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**HIV/AIDS impacts on commercial-orientation in home garden cultivation: a case study of rural Ghana**

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**Abstract**

Recent studies on home gardens have focused on their potential in enhancing food security in rural households in HIV/AIDS affliction. Their role in contributing to cash income has received relatively limited research attention. This study assessed the extent of variations and similarities in crop species composition and diversity, availability of products and external inputs used in commercially and subsistence oriented home gardens cultivated in rural households in HIV/AIDS and non-HIV/AIDS affliction in the Eastern region of Ghana and discussed their significance in food security. Commercially oriented and subsistence oriented home gardens of a purposive sample of 32 HIV/AIDS and a random sample of 48 non-HIV/AIDS afflicted rural households were surveyed. Seventy-five crop species consisting of 49 food crops and 26 other species were identified. Seventeen species were found in all four home garden types and twenty eight species were found solely in one home garden type. In HIV/AIDS affliction, commercially oriented home gardens cultivated were significantly larger, had more species and individual plants, and also had more perennials and species that were harvested throughout the year, evenness was lower but there was no significant difference in species diversity compared with subsistence oriented home gardens. Chemical fertilizer was used in a higher proportion of commercially oriented home gardens. HIV/AIDS affliction had no effects within the subsistence oriented home garden category. Rural households in HIV/AIDS affliction aim for a dual purpose home garden in cultivating commercial home gardens by cultivating crop species to meet subsistence food needs in addition to cash income and have better food security.

Keywords: subsistence-oriented home gardens, HIV/AIDS affliction, species composition, species diversity, home garden products, external inputs

**Introduction**

Recent studies on home gardens have focused on their potential in enhancing food security in HIV/AIDS afflicted rural households. Their role in contributing to cash income has received relatively limited research attention (High and Shackleton, 2000; Akrofi *et al.*, 2008; Murphy, 2008). Among the African rural poor, home gardens are

strategic in ensuring household food security by offering diversity in diet and providing cash income (Aigeelaagbe *et al.*, 1998; High and Shackleton, 2000; Garí, 2003; Barany *et al.*, 2004). In the situation of HIV/AIDS affliction in rural households, labour is constrained due to ill-health or the need to divert time to care for the sick which impacts household food availability and income earning ability (Broomberg *et al.*, 1991; De Waal and Tumushabe 2003; Murphy, 2008). Home garden cultivation then assumes an important role due to proximity to the home stead, diversity in crop species and flexible labour requirements (Garí, 2003). Home gardens in the Eastern Region of Ghana are either extensively cultivated for subsistence or intensively managed for commercial production (Asare *et al.*, 1990; Bennet-Lartery *et al.*, 2001). A Household's engagement in home garden production for subsistence or income generation has varied effects on species diversity in home gardens (Trinh *et al.*, 2003). Empirical information on home gardens cultivated by HIV/AIDS afflicted rural households where products are mainly for subsistence or for cash income is limited. This paper presents the results of a study assessing the extent of differences and similarities in crop species composition, availability of products and external inputs used in commercial and non-commercial home gardens of HIV/AIDS and non-HIV/AIDS afflicted rural households in the Eastern Region of Ghana and discusses the implication for household food security.

### **Materials and methods**

The study was conducted in 17 rural communities in the moist and dry semi-deciduous forest zone of the Eastern Region of Ghana. The area is characterized by a bi-modal rainfall pattern with average annual rainfall ranging between 1250 mm and 1800 mm. The forest soils of the region support the cultivation of high-value cash crops such as cocoa, oil palm and citrus, and food crops such as maize, cassava and vegetables.

HIV/AIDS afflicted household in this study referred to a household where at least one member suffered from confirmed HIV/AIDS infection, whilst a non-HIV/AIDS afflicted household was one in which no member was known to have HIV/AIDS infection (Barnett and Blaikie, 1992). A home garden was defined as commercially oriented when 50% or more of the produce of one or more types of crop produce was cultivated mainly for cash income, and was defined as subsistence oriented when for all crop species less than 50% was sold. Data were collected through a home garden survey of a purposively selected sample of commercially and subsistence oriented home gardens of 32 HIV/AIDS afflicted rural households and a random sample of 48 non-HIV/AIDS afflicted rural households. Information obtained from the survey included household livelihoods and dietary intake. In-depth interviews were conducted with a selection of households of the four home garden types.

The proportion of each home garden type in which a species was found, expressed as a percentage, was used as a quantitative indicator of the presence of the crop species (Zaldivar *et al.*, 2001). The ecological indices species richness (which represents the number of species per home garden), species diversity, the Shannon-Wiener Index (which indicates the overall crop species diversity in each home garden), evenness (which indicates the relative abundance of each species) and Sørensen's Index of Similarity (indicating the degree of similarity in crop species composition between home garden types cultivated in HIV/AIDS and non-HIV/AIDS affliction) were estimated to quantify the diversity of the crops in each home garden (see also Frankel *et al.*, 1995; Gautam *et*

*al.*, 2008). The Shannon-Wiener Index (H'), Evenness (E) and the Sørensen's Index of Similarity (SI) were calculated as given by Magurran (1988). Crop species were assigned to one of the four harvesting periods: rainy season only, dry season only, both rainy and dry seasons, and all year round based on gardeners' and botanist's information and literature (Irvine, 1969; Burkill and Dalzie, 1985-1997).

## **Results and discussion**

Seventy-five crop species consisting of 49 food crops and 26 non-food species which belong to 40 families were recorded across the home gardens surveyed (Appendix I). A greater proportion of the species present in all four home garden types consisted of food crops (vegetables, root and tubers, fruits) which could suggest similar dietary habits between households (Shrestha *et al.*, 2001; Lengkeek, 2004). A significantly higher proportion of commercially oriented home gardens had cocoa and oil palm trees, the major cash crops in the study area, compared with subsistence oriented home gardens (27% and 4%, and 60% and 12%, respectively). This could be due to the high producer price of cocoa and the importance given to oil palm as a major source of edible oil and a key agro-industrial crop (Gyasi, 1994; Amanor and Diderutuah, 2001). There was a moderately high Sørensen's similarity index between crop species composition in commercially and subsistence oriented home gardens in both HIV/AIDS and non-HIV/AIDS affliction which implies a high level of species similarity. This is attributed to the home gardens being located in the same agroecological zone where variations in temperature rainfall and humidity are minimal (Fernandes and Nair, 1986; Castinêiras *et al.*, 2001). Seventeen species including the food crops plantain (*Musa sapientum*) and the African oil palm (*Elaeis guineensis*), yam (*Dioscorea* spp.) and pineapple (*Ananas comosus*) were present in all four home garden types. These crop species are vegetatively propagated species and planting materials are easily available; besides cultivation is easy, minimum care is required in management of these crops and products are available all year round. Twenty eight species were found solely in one home garden type; these were maintained in home gardens purposely for their food crop and non-food crop uses. This confirms the report of Ezaguirre and Linares (2004) that home gardens could serve as a place for experimentation, introduction and domestication of useful plant species.

Commercially oriented home gardens cultivated by HIV/AIDS afflicted households were significantly larger (2140 m<sup>2</sup> vs. 1246 m<sup>2</sup>), had significantly greater number of species (8.5 vs. 5.0), individual plants (234 vs. 70), perennial species (2.0 vs. 1.0) and species that were harvested year round (6.5 vs. 3.0) but there was no significant difference in the Shannon-Weiner diversity index and evenness was lower (0.42 vs. 0.57) compared with subsistence oriented home gardens (Table 1). The proximity of the home garden to the homestead and its flexible labour requirement provided a suitable strategy for HIV/AIDS afflicted households who require more food security, better nutrition and lower labour-investment (Garí, 2003; Loevinsohn and Gillespie, 2003; Lengkeek, 2004). Consequently, available labour and access to land enabled commercial home garden owners in HIV/AIDS affliction to cultivate significantly larger home garden areas with more species. By cultivating significantly more perennial food crop species commercially oriented home garden owners in HIV/AIDS affliction were able to maintain food crops in their home garden and also engaged in cash crop production to enhance household income and access to food. Incorporating cash crops into regular cultivation of food crops

in the commercially oriented home gardens of HIV/AIDS afflicted accounted for the significantly greater number of individual plants (Mendez *et al.*, 2001; Trinh *et al.*, 2003). There was no significant difference between species diversity in commercially and subsistence oriented home gardens of HIV/AIDS afflicted households. This supports the findings of Trinh *et al.* (2003) that commercialization of home garden production does not lead to lower levels of diversity in home gardens. The significantly lower evenness in commercially oriented home gardens of the HIV/AIDS afflicted may be because the few species cultivated for cash income were present in a relatively greater number of individual plants compared to the other species in the home garden. In commercially oriented home gardens cultivated in HIV/AIDS affliction a significantly higher number of perennial crop species with different maturity periods provided products in the form of leaves, corms, rhizomes, flowers and fruits all year round than in subsistence oriented home gardens.

Improved planting material and chemical fertilizer were used in a significantly greater proportion of commercially oriented home gardens cultivated in HIV/AIDS and non-HIV/AIDS affliction compared with subsistence oriented home gardens to increase yield for the local market (100% vs. 0%; 90% vs. 10% and 100% vs. 0%). On-farm activity was a major source of income for significantly more HIV/AIDS afflicted commercially and subsistence oriented home garden owners compared with non-HIV/AIDS afflicted subsistence oriented home gardens owners (83% vs. 17% and 73% vs. 27%). This suggests that cash income earnings from the sale of home garden products is a major part of on-farm income for commercially oriented home garden owners in HIV/AIDS affliction (Murphy, 2008). A significantly higher proportion of commercially oriented home garden owners in HIV/AIDS and non-HIV/AIDS affliction consumed a staple crop present in the home garden 24 hours prior to the survey compared with subsistence home gardens owners in HIV/AIDS (88% vs. 13%, and 91% vs. 9%). This indicates that commercially oriented home garden owners in HIV/AIDS have the primary aim to maintain food supply in cultivating home gardens.

These variations imply that rural households in HIV/AIDS affliction in cultivating commercially oriented home gardens aim to produce food crops to satisfy their subsistence food needs in addition to cash income and have better access to food directly from their home garden and indirectly from home garden earnings, than households that cultivate subsistence oriented home gardens.

### **Conclusions and recommendations**

The study showed that rural households in HIV/AIDS affliction in cultivating commercially oriented home gardens adapt the structure, species composition and management of home gardens to suit their specific needs and preferences. They cultivate a dual purpose home garden that supplies subsistence food and provide cash income for other needs and therefore have better food security than households with subsistence oriented home garden. Households that cultivate subsistence oriented home gardens in HIV/AIDS affliction should be the target in developing management strategies to improve food security in rural households in situation of HIV/AIDS. Provision of extension support services to address constraints on access to good planting material and efficient use of inputs could improve the management of their home gardens and consequently enhance their food security.

**Table 1: Differences and similarities in size and diversity characteristics of the different home garden types**

Variable <sup>1</sup>	HIV/AIDS afflicted households		Non-HIV/AIDS afflicted households		Kruskal-Wallis <i>p</i> -value*
	Commercially oriented home gardens (n = 20)	Subsistence oriented home gardens (n = 12)	Commercially oriented home gardens (n =35)	Subsistence oriented home gardens (n=13)	
Home garden size in m <sup>2</sup>	2140 (366-7176) <b>a</b>	1246 (220- 4428) <b>b</b>	1512 (380-4824) <b>b</b>	1230 (476-2688) <b>b</b>	<b>0.028</b>
No. of individual plants	234 (73-1813) <b>a</b>	70 (31-197) <b>b</b>	138 (32-549) <b>b</b>	72 (40-324) <b>b</b>	<b>0.000</b>
No. of species	8.5 (4-17) <b>a</b>	5.0 (3-12) <b>b</b>	8.6 (1-18) <b>a</b>	6.0 (2-15) <b>ab</b>	<b>0.009</b>
No. of perennial food crop species	2.0 (1-5) <b>a</b>	1.0 (0-2) <b>b</b>	2.0 (1-7) <b>a</b>	2.0 (0-5) <b>ab</b>	<b>0.003</b>
No. of species harvested year round	6.5 (2-9) <b>a</b>	3.0 (1-6) <b>b</b>	5.0 (1-10) <b>ab</b>	4.0 (1-8) <b>ab</b>	<b>0.019</b>
Shannon–Wiener diversity index (H')	1.15 (0.54-2.11)	1.17 (0.31-1.89)	1.46 (0- 2.28)	1.10 (1.07-1.84)	0.064
Evenness (E)	0.42 (0.23-0.69) <b>b</b>	0.57 (0.27-0.90) <b>a</b>	0.56 (0.27-1.00) <b>a</b>	0.51 (0.27-0.84) <b>ab</b>	<b>0.002</b>
Sørensen's similarity index	62.2%		65.9%		

<sup>1</sup> Values are medians unless otherwise indicated; Figures in brackets are ranges.

\* *p*-values in bold are significant at probability < 0.05

Medians in a row bearing different letters are significantly different at *P*<0.05

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**Appendix 1: Inventory of crop species identified in home gardens, their latin, common and local names, growth habit, use and the harvest season**

Botanical name	Family	Common name	Local name	Growth habit/ Economic product	Harvest season
<b>Vegetables</b>					
<i>Capsicum annuum</i>	Solanaceae	Chilli pepper	Meko	Annual herb/fruit	Year round
<i>Lycopersicon esculentum</i>	Solanaceae	Tomato	Ntoso	Annual herb/fruit	Rainy season
<i>Solanum aethiopicum</i>	Solanaceae	Eggplant	Aworowo	Annual herb/fruit	Rainy season
<i>Solanum macrocarpon</i>	Solanaceae	African eggplant	Gboma	Perennial herb/fruit	Year round
<i>Solanum melongena</i>	Solanaceae	Aubergine	Ntorobabayin	Perennial herb/fruit	Year round
<i>Solanum torvum</i>	Solanaceae	Prickly solanum	Saman-ntoroba	Perennial shrub/fruit	Year round
<i>Luffa acutangula</i>	Cucurbitaceae	Ridged gourd		Annual herb/fruit	Rainy season
<i>Cucurbita spp.</i>	Cucurbitaceae	Pumpkin		Annual herb/fruit	Rainy season
<i>Trichosanthes cucumerina</i>	Cucurbitaceae	Snake gourd	Kroboko	Annual herb/fruit	Rainy season
<i>Abelmoschus esculentus</i>	Malvaceae	Okra	Nkruma	Annual herb/fruit	Year round
<i>Hibiscus cannabinus</i>	Malvaceae	Kenaf		Annual herb/leaf	Year round
<i>Elaeis guineensis</i>	Arecaceae	African oil palm	Abè	Palm/fruit	Year round
<i>Cajanus cajan</i>	Papilionaceae	Pigeonpea		Perennial shrub/grain	Rainy season
<i>Phaseolus lunatus</i>	Fabaceae	Lima bean	Adua	Perennial herb/ grain	Rainy season
<i>Vigna unguiculata</i>	Fabaceae	Cowpea	Adua	Annual herb/grain	Rainy season
<i>Canavalia ensiformis</i>	Fabaceae	Jack bean		Perennial vine/grain	Rainy season
<i>Arachis hypogaea</i>	Papilionaceae	Groundnut	Nkate	Annual herb/kernel	Rainy season
<i>Zea mays</i>	Poaceae	Maize	Abro	Annual herb/fruit	Rainy season
<i>Musa sapientum</i>	Musaceae	Plantain	Brodie	Perennial herb/fruit	Year round
<i>Vernonia amygdalina</i>	Asteraceae	Bitterleaf	Bonwen	Perennial shrub/leaf	Year round
<i>Talinum triangulare</i>	Portulacaceae	Waterleaf	Boroboro	Annual herb/leaf	Year round
<i>Corchorus olitorius</i>	Tiliaceae	Jew's mallow	Ayooyo	Annual herb/leaf	Year round
<i>Bombax buonopozense</i>	Bombacaceae	Red flowered silk-cotton tree	Akokonre	Tree/flower	Dry season
<i>Amaranthus spp.</i>	Amaranthaceae	African spinach	Aleefu	Annual herb/leaf	Year round
<b>Root tubers</b>					
<i>Dioscorea spp.</i>	Dioscoreaceae	Yam	Bayerè	Annual herb/tuber	Rainy season
<i>Manihot esculenta</i>	Euphorbiaceae	Cassava	Bankye	Annual shrub/tuber	Year round
<i>Xanthosoma sagittifolium</i>	Araceae	Cocoyam	Mankani	Perennial herb/Annual herb/corm	Year round
<i>Colocasia esculenta</i>	Araceae	Taro	Kookoo	Perennial herb/Annual herb/corm	Rainy season

<i>Ipomoea batatas</i>	Convolvulaceae	Sweet potato	Ntrumōō	Perennial herb/Annual herb/tuber	Rainy season
<b>Fruits</b>					
<i>Citrus limon</i>	Rutaceae	Lemon		Tree/fruit	Rainy & Dry seasons
<i>Citrus aurantifolia</i>	Rutaceae	Lime	Ankaatwaree	Tree/fruit	Rainy & Dry seasons
<i>Citrus sinensis</i>	Rutaceae	Sweet orange	Akutu	Tree/fruit	Rainy & Dry seasons
<i>Musa x paradisiaca</i>	Musaceae	Banana	Kwadu	Perennial herb/fruit	Year round
<i>Ananas comosus</i>	Bromeliaceae	Pineapple	Abrobè	Annual herb/fruit	Year round
<i>Carica papaya</i>	Caricaceae	Pawpaw	Brōfrè	Tree/fruit	Year round
<i>Saccharum officinarum</i>	Poaceae	Sugar cane	Ahwidie	Grass/stem	Year round
<i>Artocarpus communis</i>	Moraceae	Breadfruit	Dziiball	Tree/fruit	Dry season
<i>Terminalia catappa</i>	Combretaceae	Tropical almond	Abrofo nkate	Tree/fruit	Dry season
<i>Annona muricata</i>	Annonaceae	Soursop	Adobo	Tree/fruit	Rainy season
<i>Annona squamosa</i>	Annonaceae	Sweetsop	Nɲawie	Tree/fruit	Rainy season
<i>Psidium guajava</i>	Myrtaceae	Guava	Oguava	Perennial shrub/fruit	Rainy & Dry seasons
<i>Anacardium occidentale</i>	Anacardiaceae	Cashew	Atea	Tree/fruit	Dry season
<i>Mangifera indica</i>	Anacardiaceae	Mango	Mango	Tree/fruit	Rainy & Dry seasons
<i>Artocarpus heterophyllus</i>	Moraceae	Jackfruit		Tree/fruit	Rainy & Dry seasons
<i>Chrysophyllum albidum</i>	Sapotaceae	Star apple	Alatsa	Tree/fruit	Dry seasons
<i>Theobroma cacao</i>	Sterculiaceae	Cocoa	Chocolate tree	Tree/fruit	Rainy & Dry seasons
<i>Persea americana</i>	Lauraceae	Avocado pear	Peya	Tree/fruit	Dry season
<i>Cocos nucifera</i>	Palmae	Coconut	Kube	Tree/fruit	Year round
<i>Pachira aquatica</i>	Bombacaceae	Saba nut		Tree/fruit	Rainy season
<b>Other species</b>					
Spices					
<i>Ocimum basilicum</i>	Lamiaceae	Basil	Eme	Annual herb/leaf	Year round
<i>Piper guineense</i>	Piperaceae	Guinea blackpepper	Soro-wisa	Perennial vine/fruit	Dry season
<i>Curcuma longa</i>	Zingiberaceae	Tumeric	Akakadrum kököö	Perennial herb/rhizome	Year round
<i>Zingiber officinale</i>	Zingiberaceae	Ginger	Akakaduro	Perennial herb/rhizome	Year round
<i>Aframomum melegueta</i>	Zingiberaceae	Grains of paradise	Famu-wisa	Perennial herb/fruit, seed	Rainy & Dry seasons
<i>Monodora myristica</i>	Annonaceae	Calabash nutmeg	Ayerew-amba	Tree/seed	Rainy season
Medicinal plants					
<i>Ocimum gratissimum</i>	Lamiaceae	Fever plant	Nunum	Perennial herb/leaf	Year round
<i>Azadirachta indica</i>	Meliaceae	Neem	Kintwo	Perennial shrub/leaf	Year round
<i>Thevetia peruviana</i>	Apocynaceae	Milkbush		Perennial shrub/leaf	Year round

<i>Cassia occidentalis</i>	Fabaceae	Negro coffee	Mofra brode	Annual herb/leaf, seed	Year round
<i>Cymbopogon citratus</i>	Poaceae	Lemon grass	Sèrè	Grass/leaf	Year round
<i>Cola nitida</i>	Sterculiaceae	Kola nut	Bese	Tree/fruit	Dry season
<i>Newbouldia laevis</i>	Bignoniaceae	Sweet Newbouldia	Sasanemasa	Tree /bark, leaf	Year round
<i>Voacanga africana</i>	Apocynaceae	Voacanga	Ofuruma	Perennial shrub/bark, leaf	Rainy season
<i>Alstonia boonei</i>	Apocynaceae	Alstonia	Sinduro	Tree/bark	Year round
<i>Alchonea cordifolia</i>	Euphorbiaceae	Christmas bush	Gyamma	Perennial shrub/leaf, stem, bark, root, fruits	Year round
<i>Paullinia pinata</i>	Sapindaceae	Nistmal	Toa-ntini	Perennial shrub/root	Year round
<i>Nicotiana tabacum</i>	Solanaceae	Tobacco	Tawa	Annual herb/leaf	Rainy season
<i>Morinda lucida</i>	Rubiaceae	Brimstone tree	Kankroma	Tree/bark, leaf	Year round
<i>Eucalyptus globulus</i>	Myrtaceae	Blue gum		Tree/leaf	Year round
<i>Jatropha curcas</i>	Euphorbiaceae	Physic nut	Nkrangyedua	Perennial shrub/seed	Year round
<i>Catharanthus roseus</i>	Apocynaceae	Madagascar periwinkle		Perennial herb/leaf, flowers, roots	Year round
<i>Rauwolfia vomitoria</i>	Apocynaceae	Swizzle stick	Kakapenpen	Tree/root	Year round
<i>Gossypium hirsutum</i>	Malvaceae	Cotton	Asaawa	Annual shrub/boll	Rainy & Dry seasons
Fodder plants					
<i>Gliricidia sepium</i>	Fabaceae	Mother of Cocoa		Tree/leaf	Year round
<i>Ficus carica</i>	Moraceae	Common fig		Tree/leaf	Year round