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The significance of African vegetables in ensuring food security for South Africa's rural poor

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Abstract Technologies and services provided to resource-poor farmers need to be relevant and compatible with the context in which they operate. This paper examines the contribution of extension services to the food security of resource-poor farmers in a rural village in South Africa. It considers these in terms of the local context and the production of African vegetables in household food plots. A mixture of participatory, qualitative and quantitative research tools, including a household survey, is used to argue that local production practices contribute more to food security requirements than the extension services. This is because of the ability of African vegetables to grow relatively well in semi-arid areas where other exotic plants do not, their ability to provide at least two foodstuffs during their life cycle, and the ability of either the fruit or the leaves, or both, to be dried and stored for consumption in the winter months. These crops can make a significant contribution in terms of household food security, but a number of social and agroecological factors are constraining their production and placing their availability under threat. Despite this, the extension services remain focused on certain activities within vegetable garden projects, even when these are not meeting their proposed purpose—food security by means of cash-crop production. The paper concludes that social and agroecological constraints could be improved if the extension services were changed. This could include the use of context specific and low-cost technologies to ensure that these crops are able to increase their contribution to household food security for resource-poor farmers in semi-arid areas.

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Introduction

The success of the Green Revolution in parts of Asia was due to the requirements (irrigation, herbicides and pesticides) of the technologies coinciding with the social, economic and ecological context in which the recipient farmers operated. The failure in other areas, particularly in Africa, was largely a result of the application of these technologies within unsuitable (and often unstable) contexts. As Nederlof and Dangbégnon (2007) illustrate, given the complexity of resource-poor agriculture, the context in which it occurs cannot be meaningfully changed to meet the requirements of technologies. Therefore, to be successful, innovations need to be developed in terms of the contexts in which they are to be applied. The importance of farmers' knowledge of their context is recognized (Chambers et al. 1989) and their involvement in the research and technology adaptation processes is now considered crucial (e.g. Scheuermeier et al. 2004). In South Africa, however, acceptance of these two criteria has been rather slow within the public sector agricultural research and extension services (Mazibuko et al. 2007).

Although Provincial Departments of Agriculture are mandated to address food security concerns at household level (DOA 2002), the provision of extension services in the former homelands is largely inadequate and inefficient (DOA 2008), especially for resource-poor farmers (Adey 2007). While it is argued that this situation is predominantly due to financial constraints and a lack of capacity, Adey (2007) has noted other important factors, which are of great concern when services are supposed to address

food insecurity of the rural poor. These include (a) extension officials' ignorance of local context, (b) the subsequent persistence with transferring unsuitable high-external-input oriented technologies, in the belief that these will transform subsistence farmers into commercial producers, and (c) an unwillingness to adapt services (including technologies) to address needs specific to local circumstances.

According to Aliber (2009), approximately 2.5 million households are involved in agricultural production. Most of these reside in the former homelands. While 81% farm to supplement their household food supplies, only about 2% regularly do so as their main income generating activity (ibid). These figures lend support to earlier arguments that most farmers in these areas are resource-poor and cultivate traditional food crops, such as maize, hardy exotic vegetables and their local landraces, predominantly for household consumption (see Nieuwoudt and Groenewald 2003). Agricultural activities are mainly done in poor soils under rain-fed conditions (ibid). Very few households make use of expensive agrochemical inputs, such as inorganic fertilizers, herbicides and pesticides (Adey 2007; Hunter et al. 2007; Vorster and Jansen van Rensburg 2005). Despite this situation, extension services do not appear willing to change their methods and approach, predominantly the transfer of technology (ToT), which is commercially oriented (DOA 2001). To address the needs of resource-poor farmers, technology is required that is sensitive and appropriate to their socioeconomic and agroecological context. Such innovations should take into account what already works and collaborate with farmers to make improvements.

Recent research undertaken in Africa (e.g. Chweya and Eyzaguirre 1999; Schippers 2002) and in South Africa (e.g. Laker 2007) has highlighted the importance of African vegetables to resource-poor farmers and household food supplies. Some of these food plants are actively cultivated, while naturally occurring ones are nurtured in homestead food gardens (food plots), where they appear after the first seasonal rains. They may be indigenous to Africa or they may be exotic vegetables that have been incorporated into the local cropping systems and diet over a number of generations due to several characteristics, which make them suitable to the many contexts in which resource-poor agriculture is practiced:

1. They can be cultivated in semi-arid environments under rain-fed conditions;
2. They do not depend on the intensive use of agrochemicals;
3. Household members prefer the taste of their leaves;
4. These plants can provide the household with at least two sources of food at different times in their life-cycle; and
5. If the leaves, seeds or fruit are dried and stored the household's vegetable supply can be extended well beyond the cropping season.

For poor households, the availability of these plants often means the difference between having and not having access to food (Schippers 2002). However, there is evidence that resource-poor farmers could do with assistance in producing some of these plants (Chweya and Eyzaguirre 1999; Hunter et al. 2007; Laker 2007).

This paper, drawing on evidence from a study of agricultural practices in a village in eastern Limpopo Province, argues that despite the prevalence and significance of African vegetables to local household food supplies, extension activities ignore these crops and local cultivation constraints. Instead, they persist with the transfer of inappropriate technologies that have little benefit for the intended beneficiaries and the village as a whole. However, assistance with local natural resource management, the present neglect of which is impacting negatively on food supplies, could improve overall agricultural production in the area.

African vegetables in South Africa

South African ethnic groups have a tradition of consuming edible plants collected from the wild (Bundy 1988; Parsons 1993). The cultivation and nurturing of a variety of African vegetables in home gardens, particularly in semi-arid areas of the former homelands, is also common practice (Jansen van Rensburg et al. 2007; Laker 2007). According to Jansen van Rensburg et al. (2007) the most common African vegetables found in South Africa are Amaranth/Pigweed (*Amaranthus* spp.), Spider flower (*Cleome gynandra* L.), Jute or Jew's Mallow (*Chorchorus olitorius* and *C. tridens*), Black Jack (*Bidens pilosa* L. *and B. bipinnata* L.), Nightshade (*Solanum nigrum* complex) and Cowpeas (Vigna inguiculata L.). Many hardy exotic vegetables are included under the rubric of African vegetables. In South Africa, these include pumpkins (*Curcubita maxima*, *Curcubita pepo*), sweet potatoes (*Ipomoea batatas*) and bitter melons (*Citrullus lanatus* sp.). Okra (*Abelmoschus esculentus*), is gradually being incorporated into South African rural diets in areas where some water is available (Laker 2007).

Typically, the young leaves of the plants are prepared as a relish, which is consumed as a regular accompaniment to the staple maize porridge. The flavor and nutritional content of the relish is enhanced by adding other parts of the plants, such as seeds, roots, tubers or fruit (Jansen van Rensburg et al. 2007). Nutritionists argue that the inclusion of these plants into the diet increases dietary diversity,

nutrient availability and absorption, contributing to the reduction of under-nutrition (Maunder and Meake (2007)).

The latest food security estimates for South Africa, using different proxies (income measures, anthropometric measures of under-nutrition and experiences of hunger) suggest that between 41% (Stats 2007) and 51.6% (Labadarios et al. 2008) of households are food insecure. A further one out of three households is at risk of becoming food insecure (Labadarios et al. 2008). In light of the high levels of food insecurity in South Africa, Maunder and Meake (2007) called for collaboration between agriculturalists and nutritionists to build on the traditions of crop production and African vegetable consumption. They argue that given the widespread consumption of these vegetables amongst those most vulnerable to food insecurity (the elderly, women and children), collaboration will improve the nutritional content of the diet in poor rural households. However, they warn that insufficient yields from some varieties and subsequent low consumption patterns decrease the potential for this improvement in some areas. Ecologists report that poor natural resource management, subsequent erosion and increasing population densities are reducing the diversity and quantities of these plants found in the wild. In areas where these conditions prevail, people access and consume low quantities of these plants (Hunter et al. 2007; Twine et al. 2003).

Such observations have resulted in calls for improved assistance to rural communities with regard to natural resource management, a greater focus on the local cultivation of these plants, and development of improved varieties and production methods (Hunter et al. 2007; Laker 2007; Vorster et al. 2003; Vorster and Jansen van Rensburg 2005). Despite the available evidence and arguments, the public sector agricultural extension service in South Africa has not taken cognizance of the importance of African vegetables to household food supplies and security.

Methods

Within the broad context of food production and the contribution of African vegetables to local food supply the research intended to achieve the following: (a) develop an understanding of local cropping practices used in food production; (b) identify the food crops produced and the reasons for their selection; (c) determine the extent to which these were cultivated and consumed in the village; and (d) investigate the influence of agricultural extension services on food production practices. As project participants are usually the intended beneficiaries of extension services, their perceptions as well as those of non-participants were sought. Given this focus, a combination of qualitative, quantitative and participatory research methods and techniques were used for data collection. These methods complemented one another and allowed for the triangulation of data from different sources. This mix of research methods is acceptable (Babbie and Mouton 2001) and is encouraged in development oriented agricultural research (Mettrick 1993). Furthermore, this approach allowed for a richer comprehension of the local social, economic and ecological situation, than if only one particular method had been used.

Following preliminary visits to villages in the area and discussions with traditional leaders and Limpopo Provincial Department of Agriculture and Environment (LPDAE) officials, the rural village of Molati was selected as the field site for several reasons. It is situated in the former homeland of Gazankulu in the Mopane District of Limpopo Province. Mopane District is characterized by at least 71% of the population living in poverty and this particular part is classified as a semi-arid zone with limited potential for agricultural production (AGIS 2008). Annual average rainfall is low at around 500 mm and pan evaporation is relatively high at between 2001 and 2200 mm^{a-1} (ibid). Local residents identified several types of African vegetables during the preliminary visit. Agricultural extension services had been present in the village since 1985, providing a suitable setting to determine their contribution to the use of these plants.

The study was conducted between January 2005 and June 2006, with the author making a follow-up visit in August 2008. The author, a social anthropologist, was assisted by two fieldworkers and a vegetable scientist. The latter was responsible for identifying the African vegetables. One of the fieldworkers was permanently based in the village during the study and the rest of the team made monthly field visits, occasionally living in the village, in order to conduct the fieldwork and better understand the socio-economic and agroecological context.

Ten participatory workshops were held in the village and at the extension projects. The Participatory Rural Appraisal (PRA) tools used in the workshops included timelines, seasonal calendars, transect-walks, trend-lines and various matrices for scoring and ranking purposes. The purpose of the workshops was to obtain a local perspective, on the following: (a) the history of the village and the extension-supported vegetable projects; (b) local agricultural practices and constraints; (c) the types of crops produced and consumed; (d) seasonal data; and (e) to develop a socioeconomic and agroecological picture of the village. A total of 42 people (two males and forty females) from the village attended the workshops. The local extension officer attended most workshops.

During June 2005, quantitative data was collected by means of a random sample survey of 108 of the 800 households in the village. The sample size of 13.5% was

based on the number of households evident from aerial photographs taken in 2003. The purpose of the survey was to obtain household demographics and data relating to the cultivation, consumption and significance of African vegetables as a foodstuff. Data collected at initial workshops and during interviews informed the design of a questionnaire with 72 items. Workshop participants recommended the month of June as the most suitable period for the survey. Although the African vegetable production season was over, recent production and harvest information would still be available. Permission for the survey was obtained from the local headman (*Nduna*). The two fieldworkers administered the questionnaire to the household members responsible for household food production, harvest and preparation. Given household dynamics during the survey, 93% of the respondents were female and 7% were male, with only 3% of respondents having no role in food production and preparation. SPSS version 14 was used to generate a random sample of households and to analyse the descriptive statistics obtained from the household survey.

Official rainfall figures for the surrounding area are based on annual averages over a ten-year period. The actual rainfall for the village is not monitored by official sources. To obtain more specific rainfall data, the fieldworker living in the village recorded this daily, from mid-April 2005 until the end of April 2006. Readings were taken at 8am every morning and then the instruments were reset.

Qualitative research tools were used for deeper exploration of the data from the survey and the workshops and to pick up on information that is not always forthcoming at participatory workshops (Nelson and Wright 1997). Specific tools included participant observation of residents' agricultural practices in home gardens and vegetable projects, semi-structured and informal interviews related to local agricultural activities and socioeconomic and ecological circumstances. These activities involved some of the men and women who attended the workshops, as well as a number of others unable to attend the workshops. Twenty-two semi-structured interviews were conducted. Ten of the interviewees (seven males and three females) had not attended any of the participatory workshops. Included in the semi-structured interviews were two extension officials and one private agricultural trainer. Informal interviews and participant observation sessions were typically carried out during the course of the research team's interaction with residents and no specific appointments were made for these visits. Most of the participant observation sessions on agricultural practices were conducted during the planting and growing season between November 2005 and March 2006. Six households agreed to be involved in maintaining household food diaries at certain periods, to illustrate seasonal trends in household food consumption. Problems were experienced with this process and diaries were only obtained from three households.

Socioeconomic and agroecological context

Given that agricultural activities and their success are to a large extent dependant on farmers' access to the means (resources) of production, this section describes the general socioeconomic and agroecological situation in the village of Molati. Basic services (such as water), extension services, livelihood and income sources, climatic conditions and the natural resource base are covered.

Access to basic services

As with most rural villages in the former homelands of South Africa the services supplied to Molati are minimal and confined to basic health, education, sanitation and water, all of which are provided by different government departments. Although electricity is available, local residents cannot afford the installation costs. Consequently, households rely on paraffin and locally harvested firewood for cooking and lighting purposes. Four boreholes, with diesel pumps supply the domestic water to communal stand-pipes.

Access to potable water is a serious problem in the village. The survey indicated that 75% of the respondents traveled more than one hundred meters in order to collect water for household purposes, an activity mainly carried out by women and children. A number of residents accessed household water from nearby summer streams because of the frequent congestion at communal standpipes. Supply from the boreholes was erratic with pumps breaking and local "pump-men" failing to switch on the pumps on the scheduled days. Pressure on the communal standpipes is such that, after water is collected for domestic purposes, there is no time to collect water for irrigation purposes. While 11% of households had a standpipe in their homestead, which they shared with neighbors, only 6% acknowledged using this water to irrigate some of the crops in their food plots.

The vegetable garden projects

Since 1985 the Gazankulu Department of Agriculture and its successor after 1994, the Limpopo Provincial Department of Agriculture and Environment (LPDAE), has supported two vegetable garden projects in the village. At the time of the study only thirty-two people (thirty women and two men) from thirty households were active in these projects. Participants are encouraged to grow cash crops such as spinach, cabbage, onions, beetroot, carrots, green

peppers, tomatoes and green beans. The local extension officer spends one day per week at each project, providing advice on exotic vegetable production and the use of agrochemical inputs. This person facilitates participants' access to project inputs, infrastructure and training. The latter emphasizes farm budgets, cash crop management and plant propagation. Over the years the extension services, directly or indirectly, have provided the projects with plant material, agrochemicals, two boreholes, four borehole pumps (two of which have been stolen), water storage tanks, irrigation piping, and fencing. According to the extension officer, the focus on the vegetable garden projects means that services only reach those participating in the projects.

Sources of income and livelihoods

Most households in this village are poor with 83% having a monthly income of less than R2000.00 per month.[1] Slightly less than 50% of households were in abject poverty with a monthly income of less than R1000.00. By their own admission 49% of households reported experiencing hunger or not having sufficient income to purchase enough food for the household during the 12 months prior to the survey. Table 1 summarizes the various livelihood sources available to village residents. It indicates that employment outside of the village and state grants are the main regular sources of household income. Almost 46% of households have a member who is employed regularly throughout the year. Seasonal employment on neighboring citrus farms and packaging sheds is highest during the late autumn and winter months, from mid-May until mid-September. This provides 20% of households with an extra income during this period. Few people are employed in seasonal work outside of this period.

Although widespread (83% of households are recipients) and regular, state social grants are relatively small, especially given the mean household size of almost five members. In 2005 old age pensioners (women of 60 years and men of 65 years) and disabled people received R810.00 per month. Households with children up to the age of 14 years were eligible for R180.00 per qualifying child per month as a child support grant. These amounts are small and were used for a range of expenses, from purchasing groceries and food to contributing to health and education. Very few households spent any income on agricultural activities.

Agricultural production was the most widespread livelihood activity with 90% of households cultivating crops in homestead food plots and 59% producing livestock—mainly poultry. Food plots were on average 853 m^2 in size, with the smallest being 100 m^2 and the largest being 4550 m^2. For most households agriculture was not a source of income. 83% of those who cultivated crops did so to provide an extra source of food for the household. Crops cultivated included maize and African vegetables with 61% of households growing small quantities of fruit, such as paw-paw (papaya), marula (*Sclerocarya birrea*), avocado, litchi and mango. Women were responsible for household food production on food plots. A handful of men and even fewer women accessed larger fields surrounding the village (approximately one hectare in size). These producers reported that they predominantly intercropped maize with groundnuts or cowpeas or cucurbits,[2] in order to generate a little extra income for themselves, but that invariably most of these crops were consumed by the household.

Most households only owned handheld agricultural implements such as spades and hoes. Only one household owned a tractor and a plough, which were sometimes hired by a few households to prepare the larger fields. Fewer than 7% of the households owned donkeys and ploughs that were hired out at between R60 and R80 per span, depending on the size of the food plot. Many women used handheld implements to prepare the soil because they could not afford to hire donkeys.

Rainfall patterns

Most rainfall occurs in the summer months from November to April. Rainfall readings taken during the study indicated that 891 mm fell during the 12-month period from April 2005 until the end of March 2006. While 22 mm fell during April, from May to October there was no rainfall. The bulk of the rain that fell between November 2005 and March 2006 (867 mm) was considered much higher than normal by local residents. This figure is also more than one-and-a-half times the official average of 500 mm per annum, for the surrounding area. Villagers reported that the 2005/2006 season was also characterized by a delay in the start of the season as the first rains normally fell in September. The above patterns are due to the El Nino and La Nina weather patterns experienced during this period and official figures are probably closer to the norm. While many households reported better yields as a result of the

[1] At the time of the study US$ 1.00 was equivalent to ZAR 7.00. With an average household size of 4.77 members 83% of the residents would be living on less than US$2 per day and 49% would be living on less than US$1 per day.

[2] Intercropping was the norm on fields and in home gardens. Villagers argued that this was necessary for two reasons. Firstly, the small sizes of their fields and gardens meant the only way to their efficient? use of the land was to intercrop. Secondly, they argued that intercropping as practiced by them restored nutrients to the soil and that certain crops grew well together.

Table 1 Household livelihood sources

Household livelihood sources	Percent
At least one member with some form of employment	66
A member with full-time employment	*22*
A member with regular part-time employment	*24*
A member with seasonal employment (predominantly in the winter months—May to September)	*20*
State grant recipient households	83
State old-age pension	*24*
State child grant or disability grant	*59*
Remittances from temporary migrants	22
Remittances from family member permanently living away from village	7
Collecting wild edible plants	7
Hunting, trapping or collecting wild animals and insects	3
Collecting and selling firewood	2
Agricultural activities	90
Production of crops	*90*
Extra source of household food	*83*
Primary source of household food	*5*
Extra source of income	*2*
Production of livestock	*59*
Extra source of household food	*29*
Primary source of household food	*26*
Extra source of income	*4*
Other livelihood sources—including resale of crops/ groceries and making traditional beer	5

Italic values add up to the previous non-italic value

heavier rains, others reported flood damage to crops and increased erosion, which is likely to negatively affect crop production in the future.

Natural resource base

The natural resource base is being depleted as a result of the mismanagement of the commons. There is extensive and unmanaged harvesting of firewood and overgrazing of livestock, especially unattended goats, donkeys and cattle. A visit during winter 2008 indicated that barren areas in the village had increased and that numerous trees on the surrounding hills had been harvested for firewood. There were some plans to reduce overgrazing, but it was said that this was hard to enforce in winter, as livestock died because forage in any form at this time of the year was generally scarce. Measures included tethering livestock and rotating them on a daily basis so that they were not able to overgraze one particular area. However, not everybody complied with this practice and during the study very few tethered livestock were actually seen on the commons and grazing areas were seldom rotated. During workshops, participants reported that since the 1960s the increase in the number of households, the number of residents and the demand for agricultural land and pasture had placed great strain on the natural resource base.

Erosion is exacerbating the situation. The village is situated on a sloping terrain (13–20% slope according to AGIS 2008), backed by foothills. Rainfall erosivity is considered to be high in this area, estimated between 701 and 800 mm (ibid). Rainfall during the summer thunderstorms is hard, but generally short in duration. Water rushes down the hills, through the village and removes the topsoil in the fields and homestead gardens. This has a significant negative impact on soil availability, fertility and the presence of seeds of the self-seeding plants in the area. Some areas were virtually free of vegetation throughout the study period. Transect walks indicated places where gullies were becoming increasingly wider. While villagers and extension services are aware of the current situation and the impact it will have on the natural resource base and the ability to produce food in the future, nobody is taking the lead in concertedly addressing the causes or ameliorating their effects.

This picture of the local context is stark. Villagers do not have the resources to engage in high input agricultural production. Almost half are food insecure and reportedly do not have sufficient income to purchase food, with the result that households experience hunger. Despite a cash crop emphasis by extension services, village agricultural activities are primarily carried out to supplement the household food supply. This is done under relatively harsh conditions in which rainfall is unpredictable and soil fertility is declining. As a result, household agricultural production concentrates on crops that are known to fare well in the semi-arid conditions that prevail, and for which local producers have developed cropping practices deemed appropriate to their situation. The majority of these food crops are those labeled African vegetables.

African vegetables in Molati

Village residents compiled a list of 33 different plants, of which the young leaves and fruit were prepared and consumed as a relish. However, only 24 were identified during the study and these are listed in Table 2 along with the parts of the plants consumed and the percentage of households that cultivated them. Villagers considered groundnuts (A*rachis hypogaea*) and bambara groundnuts (*Vigna subterranean L.*) to fall within the category of African vegetables. While the leaves of these plants are not actually consumed, the nuts are considered an essential component of most local relishes and are almost always only eaten as such or as a snack. Of the surveyed households, 95% had African vegetables in their homestead gardens at some stage during the twelve months preceding

Table 2 Identified naturally occurring and cultivated African vegetables in Molati village

	Tsonga name	Common name	*Latin name*	% Households actively cultivating	Parts consumed fresh	% Households drying & storing leaves
Naturally occurring or nurtured						
1	Muxiji	Blackjack	*Bidens pilosa* L. *and B. bipinnata* L.	–	Leaves	47%
2	Guxe	Jews/Jutes Mallow	*Corchorus tridens*	4%	Leaves	88%
3	Xiyakayana	Wild gherkin	*Cucumus anguria*	3%	Leaves	34%
4	Gumbu-gumbu	Milk Thistle	*Sonchus oleraceus*	–	Leaves	–
5	Nkaka	Balsam pear	*Momordica balsamina*	5%	Leaves	42%
6	Vilolo	Purple flower	*Talinum* sp	–	Leaves	–
7	Rirhudzu	Spiderflower plant/cat's whiskers	*Cleome gynandra* L.	4%	Leaves	43%
8	Thyeke	Amaranth	*Amaranthus grassians/ spinosum/cruentus*	1%	Leaves	43%
9	Sindza mbita	Meidebossie	*Waltheria indica*	–	Leaves	–
10	Nkeketi	Wild Bindweed	*Convolvulus farinosus*	–	Leaves	–
11	Vurhakarhaka	Wild gherkin	*Cucumus* sp	5%	Leaves and fruit	18%
Actively cultivated						
12	Tinhwembe	Pumpkin/Squash	*Cucurbita sp.* (often local landrace of *C. pepo*)	79%	Leaves, fruit and flowers	95%
13	Tinyawa	Cowpeas	*Vigna unguiculata*	74%	Leaves and fruit	74%
14	Marhanga	Calabash/Bottle gourd	*Lagenaria siceraria*	40%	Leaves and fruit	9%
15	Mandhanda	Okra	*Abelmoschus esculentus*	40%	Leaves and fruit	19%
16	Makalavatla	Bitter melon	*Citrullus lanatus var lanatus*	31%	Leaves and fruit	21%
17	Mihlata	Sweet Potato	*Ipomoea batatas*	28%	Leaves and tubers	1%
18	Mariwa	Tsamma	*Citrullus lanatus*	20%	Leaves and fruit	–
19	Biriviri	Local Chilli	*Capsicum frutescens* L.	22%	Fruit	–
20	Phuphuruka	Kale	*Brassica oleracea* L./ *Sabellica* L.	8%	Leaves	–
21	Mapampunu	Boerpampoen	*Cucurbita maxima*	10%	Fruit	–
22	Ntsumbula	Cassava/Manioc	*Manihot esculentum*	25%	Leaves and tubers	–
23	Timanga	Peanut/Groundnut	*Arachis hypogaea*	22%	Nuts	–
24	Tindluwa	Bambara Groundnut	*Vigna subterranean* L.	20%	Nuts	–

the survey. For various reasons, the remaining 5% did not make use of their food plots during this period.[3] Those residents who had African vegetables in their food plots said that these either occurred naturally (95%) or were actively cultivated (79%).

Naturally occurring plants

Table 2 lists 11 of the naturally occurring African vegetables found in the village. Another nine plants were mentioned but the research team was unable to identify any of these and they are not reported. Of these 11 identified plants, wild gherkin (*Cucumis anguria*) is the only one of which both the fruit and leaves are consumed. The survey indicated that 82% of households encouraged and nurtured naturally occurring African vegetables. This was mainly done by allowing the plants to remain in the food plot after germination. If there were too many plants in one place, or if they threatened the growth of a cultivated crop they would be removed. Less than 6% of households actually cultivated any of these plants. Those women who did, would collect and save the seed, broadcasting it in areas where they wanted the plant. The predominant practice in most households was to allow the naturally occurring African vegetables to flower and reseed themselves at the end of the growth cycle.

[3] Reasons included (a) insufficient funds for purchasing fencing materials to enclose food plots and protect them from roaming livestock, and (b) no time to work in food plots.

Cultivated plants

Most of the households (79%) cultivated a range of other vegetable plants. Although many of these are hardy exotic vegetables they were also categorized as African vegetables, because of their integral part in the local food culture. Thirteen of these plants are listed in Table 2 and the seeds (or vines, as in the case of sweet potato) were sown or broadcast at the time of plowing. Fertilization practices varied amongst the households and largely depended on the household's resources, especially access to fertilizer, manure and compost. All households reported turning over the soil and working the previous season's crop residues into the soil prior to the first rain. Only those owning livestock that supplied sufficient manure reported working manure into the soil. A very small number of households (6%) added inorganic fertilizer mixes. Manure, compost and fertilizer might be spread on the soil a few weeks prior to or immediately before plowing. According to a few households, cucurbits, okra and kale might be watered during the first month. All other cultivated and naturally occurring African vegetables relied exclusively on rainfall. Despite the exotic origin of a number of these plants, commercial herbicides and pesticides were not used during cultivation. In the food plots weed management was limited, as many of the so-called weeds were consumed as African vegetables. Pest control was also limited to the extent that it was only done in very small food plots, as it involved the removal of the pest by hand.

The seeds of many cultivated African vegetables are available at the agricultural cooperative in the nearby town. However, many women reported preferring to save and store seeds, as this not only saved money but also allowed them to select the best seeds for storage and replanting. Consequently, a number of the more entrenched cultivated African vegetables were local landraces. Seeds were usually replaced if they were damaged during storage or if the yields appeared to be declining, despite sufficient rainfall. Women reported exchanging seeds amongst themselves but acknowledged that if many people were short of seed then people usually purchased seed from the cooperative. Okra and kale had only been introduced to the village, by other farmers, in recent years. These seeds could not be purchased at the cooperative. Despite the increasing popularity of these two crops, most people reported that seed-saving practices were poor with only about four women saving seeds and supplying to the others.

Prioritization of African vegetables

The most important and popular African vegetables provided a household with more than one foodstuff during the plant's lifecycle, such as cucurbits, cowpeas and okra. Second place was given to those plants, the leaves of which could be dried and stored for consumption during late autumn and the winter months. Perceived nutritional value and the ability of the plant to be drought tolerant to some degree were given subsequent priority. Taste became a preference after these factors. The ability to provide the household with foodstuff over a protracted period of time, under local conditions, determined the popularity and importance attributed to a plant.

Survey data supported this pattern, with 95% of households indicating that both cultivated and naturally occurring African vegetables were essential foodstuffs. More than 90% of the surveyed households cited the following reasons for the local importance attributed to African vegetables: (a) they are believed to be nutritious (98%); (b) they grow relatively well under local conditions and do not require irrigation (97%); (c) their taste is preferable to that of similar exotic vegetables such as cabbage and spinach (96%); (d) some can be easily dried and stored for consumption during the winter months when they are not freshly available (94%); and (e) they are locally available in much greater quantities than similar exotic vegetables (90%).

Consumption patterns

During the survey all of the respondents reported eating African vegetables at some stage during the preceding twelve months. Slightly more than 72% of the households reported generally consuming African vegetables twice a day. Maize porridge was consumed twice a day by 89% of the households. When they could afford to do so, households would consume meat with maize porridge.[4] Food diary recording and observations indicated that meat was seldom consumed more than twice a week. On the other hand, vegetables were consumed at most midday and evening meals. However, if meat was available African vegetables were not consumed.

The leaves of some of the African vegetables were often dried and stored for consumption during winter months. The types of leaves that are dried and stored and the percentage of households that did so are included in Table 2. For most households (94%), dried leaves were the main source of vegetables in winter when fresh vegetables were scarce. Nobody reported being able to successfully dry and store the leaves of exotic vegetables such as cabbage and spinach.

[4] Although a preference, red meat was seldom consumed. Chicken (mainly necks, head and feet) and fish (mainly canned fish or fish heads) were most often consumed. The regularity of consuming any type of meat depended largely on a household's access to small livestock (poultry) and income, as most meat was purchased.

Table 3 Seasonal consumption patterns of African vegetable fresh and dried leaves

Crop	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug[a]	Sept[a]
Jute mallow	F	F	F	F	F	F	F	F	D	D	D	D
Pumpkin	D	D	F	F	F	F	F	D	D	D	D	D
Cowpeas				F	F	F	D	D	D	D	D	
Balsam pear		F	F	F	F	F	F	D	D	D	D	
Okra			F	F	F	F	F	D	D	D	D	
Spiderflower		F	F	D								
Amaranth		F	F	D								
Black jack		F	F	D								

D Dried, *F* Fresh, *Blank Space* Not consumed in any form

[a] Low to non-existent stock

The quantities and frequency of African vegetable consumption is probably less during winter, when households rely on their supplies of dried African vegetables. These supplies are dependent on how much is harvested, dried and stored during summer. Very few households harvest sufficient quantities to store for the entire dry season. Stocks were generally depleted two months before the next summer rains, indicating that they were consumed for approximately four months after the summer rainfall season. Table 3 illustrates the seasonal consumption patterns of some African vegetables, the leaves of which were eaten fresh and dried.

In autumn and winter, when some households had at least one member doing seasonal work on the citrus plantations, residents indicated that cabbages were often purchased and consumed with maize porridge to diversify their diet. This seasonal increase in income allowed some households to purchase other food stuffs in limited quantities, which diversified their diet. The limited food diary exercise suggested that dried African vegetables could contribute up to about 80% of the total vegetable consumption of some households in winter, especially the poorer households.[5] In summer this figure was closer to 95%, given the greater availability of these foodstuffs. Wealthier households appeared to consume lower amounts during both seasons.

The significance of African vegetables in household food security

As many as 95% of the households identified African vegetables as important to their annual food supply. A major reason for this was the fact that they were easier to produce under local socioeconomic and agroecological conditions. During workshops it was reported that local people grew up with these crops and had developed the knowledge to produce, dry and store them. On the other hand, most exotic vegetables were recent additions to the food basket and they had to be purchased as the local situation was not conducive to their production. Only 3% of households grew exotic vegetables. This was attributed to the scarcity of water for irrigation and the high cost of other necessary production inputs. Most people believed that if these inputs were not used then the exotic crops would fail.

During discussions on household food security, the general impression was that the importance attributed to African vegetables differed vastly from household to household. Households without a constant income tended to be more reliant on African vegetables during summer and winter. This was especially true for households where unemployment was high, where children no longer qualified for child support grants and adults were not yet eligible for state old age pensions. In South Africa, food is generally more expensive in the rural areas and own production means that households can use scarce income for other requirements.

Declining availability of African vegetables

Despite local popularity and significance for household food supplies, trend diagrams and the transect walks illustrated that the relative availability of African vegetables had decreased since the 1960s. Some older participants were of the opinion that there were at most half the amount of African vegetable plants growing wild in the veldt than in the 1960s. Reduced plant diversity was apparent, with several plants either not found in fields or the acknowledgement that these were no longer growing in the area. This decline was attributed to population increase, overgrazing by livestock, erosion, and erratic rainfall patterns. Older residents noted that consumption patterns had changed over time, with the gradual inclusion of crops

[5] Observations indicated that quantities consumed, rather than regularity, decreased over the winter period as women tried to extend the supply until the summer rains.

identified as exotic vegetables into the diet and the decline in the availability of naturally occurring African vegetables on the commons. Very few plants are now actually harvested in the wild. Most identified African vegetables are typically found in home gardens where they receive some conservation given their contribution to household food supplies (see also Twine et al. 2003; Hunter et al. 2007). However, it is likely that the availability of naturally occurring plants as foodstuff will continue to decline. Very few households actually save the seeds of these plants and over-consumption, without actively replenishing the seedbed, will pose a serious threat to food security. Local residents will either have to conserve these plants or they will need to rely on the few hardy exotic plants that become integrated into the local food culture, the seeds of which are available from commercial suppliers. Other research (Twine et al. 2003) suggests that plants that are not used and are not actively looked after, decline in number. Given the preference of the youth for exotic vegetables, such as spinach and cabbage, based on their taste, it is unlikely that they will actively conserve the seeds of naturally occurring African vegetables. The typical perception in urban areas and amongst the youth, that these crops are 'the food of the poor', is also unlikely to prompt the next generation of producers to conserve these crops.[6] However, the elderly argue that taste should not be the only requirement as many African vegetables are higher in nutrition than the preferred exotic alternatives. Household food plots would seem like a good starting point for the conservation and improvement of the yields of African vegetables.

Besides the human role in seed selection and saving, poor water and land management practices are leading to erosion, which constrain the conservation of African vegetables in the village. Human intervention in some of these factors could help conserve the local availability of these plants. However, the extension services that could assist in this are confined to the two vegetable garden projects and appear narrow in their focus.

Realigning the extension services

LPDAE extension services are limited to promoting cash crops and the transfer of conventional technology within the confines of the two vegetable projects.[7] The emphasis of the projects is to improve local food security by getting the few participant farmers to cultivate cash crops for sale to local supermarkets. The technology and purpose are inappropriate to those outside of the projects; meanwhile, less than 5% of households have ever been involved in the projects. The services within the projects are also inadequate due to water constraints, which prevent the cultivation of cash crops at the project and also at home. Both projects had their irrigation pumps stolen; one in 1991 and the other in 2004. While both have received new pumps in 2005 and 2006, these are largely ineffective. In August 2008 one had not been connected because the LPDAE refuses to pay the few hundred rand required to fit the new pump to the old borehole mechanism. The other is a weak pump and cannot irrigate a plot larger than 400 m^2, but it is required to irrigate more than two hectares of land in order for the project to be economically viable.

Without irrigation water, villagers can only grow 'traditional food'—maize and the African vegetables described. The cultivation of these crops was actually encouraged at the vegetable project sites when the irrigation pumps did not function. Besides providing the households involved with extra land to cultivate crops for home consumption, it enabled the extension service to regularly report that the projects remained active, despite irrigation problems.

A local trainer reported that attempts at establishing home-nurseries of exotic vegetables were severely constrained by a lack of water in the area and the inability of villagers to cultivate these crops at home. Project participants explained that they could not cultivate exotic crops in their food plots for a number of reasons:

1. They never had access to irrigation water at home;
2. The exotic crops required numerous inputs, without which they would not grow;
3. Plant spacing and monocropping requirements meant that less could be planted and subsequently harvested—land was not optimally used;
4. The inputs are too expensive for virtually all the households; and
5. The crops they selected grew far better under local conditions during most seasons and low-input practices reduced risk.

A few women reported that the production of traditional foods was important for food supply and was an important part of their 'traditional way of life'. It was not something they would willingly give up completely. The study suggested that while by no means always a positive practice, local agricultural production was contributing more to household food security in the village than the two extension-supported projects were contributing to their members.

The extension services do not appear to be able to see their contribution beyond the projects. While there are a

[6] Despite their preference for exotic vegetables the youth acknowledged having to consume African vegetables as their socioeconomic and ecological circumstances prevented them from purchasing or producing the preferred exotic vegetables most of the time.

[7] Conventional technology here involves the cultivation of monocropped, hybrid varieties, requiring irrigation and which is managed using inorganic fertilizer, pesticide and herbicide.

number of areas where support and assistance could be provided to improve the general state of agricultural production and the natural resource base in the village, the confinement of activities to vegetable projects ignores this. It is argued that by moving their focus beyond the vegetable projects and to include a focus on the broader management of natural resources, the extension services could contribute more to agricultural development and food security in the village.

A focus on food plots and associated practices could well support local food security initiatives. Such a focus may also bring about the conservation of African vegetables and also expose resource-poor farmers to hardy exotic crops, which could grow well under the current conditions. This could increase diversity and also the duration over which fresh plant products could be harvested. The introduction of suitable harvesting practices could extend the duration over which the young leaves of African vegetables could be harvested from a single plant.

Extension services should attempt to intervene in the problem of overgrazing. However, this is an institutional problem and requires that the extension services are both gender sensitive and able to work with heterogeneous groups. Generally, extension officials in South Africa have a low level of qualification (Düvel 2004) and group work is not a strong feature. Therefore, it is suggested that if extension services only confined themselves to technical aspects they could still make an improvement to the important ecological issue of water management. This would reduce erosion in some instances and would also improve in-field, surface and roof-top rain water harvesting (RWH). If done appropriately RWH could enable households to extend their production periods and manage the water which currently goes to waste and causes ecological damage.

A few female residents tried to control water run-off by erecting stone bunds and digging furrows. However, rather than collecting the water or controlling the flow, these methods tended only to divert the water away from these homesteads towards others and the gravel roads, causing down-stream problems. Extension services could contribute here by identifying appropriate methods so that the water run-off is used efficiently and does not cause down-stream problems.

In the smaller home gardens it was observed that people did not plough across the slope. Inadvertently, much of the rainwater ran down the slope, without penetrating the soil sufficiently. While intercropping may contribute to erosion control, under this practice it is not efficient. Villagers had no knowledge of simple but effective water management technologies, such as grass strips, planting pits, semi-circular pits, earth basins and raised beds. Similarly there was no use of household grey water for crop production. Water management could improve production and allow for the cultivation of certain crops during autumn, thereby extending the supply of fresh food by another month or two.

Despite the potential for rooftop rainwater harvesting, it is not practiced. Almost 92% of the main dwellings had sloping corrugated zinc roofs but none had gutters or storage tanks. During heavy downpours a few households would place small containers underneath the roofs to collect runoff water. However, this was ineffective and the small amounts of water harvested were used for domestic requirements. The simple technology to utilize this potential exists and has been tested under various conditions in South Africa. Extension services would need to transfer and adapt the most appropriate of these technologies in conjunction with the resource-poor farmers.

Conclusions

Government attempts at food security in this particular rural village (and in many similar villages) are inadequate, as the exotic vegetables they promote cannot be cultivated without functioning boreholes and irrigation systems. Similarly, the promotion of such crops includes the use of expensive inputs, which many people cannot afford. Despite the widespread cultivation of African vegetables and traditional crops, no support is given to improve their production. In fact, they are seemingly ignored and only permitted on 'official' extension projects when the irrigation systems are inoperable and nothing else can grow. The study illustrates that African vegetables are locally considered to be significant to household food security, providing the household with access to a variety of vegetables, in and out of season.

However, it is disconcerting that despite their significance and regular consumption, just under half of the households experienced a food shortage at some time during the twelve months prior to the survey. Qualitative data suggests that this is largely due to reduced availability of African vegetables, which in turn leads to reduced consumption of both fresh and dried African vegetables. Some of the reasons for reduced production, harvest and consumption are social (over-consumption and lack of efficient seed saving and replanting) and some are ecological (erratic rainfall and erosion) and some are a combination of both, such as the mismanagement of water and grazing on the commons. Perhaps more striking and more damaging is the fourth reason, an apparent lack of support by the extension services.[8] Although extension projects are

[8] Extension officers and their activities are embedded in a hierarchical bureaucratic structure and as such their activities are often highly dependent on national and provincial policies, objectives and budgets.

failing to deliver in terms of their intended purpose, officials do not consider ways in which they could generally improve the local situation. It is almost as if the ecological and socioeconomic circumstances (semi-arid conditions, poverty, and food insecurity) beyond the project fences are inconsequential, although they are cited as the very reasons for conceptualizing and supporting the projects in the beginning. Unfortunately, even the basic technologies transferred at the projects cannot be used at home because they and the promoted crops are not compatible with the circumstances surrounding food plot production. Under the circumstances described here, African vegetables appear to be a more appropriate crop for local production.

If African vegetables are to be promoted as sustainable contributors to household food security of poor agrarian households in semi-arid rural areas, then these constraints will need to be addressed. If not, the existing conditions are likely to result in the further decline of the presence of African vegetables, as well as the local ability to cultivate them.

In light of the importance attached by rural inhabitants to these plants as foodstuffs, their cultural significance and the fact that they are the most predominant vegetables consumed by elderly adults, women and young children (all categorized as vulnerable groups), their conservation and cultivation should be supported by public research and extension services. Such support needs to consider local peoples' socio-economic and agroecological circumstances. This could include testing the various inexpensive water management strategies cited, with the producers. Soil reclamation and conservation technologies can also be adapted in conjunction with producers and their environment to improve soil fertility. The introduction of similar and hardy plants and the development of improved varieties, which take climate change into consideration without affecting the plants' value as a foodstuff, are further options worth considering.

Support and development that requires high inputs is not suitable as most households are unable to afford these. The ability of African vegetables to grow relatively well in semi-arid environments without the use of expensive inputs is the main reason that these crops are found in home gardens. Given that so many rural households in South Africa's semi-arid areas grow these crops because they cannot grow alternative exotic vegetables, if these species were to disappear many households would face a food security crisis more severe than the recent one, which was brought about by the high prices of cash crops. Like their forefathers, many Africans continue to survive by consuming African vegetables. Possibly, the only difference is that they now have to cultivate many of these plants.

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Footnote 8 continued

These determine the focus and content of services. While some officials may see areas of concern and the significance of redirecting services towards these, they are largely powerless to change the focus of the current services due to policy design (see DOA 2001) and budget constraints. Criticisms are directed at the extension service as a whole and not at individual officials.

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