



Check for updates

**AUTHORS:**

Grant Carstens<sup>1</sup>   
Richard Hay<sup>1</sup>   
Michael van der Laan<sup>1</sup>

**AFFILIATION:**

<sup>1</sup>Department of Plant and Soil Sciences, University of Pretoria, Pretoria, South Africa

**CORRESPONDENCE TO:**

Grant Carstens

**EMAIL:**

grant97carstens@gmail.com

**DATES:**

Received: 02 Aug. 2020

Accepted: 23 Mar. 2021

Published: 29 Sep. 2021

**HOW TO CITE:**

Carstens G, Hay R, Van der Laan M. Can home gardening significantly reduce food insecurity in South Africa during times of economic distress? *S Afr J Sci.* 2021;117(9/10), Art. #8730. <https://doi.org/10.17159/sajs.2021/8730>

**ARTICLE INCLUDES:**

- Peer review
- Supplementary material

**DATA AVAILABILITY:**

- Open data set
- All data included
- On request from author(s)
- Not available
- Not applicable

**EDITORS:**

Teresa Coutinho   
Salmina Mokgehle

**KEYWORDS:**

home gardens, malnutrition, food sovereignty, economic crisis

**FUNDING:**

None

# Can home gardening significantly reduce food insecurity in South Africa during times of economic distress?

The novel coronavirus has revealed major impediments in South African food distribution. Existing challenges will be greatly exacerbated by an economic recession projected to be worse than the Great Depression. Home gardens are decidedly utilised to fortify food security and economic resiliency in the face of crises, especially in impoverished communities. For these communities, home garden produce favourably augments diets consisting predominantly of industrially produced staples and the surplus yield can be sold. Despite many campaigns to alleviate food insecurity – some aimed at developing industrial agriculture and others to establish and uplift home gardens – malnutrition and hunger still plague the impoverished. Dissection of these campaigns reveals common flaws in those that failed and key aspects related to those that succeeded, with successful projects even managing to provide a household's total supply of vegetables. One of the crucial failings was a 'top-down' approach that condescended to participants, ignoring existing knowledge, preferences and social consolidation whilst focusing on meticulously consistent packaged methodologies. Successful projects exalted recipients' own bid for food sovereignty and increased individual and community capacity by providing insightful consultation and access to requested necessary inputs. Obstacles especially present in South Africa include drought and collapse of social capital after withdrawal of institutional support. It has been proven possible that these can be overcome with application of technologies, such as rainwater harvesting, and the creation of common cause such as in national drives. This review of the literature clearly reveals that purposefully uplifted home and community gardens alleviate food insecurity.

**Significance:**

- Citizens aim for food sovereignty in times of economic crises such as will be brought about by the novel coronavirus.
- We assess the potential of the establishment of home and community gardens to alleviate food insecurity in South Africa.
- Home gardens should mainly target the alleviation of malnutrition, producing vegetables to augment cereal-based diets.
- Protection of social capital by institutional networks ensures durability and long-term success of campaigns.
- Rainwater harvesting technology is immensely influential for the success of home gardens in a South African context.

## Introduction

Cultivation of food has long been considered the foundation for a civil society's success<sup>1</sup> and citizen participation is an essential ingredient of democratic processes<sup>2</sup>. The last few centuries have been characterised by professional specialisation within populations.<sup>3</sup> The modern farmer, in contrast to the subsistence or small-scale farmer, mass produces one to a few crops, usually staples, solely for income.<sup>4</sup> In South Africa, each specialised commercial farmer feeds, on average, 82 non-farmers of the population, although there exist 2.9 million households involved in smallholder and subsistence agriculture.<sup>5</sup> This demographic is far removed from the greater market.<sup>6</sup> In South Africa, the total number of people suffering from insufficient food totals 12 million or 20%, despite the country being a consistent net exporter<sup>7</sup>. Commercial agriculture has led to value chains that are funnelled towards urban centres flowing along socio-economic lines.<sup>8</sup> It has also reduced the need and desire for cultivation of home gardens.<sup>9</sup> Home gardens are defined as plots of cultivated plants maintained typically, but not always, near homes, by individuals or households who have some self-arranged access to land, either through customary or common law.<sup>10</sup> A wide variety of plants are cultivated for many uses.<sup>11</sup> Watkinson and Makdeta<sup>12</sup> reported that only 5% of households in South Africa were still farming for their main source of food and 10% were farming for supplementary food.

On 15 March 2020, a state of national disaster was declared in South Africa due to the COVID-19 pandemic. The country implemented some of the most stringent lockdown measures on the continent in an attempt to contain the spread.<sup>13</sup> These measures have resulted in collective conservative consumption and investment.<sup>14</sup> There has been profound impact on the economic function of the country with the growth forecast being revised downward from 0.7% to 0.4% for 2020, indicating pronounced downturn and recession.<sup>15</sup> The stifled economic activities have fueled rising levels of hunger and desperation in the country<sup>16</sup>, with low-wage workers and those in precarious



employment being disproportionately affected. The poorest 60% of South African households now rely more on social grants than on paid employment to obtain food.<sup>17</sup>

The way in which food supply has been organised has long been noted to decrease food sovereignty<sup>18</sup>, creating a troubling situation in which resilience to food shortages is strongly determined by financial standing. Reviews reveal that when food is limited, individuals and communities take to reclaiming food sovereignty through home gardening and urban agriculture.<sup>19,20</sup> Food insecurity manifests when food supplies become compromised despite purchase power, social safety welfare nets are ineffective and families cannot produce enough food.<sup>21</sup> Nutrition security should be one of South Africa's main priorities as the country is listed by the World Health Organization (WHO) as a high-burden country with especially high numbers of stunted children.<sup>22</sup> This is attributed to the average household consumption of fruits and vegetables being half the WHO-recommended rate.<sup>23</sup> The majority of the diet of impoverished people in South Africa is seen to be ultra-processed packaged foods known to be sugar-rich, but nutrient poor.<sup>24</sup> This leads to attempts at alleviating starvation that result in increasing incidences of obesity and non-communicable diseases as caloric needs are met but nutritional needs are not.<sup>25</sup> The resulting phenomenon of 'hidden hunger' haunts much of mainstream food aid and marginalisation of home gardens in agricultural policy has often been correlated with an increase in household vulnerability.<sup>26</sup> This is because nutrient-rich fruits and vegetables are replaced by grains that are easily produced through commercial means, processed, and travel well, although they have insufficient levels of many vital nutrients such as Ca, Mg, Zn, folate, vitamin C and several vitamin precursors.<sup>8</sup>

The aim of this review was to urgently evaluate the role that home gardening can play in improving food security in South Africa against the backdrop of poverty and hunger issues that have existed for decades, which are now combined with the global COVID-19 crisis. This pandemic has been predicted to place massive economic strains on livelihoods,

with unemployment expected to rise to as much as 50% and the economic climate predicted to drop below that of the Great Depression.<sup>27</sup>

### The 'home gardening' concept

Home gardens vary according to format, layout and crop mix.<sup>28</sup> The variability is determined by unique and complex interactions between culture, surrounding ecology, available resources, skills and preferences, and climate variability.<sup>29</sup> The literature largely suggests that the ideal garden structure mostly depends on the socio-economic standing of those who are self-provisioning. In general, richer families cultivate a greater diversity of herbaceous ornamentals and exotic horticultural crops with less economically stable gardeners focusing on staples and crops for uses other than consumption, such as for fibre and medicine.<sup>30</sup>

Many reviews exist for general observation on home gardens and correlation with social indicators rather than empirical testing of specific designs.<sup>19,31-33</sup> This is most likely due to difficulties in collecting data on harvesting. The promise of institutionally supported packaged methodologies is widely acknowledged but largely unquantified. However, home gardening is considered the most significant form of food production for most people in developing countries<sup>34-36</sup> due to a lower intensity of inputs and investment for nutritional return<sup>37</sup>. Although many home gardens have been abandoned due to economic unfeasibility and calorie-focused nutrition, many sources claim home gardens to be an essential augmentation to increase the resilience and livability of impoverished communities.<sup>10,38,39</sup>

### Lessons from other countries and time periods

A commonly touted success story of self-provisioning is the 'Victory Garden' and 'War Garden' promoted by the US government during the World Wars. A schematic of one of the many versions of these gardens is shown in Figure 1. The US Department of Agriculture made available a substantial amount of material at the public's request concerning how to successfully cultivate and process various crops for home consumption.



**Figure 1:** Plan for a 'Victory' or 'War' garden disseminated to the American public in 1914<sup>1</sup> judged to be a successful programme (left), and a schematic disseminated to gardeners in the British 'Dig for Victory' campaign<sup>48</sup> deemed to be over-complicated and less successful (right).

At least 20 million households participated.<sup>20</sup> The widespread undertaking of gardening was largely because it was promoted as a national duty through many corporate channels.<sup>40</sup> The Victory Garden succeeded in maintaining dietary diversity in the face of crisis as they were estimated to have produced 8 million tonnes of produce, amounting to 40% of the domestic demand.<sup>41</sup> Participation declined sharply after both wars, highlighting how community encouragement is key.<sup>20</sup> Successful establishment of Victory Gardens was vigorously supported by a government-driven national campaign that supplied information, and patriotic common cause.

In Cuba, Mexico and Zimbabwe, home gardens are widely used to provide food and generate income in the face of the uncertainties of local monocropping, political volatility and changing ecosystems.<sup>42,43</sup> In Cuba, where the country entered economic crisis due to the collapse of the Soviet Bloc, home gardens rose to meet the demand for economic resiliency as they ‘sustained morale’ and dietary diversity during ongoing economic crises.<sup>44</sup> It is noted, however, that staples are not included as popularly cultivated plants because the gardens are kept to augment nutrition obtained from ration cards.<sup>44</sup> In Mexico, propagation material and information is largely exchanged through social networks in local populations.<sup>45</sup> These local populations increase the value of crop diversity.<sup>46</sup> In Zimbabwe, due to the arid climate, crop production relies heavily on irrigation.<sup>33</sup> There exists a large subsistence sector out of necessity due to 72.3% of Zimbabweans surviving on less than USD2 per day, although their exact contribution to food production is unknown.<sup>47</sup> Irrigation schemes have been shown to bring huge benefits in the form of stability and enabling year-round production.<sup>33</sup> Drescher et al.<sup>35</sup> noted a difference between the supported gardens and those tended spontaneously. Supported gardens were designed for optimal production, while spontaneous gardens fulfilled multiple functions. Spontaneous designs also contained a far higher diversity of plants with lower production risks.

Evaluating the success of government programmes in Southeast Asia, Martin et al.<sup>31</sup> found that the large diversity of species occurring indigenously in home gardens led to the success of the gardens. Home gardens were an average size of 0.12 ha and were in addition to cash cropping. Those with greater incomes from cash cropping relied less on home gardens for their food staples, although in resource-poor households, an increase in food consumption often correlated with intensification of home gardening.<sup>42</sup>

## Lessons from failures in other countries and time periods

In Uganda, home gardens are considered the most primary source of food and are well known to provide dietary diversity for impoverished people.<sup>32</sup> Whitney et al.<sup>32</sup> concluded that the resilience conferred by these home gardens is threatened by government development programmes. This, together with the co-threat of drought, was causing the loss of traditional knowledge and crops resulting in decreased food sovereignty. The ambitious development programmes trade biodiversity for productivity, curbing resiliency yet increasing dependence on centralised food systems.

Just as the ‘Victory Gardens’ were considered successful, so too was the ‘Dig for Victory’ campaign in Great Britain. Domestic vegetable production increased from 2 million to 3 million tonnes during the movement.<sup>48</sup> Analysis reveals that the success was mostly due to spontaneous citizen-led action. Only 10% of gardeners are documented to have used the information made available by government and only 34% named the campaign as their motivation.<sup>49</sup> The ‘Growmore Leaflets’ released are known for being overly-specific and conveying the general fear of the ‘muddled agrarianism’ that the masses would practise.<sup>50</sup> Campaign leaders wanted to enforce specific production systems, shown in Figure 1, in comparison to the Victory Gardens, that made information available upon public request.<sup>49</sup> What resulted was an alienation of the population.<sup>48</sup> Although home gardening was successfully used for self-provisioning in the face of crisis, failure of the Dig for Victory campaign itself reveals the need for inclusion of participants.

When the East Bwabwata National Park in Namibia was established in 2007, the native Khwe San were no longer permitted to hunt and gather. In compensation, the government promised assistance through the establishment of subsistence agriculture. Despite this assistance, they remain dependent on government food aid<sup>51</sup>, with a reliance on grains, which are generally considered nutritionally inferior<sup>52</sup>. The gardening programme was first established with a community approach, yet due to stealing and a lack of cooperation, this quickly dissolved into individual home gardens. Other challenges faced by the gardeners included lack of infrastructure for protection from animals, complicated irrigation because of long distances to water sources and lack of seed.<sup>51</sup> As well as exclusion from aid and market, many home gardeners were unfamiliar with the vegetables provided. This developing case exhibits the importance of continuous communication channels.

Despite home gardens being described as viable livelihood strategies<sup>43,53,54</sup>, worrying observations have been made regarding developing dependency syndromes<sup>54,55</sup>. Gardens that were flourishing with direct contact of the NGO rapidly shrank following withdrawal and eventually folded due to lack of new seed as well as social factors, such as community disputes and crop theft.<sup>54</sup> Successful campaigns keep gardeners accountable and remain instructive whilst not ignoring cultural preferences.<sup>55</sup>

## Recent and current operations in South Africa

Currently in South Africa, the combined area of home gardens of rural homesteads amounts to 200 000 ha.<sup>37</sup> This number does not consider urban areas, but it is noted that 72% of South Africa’s impoverished people live in rural areas. Production fluctuates wildly<sup>26,56</sup> – primarily due to water availability – which severely undermines the capacity to alleviate food insecurity. Crops grown include maize, sorghum (*Sorghum bicolor*), sweet potatoes (*Ipomoea batatas*), cabbage (*Brassica oleracea* var. *capitata*), squashes (*Cucurbita* sp.) and spinach (*Spinacia oleracea*).<sup>38</sup> Figure 2 shows how direct sales and own consumption make up 41% of the produce distribution in South Africa, indicating a significant portion of production exhibits similar distribution channels of home-grown produce and that there already exists a culture, whether inherent or compelled economically, of buying locally and from small-scale production. This demonstrates willingness for people to consume and purchase home-grown produce compared to countries where most citizens consume produce that is highly travelled and has had to meet many regulatory standards. Common reasons for not home gardening are the lack of labour and inputs. Many attempts to implement home gardening have failed and drought is thought of as a major factor for decreasing garden production and causing food prices to rise, as is lack of community cooperation, community feedback and hasty withdrawals by institutions.<sup>57,58</sup>

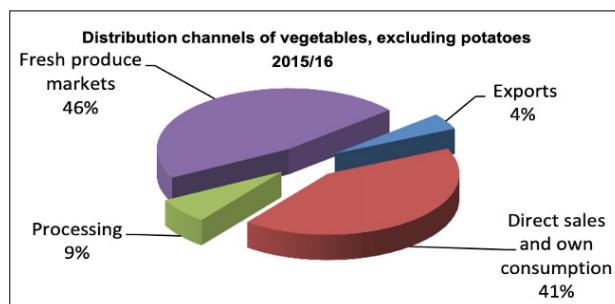


Figure 2: Destinations of vegetables domestically produced in South Africa.

The fate of projects across KwaZulu-Natal is well documented. Modis<sup>56</sup> tested year-round organic production under virtual dryland conditions. Plots of 0.1 ha or 1000 m<sup>2</sup> were assigned to individuals who were given finances for the year amounting to ZAR3000 for seeds and seedlings, and ZAR2400 for labour.<sup>59</sup> Assessments of the harvests revealed that fresh vegetable yields of 19–27 t/ha were achieved with year-round production; variability was attributed to climatic differences influencing



yields because of the dryland approach. Of the total yields from each plot, 12–22 t/ha was consumed by beneficiaries and income amounting to ZAR6000–ZAR15 000 was generated from selling the rest. It was concluded that, under the directive of an informed campaign, crop yields from 0.1 ha would be adequate to meet the food security needs of an average household.<sup>66</sup> Using rainfed systems is risky though, as depicted by Hadebe<sup>60</sup> who evaluated home gardens in the Umkhanyakude district that usually receive similar average rainfall to those sites evaluated by Modi<sup>66</sup> but, at the time of study, experienced a severe drought. Non-irrigators made no income from sales of produce although gardens did satisfy home needs.

Some community garden projects have been considered failures as participants did not see their food security ensured. Shisanya and Hendriks<sup>61</sup> observed that although the gardeners did not exceed a certain threshold of perception of food availability, access to food was nonetheless improved and negative consumption habits avoided. Shisanya and Hendriks<sup>61</sup> also detected flaws in the designs and establishment of these gardens, specifically: plots were too small, participants were given little to no agricultural and nutritional advice, and crop theft was rife. In KwaMashu Township, there is the One Home One Garden programme which started in 2009. By 2010, the programme had established 11 530 household gardens, 30 community gardens and 88 institutional gardens, although evaluation revealed very few households experiencing alleviation of food insecurity and those that did 'governed their gardens independent of state support'.<sup>3</sup> The reason for this is that beneficiaries were completely excluded from decision-making processes.<sup>62</sup> By comparison, in a One House One Farm project implemented in rural Bangladesh which succeeded, participants chose their seeds.<sup>63</sup> Further differences and reasons for failure of the One Home One Garden programme include: unidirectional communication as well as the prevalence of gardener apathy fuelled by state grants.<sup>62</sup>

When evaluating home gardens in the Eastern Cape, Adekunle<sup>21</sup> noted how important they were at providing food on an almost daily basis. Over 60% of rural poor were observed to depend on their own produce year-round. Notably, the majority of successful self-provisioners were married (70.4% and 65% of the male and female participants, respectively).<sup>21</sup> This was attributed to the fact that labour inputs could be delegated. A notable unsuccessful project was the Food Security Community Gardens in Cape Town. Investigations into the failure of these gardens found that whilst they attempted to address lack of skills, land and water, the project neglected the need for leadership and effective communication.<sup>64</sup> It was recommended by Zenda<sup>65</sup> that projects require greater institutional integration.

A particular success story from the Eastern Cape is the Lusikisiki project where the cultivation of  $\beta$ -carotene-containing vegetables was promoted in a combined crop-based and educational intervention.<sup>66</sup> Reviews of the project showed that 'children in the project households experienced alleviation of deficiency symptoms'.<sup>66</sup> Further studies of this dual approach show that virtually all participants eventually obtain substantial food from home gardens with children from project households consuming vegetables more frequently than children from control households.<sup>22</sup> Further, gardening is seen to persist after careful withdrawal focusing on establishing a sustainable source of seed.<sup>66</sup> Another applicable success case is the Siyazondla Homestead Food Production Programme in the Nkonkobe municipality established in 2004/2005. Inputs such as seeds, tools, fencing and water harvesting equipment were disseminated.<sup>67</sup> This programme included urban and rural participants and, although participation varied, vegetable consumption was seen to increase significantly for beneficiaries with 37% reporting that they obtained all their vegetables from their gardens.<sup>68</sup> Notably, 13% of participants reported sharing inputs and produce with non-participants, showing how projects can beneficially spill over.<sup>67</sup> There were, however, a few points for improvement. It was found that only 30.8% of participants used the water harvesting tanks to irrigate.<sup>69</sup> A larger number of tanks, and better demonstration of their effective use, were required. Further, it was found that 85% of participants bought seed over-and-above those provided and cited a shortage as the reason.<sup>67</sup>

In Johannesburg, Gauteng, the Homestead Food Programme began in 1997 as a response to poverty and malnutrition<sup>70</sup> and consisted of the dissemination of production packages containing tools and seed packets<sup>71</sup>. Participants were also given three days' training. The programme reduced food insecurity by 41.5% as gardeners consumed produce directly and generated income from sales.<sup>70</sup> Papers reviewing the project have noted that there was a significant selection bias wherein families that experienced greater food insecurity were more likely to participate.<sup>71</sup> The programme exhibits how food production systems centred around individual households are more reliable and sustainable than standard nutrition interventions such as food aid or state grants.<sup>72</sup>

It has been claimed that the full potential of many home garden programmes is not reached due to lack of exploitation of rainwater harvesting technology.<sup>37,73</sup> Rainwater harvesting is defined as the process of concentrating, collecting and storing rainwater for use at a later time.<sup>74</sup> When evaluating rainwater harvesting use in the Umlazi River catchment, Everson et al.<sup>75</sup> demonstrated that optimal application increased yields by as much as 40–60%, resulting in 75% of farmers finding that community gardens alleviated poverty.

## Outlook for South Africa

There are adjunct benefits to home gardening that go beyond food security. It is well known that home gardening can greatly benefit well-being and mental health as well as support plant genetic diversity with well-managed gardens containing as many as 60 different vegetable plant species.<sup>28</sup> Home gardens can mitigate urban heat island effects, regulate stormwater run-off and maintain soil carbon stocks and other aspects of soil quality.<sup>10</sup> They also preserve indigenous knowledge and culture<sup>19</sup> and present opportunities for education and community engagement.

Home gardens are the default in South Africa to supplement food procured with income by those below the poverty line. They buffer vulnerable portions of the population in times of economic downturn.<sup>38</sup> Often, 12–20 people organise themselves into a co-op cultivating 1–2 ha.<sup>50</sup> Many home gardens do not meet their production potential due to factors that are commonly associated with being impoverished: lack of capital, training and education and ability to assume risk. Most programmes aiming at advancing home gardens target specifically rural populations when urban sectors could experience the same benefits, albeit considering site-specific land availability. This is demonstrated by the fact that the average garden size in rural Limpopo is almost double that of the Eastern Cape.<sup>26</sup>

## Projecting needs from home gardens

The WHO recommends at least five servings of 80 g, totalling 400 g, of vegetables per person per day.<sup>76</sup> Assuming South African home garden yields of cabbage and Swiss chard of 33 t/ha, beans of 1.4 t/ha, tomatoes of 11 t/ha, and potatoes of 25 t/ha<sup>56,60,69</sup> to reach a grand average of 18 t/ha or 1.8 kg/m<sup>2</sup>, and three crops per year to achieve production of 5.4 kg/m<sup>2</sup>, each person will need around 27 m<sup>2</sup> of land for their vegetable requirements, or an area roughly 5 × 5 m<sup>2</sup>. This may also require around 20 000–25 000 L of water per year depending on growing conditions. Assuming 100 g of vegetables contains approximately 65 calories, a person's vegetable requirement will also satisfy 260 calories for a particular day. As well as accounting for just over 10% of a person's daily energy requirement of 2400 calories per day, the vegetables will satisfy many micronutrient deficiencies, especially Fe and vitamin A, serving as necessary augmentation for a diet in which caloric demand is mostly met by industrially produced cereals. These calculations are complex and highly dependent on site-specific conditions but do have value in moving toward quantitatively determining the potential of home gardens. While an area of over 20 m<sup>2</sup> per person may be unrealistic in many cases, even much smaller areas can contribute to addressing micronutrient deficiencies.

## Conclusions

From this review and simple calculation, home gardens show potential for alleviating food insecurity in South Africa in the face of an economic

crisis. Lessons from case studies show clear measures to improve the chance of success. The most important resource is the establishment of networks facilitating two-way dialogue between growers and facilitating institutions to overcome knowledge gaps and deficiencies in capacity.<sup>22</sup> Clearly returning a community's food sovereignty to some degree can bring huge benefit, with the most successful projects proving that it is possible to meet the total demand for vegetables with a home garden.

We therefore conclude that government and/or private institution driven campaigns to promote home gardens can play a significant role in addressing economic and food security challenges. Inciting common cause, whilst avoiding the failings of rigid 'top-down' projects, will be key to successfully transferring packaged methodologies. For doing so in South Africa, we recommend:

- Providing funding for rainwater harvesting systems for home gardens.
- Embracing indigenous knowledge and incorporating crop preferences of local communities.
- Committing to long-term engagement with eventual careful withdrawal accompanied by formation of local committees.
- Evaluation needs to recognise how to target knowledge, planting material and capital dissemination productively.
- Designing proper response to incoming community feedback.
- Gardening being promoted as a national duty to ensure social consolidation and ongoing contact.
- Providing a stable supply of diverse propagation material.
- Provisioning according to gardener inexperience and lack of access to inputs.
- Applying measures of success beyond just yield, such as nutrition profiles, especially in early stages.
- Providing across levels of social differentiation.

## Competing interests

We have no competing interests to declare.

## Authors' contributions

G.C.: Writing the initial draft, review of literature. R.H.: Conceptualisation, writing revisions. M.v.d.L.: Writing revision, validation, conceptualisation.

## References

1. Harrar G, Smith LG, Snyder JC. Victory gardens: Farm. Washington: State College of Washington; 1943.
2. Chihambakwe MT. Deliberative or instrumental participation?: Perceptions of households on the development and implementation of the One Home One Garden programme in KwaMashu Township, [master's thesis]. Durban: University of KwaZulu-Natal; 2014. <http://hdl.handle.net/10413/14396>
3. South African Department of Agriculture, Forestry and Fisheries (DAFF). Trends in the agricultural sector [document on the Internet]. c2018 [cited 2020 Jul 28]. Available from: <https://www.dalrrd.gov.za/Portals/0/Statistics%20and%20Economic%20Analysis/Statistical%20Information/Trends%20in%20the%20Agricultural%20Sector%202018.pdf>
4. Galor O. From stagnation to growth: Unified growth theory. In: Aghion P, Durlauf SN, editors. Handbook of economic growth. Volume 1 part A. Amsterdam: Elsevier; 2005. p. 171–293. [https://doi.org/10.1016/s1574-0684\(05\)01004-x](https://doi.org/10.1016/s1574-0684(05)01004-x)
5. South African Department of Agriculture, Forestry and Fisheries (DAFF). Annual report 2015/16 [document on Internet]. c2016. [cited 2020 Aug 10]. Available from: [https://www.gov.za/sites/default/files/gcis\\_document/201610/daff-annual-report-2015-2016a.pdf](https://www.gov.za/sites/default/files/gcis_document/201610/daff-annual-report-2015-2016a.pdf)
6. Lahiff E, Cousins B. Smallholder agriculture and land reform in South Africa. *IDS Bull.* 2005;36(2):127–131. <https://doi.org/10.1111/j.1759-5436.2005.tb00209.x>
7. Ntombela SM, Bohlmann HR, Kalaba MW. Greening the South Africa's economy could benefit the food sector: Evidence from a carbon tax policy assessment. *Environ Res Econ.* 2019;74(2):891–910. <https://doi.org/10.1007/s10640-019-00352-2>
8. Broadley MR, White PJ. Eats roots and leaves. Can edible horticultural crops address dietary calcium, magnesium and potassium deficiencies? *Proc Nutr Soc.* 2010;69(4):601–612. <https://doi.org/10.1017/s0029665110001588>
9. Odebode S. Assessment of home gardening as a potential source of household income in Adinyele Local Government area of Oyo State. *Niger J Hortic Sci.* 2006;11(1):47–55.
10. Drescher AW, Holmer RJ, Iaquinta DL. Urban homegardens and allotment gardens for sustainable livelihoods: Management strategies and institutional environments. In: Kumar BM, Nair PKR, editors. Tropical homegardens: Advances in agroforestry. Volume 3. Dordrecht: Springer; 2006. p. 317–338. [https://doi.org/10.1007/978-1-4020-4948-4\\_18](https://doi.org/10.1007/978-1-4020-4948-4_18)
11. Peyre A, Guidal A, Wiersum KF, Borgers F. Dynamics of homegarden structure and function in Kerala, India. *Agrofor Syst.* 2006;66(2):101–115. <https://doi.org/10.1007/s10457-005-2919-x>
12. Watkinson E, Makgetla N. South Africa's food security crisis. Report for National Labour and Economic Development Institute [document on the Internet]. c2002 [cited 2020 Aug 13]. Available from: [https://sarpn.org/documents/d0000077/P93\\_safscrisis.pdf](https://sarpn.org/documents/d0000077/P93_safscrisis.pdf)
13. Renzaho A. The need for the right socio-economic and cultural fit in the COVID-19 response in sub-Saharan Africa: Examining demographic, economic political, health, and socio-cultural differentials in COVID-19 morbidity and mortality. *Int J Environ Res Public Health.* 2020;17(10):3445. <https://doi.org/10.3390/ijerph17103445>
14. Ozili PK, Arun T. Spillover of COVID-19: Impact on the global economy [preprint]. *SSRN* 3562570. 2020. <https://doi.org/10.2139/ssrn.3562570>
15. Ataguba JE. COVID-19 pandemic, a war to be won: Understanding its economic implications for Africa. *Appl Health Econ Health Policy.* 2020;18:325–328. <https://doi.org/10.1007/s40258-020-00580-x>
16. Singh JA. How South Africa's Ministerial Advisory Committee on COVID-19 can be optimised. *S Afr Med J.* 2020;110(6):439–442. <https://doi.org/10.7196/SAMJ.2020.v110i6.14911>
17. Baldwin-Ragaven L. Social dimensions of COVID-19 in South Africa: A neglected element of the treatment plan. *Wits J Clin Med.* 2020;2(SI):33. <https://doi.org/10.18772/26180197.2020.v2nsia6>
18. Windfuhr M, Jonsén J. Food sovereignty: Towards democracy in localized food systems. Warwickshire: ITDG Publishing; 2005. <https://doi.org/10.3362/9781780441160>
19. Galhena DH, Freed R, Maredia KM. Home gardens: A promising approach to enhance household food security and wellbeing. *Agric Food Secur.* 2013;2(1):1–13. <https://doi.org/10.1186/2048-7010-2-8>
20. Schupp JL, Sharp JS. Exploring the social bases of home gardening. *Agric Hum Values.* 2012;29(1):93–105. <https://doi.org/10.1007/s10460-011-9321-2>
21. Adekunle OO. The role of home gardens in household food security in Eastern Cape: A case study of three villages in Nkonkobe Municipality. *J Agric Sci.* 2013;5(10):67. <https://doi.org/10.5539/jas.v5n10p67>
22. Faber M, Witten C, Drimie S. Community-based agricultural interventions in the context of food and nutrition security in South Africa. *S Afr J Clin Nutr.* 2011;24(1):21–30. <https://doi.org/10.1080/16070658.2011.11734346>
23. Maunder E, Meaker J. The current and potential contribution of home-grown vegetables to diets in South Africa. *Water SA.* 2007;33(3):401–406. <https://doi.org/10.4314/wsa.v33i3.4914-5>
24. Corburn J, Vlahov D, Mberu B, Riley L, Caiaffa WT, Rashid SF, et al. Slum health: Arresting COVID-19 and improving well-being in urban informal settlements. *J Urban Health.* 2020;97:348–357. <https://doi.org/10.1007/s11524-020-00438-6>
25. Stevano S, Johnston D, Codjoe E. The urban food question in the context of inequality and dietary change: A study of schoolchildren in Accra. *J Dev Stud.* 2020;56(6):1177–1189. <https://doi.org/10.1080/00220388.2019.1632434>
26. Shackleton C, Paumgarten F, Cocks M. Household attributes promote diversity of tree holdings in rural areas, South Africa. *Agrofor Syst.* 2008;72(3):221–230. <https://doi.org/10.1007/s10457-007-9066-5>

27. Nicola M, Alsaifi Z, Sohrabi C, Kerwan A, Al-Jabir A, Iosifidis C, et al. The socio-economic implications of the coronavirus and COVID-19 pandemic: A review. *Int J Surg.* 2020. <https://doi.org/10.1016/j.ijsu.2020.04.018>
28. Asfaw Z. Home gardens in Ethiopia: Some observations and generalizations. In: Watson JW, Eyzaguirre PB, editors. Home gardens and in situ conservation of plant genetic resources in farming systems. Proceedings of the Second International Home Gardens Workshop; 2001 July 17–19; Witzenhausen, Germany. Rome: International Plant Genetic Resources Institute; 2002. p. 125–139. <https://doi.org/10.1017/s0014479702251054>
29. Egerer MH, Lin BB, Threlfall CG, Kendal D. Temperature variability influences urban garden plant richness and gardener water use behavior, but not planting decisions. *Sci Tot Environ.* 2019;646:111–120. <https://doi.org/10.1016/j.scitotenv.2018.07.270>
30. Poot-Pool WS, Van Der Wal H, Flores-Guido S, Pat-Fernández JM, Esparza-Olguín L. Economic stratification differentiates home gardens in the Maya village of Pomuch, México. *Econ Bot.* 2012;66(3):264–275. <https://doi.org/10.1007/s12231-012-9206-3>
31. Martin M, Geiger K, Singhakumara BMP, Ashton MS. Quantitatively characterizing the floristics and structure of a traditional homegarden in a village landscape, Sri Lanka. *Agrofor Syst.* 2019;93(4):1439–1454. <https://doi.org/10.1007/s10457-018-0254-2>
32. Whitney CW, Luedeling E, Tabuti JR, Nyamukuru A, Hensel O, Gebauer J, et al. Crop diversity in homegardens of southwest Uganda and its importance for rural livelihoods. *Agric Hum Health.* 2018;35(2):399–424. <https://doi.org/10.1007/s10460-017-9835-3>
33. Maroyi A. Traditional homegardens and rural livelihoods in Nhema, Zimbabwe: A sustainable agroforestry system. *Int J Sustain Dev Worl Ecol.* 2009;16(1):1–8. <https://doi.org/10.1080/13504500902745895>
34. Drimie S. Food security and HIV/AIDS in southern Africa: Case studies and implications for future policy. Report prepared for Action Aid. Pretoria: HSRC; 2004. <http://repository.hsrc.ac.za/handle/20.500.11910/7219>
35. Drescher A, Hagmann J, Chuma E. Homegardens – a neglected potential for food security and sustainable land management in the communal lands of Zimbabwe. *J Agric Rural Dev Trop Subtrop.* 1999;100(2):163–180.
36. Nair P. Tropical homegardens: A time-tested example of sustainable agroforestry. *Adv Agrofor.* 2006. <https://doi.org/10.1007/978-1-4020-4948-4>
37. Baiyegunhi LJS. Determinants of rainwater harvesting technology (RWHT) adoption for home gardening in Msinga, KwaZulu-Natal, South Africa. *Water SA.* 2015;41(1):33–39. <https://doi.org/10.4314/wsa.v41i1.6>
38. Cousins B, Aliber M. Unworkable land reform project designs offer inappropriate farming models to rural dwellers. Cape Town: PLAAS, University of the Western Cape; 2013.
39. Andrew M, Ainslie A, Shackleton C. Land use and livelihoods: Have they been enhanced through land reform? Cape Town: PLAAS, University of the Western Cape; 2003. [http://repository.uwc.ac.za/xmlui/bitstream/handle/10566/4245/pb\\_5\\_land\\_use\\_rural\\_livelihoods\\_2003.pdf?sequence=1&isAllowed=y](http://repository.uwc.ac.za/xmlui/bitstream/handle/10566/4245/pb_5_land_use_rural_livelihoods_2003.pdf?sequence=1&isAllowed=y)
40. Cole G. Gardening for victory: Victory gardens in American popular periodicals during World War II. *The North Dakota Quarterly.* 1993;61(3):163–176.
41. Sumner J. Plants go to war: A botanical history of World War II. Jefferson, NC: McFarland; 2019.
42. Danoesastro H, editor The role of homegardens as a source of additional daily income. Paper presented at: Seminar on the Ecology of Homegardens III; 1980 October 25–26; Bandung, Indonesia.
43. Svtowa E, Manyahaire I, Makombe P. Sustainable gardening on wetlands in the communal lands of Zimbabwe. *Electron J Environ Agric Food Chem.* 2008;7(3):2754–2760.
44. Buchmann C. Cuban home gardens and their role in social-ecological resilience. *Hum Ecol.* 2009;37(6):705–721. <https://doi.org/10.1007/s10745-009-9283-9>
45. Altieri MA, Companioni N, Cañizares K, Murphy C, Rosset P, Bourque M, et al. The greening of the ‘barrios’: Urban agriculture for food security in Cuba. *Agric Hum Values.* 1999;16(2):131–140. <https://doi.org/10.1023/a:1007545304561>
46. Bellon MR. Conceptualizing interventions to support on-farm genetic resource conservation. *World Develop.* 2004;32(1):159–172. <https://doi.org/10.1016/j.worlddev.2003.04.007>
47. Davies IA, Torrents A. Overcoming institutional voids in subsistence marketplaces: A Zimbabwean entrepreneurial case. *J Macromarketing.* 2017;37(3):255–267. <https://doi.org/10.1177/0276146717698020>
48. Uglov J. A little history of British gardening. London: Pimlico; 2012.
49. Ginn F. Dig for Victory! New histories of wartime gardening in Britain. *J Hist Geogr.* 2012;38(3):294–305. <https://doi.org/10.1016/j.jhg.2012.02.001>
50. Spudić S. The new victory garden. Surrey: Royal Horticultural Society; 2007.
51. Mäkelä L. Gardening opportunities as a part of the Khwe San people’s food security in the East Bwabwata National Park. Helsinki: University of Helsinki; 2018.
52. Boden G. The Khwe and West Caprivi before Namibian independence: Matters of land, labour, power and alliance. *J Namib Studies Hist Polit Cult.* 2009;5:27–71.
53. Mudavanhu C, Zinyandu T, Mudavanhu N, Mazorodze S, Chinyanganya T, Manyani A, et al. Smallholder gardening as a sustainable livelihood strategy in Chikwanda communal lands, Gutu, Zimbabwe. *Glob Adv Res J Peace Gend Develop Stud.* 2012;2(1):1–13.
54. Matsa M, Dzawanda B. Dependency syndrome by communities or insufficient ingestion period by benefactor organizations? The Chirumanzu Caritas Community Gardening Project experience in Zimbabwe. *J Geogr Earth Sci.* 2014;2(1):127–148.
55. Williamson S. The dependency syndrome: Pesticide use by African smallholders: A report for PAN UK’s pesticides poverty and livelihoods project. London: Pesticide Action Network; 2003.
56. Modi AT. A simple model to evaluate integrated vegetable production for food security in KwaZulu-Natal, South Africa. *Food Res Int.* 2015;76(4):946–952. <https://doi.org/10.1016/j.foodres.2015.04.037>
57. Quinn CH, Ziervogel G, Taylor A, Takama T, Thomalla F. Coping with multiple stresses in rural South Africa. *Ecol Society.* 2011;16(3), Art. #2. <https://doi.org/10.5751/es-04216-160302>
58. Devereux S, Maxwell S. Food security in sub-Saharan Africa. London: ITDG Publishing; 2001. <https://doi.org/10.3362/9781780440170.000>
59. Nemli S, Asciogul TK, Kaya HB, Kahraman A, Esiyok D, Tanyolac B. Association mapping for five agronomic traits in the common bean (*Phaseolus vulgaris* L.). *J Sci Food Agric.* 2014;94(15):3141–3151. <https://doi.org/10.1002/jsfa.6664>
60. Hadebe N. The impact of capital endowment on smallholder farmers’ entrepreneurial drive in taking advantage of small-scale irrigation schemes: Case studies from Makhathini and Ndumo B irrigation schemes in KwaZulu-Natal, South Africa [master’s thesis]. Pietermaritzburg: University of KwaZulu-Natal; 2016. [https://ukzn-dspace.ukzn.ac.za/bitstream/handle/10413/13975/Hadebe\\_Nolwazi\\_2016.pdf?sequence=1&isAllowed=y](https://ukzn-dspace.ukzn.ac.za/bitstream/handle/10413/13975/Hadebe_Nolwazi_2016.pdf?sequence=1&isAllowed=y)
61. Shisanya SO, Hendriks SL. The contribution of community gardens to food security in the Maphephetheni. *Develop South Afr.* 2011;28(4):509–526. <https://doi.org/10.1080/0376835x.2011.605568>
62. Mthethwa MN. Urban agriculture in Kwamsane, KwaZulu-Natal community and home gardens as an option for food security and poverty reduction [master’s thesis]. Durban: University of KwaZulu-Natal; 2012. [https://ukzn-dspace.ukzn.ac.za/bitstream/handle/10413/10122/Mthethwa\\_Menziwokuhle\\_Ndumiso\\_2012.pdf?sequence=1&isAllowed=y](https://ukzn-dspace.ukzn.ac.za/bitstream/handle/10413/10122/Mthethwa_Menziwokuhle_Ndumiso_2012.pdf?sequence=1&isAllowed=y)
63. Ghosh AK, Maharjan KL. Kitchen gardening practices through people’s participation: An action research project of three marginalized *bagdi* villages in Bangladesh. *J Int Develop Coop.* 2013;19(4):107–119. Available from: [https://ir.lib.hiroshima-u.ac.jp/files/public/3/35055/2014101620400696602/JIDC\\_19-4\\_107.pdf](https://ir.lib.hiroshima-u.ac.jp/files/public/3/35055/2014101620400696602/JIDC_19-4_107.pdf)
64. Mtshisazwe MS. Investigation of the failure of critical food security community gardens as poverty alleviation projects in Cape Town [master’s thesis]. Cape Town: Cape Peninsula University of Technology; 2018.
65. Zenda SM. A systems approach to marketing in less developed agriculture with reference to Bululwane Irrigation Scheme [master’s thesis]. Alice: University of Fort Hare; 2002. <http://hdl.handle.net/10353/d1001045>

66. Laurie SM, 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(12):2093–2101. <https://doi.org/10.1002/jsfa.3319>
67. Phezisa B. A situational survey of Siyazondla Homestead Food Production Programme and food security, poverty alleviation in selected communities of Nkonkobe local municipality of the Eastern Cape [master's thesis]. Alice: University of Fort Hare; 2016. <http://libdspace.ufh.ac.za/handle/20.500.11837/248>
68. Kubheka BP. Impact assessment of the Siyazondla Homestead Food Production Programme in improving household food security of selected households in the Amathole District, Eastern Cape [master's thesis]. Pietermaritzburg: University of KwaZulu-Natal; 2015.
69. Madyibi Z. The Massive Food Production Programme: Does it work? In: Hebinck P, Cousins B, editors. In the shadow of policy: Everyday practices in South Africa's land and agrarian reform. Johannesburg: Wits University Press; 2013. p. 217–230. <https://doi.org/10.18772/22013107458.22>
70. Rudolph M, Kroll F, Ruysenaar S, Dlamini T. The state of food insecurity in Johannesburg. AFSUN Food Security Series 12. Cape Town: AFSUN; 2016. Available from: <http://www.afsun.org/wp-content/uploads/2016/06/afsun12.pdf>
71. Tesfamariam BY, Owusu-Sekyere E, Emmanuel D, Elizabeth TB. The impact of the homestead food garden programme on food security in South Africa. *Food Secur.* 2018;10(1):95–110. <https://doi.org/10.1007/s12571-017-0756-1>
72. Girard AW, Self JL, McAuliffe C, Olude O. The effects of household food production strategies on the health and nutrition outcomes of women and young children: A systematic review. *Paediatr Perinat Epidemiol.* 2012;26:205–222. <https://doi.org/10.1111/j.1365-3016.2012.01282.x>
73. Kahinda JM, Taigbenou A, Boroto RJ. Domestic rainwater harvesting as an adaptation measure to climate change in South Africa. *Phys Chem Earth.* 2010;35(13–14):742–751. <https://doi.org/10.1016/j.pce.2010.07.004>
74. Hatibu N, Mahoo HF, Gowing JW, Kajiru G, Lazaro E, Mzirai O. Rainwater harvesting for natural resources management: A planning guide for Tanzania. Nairobi: RELMA; 2000.
75. Everson CS, Everson T, Modi A, Csiwila D, Fanadzo M, Naiken V, et al. Sustainable techniques and practices for water harvesting and conservation and their effective application in resource-poor agricultural production through participatory adaptive research [document on the Internet]. c2011 [cited Aug 02]. Available from: [https://www.researchgate.net/profile/Raymond-Auerbach-2/publication/321577153\\_Sustainable\\_techniques\\_and\\_practices\\_for\\_water\\_harvesting\\_and\\_conservation\\_and\\_their\\_effective\\_application\\_in\\_resource-poor\\_agricultural\\_production\\_through\\_participatory\\_adaptive\\_research/links/5a27a36c0f7e9b71dd0cac45/Sustainable-techniques-and-practices-for-water-harvesting-and-conservation-and-their-effective-application-in-resource-poor-agricultural-production-through-participatory-adaptive-research.pdf](https://www.researchgate.net/profile/Raymond-Auerbach-2/publication/321577153_Sustainable_techniques_and_practices_for_water_harvesting_and_conservation_and_their_effective_application_in_resource-poor_agricultural_production_through_participatory_adaptive_research/links/5a27a36c0f7e9b71dd0cac45/Sustainable-techniques-and-practices-for-water-harvesting-and-conservation-and-their-effective-application-in-resource-poor-agricultural-production-through-participatory-adaptive-research.pdf)
76. World Health Organization. Promoting fruit and vegetable consumption around the world. Vienna: WHO Regional office for Europe; 2020. Available from: <https://www.euro.who.int/en/health-topics/disease-prevention/nutrition/activities/technical-support-to-member-states/promoting-fruit-and-vegetable-consumption>