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LOCAL KNOWLEDGE AND AGRICULTURAL APPLICATIONS: LESSONS FROM A UGANDAN PARISH

T.G.B. Hart[1]

Correspondence author: TGB Hart, URED, HSRC, Private Bag X41, Pretoria, 0001, Tel: +27 12 302 2721, Email: thart@hsrc.ac.za.

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ABSTRACT

A multidisciplinary team of agricultural researchers worked with residents of a rural parish in south-western Uganda to generate local knowledge about the diverse use of plants identified as African vegetables. While some were sold at the commercial fresh produce market in Kampala most were cultivated for household consumption. Some plants had properties which, when planted in specific ways, could improve the fertilisation of farmers' marginal soils and protect their crops from pests. By focusing on people's local knowledge research and extension officials became aware of the importance of this knowledge for production purposes. The research illustrates, by using African vegetables as an example that it is important to focus on local knowledge in order to understand observed practices; including gender responsibilities. Such practices are largely governed by people's socio-economic and agro-ecological circumstances. In such contexts the utilisation of local resources are important. Understanding can enable agricultural professionals to optimise the integration of local knowledge in agricultural development.

1. INTRODUCTION

Wolf (1986) indicates that at least 300 million people living in sub-Saharan Africa are dependent on resource-poor agriculture for their livelihoods and that often this is their main source of household food. Despite their social, economic and agro-ecological circumstances and the oft inadequacy of conventional agricultural development models

[1] *URED, HSRC, Private Bag X41, Pretoria, 0001, Tel: +27 12 302 2721, Email: thart@hsrc.ac.za.*

and technology to address these (Stoop & Hart 2005), farmers living under such conditions have managed to survive; usually by virtue of their own initiatives. Agricultural and development professionals have attempted to understand this situation. Some have argued that survival and often growth is a result of farmers' utilizing indigenous or local knowledge[2], their flexibility and ability to adapt to changing circumstances by virtue of local innovations (Reintjies *et al,* 1993, Scoones & Thompson, 1994, Van Veldhuizen *et al,* 1997 and Waters-Bayer & Van Veldhuizen 2004). According to Mettrick (1993), historically, local knowledge and farmer experimentation has contributed to major developments in agriculture. These include the domestication of crops and livestock, the development of animal traction, and the dissemination of species around the world.

During the 1990s and early 21st century a number of African based studies emphasized the increased importance that rural and urban African communities attach to crops generally identified as African vegetables[3] (Chweya & Eyzaguirre, 1999, Hart & Vorster, 2006, Raemakers, 2001, Rubaihayo, 1995, Rubaihayo 2002 and Schippers, 2000). These crops are usually produced by rural households and consumed at meal times, to some degree providing households with a measure of immediate and self-produced food security. While some have higher nutrition levels than commonly consumed exotic crops

[2] *In this discussion I use the term local knowledge rather than indigenous knowledge. People often assume that indigenous knowledge is static, excluding the influence of external sources of knowledge, and is confined to the original inhabitants of an area, despite the fact that these might change over-time and is distinct from scientific knowledge. Warren (1991), correctly, argues that indigenous knowledge is that which local people in a specific area have developed overtime and which they continue to develop as a result of their experience and exposure to other sources of knowledge. Such knowledge is not static and nor is it confined to the 'original' inhabitants of an area; rather it is locally and continually developed (Grenier 1998; IIRR 1996; Langill 1999; Warren 1992) and as Pottier (2003) notes the distinction between science and local knowledge is not clear as knowledge is never free from the context in which it is produced. My use of local knowledge refers to knowledge that is non-static, locally and continuously developed.*

[3] *While discussing the complexity and difficulty of defining indigenous vegetables Schippers (2000) uses the term exclusively for those plants that originated in Africa. Here I use the more inclusive term African vegetables to discuss plants and plant parts that are incorporated into African agricultural and food systems, irrespective of their origin. Local residents use this more inclusive definition.*

others are attributed with having medicinal properties. However, little is known about their other properties and their importance in African agriculture. As a result of this situation and the historical lack of official research on these crops and a subsequent lack of knowledge on the part of the extension services (Rubaihayo, 2002) a group of Ugandan and South African researchers agreed to collaborate on a multi-year and multi-sited project that would determine the nutritional value and diversity of crops labelled as African vegetables. It was believed that such a study would lead to a greater awareness of the benefits of these crops and their importance in local farming and food systems.

The first phase of the research concerned the identification of African vegetable crops and the recording of local knowledge and practices relating to their cultivation and use in eight parishes in Uganda. The historical lack of official interest and research on these crops resulted in rural producers being the custodians of most of the knowledge pertaining to the cultivation and use of African vegetables, making it imperative that they participate in any intervention involving African vegetables. Local knowledge was seen as the starting point due to the scarcity of official research data and because numerous professionals working in Africa have argued the importance of local knowledge as a source of useful information and as a significant cornerstone in smallholder agricultural development (Chambers *et al*, 1989, IIRR, 1996, Langill, 1999, Langill & Ndathi, 1998, Mettrick, 1993, Reijntjes *et al*, 1993, Scoones & Thompson, 1994a, Torkelsson & Anandajayasekeram, 2000). To ensure dialogue with local residents the team made use of Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA) tools as suggested by Grenier (1998). The study reported here concentrates on the results of the first phase of the study and concerns a single rural parish of Luganda speakers situated some 50 km southwest of Kampala[4].

Using African vegetables as an example, this paper argues that local knowledge is important to understanding household food security, local resource utilisation, farmers' cropping systems and agricultural practices. Local knowledge is related to historical and current

[4] *A parish is the second lowest tier of local government in Uganda and typically consists of number of villages. A village is the lowest level. This parish consisted of 8 villages.*

circumstances and therefore also relevant for future agricultural development interventions. For interventions to be relevant it must be understood by extension and research actors.

2. RESEARCH METHODOLOGY AND TOOLS

From the 1970s onwards various agricultural development practitioners promoted the use of participatory research methods as complementary methods, when undertaking agricultural research in collaboration with rural residents, enabling them to understand and make use of local knowledge (Chambers *et al*, 1989, Donnelly-Roark, 1998, Grenier, 1998 and Scoones & Thompson, 1994). In line with this approach the research team initially considered the use of the long-term Participatory Rural Appraisal method (PRA). However, given various constraints relating to resources, such as time, finances, human resources, etc., the research team decided to use the quicker and more extractive Rapid Rural Appraisal method (RRA) with the understanding that the recommendation was that from the second phase it be succeeded with a more participatory and long-term approach such as Participatory Technology Development (PTD) as postulated by Van Veldhuizen *et al* (1997) or Participatory Innovation Development (PID) as outlined by Waters-Bayer & Van Veldhuizen (2004). The use of the RRA method was considered acceptable because, like PRA, it is able to contextualize the vast amount of relevant knowledge that is generated in a research project of this kind. The following RRA and PRA tools were used to elicit and record information during interactions with local farmers:

- Time lines;
- Social and natural resource maps;
- Livelihood maps;
- Transect walks;
- Pair-wise ranking matrices;
- Trend lines and charts;
- Seasonal calendars;
- Bar graphs and pie charts; and
- Various matrices.

Further information and triangulation was achieved by conducting semi-structured interviews with district agricultural officials, parish chairpersons and local farmers.

The multidisciplinary research team, which carried out research in this parish, consisted of six researchers from the following scientific disciplines:

1. Agricultural Economist
2. Agricultural Engineer
3. Social Anthropologist
4. Plant Breeder
5. Nutritional Biochemist
6. Postgraduate Agricultural Economics student

The local extension officer was also part of the team and introduced the team to the village.

Due to the various resource constraints the team spent four and a half days in this parish as part of the process of generating and recording local knowledge data. About seventy males and females of various ages participated in the study. While interactive workshops were the main means of generating and sharing information, some residents who did not attend the workshops were visited and interviewed during the course of the transect walks.

3. AFRICAN VEGETABLES AND FOOD SECURITY

3.1 Overview

In East, West and Southern Africa African vegetables are important household food security. This is for immediate consumption and, increasingly, for commercial sales (Schippers, 2000). These crops are prepared in various ways and are typically consumed as a relish which complements common staples such as rice, maize porridge, millet, highland cooking bananas ('Matoke'), sorghum and occasionally with meat (Chweya & Eyzaguirre, 1999 and Rubaihayo, 2002). In Uganda these vegetables are increasingly important as foodstuffs for both rural and urban residents, following increased trends in urbanization and associated urban demands for cheaper alternatives to exotic vegetables (TUAN, 1999). According to parish farmers their importance as food is attributed to the following commonly perceived characteristics:

- They grow easily, as they require less external inputs such as mechanization and agro-chemicals. Some are also believed to be more drought tolerant than exotic vegetables;

- Cultivation practices are generally adapted to locally available resources and in line with sustainable agriculture principles while continually adapted to meet changing circumstances;

- Some are more nutritious than commonly consumed exotic vegetables, such as lettuce, spinach, cabbage, etc.;

- In urban areas they are cheaper to purchase than these exotic vegetables;

- They are an important part of local food culture.

Prior to the 1970s, parish farmers predominantly produced African vegetable crops for home consumption. These crops were not found in urban markets. At that time local farmers did not produce exotic vegetables, such as cabbages, carrots, lettuce, etc. These were produced on plantations and mainly consumed by the European and Asian populations, or exported. The vegetables produced and consumed by the rural African population were considered traditional/indigenous African vegetables for at least two reasons.

1. While some plants were actively cropped, others were readily available and harvested in their natural habitat, lending some support to the idea of their 'indigenousness', although strictly speaking, many are found worldwide and originate outside Africa (Hart 2004).

2. Many of these plants had been consumed for countless generations, signifying their importance in local culture. In some instances, the fruit, leaves and roots of a plant were consumed.

During the latter part of the colonial period, farmers had started producing crops such as coffee, mangoes, avocadoes, oranges and pineapples for commercial purposes. However, like exotic vegetables, the bulk was produced on European plantations and these parish farmers received virtually no extension support until the late 1990s. The

researchers undertaking the current study were the first to enter this parish. Parish farmers reported that the Amin regime encouraged African farmers to produce exotic vegetables for commercial purposes. This practice still continues. Farmers indicated that the cultivation of exotic vegetables as a cash crop was constantly increasing due to market demand in Kampala, with more and more land allocated for cultivation. This is a result of perceived political stability, recent developments in tourism and commerce that encourage the subsequent increase in international visitors from around the world and the associated demand for exotic vegetables. During the study it was observed that about 90% of the residents produced vegetables and other crops. While many of the crops grown were for household consumption, the allocation of agricultural resources for producing non-staples, such as vegetables, went primarily to those with commercial value.

3.2 Demand

The demand for African vegetables has also increased to some extent. Since Ugandan independence in 1962, the number of people living in Kampala and other urban centres has increased. Most of these new urban residents came from the rural areas. Their presence brought about a demand for traditional vegetables and resulted in a number of popular varieties being grown as cash crops for the urban markets. These include Doodo (*Amaranthus blitum*), Ejobyo (*Cleome gynandra*) and Nakati (*Solanum aethiopicum*). This demand is directly related to migrants' preferences and the lower prices charged for African vegetables in comparison to prices charged for exotic vegetables. According to Rubaihayo (2002) and Rubaihayo *et al* (2003) the diet of the average Ugandan rural dwellers is deficient in vitamins A, B and C, proteins and minerals such as calcium, iron, riboflavin and iodine that are needed for normal growth. African vegetables can supply many of these vitamins, proteins and minerals (FAO, 1998 and Rubaihayo, 2002) if they are produced and consumed in sufficient quantities. Many producers and consumers believe that these vegetables are more nutritious than exotic vegetables such as carrots, cabbage, lettuce, etc. Recent research by the International Plant Genetic Resources Institute (IPGRI) in Kenya has substantiated this for some African vegetables. In Table 1 five popular African vegetables are compared with cabbage (the control) as it is often consumed when these vegetables are not available. Generally, and also evidenced in Table 1 African vegetables are more

Table 1: Comparison of the nutritional content of five African vegetables and one domesticated vegetable

	Amaranth *Amaranthus sp.*	**Spider plant** *Cleome gynandra*	**Cowpea leaves** *Vigna inguiculata*	**Jute/Jews mallow** *Corchorus olitorius*	**Pumpkin leaves** *Cucurbita maxima*	**Cabbage** *Brassica oleracea var. capitata*
Iron (mg)	8.9	6.0	3.9	6.3	15.9	0.7
Protein (g)	4.6	4.8	4.1	5.2	4.2	1.7
Moisture (%)	84.0	86.6	87.6	81.0	87.3	91.4
Calories	42	34				26
Carbohydrates (g)	8.2	5.2	6.8	10.3	5.0	6.0
Fibre (g)	1.8					1.2
Ascorbic acids/ Vit C (mg)	64	13				54
Calcium (mg)	410	288	221.1	548.5	382.9	47
Phosphorus (mg)	103	111	80.1	136.4	119.2	40
ß-carotene/Vit A (mg)	5716		2249.35	3662.99	1694.55	100
Thiamine	0.05		0.05	0.07	0.12	0.04
Riboflavin	0.42					0.1
Folic acid (mg/ 100g)	122		107	90		

Source: *Adapted from Food and Agricultural Organisation of the United Nations, University of Pretoria and University of the North West.)*

nutritious than similar exotic vegetable counterparts. This is important as most of these vegetables are grown by poor rural households and are cheaper to purchase in urban areas in contrast to exotic vegetables, making them an important source of nutrition for the most vulnerable members of the population; the rural and urban poor. Given this situation the nutritional deficiency indicated by Rubaihayo *et al* (2003) could be alleviated if production was improved and consumption increased. Production of African vegetables for commercial sales takes precedence illustrating that production for household food security is not the first priority when resources are allocated to production. So, while African vegetables are produced locally the amounts produced seem to be insufficient to provide for adequate household consumption that can significantly impact on existing nutrition deficiency.

3.3 Versatility

In many cases the increased cultivation of exotic vegetables has resulted in parts of these plants being labelled as African vegetables because of their inclusion into the local food culture. This has been particularly so for the leaves of exotic vegetables which were initially cultivated for their fruit or roots. An example of this is the common green bean (*Phaseolus vulgaris*). The leaves are considered to be African vegetables and go by the local name of 'Esisiboza'. The actual fruit, or beans, are considered to be exotic vegetables and known as common green beans. Most farmers reported that they generally did not eat exotic vegetables (in this case the green beans). In practice they usually sold the beans and consumed the leaves, thereby ensuring that the plant simultaneously provided for commercial and household purposes. Only when similar African vegetables were scarce did the farmers eat the beans. In other instances farmers consumed the different parts of the plant at different times during its lifecycle. In the case of the cowpea plant (*Vigna unguiculata*) the ripe and unripe fruit were consumed. The unripe pods were identified as the African vegetable 'Empinde enganda'. The pumpkin plant (*Cucurbita maxima*) presented a mixture of these two cases as the young green leaves were known as 'Esunsa', while the unripe pumpkins were known as 'Ensuju'. *Cucurbita maxima* plants are exotic and were initially cultivated for their fruit; the ripe pumpkins. However, they are hardy and fairly drought tolerant, thus they grow better than some other crops during dry seasons. This, along with the preferred taste of the leaves and unripe pumpkins, has resulted

in it being a popular food bearing plant in marginal agro-ecological zones in southern, eastern and central Africa (Chweya & Eyzaguirre 1999). Consequently it has become an important part of the local diet.

The numerous culturally accepted edible parts derived from a single plant supplies local farmers and consumers with a constant supply of diverse and nutritious fresh vegetables at different times during a particular plant's lifecycle. This aids local food security endeavours. By eating the different parts of the plants at different growth stages farmers and local residents have, to a limited extent, also overcome the need to process and store the vegetables. However, in many cases the leaves of the plants were dried in the sun and stored for use in times when African vegetables are generally scarce. It seems that food security, consumption and livelihood considerations have resulted in many exotic vegetables being identified as African vegetables.

4. THE IMPORTANCE OF LOCAL RESOURCES

4.1 Significance

Parish farmers generally used and managed local resources whereby they 'mimicked' nature. They tended to follow low external input sustainable agricultural principles in that they used local materials for making poles and ropes, for constructing nurseries and for protecting seedling beds. This implies that any agricultural development in the parish and in areas where similar circumstances prevail should concentrate on the use of low external input sustainable agricultural principles in preference to high external input usage as is generally promoted by the conventional research and extension model. Availability and use of local resources is important. In this parish some commercial farmers followed the conventional approach to some extent (but at no time exclusively), as this was the currently imparted extension message for producing exotic crops. However, the farmers' predominant use of local resources as agricultural inputs contrasted with this approach. Conventionally, the developed and transferred technology depends almost exclusively on externally derived inputs, the success of which is determined by their application in favourable conditions and environments. The high costs of conventional agricultural inputs prevented many people from buying them. Households needed to spend money on education and health services

and goods that they could not produce. In this parish locally available plant and other resources were used in a number of interesting ways to overcome the lack of external inputs. These are discussed below.

4.2 Crop protection

While local farmers use some external inputs and conventional farming practices when cultivating both African and exotic vegetables for commercial purposes, they mainly use locally developed and available inputs to cultivate African vegetables for household consumption, i.e. to meet household food consumption requirements. In order to control the pests and diseases affecting African vegetables the farmers used various homemade solutions that included combinations of the following ingredients: ash; urine; water; acacia leaves; cannabis leaves and chilli peppers. Sometimes, onion or garlic plants were planted as border crops around plant beds in order to prevent pests from attacking the plants in the beds. Farmers reported that the knowledge on how to do this was passed down from generation to generation and was adapted as needed. When undertaking commercial vegetable production some farmers made use of limited external technical inputs. They purchased the agro-chemicals Dithane® and Ambush®, when they could afford these. However, farmers indicated that neither local remedies nor external agro-chemicals proved to be as effective as they desired. Given that farmers did not experience tangible results with the use of the agro-chemicals it is possible that because the agro-chemicals were expensive and scarce commodities they applied them incorrectly in attempts to extend their availability, irrespective of whether they used them on African or exotic vegetables[2]. Only a few commercial farmers in this parish could afford agro-chemicals and other external inputs. The remainder relied exclusively on traditional practices and their own innovations, using the resources at hand.

4.3 Cropping practices

Farmers regularly practice the use of hedgerows, multistorey-cropping and companion planting. While these act as means of pest control they

[5] *One farmer reported using DITHANE®, a fungicide, as a means of pest control, thereby explaining its ineffectiveness when used on both exotic and traditional vegetables. This also suggests that local farmers have more knowledge about local inputs as opposed to external inputs.*

also provide shade, windbreaks, trap water and reduced erosion. Crops grown in this fashion provide foodstuffs and fuel for the household and occasionally extra income. The seasonal organic matter from such crops is used to provide mulching which has the benefit of conserving water and controlling weeds. While natural decomposition returns nutrients to the soil and increases the organic content of the soil it can also be used as compost for fertilization purposes. In this regard some farmers had compost pits and were using raised planting beds that were filled with compost in-between seasons to ensure their readiness for planting in the next cropping season.

Intensive mixing and intercropping of different crops were common, as this allowed farmers to spread their risk – the failure of one crop would not necessarily result in the failure of the other crops. Failure of a monocrop would bring about complete failure of the system resulting in no food and no income. Farmers argued that such practices also allowed them to maximize the use of the scarce land resources at their disposal and to reduce soil erosion and weeds. This meant that they spent less time on weed control, while having an extra means to control erosion and water loss. By controlling erosion and topsoil run-off the farmers were able to conserve some of the soil nutrients. The more commercially oriented farmers, especially those who grew a lot of exotic vegetables and African vegetables for sale in Kampala, predominantly practised mono-cropping. However, this is different to what is found on the more industrialised farming estates as the size of each mono-cropped area was relatively small involving a couple of square meters, rather than acres or hectares. Also the crop was often planted at different temporal and spatial intervals in these separate areas in order to extend the growing and harvesting seasons. In some instances crops from different families are planted in separate areas and seasonally rotated. Farmers said that this system enabled them to manage their production output and to fertilize the soil, without purchasing inputs.

4.4 Fertilization

The scarcity of sufficient land resources prevented farmers from resting the land in between seasons. They had to develop alternative methods for restoring the nutrients lost after planting and harvesting. However, animal manure was seldom used to fertilize the soil. As a result of the political unrest that characterized this area during the period between

the 1970s and the 1990s virtually all livestock were decimated. Some farmers were in the process of re-populating their herds but most did not have enough animals to follow manuring practices that depended on livestock. The alternative has been the development of the green manuring and fertilization practices.

Farmers practised various methods of fertilization, including slash and burn agriculture, working and reworking organic material into the plant beds before planting and after harvest, composting and the rotation of crops. Through a process of self-experimentation, farmers found that by reworking organic plant matter into the soil after harvest, they improved the nutrient content of the soil. This was evident from the fact that vegetable crops planted in soil in which organic matter had been reworked had a higher yield than the same crops planted in soil in which no organic matter had been reworked. After further experimentation, the farmers concluded that when the organic matter of African vegetable crops was reworked into the soil, the subsequent yield was greater than when organic matter from exotic vegetables or other crops was worked into the soil. However, farmers realized that some harvesting practices (the uprooting of the entire pant, as opposed to the picking of the fruit and leaves) reduced the post-harvest availability of sufficient organic matter in the form of crop residues, necessitating an alternative solution for beds in which such crops were grown.

In order to restore nutrients into the soil farmers rotated various exotic vegetables with African vegetables. Through a process of experimentation they observed that the former crops grew better when this was done. Experimenting with crop rotation led farmers to believe that this activity provided benefits to the soil and improved the yields of crops planted in such a fashion, in contrast to when crops were not rotated in this fashion. Further experimentation led the farmers to conclude that by rotating specific exotic vegetable with specific African vegetable, the result was that the exotic vegetable crops grew better and produced a higher yield in comparison to when they were planted in soil that had not previously hosted these African vegetables.

Parish farmers gave the example of rotating green beans (*Phaseolus vulgarus*), 'Ebugga' or amaranth (*Amaranthus dubius*), and tomatoes (*Lycopersicum lycopersicon*) in this order because the amaranth seems to

add beneficial properties to the soil that improves the growth of the other two crops. Farmers believed that amaranth neutralizes the soil when it is planted after the green beans, and in so doing prepared the soil for the tomatoes. They informed researchers that certain exotic and African vegetables extracted nutrients from the soil. These nutrients are essential to the continued optimal growth of these crops. The rotation of specific traditional and exotic vegetables seemed to allow their yields to remain good when they were subsequently planted, in comparison to when no such rotation pattern was employed. In some cases the combination of exotic and African vegetables seemed to support each others development and optimal growth. With regard to the crop rotation system described, *amaranthus sp.* is known to suppress root-knot nematode populations (a major pest for tomatoes) in the soil. It is clear that farmers observed the effects of the different plants on one another, but what is not clear is what is actually happening in scientific terms – are the crops acting as a fertilizer or a pesticide (biofumigation)? Thus, understanding local knowledge not only explains what farmers were doing and why, but also illustrates areas that require further research in conjunction with farmers.

4.5 Labour resources and practices

African vegetable cultivation is labour intensive. The scarcity of livestock and financial resources meant that local farmers did not have access to mechanized or animal traction implements. Only the wealthy had livestock, such as cattle, that could be used to draw implements. However, none of the farmers interviewed had implements and did all the necessary cultivation and harvesting activities using simple handheld implements such as hoes and knives (*machetes*). Any attempt to promote agricultural practices requiring mechanical or animal traction would be problematic in this parish given the existing situation regarding resources such as livestock, implements and finances. Even if such implements were provided the lack of resources to operate and maintain them would make their use unsustainable.

While most households were responsible for the labour they required for production, a system of exchange had developed between wealthier and poorer households. This was particularly so for the landless who exchanged labour for food, housing or wages.

A gender-based division of labour that was influenced by the amount of physical strength required to perform a particular task was evident. Men did those activities that required greater physical strength, such as clearing of new land prior to the first planting – especially the removal of rocks and trees. Women were expected to carryout the seasonal preparation of land and to do regular weeding. They were also expected to collect water for household use and ensure that livestock, such as sheep, rabbits and pigs, were watered and fed. Some of these tasks were delegated to their children. However, men retained control over the use of larger livestock such as sheep due to their higher commercial value.

At those homesteads where African vegetables were predominantly cultivated for commercial purposes the men harvested the commercial crops. They also accompanied these crops to the Kampala market and were responsible for the sales at this market. This effectively denied women access to the market and to the subsequent income.

5. SOME LESSONS

A few significant lessons can be drawn from this study of the use of local knowledge in the production of African vegetables:

- African vegetables include those parts of exotic vegetable plants which are not typically consumed by Europeans. In many cases these are the leaves or unripe fruit. The term is not exclusively applied to plants of African origin as many originated elsewhere and have become adapted to the local environment.

- African vegetables are an important resource in promoting food security, nutrition and for deriving an income. They are also significant in maintaining soil quality ensuring that agriculture can continue to contribute towards food security.

- By means of experimentation farmers are able to identify important properties of both traditional and exotic vegetables that make combined production mutually beneficial, while simultaneously improving soil quality.

- The constraints of expensive modern agricultural inputs do not necessarily prevent farmers from effectively producing marketable crops, in fact such constraints can encourage them to seek alternatives and innovate using local resources. In this parish farmers introduced location specific improvements through minimal or no use of external inputs, such as mineral fertilizers and other agro-chemicals to improve pest control, soil structure, water holding capacity and control erosion.

- Farmers continually innovate to solve problems. In this case farmers could improve the soil by working crop residues and organic matter into the planting beds but when organic matter was scarce an alternative method, crop rotation, was identified and fine tuned through means of further self-experimentation.

- Gender roles are often split to accommodate the physical requirements of tasks and also the commercial significance of the products derived from agriculture.

- Agricultural development would be best served by educating researchers and extensionists in the significance, complexity and usefulness of local knowledge. This is not only relevant to the production of African vegetables but also applies to other crops, which in this parish included vanilla, bananas, cassava, avocados, groundnuts and papaya.

6. CONCLUSION

In marginal agro-ecological areas, such as this parish, where local peoples' socio-economic circumstances are generally poor certain non-commodity crops, loosely termed African vegetables, are important for household food security and nutrition. However, given their commercial significance they are also important for generating an income to purchase other needed goods and services. This means that commercial production takes primary priority in the allocation of production resources so that less are available for producing for household consumption. The presence of African vegetables, along with farmers' experimentations and subsequent innovations, enable farmers to improve crop production for both exotic and African vegetables without, or with limited use of, expensive conventional agricultural

inputs. While certain cropping practices indicate improvement in crop production, the precise reasons for this are not always clear. Given the widespread occurrence of these plants and their use as foodstuffs for Africa's poor there is a need for further research to uncover what is occurring in scientific terms, enabling a move beyond farmer observed changes. This verification process is necessary so that, if warranted, the results can be replicated by extension in similar areas where such plants are grown, if local farmers are not already using these techniques. Similarly, where appropriate further research can be developed to build on or improve these practices in order to improve production and consumption of those African vegetables that are scarce or are sold. This could alleviate nutrition deficiencies experienced by rural dwellers.

The information obtained from the farmers in the parish strongly suggests that in the absence of conventional inputs, local knowledge about, access to and experimentation with local resources, in particular natural resources, allowed farmers to improve their production of some crops, which they consider important to their livelihoods. This was done despite poor socio-economic and environmental conditions.

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