Kiess L, Bloem MW. Association of household rice expenditure with child nutritional status indicates a role for macroeconomic food policy in combating malnutrition. *J Nutr*. 2003;133:1320-1325.
31. West KP, Mehra S. Vitamin A intake and status in populations facing economic stress. *J Nutr*. 2010;140:201-7S.
32. Aliber M, Hart TGB. Should subsistence agriculture be supported as a strategy to address rural food security. *Agrekon*. 2010;48(4):434-458.
33. HKI/APRO. Homestead food production model contributes to improved household food security, nutrition and female empowerment: experience from scaling-up programmes in Asia (Bangladesh, Cambodia, Nepal and Philippines). Helen Keller International Nutrition Bulletin 2010 March;8(1). [homepage on the Internet]. c2010. Available from: [http://www.hki.org/research/APRO%20Bulletin\\_HFP%20and%20Food%20Security.pdf](http://www.hki.org/research/APRO%20Bulletin_HFP%20and%20Food%20Security.pdf)
34. Iannotti L, Cunningham K, Ruel M. Improving diet quality and micronutrient nutrition: homestead food production in Bangladesh. IFPRI Discussion Paper 00928. Washington DC: International Food Policy Research Institute; 2009. [homepage on the Internet]. c 2010. Available from: <http://www.ifpri.org/sites/default/files/publications/ifripd00928.pdf>
35. World Education (INGO) Philippines. Resource manual on integrated production and pest management (IPPM) in vegetables. Philippines: World Education (INGO); 2005.
36. West CE, Eilander A, Van Lieshout M. Consequences of revised estimates of carotenoid bioefficacy for dietary control of vitamin A deficiency in developing countries. *J Nutr*. 2002;132:2920-6S.
37. Haskell MJ, Jamil KM, Hassan F, et al. Daily consumption of Indian spinach (*Basella alba*) or sweet potatoes has a positive effect on total-body vitamin A stores in Bangladeshi men. *Am J Clin Nutr*. 2004;80:705-714.
38. Van Jaarsveld PJ, Faber M, Tanumihardjo SA, et al.  $\beta$ -carotene-rich orange-fleshed sweet potato improves the vitamin A status of primary school children assessed with the modified-relative-dose-response test. *Am J Clin Nutr*. 2005;81:1080-1087.
39. Haskell MJ, Pandey P, Graham JM, et al. Recovery from impaired dark adaptation in nightblind pregnant Nepali women who receive small daily doses of vitamin A as amaranth leaves, carrots, goat liver, vitamin A-fortified rice, or retinyl palmitate. *Am J Clin Nutr*. 2005;81:461-471.
40. Takyi EEK. Children's consumption of dark green, leafy vegetables with added fat enhances serum retinol. *J Nutr*. 1999;129:1549-1554.
41. Takahata Y, Noda T, Nagata T. HPLC determination of  $\beta$ -carotene of sweet potato cultivars and its relationship with colour values. *Jpn J Breeding*. 1993;43:421-427.
42. Laurie SM, Van den Berg AA, Magoro MD, Kgonyane MC. Breeding of sweet potato and evaluation of advanced breeding lines and imported varieties in off-station trials in South Africa. *Afr Crop Sci J*. 2004;12:189-196.
43. Faber M, Laurie S, Venter S. Home gardens to address vitamin A deficiency in South Africa: a food-based approach. Pretoria: Agricultural Research Council; 2006.
44. Bonnard P. Improving the nutritional impacts of agriculture interventions: strategy and policy brief. Washington DC: Food and Nutrition Technical Assistance Project; 200 [homepage on the Internet]. c2010. Available from: [www.fantaproject.org/downloads/pdfs/NutAg\\_Mar01.pdf](http://www.fantaproject.org/downloads/pdfs/NutAg_Mar01.pdf)
45. Faber M, Oelofse A, Benadé AJS. A model for a community-based growth monitoring system. *Afr J Health Sci*. 1998;5:72-78.
46. Faber M, Phungula MAS, Kvalsvig JD, Benadé AJS. Acceptability of community-based growth monitoring in a rural village in South Africa. *Food Nutr Bull*. 2003;24:350-359.
47. Faber M, Phungula MAS, Venter SL, et al. Home gardens focusing on the production of yellow and dark-green leafy vegetables increase the serum retinol concentrations of 2-5-y-old children in South Africa. *Am J Clin Nutr*. 2002;76:1048-1054.
48. Faber M, Jogessar VB, Benadé AJS. Nutritional status and dietary intakes of children aged 2 to 5 years and their caregivers in a rural South African community. *Int J Food Sci Nutr*. 2001;52:401-411.
49. Faber M, Venter S, Benadé AJS. Increased vitamin A intake in children aged 2 to 5 years through targeted home gardens in a rural South African community. *Public Health Nutr*. 2002;5:11-16.
50. Faber M, Phungula M, Venter S, et al. A home-gardening programme focusing on yellow and dark-green leafy vegetables to improve household food security and undernutrition with special reference to vitamin A status of preschool children. Tygerberg: Medical Research Council; 2001.
51. Faber M, Venter S, Phungula MAS, Benadé AJS. An integrated primary health-care and provitamin A household food-production programme: impact on food-consumption patterns. *Food Nutr Bull*. 2001;22(4):370-375.
52. Faber M, Van Jaarsveld PJ, Laubscher R. The contribution of dark-green leafy vegetables to total micronutrient intake of two-to five-year-old children in a rural setting. *Water SA*. 2007;33(3):407-412.
53. Faber M, Benadé AJS. Integrated home gardening and community-based growth monitoring activities to alleviate vitamin A deficiency in a rural village in South Africa. *FNA*. 2003;32:24-30. [homepage on the Internet]. c 2010. Available from: <ftp://ftp.fao.org/docrep/fao/005/y8346m/y8346m03.pdf>
54. Faber M, Laurie SM. A home gardening approach developed in South Africa to address vitamin A deficiency. In Thompson B, Amoroso L, eds. Combating micronutrient deficiencies: food-based approaches. FAO and CABI bookshop; 2011;163-182.
55. Laurie S, Faber M. Integrated community-based growth monitoring and vegetable gardens focusing on crops rich in  $\beta$ -carotene: project evaluation in a rural community in the Eastern Cape, South Africa. *J Sci Food Agric*. 2008;88:2093-2101.
56. Maunder EMW, Meaker JL. The current and potential contribution of home-grown vegetables to diets in South Africa. *Water SA*. 2007;33(3):401-405.
57. Krinsky NI, Johnson EJ. Carotenoid actions and their relation to health and disease. *Mol Aspects Med*. 2005;26:459-516.
58. Lock K, Pomeroy J, Cause L, et al. The global burden of disease attributable to low consumption of fruit and vegetables: implications for the global strategy on diet. *Bull World Health Organ*. 2005;83:100-108.
59. Twine M, Hunter L. AIDS mortality and the role of natural resources in household food security in a rural district of South Africa. Brief 11. HIV, livelihoods, food and nutrition security: findings from renewal research (2007-2008). Washington, DC: International Food Policy Research Institute; 2008.
60. Drimie S, Gandure S. The impact of HIV/AIDS on rural livelihoods in Southern Africa: an inventory and literature review. November 2005. Food and Agricultural Organization of the United Nations Sub-Regional Office for Southern and Eastern Africa: Harare, Zimbabwe; 2005 [homepage on the Internet]. c2010. Available from: <http://www.zimrelief.ingo/>
61. McGarry DK. Is HIV/AIDS jeopardising biodiversity? *Environmental Conservation* 2009;36(1):5-7.
62. Food and agricultural organization. The state of food insecurity in the world: economic crises: impacts and lessons learnt. Rome: Food and Agricultural Organization; 2009 [homepage on the Internet]. c2010. Available from: <http://www.fao.org/docrep/012/i0876e/i0876e00.htm>

63. Toledo A, Burlingame B. Biodiversity and nutrition: a common path toward global food security and sustainable development. *J Food Comp Anal.* 2006;19:477-483.
64. Smith IF, Eyzaguirre P. African leafy vegetables: their role in the World Health Organization's global fruit and vegetable initiative. *Afr J Food Agric Nutr Develop.* 2007 [homepage on the Internet]. c2007. Available from: <http://www.ajfand.net/index.html>
65. Labadarios D, Steyn NP. South African food-based dietary guidelines : guidelines for whom? *S Afr J Clin Nutr.* 2001;14(1):5-6.
66. Vorster HJ. The role and production of traditional leafy vegetables in three rural communities in South Africa. MSc thesis. Pretoria: University of Pretoria; 2007 [homepage on the Internet]. c2009. Available from: <http://upetd.up.ac.za/thesis/available/etd-02122009-115129>
67. Faber M, Oelofse A, Van Jaarsveld PJ, et al. African leafy vegetables consumed by households in the Limpopo and KwaZulu-Natal provinces in South Africa. *S Afr J Clin Nutr.* 2010;23(1):30-38.
68. Pretty J. Agricultural sustainability: concepts, principle and evidence. *Phil Trans R Soc.* 2008;363:447-465.
69. Laurie SM, Mtsheni MM, Mphaphuli NS, et al. Experiences with orange-fleshed sweetpotato in vegetable garden projects. In: Faber M, Laurie S, van Jaarsveld P, eds. *Proceedings Orange-fleshed Sweetpotato Symposium*, Pretoria, 2007. Tygerberg: Medical Research Council; 2008:49-56.
70. Bokeloh G. Actions/intervention to improve food and nutrition security at meso and micro level. In: Klennert K, ed. *Achieving food and nutrition security*. 3rd ed. InWEnt: Germany; 2009.
71. Department of Education. National guidelines for the implementation, monitoring and reporting on the National School Nutrition Programme 2008. Pretoria: National Department of Education; 2008.
72. Department of Education. National School Nutrition Programme 2007/2008 financial year report for sustainable food production in schools. Pretoria: National Department of Education; 2008.
73. Witten C, Chopra M. CD Cynergy "Mdantsane for Vitamin A Project" final report. Cape Town: 2004.
74. Randell J. Final report: international programme to prevent and control micronutrient malnutrition. Report submitted to Centres for Disease Control and Prevention (CDC), Georgia, 2004.
75. Public Service Commission. Report on the evaluation of the National School Nutrition Programme (NSNP). Pretoria: Public Service Commission; March 2008 [homepage on the Internet]. c2009. Available from: <http://www.psc.gov.za>
76. De Pee S, Bloem MW. The bioavailability of (pro) vitamin A carotenoids and maximising the contribution of homestead food production to combating vitamin A deficiency. *Int J Vit Nutr Res.* 2007;77:182-192.
77. Mabusela L. Home gardens in the central region of the Eastern Cape Province, South Africa: a socio-economic study. Agricultural University of Norway; 1999.
78. Sally B. Gender issues in agricultural liberalisation: topic paper prepared for Directorate General for Development (DGVIII) of the European Commission. Institute of Development Studies: Brighton; 1998 [homepage on the Internet]. c2010. Available from: <http://www.ids.ac.uk/bridge>
79. IFAD contribution to MDG 3: gender equality and women's empowerment 2010 [homepage on the Internet]. c2010. Available from: <http://www.ifad.org/gender>
80. Low JW, Arimond M, Osman N, et al. Ensuring supply and creating demand for a biofortified crop with a visible trait: lessons learned from the introduction of orange-fleshed sweet potato in drought-prone areas of Mozambique. *Food Nutr Bull.* 2007;28:S258-S70.
81. Hendriks SL. The potential for nutritional benefits from increased agricultural production in rural KwaZulu-Natal. *S Afr J Agric Extension.* 2003;32:28-44.
82. Low JW, Van Jaarsveld PJ. The potential contribution of bread buns fortified with  $\beta$ -carotene-rich sweet potato in Central Mozambique. *Food Nutr Bull.* 2008;29:98-107.
83. Gillespie S, Kadiyala S. HIV/AIDS and food and nutrition security: from evidence to action. Washington, DC: International Food Policy Research Institute; 2005.
84. Department of Health. National Antenatal Sentinel HIV and Sypthiis Prevalence Survey in South Africa 2008. Pretoria: South African Department of Health; 2009 [homepage on the Internet]. c2010. Available from: <http://www.info.gov.za/view/DownloadFileAction?id=109007>
85. UNAIDS. AIDS epidemic update. United Nations Programme on HIV/AIDS (UNAIDS) and World Health Organization (WHO), 2009 [homepage on the Internet]. Available from: [http://data.unaids.org/pub/Report/2009/JC1700\\_Epi\\_Update\\_2009\\_en.pdf](http://data.unaids.org/pub/Report/2009/JC1700_Epi_Update_2009_en.pdf)
86. Regional Centre for Quality of Health Care (RCQHC)/FANTA/AED. Nutrition, food security and HIV: a compendium of promising practices. Washington, DC: FANTA; 2008 [homepage on the Internet]. c2010. Available from: [http://www.pronutrition.org/files/fshiv\\_compendium2008.pdf](http://www.pronutrition.org/files/fshiv_compendium2008.pdf)
87. Food and Trees for Africa. Home-based care food gardens with Johnnic Communications [homepage on the Internet]. c2010. Available from: <http://www.trees.co.za>
88. Lekganyane EM. The role of food gardens in mitigating the vulnerability to HIV/AIDS of rural women in Limpopo, South Africa. Master's thesis. Pretoria: UNISA; 2008 [homepage on the Internet]. c2010. Available from: [http://uir.unisa.ac.za/bitstream/10500/3758/1/dissertation\\_lekganyane\\_m.pdf](http://uir.unisa.ac.za/bitstream/10500/3758/1/dissertation_lekganyane_m.pdf)
89. Department of Agriculture. The integrated food security strategy for South Africa. Pretoria: South African Department of Agriculture; 2002.
90. Drimie S. Renewal National Advisory Panel Workshop, 10 December 2008. Johannesburg, 2008.
91. Berti PR, Krasevec J, FitzGerald S. A review of the effectiveness of agricultural interventions in improving nutrition outcomes. *Public Health Nutr.* 2004;7(5):599-609.
92. Ruel MT. Can food-based strategies help reduce vitamin A and iron deficiencies? A review of recent evidence. Washington DC: International Food Policy Research Institute; 2001.
93. United Nations Children Fund (UNICEF). Strategy for improved nutrition of children and women in developing countries. New York: UNICEF; 1990.



## Cape NSSA News

The Cape Branch of the Nutrition Society of South Africa hosted a half-day mini-symposium entitled *Updates in public health nutrition* on Wednesday, 16 February, 2011, at the Nutritional Intervention Research Unit of the Medical Research Council, Cape Town.

Prof Norman Temple, Athabasca University, Canada, gave an overview of recent developments in public health nutrition, and included his collaborations with South Africa.

Prof Eugene Cloete, Dean of Science, Stellenbosch University, reported on the tea-bag-sized water filter, a highly significant global innovation in public health.

Prof Marjanne Senekal, University of Cape Town, presented an update on the implications of nutrigenomics for public health nutrition.

Prof Rina Swart, University of the Western Cape, presented a brief update on the registration of nutritionists. Currently, there are 62 registered nutritionists and 155 student nutritionists in South Africa. Student nutritionists currently study at the universities of Venda, KwaZulu-Natal and North-West.