Home garden: a potential strategy for food and nutrition security in HIV households.

A case study in rural Ghana

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Susana Akrofi

Thesis

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Dedication

To the honour of my late father Philip Antwi Fleischer, my mother Alice Esi Fleischer, my husband Andrews Yaw Akrofi, my son Owuraku Annor Akrofi and my daughter Afua Ofosua Akrofi

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Abstract

Susana Akrofi (2012) Home garden: a potential strategy for food and nutrition security in HIV households. A case study in rural Ghana. PhD thesis, Wageningen University, Wageningen, The Netherlands, 239 pp.

The aim of this thesis was to explore how rural households with HIV and AIDS in Ghana are employing home garden management strategies to enhance food and nutrition security and also to examine the seasonal dimension of coping with food insecurity in these rural households through documentation of the frequency and severity of the food–related coping behaviours adopted during periods of peak seasonal food shortages. In Sub-Saharan Africa, home garden cultivation is considered to be a potential strategy for rural households with HIV and AIDS to cope with labour constraints and to improve food and nutrition security. However, existing research that has addressed the relationship between HIV and AIDS, home gardens and food security focused on predictions; there is severe dearth of empirical evidence. Qualitative and quantitative research methodologies were used in this study. Data collection methods included focus group discussions, interviews with key informants, a questionnaire-based survey, in-depth interviews in case studies and participant observations. A 24-hour qualitative dietary recall was used to assess dietary intake of households studied and the Coping Strategy Index was used to assess the severity of household food-related coping behaviours. Data on biophysical aspects of the home gardens was obtained through a home garden survey. The results showed that when labour constraint reduced field cultivation in rural households with HIV and AIDS, labour input in home garden significantly increased; rural households did not cultivate a greater diversity of plant species in home gardens, but rather relatively more food items of the essential food groups were consumed from home gardens. This contributed significantly to dietary diversity. Uncovering the effect of the interaction between household HIV status and gender of the household head on home garden biodiversity indicated that female-headed households with HIV and AIDS depended more on home gardens than their counterparts without HIV and AIDS in producing crops for sustenance and dietary diversity. Exploring the biodiversity in home gardens of rural households with HIV and AIDS when home garden cultivation is also meant to generate cash income revealed that rural households experiencing HIV and AIDS illness in cultivating

commerce-oriented home gardens cultivated a dual purpose home garden that provided cash income and also supplied subsistence food. Assessing the frequency and severity of the food-related coping behaviours adopted by farm households with HIV and AIDS during the post-harvest period and in the lean season showed that farm households with HIV and AIDS were more vulnerable to food insecurity in both the post-harvest and lean season; this vulnerability was also reflected in their poverty, family care burdens (larger number of dependents and ill persons), lower education level and meagre income earning opportunity. It is essential that concerted efforts are made to improve the general well-being of farm households with HIV and AIDS by empowering rural households with HIV and AIDS in terms of capacity building, access to livelihood assets and access to finance.

Keywords: Home garden, HIV and AIDS, dietary diversity, plant species diversity, coping strategy index, food security, Ghana.

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List of acronyms

ACC/SCN	Administrative Committee on Coordination/Subcommittee on Nutrition of the United Nations
CARE/WFP	Cooperative for Assistance and Relief Everywhere, Inc. / World Food Programme
C-SAFE	Centre for Sustainability: Agriculture, Food, Energy, Environment
DFID	United Kingdom Department for International Development
FAO	Food and Agriculture Organization
GAC	Ghana AIDS Commission
GPRS	Ghana Poverty Reduction Strategy
GSS	Ghana Statistical Service
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
HKI	Helen Keller International Integration
IFAD	International Fund for Agricultural Development
NACP	National AIDS Control Programme
SADC/FANR	Southern Africa Development Community/Food Agriculture and Natural Resources Vulnerability Assessment Community
SAfAIDS	Southern Africa AIDS Information Dissemination Service
UNAIDS	Joint United Nations Programme on HIV/AIDS
WHO	World Health Organization
UN	United Nations

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CHAPTER 1

1. General introduction

In this introductory chapter, the background to the thesis is provided. The rationale for exploring the home garden management strategies used by rural households with HIV and AIDS is provided. The research objectives and research questions are also elaborated. The last part of this Chapter 1 indicates how the thesis is organized and provides an overview of its chapters.

1.1. Background

The sustained and long-term impacts of the HIV and AIDS epidemic include slowly eroding food security, destroying rural livelihoods and exacerbating poverty (Steiner *et al.,* 2004). If left unchecked the epidemic might undermine all efforts aimed at achieving the Millennium Development Goals, especially the ones related to halving the number of poor and hungry in the world by 2015 (Ekaas, 2003). Ghana has made significant progress at the national level in reducing poverty and improving food security in recent years. However, about one-third of its 22 million people is still poor and cannot meet its basic food and nutritional needs. It is of great concern that 59% of this group constitute subsistence farmers who mainly depend on rain-fed subsistence agriculture for their livelihoods (WFP, 2005). Research shows that it is this group of resource poor and vulnerable farming households which suffers greater livelihood impacts from HIV and AIDS (FAO, 2005; Gillespie and Kadiyala, 2005; Loevinsohn and Gillespie, 2003; Niehof and Price, 2008). HIV and AIDS in rural households are associated to decline in household food security due to increases in poverty, declines in agricultural production, reductions in income earning activities and opportunities (FAO, 2005; Gillespie and Kadiyala, 2005; Loevinsohn and Gillespie, 2003). In Sub-Saharan Africa, home garden cultivation is considered to be a potential strategy for rural households with HIV and AIDS to cope with labour constraints and to improve food and nutrition security (Bukusuba *et al*., 2007; Garí, 2003; Keatinge and Amoaten, 2006; Murphy, 2008; Murphy *et al*., 2006).

Several studies suggested that labour input in home garden cultivation is lower compared with other agricultural fields (Garí, 2003; Shrestha *et al*., 2002). The literature emphasizes that home gardens cultivated by women have greater species diversity than those

cultivated by men and this greater diversity enhances food and nutrition security (Asfaw, 2001; Boto *et al*., 2004; Dreschler, 1997; Howard, 2003). Additionally, other studies indicated that, in the context of HIV and AIDS, female heads of rural households adopt innovative survival strategies in agricultural production to reduce food insecurity (Steiner *et al*., 2004). Studies also pointed out that female-headed households depend more on home gardens than the average household to produce crops for sustenance and dietary diversity when field cultivation is constrained (Salick, 1997). Introduction of cash crops into home gardens is accompanied by a reduction in species diversity, but rural households with HIV and AIDS require high species diversity in home gardens to enhance food and nutrition security (Abdoellah *et al*., 2006; Garí, 2003). This raises many questions, including the following: 1) how does the home garden as an agricultural resource mitigate labour constraints and the food and nutrition insecurity caused by HIV and AIDS? 2) what are the survival strategies that are adopted in home gardens of female-headed rural households with HIV and AIDS to enhance food and nutrition security? and 3) how do home garden management strategies in rural households with HIV and AIDS enhance food and nutrition security when the primary aim in home garden production is generating cash income?

Rural households with HIV and AIDS adopt various strategies to cope with food insufficiency and food insecurity (Haddad and Gillespie, 2001; Maxwell, 1996). In a situation of seasonal food shortage the already resource poor farm households with HIV and AIDS may face acute food insecurity (De Waal 2007; De Waal and Whiteside, 2003; Gillespie and Drimie, 2009). To understand when and how interventions can best be made and promoted to reduce suffering in rural households with HIV and AIDS, it is vital to know and understand the magnitude of food insecurity experienced by these households during periods of peak seasonal food shortages.

From the first case of HIV and AIDS recorded in Ghana in 1986, the HIV prevalence rate in Ghana increased from 2.6% in 1994 to 3.6% in 2003, declined in 2004 to 3.1%, and 2.7% in 2005, and increased again to 3.2% in 2006 (Ghana AIDS Commission, 2008). There were an estimated 240,000 Ghanaians living with HIV at the end of 2005, the time when the field work described in this thesis was initiated (UNAIDS/WHO, 2006). Despite the overall low national HIV prevalence in Ghana (UNAIDS, 2004), there is a significant concern in the country to deploy strategies which are responsive to nutritional needs of HIV and AIDS affected households (Soyiri and Laar, 2004). Therefore this study seeks to explore how rural households with HIV and AIDS in Ghana are employing home garden management strategies to enhance food and nutrition security. It also examines the seasonal dimension of coping

with food shortages through the documentation of the frequency and severity of the food-related coping behaviours adopted in rural households living with HIV and AIDS during periods of peak seasonal food shortages.

The study was carried out as part of the African Women Leaders in Agriculture and the Environment (AWLAE) Programme of Winrock International, in partnership with Wageningen University. This programme thematically focuses on the impacts of HIV and AIDS on livelihood and food security in relation to gender in rural Sub-Saharan Africa and aims to create a group of professional African women at PhD level that will be able to influence policy in their home countries in ways that will support women in agriculture. Funding for the programme was provided by the Government of the Netherlands.

1.2. Research problem and objectives

The effects of HIV and AIDS on available labour in rural households and their subsequent limitations on agricultural production, income earning opportunities and the implications for household food availability and food diversity are well known (Balyamujura *et al*., 2000; Drimie, 2002; Van Liere, 2002). Some researchers argue that rural households with HIV and AIDS adopt coping strategies to alleviate labour loss. Some households reallocate productive tasks among household members to cope with the labour shortage; other ones put in extra labour to make up for the labour shortage (Gillespie *et al.*, 2001; Muchungiuzi, 1999; Sauerborn *et al*., 1996). Other researchers maintain that land preparation, planting, weeding and harvesting of crops are delayed; some households reduce cultivated areas, and other ones reduce the number and range of crops grown, or shift from producing labour intensive to less-labour demanding but also less nutritional crops (De Waal and Tumushabe, 2003; du Guerny, 2001; Gillespie and Kadiyala, 2005; Haddad and Gillespie, 2001; Topouzis, 2003). It is envisaged that the reduction in the cultivated field area and the range of crops cultivated would limit the quantity and quality in the household's diet (du Guerny, 2001; Jayne *et al*., 2004). In the longer run, the individual with HIV may experience more frequent and more severe opportunistic infections; this will consequently hasten the progression of HIV illness to AIDS, and other household members may also suffer from malnutrition (ACC/SCN, 1998; Bukusuba *et al.,* 2007; Gillespie, 2006). Several authors have emphasized the importance of home gardens for coping with labour constraints and enhancing food and nutrition security for poor households with HIV and AIDS (Bukusuba *et al*., 2007; Garí, 2003; Keatinge and Amoaten, 2006; Murphy, 2008). The location of home gardens close to the home enables

household members to perform home garden tasks and domestic duties simultaneously to enhance labour input in home garden cultivation. Home garden cultural practices do not require strict timing and can be better distributed through time than practices in other agricultural fields (Garí, 2003; Shrestha *et al*., 2002). The diversity of plant species in home gardens provides vegetables, fruits and staples that can be harvested on a daily or seasonal basis to meet the increased nutritional needs of the HIV-positive individual and support other household members. Medicinal plants and other species cultivated in home gardens provide herbs for various ailments and non-food necessities (Bukusuba *et al*., 2007; Garí, 2003; Keatinge and Amoaten, 2006; Murphy, 2008). Surplus produce and cash crops from home gardens can provide cash income to pay for additional food. Poultry and small domestic livestock reared in the homestead provide meat and income (Faber and Van Jaarsveld, 2007; High and Shackleton, 2000). However, the literature is unclear whether the home garden in a rural household with HIV and AIDS has more or less plant species diversity; whether more or less labour is allocated to these home gardens; and whether these two phenomena are causally related. In view of the high HIV and AIDS prevalence rates in some rural communities in Ghana and the related labour constraints and food and nutrition security challenges, it is imperative to investigate the relationship between the biodiversity and labour input in home gardens and how this enhances food and nutrition security in rural households living with HIV and AIDS.

Research indicates that women cultivate home gardens with higher plant species diversity than men because they are responsible for providing household food and nutrition (Asfaw, 2001; Boto *et al*., 2004; Dreschler, 1997; Howard, 2003). Other studies emphasize that in the situation of HIV and AIDS female-headed rural households, which are amongst the most vulnerable, grow more quality food crops, rich in protein and vitamins to enhance food security (Steiner *et al*., 2004). Studies also point out that female-headed households depend much more on the home gardens than the average household for sustenance and dietary diversity when field cultivation is limited (Salick, 1997). Investigating home garden management strategies in female-headed households with HIV and AIDS is essential to the development of interventions to mitigate the impacts of HIV and AIDS.

Existing research indicates that when the primary aim in home garden cultivation is to generate cash income, there is reduced plant species diversity which affects household nutrition (Abdoellah *et al*., 2006; Asare *et al*., 1990; Garí, 2003). On the contrary, other studies claim that the introduction of cash crops into home gardens leads to a slightly higher species diversity or to more diversity in terms of total number of plant species (Bernholt *et*

al., 2009; Trinh *et al*., 2003). In addition, other studies maintain that in the situation where increased income from the introduction of cash crops in subsistence agriculture is spent on food, household nutrition improves (Von Braun *et al*., 1991). HIV and AIDS related studies that have empirically explored the biodiversity in home gardens of rural households where production is mainly for cash income generation, and its influence on food and nutrition, are scarce.

Researchers claim that households with HIV and AIDS adopt various strategies to cope with food shortfalls. These households may rely on less-preferred food, buy food on credit, reduce the number of meals eaten per day or regularly skip food for an entire day to maintain food security (Alkenbrack Batteh *et al*., 2008; Tang, 2003). However, studies indicate that when food insecurity in rural households with HIV and AIDS due to labour constraint coincide with seasonal food shortages, household food insecurity may become more severe, coping strategies adopted may have negative consequences and households may descend into destitution, and the possibilities to recover are much reduced; a situation that is hypothesized as the "new variant famine" (De Waal and Whiteside, 2003; Gillespie and Drimie, 2009). Therefore, to ascertain the need for intervention and the form of interventions required to reduce food insecurity in rural households living with HIV and AIDS, it is crucial to know and understand the seasonal differences in food insecurity experienced by these households by assessing the frequency and severity of the coping strategies adopted during periods of peak seasonal food shortages. Thus the main objectives of this study are to:

1. Explore how rural households with HIV and AIDS employ home garden management strategies to enhance food and nutrition security.
2. Examine the seasonal dimension of coping with food shortages in farm households living with HIV and AIDS through the documentation of the frequency and severity of food-related coping behaviours adopted during periods of peak seasonal food shortages.

Given these two general objectives the study specifically assesses biodiversity in home gardens of rural households with HIV and AIDS in the Eastern Region of Ghana and evaluates its contribution to dietary diversity. It uncovers the effect of the interaction between household HIV status and gender of household head on biodiversity in home gardens and explores the biodiversity in home gardens of rural households with HIV and AIDS when the primary aim in home garden cultivation is generating cash income. In addition, the study evaluates the food insecurity of farm households with HIV and AIDS in the Eastern Region of Ghana during the post-harvest period and in the lean season through assessing the frequency and severity of the food-related coping behaviours adopted by the households in

the two different periods.

Given the complexity of the processes that determine home garden management strategies and those which indicate the severity of coping strategies that households adopt in response to peak seasonal food shortages, the research established a multi-methodology approach and was conducted in 17 rural communities in 12 districts in the Eastern Region of Ghana. The household was the unit of analysis.

1.3. Relevance of the research

The impact of HIV and AIDS on agricultural production has been extensively and intensively studied. The effect of labour constraint on crop production and the subsequent limitation in food availability and food diversity in rural households with HIV and AIDS are well documented (Balyamujura *et al*., 2000; Drimie, 2002). The unique role of home gardens in enhancing food and nutrition security in rural households with HIV and AIDS has been well explained (Murphy, 2008; Murphy *et al*., 2006). However, existing research that has addressed the relationship between HIV and AIDS, home gardens and food security have focused on predictions. There is a severe dearth of empirical evidence on how HIV and AIDS impact home garden management strategies and affect household food security. The current research fills this information gap by assessing the management strategies in home gardens of rural households with HIV and AIDS and by examining the seasonal dimension of coping with food shortages in rural households living with HIV and AIDS.

This study is of particular significance to Ghana due to the persistently high prevalence of the HIV and AIDS in some rural communities, the consequences of labour constraints and the important contribution of home gardens to household's food and nutritional security (Hesselberg and Yaro, 2006; UNAIDS, 2004). In addition, the fact that female heads of households, who carry the double burden of providing household food security and offering care to the individual with HIV and AIDS, form a large proportion of rural household heads in Ghana with HIV and AIDS, makes this study even more pertinent (Agboh-Noameshie *et al*., 2007; Loewenson and Whiteside, 1997). The findings of the study could be integrated into programmes and projects which put emphasis on using labour-management technologies to eradicate food insecurity and improve nutrition which are key forces in combating AIDS-related diseases and health problems in the progression of HIV and AIDS. It is anticipated that results obtained from the study would facilitate the formulation of policies for the agriculture and health sectors to mitigate the impact of the

HIV and AIDS epidemic.

1.4. Outline of thesis

This thesis is organized into the following eight chapters:

Chapter 1 provides an introduction of the research. It outlines the rationale for exploring the home garden management strategies used by rural households with HIV and AIDS in Ghana. The food insecurity situation and the associated coping strategies in rural households with HIV and AIDS are discussed. A summary of the contribution of the research to theory formation, social significance of the study, and the relevance for policy is presented. The references belonging to Chapter 1 are listed at the end of Chapter 2, the literature review.

Chapter 2 presents a review of the relevant literature on HIV and AIDS, field production and home gardens cultivation in relation to food security. It discusses the key concepts of the study, which are derived from social science, plant sciences and nutrition sciences, and the conceptual framework. The concepts include labour, home garden, household, household HIV status, strategic decision, biodiversity, species diversity and dietary diversity score. This chapter ends with a presentation of the research objectives, and the research questions that I seek to answer in this thesis.

Chapter 3 presents the research design and methodology used to collect primary and secondary data. It describes the study area and discusses the research design and methods, research techniques and strategies used in data collection, data analyses and data management. Problems encountered in data collection are also presented.

Chapter 4 shows the significant contribution of home gardens to dietary diversity in HIV-positive rural households. The differences in field and home garden cultivation and plant species diversity in home gardens between HIV-positive and HIV negative farm households are analyzed. The difference in contribution of home garden produce to the dietary diversity score in HIV-positive and HIV negative rural households is estimated, and the relationship between plant species diversity in home gardens and household dietary diversity score is assessed.

Chapter 5 shows how female-headed HIV-positive farm households manage the biodiversity in home gardens to enhance household food and nutrition when labour is constrained for field cultivation. The differences in field and home garden cultivation, plant species composition

and species diversity in home gardens, poultry and domestic livestock production, and the dietary diversity score across female-headed HIV-positive and HIV-negative farm households and dual headed HIV-positive and HIV-negative farm households are assessed.

Chapter 6 explores the biodiversity in subsistence oriented and commerce oriented home gardens of HIV-positive and HIV-negative rural households and their significance to food security. Differences and similarities in crop composition, species diversity, seasonal availability of produce, management practices and consumption of staple food from subsistence oriented and commerce oriented of HIV-positive and HIV-negative rural households are captured.

Chapter 7 illustrates the general vulnerability of HIV-positive farm households in the Eastern Region of Ghana to food insecurity. The food insecurity of HIV-positive and HIV-negative farm households in the Eastern Region of Ghana was evaluated during the post-harvest period and in the lean season by assessing the differences in frequencies and severities of household food-related coping behaviours adopted; agricultural production in regard to farm and home garden crop production and domestic livestock and poultry production; and income activities that are agriculture and non-agriculture related in the two periods.

Chapter 8 integrates the major findings of the study and presents the main conclusions that can be drawn from the preceding chapters. The chapter also points out implications for intervention and, based on the findings and the limitations of the study, provides suggestions for further research.

CHAPTER 2

2. Literature review and conceptual framework

In this chapter, studies and issues related to HIV and AIDS, home gardens and food security in farming communities are reviewed. The chapter examines: a) the impact of HIV and AIDS on rural household labour and food security; b) the impact of HIV and AIDS on income generating activities in rural households; c) home garden cultivation and household nutrition; d) effect of gender of home garden owner on biodiversity in home gardens; e) primary objectives in home garden cultivation on biodiversity in home gardens; f) seasonality and household food security; and g) the impact of HIV and AIDS on food-related coping behaviours in rural households. Conclusions are drawn from each topic reviewed.

2.1. Literature review

2.1.1. Impact of HIV and AIDS on agricultural production and rural household food security

Research into field and home garden cultivation of rural households with HIV and AIDS has implications for food security. Rural households with HIV and AIDS are vulnerable to food insecurity as they tend to fall short in agricultural production due to labour constraints (ACE-Africa, 2006). Studies from a number of African countries indicate that HIV and AIDS illness of a productive household member leads to loss of labour of the sick individual (Baylies, 2002; Haddad and Gillespie, 2001; Mutangadura *et al.*, 1999). Reallocation of time by household members to look after the sick individual further reduces household labour for farm operations (Topouzis, 2003). Rugalema (1999) noted that women in Tanzania spent 60% less time on agricultural activities because their husbands were ill. Bojang (2006) indicated that in Ethiopia, households with HIV and AIDS spent about 11-16 hours per week on farming compared with an average of 33 hours for non-HIV households. Rural households with HIV and AIDS adopt strategies to reduce labour stress (Gillespie *et al.*, 2001; Muchungiuzi, 1999; Sauerborn *et al*., 1996). Studies conducted in the Central Region of Malawi reported delays in land preparation, planting, weeding and harvesting of crops and a reduction in the total area under cultivation in households with HIV and AIDS which subsequently reduced crop yields (Black-Michaud, 1997; Shah *et al*., 2002; Topouzis, 1999). Other households replaced valuable and nutritious crops that are labour-intensive with crops

that are less labour demanding and fast-maturing but are less nutritious (Gillespie *et al*., 2001). Jayne *et al.* (2004) observed that farming households with HIV and AIDS in Uganda changed from growing fruits and vegetables, such as beans and leafy vegetables, to staple crops, such as cassava and sweet potato, which required less labour.

The reduction in quantity and quality of household food available to households consequently may lead to malnutrition in household members and to more frequent and more severe opportunistic infections in the individual with HIV which will hasten the progression of illness due to AIDS (ACC/SCN, 1998). The potential of home gardens in reducing labour constraint and enhancing food and nutrition security for rural households with HIV and AIDS is emphasized by several authors (Faber and Van Jaarsveld, 2007; Garí, 2003; Murphy, 2008). Moreover, Murphy (2008), in her studies on kitchen gardens and HIV and AIDS in Western Kenya, noted that HIV and AIDS networks as channels for diffusion of information about gardens and HIV and AIDS, spread knowledge about home garden crops and their nutritional needs and new crops, and, less visibly, increased the diversity of plants and intensity of cultivation techniques.

Labour input in home gardens is reported to be lower compared with other agricultural fields and the diverse plant species provide food, nutrition, and income to purchase additional food (Garí, 2003; Shrestha *et al*., 2002). To date no comprehensive study has investigated how the association between field and home garden cultivation in rural households with HIV and AIDS influences food and nutrition security.

2.1.2. Impact of HIV and AIDS on income activities in rural households

Income-generating activities enable rural households to maintain food security and buffer themselves against the impact of HIV and AIDS (FAO, 1995). Studies conducted in rural Burkina Faso, in rural Zambia, and in Uganda, found that rural households that cannot meet their food requirements, or cannot obtain cash, through agricultural production, undertake a range of income-generating activities such as selling firewood, brewing millet beer, selling livestock, building fences, selling handicrafts, tailoring, and petty trade to supplement their income (Barnett *et al*., 1995; Sauerborn *et al*., 1996). In Malawi, Munthali (1998) reported that households cope by providing casual labour in neighbours' fields to earn some income. In rural Zambia, some members of rural households migrated to urban areas in search of employment so that they can remit some income to their rural homes (SAfAIDS, 1998). On the other hand, other studies emphasize that rural households with HIV and AIDS experience reduced income opportunities due to labour constraints (Bachmann and Booysen, 2003).

Rugalema (1999) reported that in Tanzania women did not have time for non-farm activities such as food processing, artisan crafts and other activities that previously contributed to household income when they were overburdened with care-giving due to chronic illness in the household. Sentongo (1995), studying the livelihoods of female traders in the Owino market in Uganda, observed that the businesses of market women who traded in perishables such as vegetables, fish and cooked food which required short turnaround time collapsed due to lost earnings when they tended to the sick for long periods of time. Van Liere (2002) pointed out that households with HIV and AIDS withdrew from marketing activities and engaged in only home-based pure subsistence activities which were likely to provide relatively less cash income. Other households were observed to have reduced their reliance on labour-intensive livestock enterprises, and focused on less labour-intensive activities such as raising small stock of pigs or poultry, a much less labour-intensive activity but which may provide less income (FAO, 1995). Hence it is essential to investigate the income-generating activities in rural households with HIV and AIDS in order to provide a better understanding of the food security situation.

2.1.3. Home gardens and household dietary diversity

The diversity of plants, domestic livestock and poultry raised in home gardens provides households with a diversity of foods, including vegetables, fruits, staples and meat, which are rich in vitamins, minerals and proteins (Garí, 2003; Marsh, 1998; Murphy *et al*., 2006; Shrestha *et al*., 2002). A baseline study carried out in Nepal showed that home gardens provided 60% of the household's total fruit and vegetable consumption (Gautam *et al.,* 2008). Talukder *et al*. (2000) monitored the consumption of fruits, vegetables and eggs from the gardens of 300 low income Nepalese households. They reported that for more than 95% of the households, their own garden was the main source of vegetables consumed and raising poultry enabled mothers and children to eat eggs. The Concern Livelihood Programme which focused on developing nutrition gardens in HIV affected households in rural Zimbabwe found that the vegetable produce from these gardens supplemented families' staple diet of maize and improved their nutrition **(**Keatinge and Amoaten, 2006). Ndaeyo (2007) examined the contribution of homestead farming to the food security of 300 households in South-eastern Nigeria and noted that for most rural households home garden crops provided vitamins, proteins and minerals which were hardly cultivated on distant farms. A large-scale home garden project implemented by Heller Keller International in Bangladesh found that households, which grew a larger variety of fruits and vegetables, had a higher intake of

vitamin A compared with other households (HKI, 2003). Marsh (1998) observed that in Bangladesh, on average, vegetables and fruits from the home garden provided households with more than 50% of the dietary needs. Castinẽiras *et al*. (2001) noted that in Cuba viands and grains, which formed a large portion of the household's diet, occupied greater areas within home gardens.

People living with HIV and AIDS (PLWHA) have special nutritional needs to assist them to ward off the opportunistic infections that accompany HIV and to prolong their lives (ACC/SCN, 1998; Gillespie, 2006). Johns *et al*. (2006) emphasized the need for diversity in the diet of PWLHA to strengthen the immune system and to combat opportunistic infections. The study of Kennedy *et al*. (2007) on the dietary intake of Filipino children based on dietary diversity scores over a reference period showed that increasing the number of food groups consumed improved the overall nutritional quality of a diet. Bukusuba *et al*. (2007) highlighted the interrelations between the practice of agriculture, household food security status and the dietary diversity; they noted that consumption of a diverse diet in a cross-section of 144 households with persons living with HIV and AIDS (PLWHA) in Jinja Eastern Uganda was significantly associated with the practice of agriculture which involved growing staples, fruits, vegetables, and the raising of poultry, bees, rabbits and other livestock within and around the home. The results showed a significant increase in dietary diversity score with increased food security score. Given the importance of a high nutritional diet in providing resistance to opportunistic diseases to the individual with HIV and good health to household members it is of much interest in this research to assess the contribution of home garden produce to the diet of rural households with HIV and AIDS.

2.1.4. Effect of gender of home garden owner on biodiversity in home gardens

Evidence from across several countries shows that while women contribute significant amounts of labour to the production of non-food cash crops, their greatest contribution is in the cultivation of subsistence food crops (Asfaw, 2001). Garí (2003) indicated that in Kagera, Tanzania, while men focused on two permanent crops, banana and coffee, which mainly provided income, women managed a wide range of key annual food and nutritional crops such as sweet potato, beans, and groundnuts within the home garden, besides cultivating distant fields. In northern Ghana, where gender roles and responsibilities are defined in maintaining household food security, Padmanabhan (2007) noted that staples such as root crops which are considered as 'male crops' were cultivated by men in distant fields, while seasonings used in the preparation of soups that accompany these staples are regarded as

'female crops' and are cultivated around the home. Dreschler (1997) surveyed the home gardens of women and men in rural Zambia and pointed out that these women's home gardens which were more subsistence oriented compared with those of men showed significantly higher species diversity. In a study on the effects of gender of home garden owner on plant diversity in Niamey, Bernholt *et al*. (2009) noted that home gardens managed by women had higher species diversity compared with those managed by men. Steiner *et al*. (2004) indicated that female-headed rural households with HIV and AIDS adopted innovative survival strategies in agricultural production; more quality crops rich in protein and vitamins were cultivated to increase food security. Salick (1997) studied the subsistence agriculture of 25 female-headed households among the Amuesha in Peru and found that home gardens of these female-headed households assumed an important position when field cultivation was constrained. These female-headed households depended on home gardens much more than the average household to supplement and supply a significant portion of the household's diet; they cultivated both major and minor crops in home gardens. However, Murphy (2008) noted in her study on AIDS and kitchen gardens in Western Kenya that the gendered aspects of gardens and AIDS intersected with changing norms and commercialization. Male and female gardeners alike value kitchen gardens for food security, nutrition and income. It is therefore relevant to incorporate a gender aspect in the investigations on the home garden management strategies in rural households with HIV and AIDS that enhance food and nutrition security.

2.1.5. Primary aim in home garden cultivation and the biodiversity in home gardens

Households cultivate a combination of species with different maturity periods in home gardens to ensure an uninterrupted supply of produce for own consumption (Garí, 2003; Okigbo, 1995). The sale of surplus produce and products from cash crops cultivated in home gardens enhances income (High and Shackleton, 2000; Murphy, 2008; Shackleton *et al*., 2008). The primary objective in home garden cultivation, which is either for subsistence production only or for cash income generation as well, influences biodiversity in home gardens (Trinh *et al*., 2003). Abdoellah *et al*. (2006) assessed the impact of commercialization on the structure of home gardens in Citarum Watershed, West Java, Indonesia, and noted that the introduction of cash crops into home gardens was accompanied by a decrease in species diversity. When Bernholt *et al*. (2009) analyzed the effects of market orientation on plant diversity in 51 urban and peri-urban gardens in Niamey in Niger, they found that non-commercial home gardens had only slightly higher species diversity and a significantly higher evenness while species richness was not different compared with

commercial gardens. [For a definition of these ecological concepts, see Section 2.2.1.] On the contrary, Trinh *et al*. (2003) noted that commercialization of Vietnamese home gardens did not lead to reduced diversity, but to more diversity in terms of total number of species. In addition, Murphy (2008) observed from her study on AIDS and kitchen garden in Western Kenya that HIV networks spread information about crops and their nutritional needs, new varieties, and new crops, which created subtle changes in the diversity of plants and intensity of cultivation techniques. However, when Von Braun *et al*. (1991) assessed the effects of commercialization of subsistence agricultural on the nutritional status of 200 households in Zaire-Nile Divide in Rwanda, they found that the incremental income that households earned from commercial potato production was spent on food which improved household nutrition. In view of the potential role of home gardens in contributing to food and nutrition security in rural households with HIV and AIDS, the current study will explore the biodiversity in home gardens of rural household with HIV and AIDS and the significance to food security in situations where the primary aim in home garden cultivation is to generate cash income.

2.1.6. Seasonality and household food security

Food security in most subsistence communities in sub-Saharan Africa is influenced by seasonality (Savy *et al*., 2005). In areas where agriculture production is mainly rain-fed and highly labour dependent, the effect of seasonality on food security is particularly pronounced (Masanjala, 2006; Savy *et al*., 2005). Masanjala (2006) pointed out that for these rural populations own farm production is available in relatively large amount, and income is received in large lump sum soon after harvest and little else during the rest of the year. These households often face food insecurity during the period between the depletion of food stocks and the next harvest (Savy *et al*., 2005). Hesselberg and Yaro (2006) studied the livelihoods of 600 households in deprived areas of Upper East Region of Ghana and found that households gradually entered into food insecurity in the dry season when food reserves declined and local income opportunities dwindled. Moreover, there was a seasonal diversification of income activities in order to reduce food insecurity; in the dry season, 54% of households from each village compared with an average of 15% in the wet season engaged in non-farm income activities, which were considered as secondary sources of income for the majority. In the dry season the cultivation of small gardens provided food and cash income and the availability of non-farm income opportunities reduced the number of food insecure households in two out of three villages. These households indicated that rearing of goats, sheep and pigs was the most important source of income which prevented acute food

insecurity in the dry season. In a recent study, Quaye (2008) investigated how 700 farm households in the three Northern regions of Ghana coped with food insecurity in the lean season. She found that generally both men and women engaged in crop production, poultry and livestock rearing, whereas only men took on trading and artesian jobs, while women engaged in food processing, petty trading, soap making, food vending, firewood collection, pottery and weaving. During periods of food shortages, households received food and cash support from relatives and friends, sold livestock and household valuables, migrated and engaged in waged labour significantly more often.

HIV and AIDS illness is associated with frequent ill health and consequently periodic labour loss (De Waal and Tumushabe, 2003). The subsequent lack of labour in critical periods during the major season of crop production in rural households with HIV and AIDS means that planting, growing or harvesting is either delayed or even missed in farm households and there is a potential loss of agricultural production, loss of income and food insecurity (Boto *et al*., 2004). These households may experience acute food insecurity during seasonal food shortage and are likely to become more vulnerable and may be unable to recover; a situation which is hypothesized as the "new variant famine" (De Waal 2007; De Waal and Whiteside, 2003; Gillespie and Drimie, 2009). To explore the seasonal dimension of coping with food insecurity in farm households living with HIV and AIDS the current study will evaluate household agricultural production and income activities during the post-harvest and the lean seasons.

2.1.7. Impact of HIV and AIDS on food-related coping behaviours

Households in sub-Saharan Africa adopt various strategies to cope with food shortfalls (Maxwell *et al*., 2000; Savy *et al*., 2005). Nyanteng and Asuming-Brempong (2003) observed that households in most areas of Ghana limited portion size at mealtimes, limited intake by adults for children to get enough and reduced the number of meals per day or skipped whole day's meals in situations of food shortage. Maxwell *et al*. (2000) explored the coping strategies of poor urban households in Accra, Ghana, to cope with food insecurity and insufficiency, and found that households shifted to less expensive and less preferred foods, purchased food on credit, purchased street food, reduced portion size at meal times, consumed fewer meals per day and refrained from eating the whole day to cope with food shortage. Quaye (2008) in her study of the food consumption strategies of 700 farm households in the three Northern regions of Ghana noted that normally households cultivated what they ate; however, during food shortage these households purchased foodstuffs that

were available on the market. They also reduced the number of meals served each day, reduced portions/sizes of meals, consumed less preferred foods and collected wild foods to cope with seasonal food shortage. Hesselberg and Yaro (2006) monitored 600 households in deprived areas of Upper East Region of Ghana to assess coping strategies adopted during periods of food shortage. They noted that households reduced the number of meals eaten in a day from the normal three meals a day to cope with food insufficiency.

Households living with HIV and AIDS adopt most of these strategies to cope with food insecurity (Gillespie and Drimie, 2009; Haddad and Gillespie, 2001; Van Liere, 2002). Bukusuba *et al*. (2007) studied the coping strategies of a cross-section of 144 households of PLWHA in Jinja, Eastern Uganda, during food shortages. He found that 95% of the households ate less preferred foods; 82.6% reduced portion sizes served to all household members; 77.0% borrowed money or food; 62.3% skipped meals by all household members and 21.5% skipped eating for the whole day by all household members. The results of the C-SAFE study conducted in Zimbabwe to assess the impact of HIV and AIDS on the livelihoods of 1625 rural households established that households with at least one chronically ill member were more likely to skip days without eating and eat less preferred foods to deal with food shortages than unaffected households (TANGO, 2003). The SADC/FANR (2003) survey confirmed that skipping meals was not only typical in all rural areas in countries in Southern Africa but was also more usual in households with a chronically ill adult. Even though these coping strategies are aimed at reducing food insecurity that occurred due to chronic illness in the household, yet households could be made more vulnerable to food insecurity as a result of frequency and severity of the coping strategies adopted (Kraak *et al*., 2000). TANGO (2003) used the coping strategies index, an indicator of household food security derived by Maxwell (1996) (CSI), which is a variable that combines frequency and severity of food-related coping behaviours adopted to assess food insecurity of rural households with and without a chronically ill member in rural Zambia. He reported a significantly higher CSI for households with a chronically ill member compared with households without a chronically ill member, because the former households skipped meals the entire day significantly more often than the latter. The conclusion drawn was that households with a chronically ill member are in a worse food insecurity situation compared with other vulnerable groups. The current study will assess the impact of HIV and AIDS on the frequency and severity of the food-related coping behaviours adopted by farm households living with HIV during seasonal food shortages.

2.2. Conceptual framework

2.2.1. Definitions and discussion of key concepts

The major concepts and approaches used in the study are derived from three different types of academic disciplines; social sciences, plant sciences and nutrition sciences. The concepts are: home garden, household, household HIV status, strategic decisions, labour, biodiversity, species diversity and dietary diversity score. These concepts are defined as they are applied in the study.

The *home garden* is a small-scale 'supplementary' food production system (Hoogerbrugge and Fresco, 1993), located within the homestead or within a 10-minute walk from the homestead, continuously cultivated by and for household members, and comprised of a complex and diverse mixture of annual and perennial plants and livestock (Mohan *et al*., 2007). The average size of the home garden area is characteristically less than that of a cultivated field, and home garden produce which is available continuously is harvested on a daily basis or seasonal from one or several plants (Fernandés and Nair, 1986; Hoogerbrugge and Fresco, 1993). Home garden crops supplement household subsistence requirements and also generate cash income by selling surplus produce and cash crops. The choice of home garden crops is determined by the availability of household labour, household's dietary preferences and the need for cash income (Abdoellah *et al*., 2006).

The *household* is defined as a group of persons who live together in the same house or compound and share the same house-keeping arrangement and are catered for as one unit (GSS, 2002). Rural households are directly dependent upon their immediate environment and their own skills to obtain the daily necessities of life such as food (Rocheleau, 1985). These households use available resources to meet the dietary needs of their members. The terms *Household HIV status / household confronted with or without HIV / HIV/AIDS afflicted and non-HIV afflicted household* in the context of this study refer to either a household with HIV and AIDS (HIV-positive household) or a household without HIV and AIDS (HIV-negative household). An HIV-positive household has at least one household member between 15 and 49 years old diagnosed with HIV or AIDS illness while an HIV-negative household has no member known with HIV (FAO, 2003). HIV and AIDS illness are characterized by frequent bouts of illness in rural households which reduce labour capacity. The individual with HIV and AIDS is unable to work and other household members have to spend time in care-giving. Rural households with HIV and AIDS are constrained in labour for agricultural production and ability to engage in economically productive activities which leads to limited food

availability and food diversity (Casale and Whiteside, 2006; Steiner *et al*., 2004). At the same time, the individual with HIV infection needs better quality food to prevent opportunistic infections and the progression of HIV to AIDS and household members also require good nutrition to prevent malnutrition (Bukusuba *et al*., 2007).

The concept *strategic decision* in this study refers to deliberate decisions taken by farm households with HIV and AIDS on how to alleviate labour constraint and to ensure food security. Households make strategic decisions through planning, organizing and directing the use of available resources to meet household's objectives among opposing factors in the environment (French and Saward, 1983). Farm households with HIV and AIDS make decisions on the use of resources in order to maintain food security.

Labour is an important household resource in this study. The availability of labour determines the level of household food production and ability to generate income from non-farm activities (Nyariki *et al*., 2002). Labour availability is therefore a major determinant of household well-being which suggests that shortage of labour for any reason could render a household vulnerable (Ellis and Freeman, 2004). HIV and AIDS limit labour and reduce farm households' ability to produce and buy food (Drimie and Casale, 2009; Topouzis, 2003). In the situation of HIV and AIDS farm households suffer the loss of labour of the sick individual. Moreover, household members divert labour to look after the sick individual leading to a reduction in on-farm operations and ability to engage in non-farm income activities.

Biodiversity in this study refers to the complex and diverse mixture of annual and perennial plants cultivated in home gardens and may include small domestic livestock and poultry. Biodiversity in home gardens is essential for household food security and also provides opportunities for income generation. The diversity of plant species in home gardens provides staples, vegetables, medicinal plants and non-food necessities such as animal fodder and firewood, and the small domestic livestock supply protein food sources (Faber and Van Jaarsveld, 2007; Garí, 2003; Murphy, 2008). The sales of surplus produce and cash crops provide cash income (High and Shackleton, 2000).

Species diversity is a measure of the composition of crop species in the home garden. It is represented by two indices in this study: the Shannon–Wiener diversity index (H') and the evenness index (E) **(**Beals *et al*., 1998). The Shannon–Wiener diversity index (H') is used to characterize the species diversity in home gardens. It is calculated through the formula: $(H') = -\Sigma (\rho_i \log \rho_i)$, where ρ_i is the proportion of occurrence of the *ith* species in a home garden in a study population expressed as a proportion of total species occurrence (N) (Kent

and Coker, 1992**).** The evenness (E) index is used to describe the diversity in terms of evenness, i.e. how equally abundant the species are in a home garden. It is calculated as E = H'/ H' max where H' max = log N, and N is the total number of species present. Species richness is the number of species represented in a home garden, independent of the number of individuals per species. For further details on these ecological variables see the individual research chapters.

Dietary diversity score (DDS) is a proxy measure of food security which represents the quality of a diet. DDS represents the number of different food groups consumed (variety) and the types of food groups consumed (quality). Increasing the variety of food across and within food groups is thought to ensure adequate intake of essential nutrients and promotes good health (WHO/FAO, 1996). Fourteen major food groups used in estimating DDS in this study are cereals; vitamin-A rich vegetables; white tubers and roots; dark green vegetables; other vegetables; vitamin-A rich fruits; other fruits; organ meat (iron rich); flesh meats; eggs; fish; pulses/legumes/nuts; milk and milk products; oils and fats (FAO, 2007). Comparing household's DDS gives a good assessment of households' access to a varied diet (Maxwell, 1996). In the current study a single 24-hour recall was adequate for estimating group average intakes because the diet of the study households did not deviate from the traditional Ghanaian diet of a staple dish of either a cereal or a root and tuber crop accompanied by a sauce made from vegetables (Nicklas *et al*., 2003; Salm and Falola, 2002).

Mutangadura *et al*. (1999) categorized the types of coping strategies adopted by rural households to mitigate the effects of HIV/AIDS. These consisted of strategies aimed at improving food security; strategies aimed at raising and supplementing income so as to maintain household expenditure; and strategies aimed at alleviating labour loss. Home garden cultivation was not considered as a strategy for the rural household to adapt to labour constraint and increased nutritional needs resulting from HIV and AIDS. Donahue (1998) developed a framework for the sequence of coping strategies to manage labour loss in HIV and AIDS situation which comprised reversible mechanisms and disposal of self-insurance assets; disposal of productive assets; and destitution. Although both studies indicated the dynamic nature and impact of the coping strategies adopted by household with HIV and AIDS, the factors which determined the households' ability to cope were not presented. Studies by Sauerborn *et al*. (1996) showed that the factors that determined the households' ability to manage labour loss included: access to resources, household size and composition, access to extended family and ability of the community to provide support. In order to fill this gap my model (Fig. 2.1) conceptualizes the home garden as a strategy to respond to the

decline in labour and reduced food availability and food diversity experienced by farm households with HIV and AIDS. Using the framework of Donahue (1998) as point of departure and incorporating the findings of Sauerborn *et al*. (1996) the model in Fig. 2.1 is composed to show the linkages between household labour, home garden species diversity and food security. The immediate impact of HIV and AIDS illness on the farm household is reduced labour available for on-farm activities. This necessitates an approach that will reduce constraints in labour and will require deliberate decisions taken by the HIV-positive farm household as indicated by the box in the middle of Fig. 2.1. HIV-positive farm household with HIV and AIDS take in extended family members to assist in care giving which will change household size and composition. The HIV-positive farm household adapts available labour by adopting a specific management strategy in home garden cultivation to mitigate the constraints in labour and to enhance food availability and food diversity. The infected individual allocates more labour to the home garden due to proximity of the home garden to the home, and flexibility in his or her labour requirement. Other household members may also carry out home garden tasks during leisure time to improve the home garden. This may lead to a general increase in labour input in the home garden in HIV-positive (L_1) compared with HIV-negative (L_0) households (where $L_1 > L_0$ as shown in Fig. 2.1). The typical initial response of a HIV-positive farm household is to produce enough for subsistence (Armstrong, 1995). The result of the increased labour input in the home garden is an increase in species diversity in HIV-positive (Sd_1) compared with HIV-negative (Sd_0) farm household (where $Sd_1 > Sd_0$ as indicated in the model). The outcome is a higher dietary diversity in HIV-positive (DDS_1) compared with HIV-negative (DDS_0) farm households (where ($DDS_1 > DDS_0$ as shown in Fig. 2.1).

The main purpose of this study is therefore to explore how rural households living with HIV and AIDS are employing home garden management strategies to enhance a number of important aspects of food and nutrition security. It also examines the seasonal dimension of coping with food shortages through the documentation of the frequency and severity of the food–related coping behaviours adopted in farm households living with HIV and AIDS.

The specific research objectives and research questions formulated for the study were as follows:

Research objective 1

To assess the biodiversity in the home garden and evaluate its contribution to dietary diversity among HIV-positive and HIV-negative rural households in the Eastern Region of Ghana.

Research questions:

1. What is the effect of HIV and AIDS on field cultivation in rural households in the Eastern Region of Ghana?
2. What is the effect of field cultivation on the number of household members who contribute to home garden cultivation in HIV-positive rural households in the Eastern Region of Ghana?
3. How does the number of household members who contribute to home garden cultivation in HIV-positive farm households compare with that of HIV-negative rural households?
4. What is the effect of the number of household members in HIV-positive rural households who contribute to home garden cultivation on the species diversity in home gardens?
5. How does the species diversity in home gardens of HIV-positive compare with HIV-negative rural households?
6. How does the dietary diversity in HIV-positive compare with that of HIV-negative rural households?
7. How does the difference in species diversity in home gardens influence the dietary diversity in HIV-positive and HIV-negative rural households?
8. What is the association between the species diversity in home gardens and dietary diversity in HIV-positive and HIV-negative the rural households?

Research objective 2

To evaluate the differences in the biodiversity in home gardens of female-headed HIV-positive and HIV-negative rural households and dual-headed HIV-positive and HIV-negative rural households in the Eastern Region of Ghana and the effect on household dietary diversity.

Research questions:

1. How does field cultivation in female-headed HIV-positive compare with that of female-headed HIV-negative and with dual-headed HIV-negative and HIV-positive rural households in the Eastern Region of Ghana?
2. How does labour input in home garden cultivation in female-headed HIV-positive compare with that of female-headed HIV-negative and with dual-headed HIV-negative and HIV-positive rural households in the Eastern Region of Ghana?
3. How does plant species composition in home gardens of female-headed HIV-positive compare with that of female-headed HIV-negative and with that of dual-headed HIV-positive and HIV-negative rural households in the Eastern Region of Ghana?
4. How does species diversity in home gardens of female-headed HIV-positive compare with that of female-headed HIV-negative and with that of dual-headed HIV-negative and HIV-positive rural households?
5. How does the dietary diversity in female-headed HIV-positive compare with that of female-headed HIV-negative and with that of dual-headed HIV-negative and HIV-positive rural households?

Research objective 3

To explore the differences and similarities in the biodiversity in subsistence oriented and commerce oriented home gardens of HIV-positive and HIV-negative rural households in the Eastern Region of Ghana and their significance in household food security.

Research questions:

1. What are the differences in crop species composition, crop diversity and the seasonal availability of home gardens produce in subsistence oriented and commerce oriented home gardens of HIV-positive and HIV-negative rural households in the Eastern Region of Ghana?
2. What are the differences in crop species composition, crop diversity and seasonal availability of home gardens produce in subsistence oriented and commerce oriented home gardens of HIV-positive and HIV-negative rural households in the Eastern Region of Ghana?

3. How do the differences and similarities in crop species composition, crop diversity and seasonal availability of home gardens produce in subsistence oriented and commerce oriented home gardens of HIV-positive and HIV-negative rural households influence food security?

Research objective 4

To evaluate the food insecurity of HIV-positive and HIV-negative farm households in the Eastern Region of Ghana during the post-harvest period and in the lean season through assessing the differences in the frequency and severity of the food-related coping behaviours adopted by the households in the two periods.

Research questions:

1. How different are the food-related coping behaviours between HIV-positive and HIV-negative farm households in the Eastern Region of Ghana in the post-harvest period?
2. How different are the food related coping behaviours between HIV-positive and HIV-negative farm households in the Eastern Region of Ghana in the lean season?
3. How do the differences in the frequency and severity of the food-related coping behaviours adopted in the posthar-vest period between HIV-positive and HIV-negative farm households influence food security?
4. How do the difference in the frequency and severity of the food-related coping behaviours adopted in the lean season between HIV-positive and HIV-negative farm households influence food security?
5. How do the differences in agricultural production and income activities in the pos-tharvest period between HIV-positive and HIV-negative farm households influence food security?
6. How do the differences in agricultural production and income activities in the lean season between HIV-positive and HIV-negative farm households influence food security?
7. How can food insecurity be improved in HIV-positive farm households?

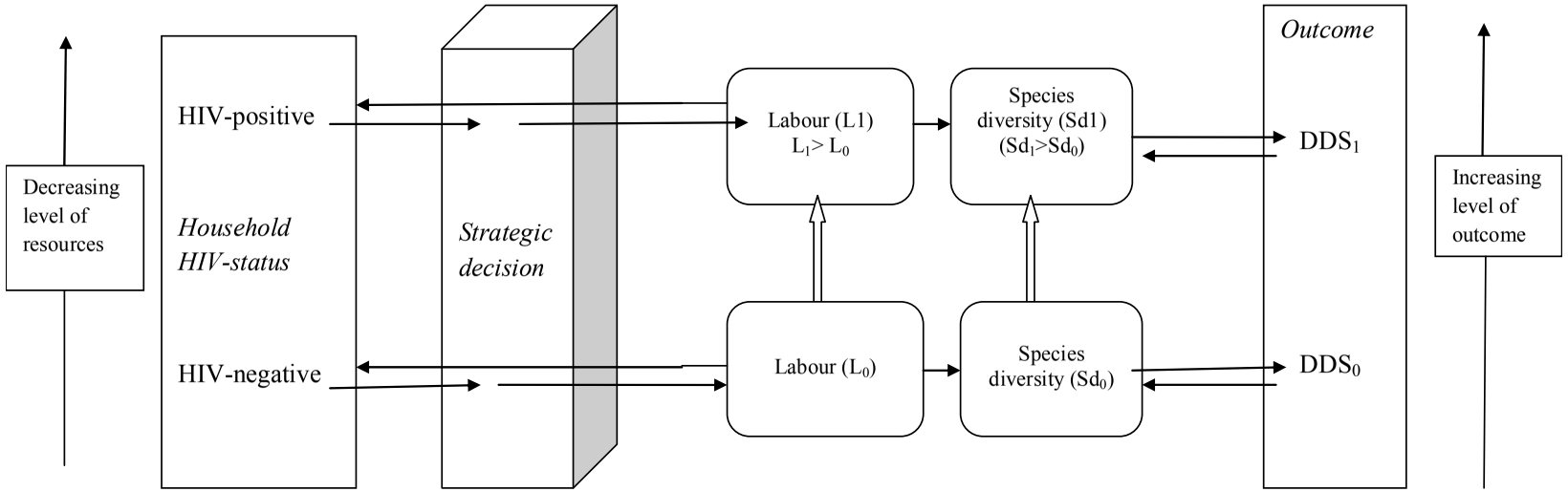

Figure 2.1: Conceptual model of management strategies in home garden in response to HIV and AIDS.

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CHAPTER 3

A. Country profile and research area

3.1. Country profile

3.1.1. Geography, climate and vegetation

The Republic of Ghana is located in West Africa along the coast of the Gulf of Guinea with Côte d' Ivoire to the west, Togo to the east and Burkina Faso in the north. Ghana has a total land area of 238,537 km^2. According to the 2000 census Ghana's population in 2000 was 18.9 million. The Eastern Region of Ghana, the sixth largest of the ten administrative regions of Ghana in terms of land area (19,323 km^2), lies between latitudes 6^o and 7^o North and between longitudes $1^o30'$ West and $0^o30'$ East. It is the third most populous region of the country (2,106,696 inhabitants) and is divided into 21 administrative districts (GSS, 2004). The Eastern Region of Ghana falls within the equatorial monsoon belt, which is characterized by two main seasons, wet and dry. The wet season is associated with a double maximum rainfall regime from April to July with mean annual rainfall of 1,270 mm and from September to October with mean annual rainfall of 1,778 mm which gives rise to major and minor growing seasons. The dry season is from December to March. The vegetation in the region varies from moist deciduous/semi-deciduous forests to degraded forest with a wide range of tall grasses. The forested areas of the Eastern Region of Ghana serve as major agricultural areas in the country.

3.1.2. Agriculture in the Eastern Region of Ghana

Farming is the dominant form of land use in the Eastern Region, and the main source of income for 55% of its population. This is related to the predominantly rural character of the Region and to the fact that the Region is well endowed with fertile soils. Soils in the semi-deciduous forest zone are feraltic representing an almost final stage of weathering known as red loamy soils, while the valleys have black alluvial lake soil deposits; these soils are the most productive forest soils of Ghana (Adu, 1992). Traditional techniques of crop production consisting of slash and burn methods are used. Farming in the Eastern Region of Ghana is predominantly labour intensive and therefore small-scaled with farm sizes usually less than 2 ha. Smallholder farmers on family-operated farms use simple tools such as hoes and cutlasses to produce about 80% of the total agricultural production in the region under rain-fed

condition. Historical accounts indicate that the major agricultural areas of the Eastern Region were initially cultivated with plantations of oil palm and later with cocoa. However, as cocoa production declined due to pests and diseases and because of reduced soil fertility, the rural population increasingly relied on producing food crops both for their own subsistence and for sale to urban areas (Amanor, 1994). Crops cultivated include basic staples such as maize, cassava, cocoyam, plantain, yam, and rice, but also fruit and green leafy vegetables (Benneh, 1973).

3.1.3. Home gardening in the Eastern Region of Ghana

The biophysical environment of the Eastern Region of Ghana enhances the cultivation of home gardens. The land immediately surrounding or near a house is intensively cropped with food crops, cash crops, medicinal plants and fodder. Soil fertility is regenerated by traditional techniques mainly involving the use of household refuse and manure from small domestic livestock kept by households. Home gardens are important sources of food and income for households. The kind of crops grown, the combination of crops, and methods of cultivation depend on climate, soil type, household preferences and management inputs available (Asare *et al*., 1990; Bennett-Lartey *et al*., 2002; Yiridoe and Anchirinah, 2005). Rural poultry production and small domestic livestock rearing are important agricultural activities in rural communities of the Eastern Region of Ghana, providing scarce animal protein in the form of meat and eggs as well as being a reliable source of petty cash. Traditional management methods are used in rearing these animals. Chicken and pigs are kept in pens during the night and let out during the day and are fed on leftovers from the kitchen. Sheep and goats are kept in pens and fed on cut fodder and household wastes, mainly cassava and plantain peels, and crop residues, or are left to graze around the compound. Children and women often undertake the daily management of these animals, by providing feed, water and bedding and by cleaning the pens. Although most farmers have access to veterinary services, curative "self-medication" is commonly practiced at times using various herbal concoctions due to the financial cost involved (Asare *et al*., 1990; Awuni, 2002).

3.1.4. Socio-economic profile of the Eastern Region of Ghana

Farm households in the Eastern Region of Ghana engage in various non-farm income activities besides agriculture. These include wage work; self-employment, involving artisan work like tailoring, hairdressing, carpentry and wood craft; and petty trading. Remittances from relatives within national boundaries and overseas are also important sources of income.

Other income sources include rent, which is income earning from leasing equipment, farm land or residential dwelling. A small percentage of households have members in salaried employment like teaching and nursing (GSS, 2000; 2002).

Poverty in Ghana is predominantly a rural phenomenon. The Eastern Region of Ghana is one of the five regions in Ghana which had more than 40% of their population living in poverty in 1999 (GPRS, 2003). Food crop farmers in the Eastern Region of Ghana form part of the 59% of the poor in Ghana (GSS, 2000). This is due to several factors including inadequate agricultural land, high cost of inputs, lack of access to markets and low levels of economic infrastructure (GPRS, 2003). Food insecurity in Ghana is a reflection of the poverty situation whereby poorer regions have more food insecure subsistence farming households (Hesselberg and Yaro, 2006). Household food security depends on a regular and sustainable supply of food throughout the year. In rural areas with limited income-earning opportunities, the ability to produce most foods on the farm and in home gardens without depending on market purchases means a better guarantee of household food security. In many rural areas, however, households often face food shortages, because crop production is seasonal and inadequate. The government of Ghana has identified household food security as an important challenge and efforts are being made to enhance access to food and adequate dietary intake (United Nations, 2005).

3.1.5. HIV and AIDS in the Eastern Region of Ghana

After the first cases of AIDS were reported in Ghana in March 1986, the disease spread slowly but steadily until 2003, when prevalence peaked at 3.1%. In 2007, the estimated adult HIV/AIDS prevalence was 1.9%, and the epidemic is currently considered stable (NACP, 2002). However, regional differences exist; the Eastern Region of Ghana has consistently recorded the highest incidence of HIV prevalence (<5.0%) since 1986 (Agyei-Mensah, 2001; Ampofo *et al*., 2006; MoH, 2000; Pellow, 1994). There is circumstantial evidence that the construction of a major hydroelectric dam in the Eastern Region of Ghana in the 1960s, the flooding of large stretches of fertile land, the disruption of the traditional way of life, and the ensuing migrations of the local population were to some extent the cause of the initial high incidence of HIV in the region. Some rural communities in the Eastern region are known to be contributing to the high prevalence; the populations of these areas are made up of significant proportions of migrants returning from Côte d'Ivoire, which is known to have one of the highest rates of infection in West Africa. It is therefore not surprising that the level of HIV infection among adults has consistently been higher (Sauvé *et al*., 2002).

3.1.6. National response to the HIV and AIDS epidemic in Ghana

The Government of Ghana is actively responding to the HIV/AIDS epidemic. There has been considerable political commitment both in the past and at present by the government, and currently the Ghana government has moved to operationalize the National Strategic Framework through multi-sector collaborations.

The Ghana AIDS Commission (GAC), established in 2000, is the coordinating body for all HIV/AIDS-related programmes in the country (GAC, 2004). It has the responsibility to oversee the response to the HIV/AIDS epidemic, by formulating policies, providing supervision, mobilizing resources and coordinating programmes. The implementation of the National Strategic Framework on HIV/AIDS for 2001–2005 (NSF I) resulted in several policies and guidelines creating an environment conducive to the delivery of effective HIV and AIDS services and stimulated the development of policy documents. Over the 5 years of its implementation there was increased awareness, community participation and support from development partners (GAC, 2008). The National Strategic Framework on HIV/AIDS II (NSF II), 2006–2010, was implemented by the GAC by building on the successes of the National Strategic Framework on HIV/AIDS for 2001–2005 (NSF I) and taking a more comprehensive approach to HIV prevention and treatment. The GAC was charged with promoting HIV/AIDS policy, advocacy, and an enabling environment; coordinating and managing a decentralized response; mitigating the social, cultural, legal, and economic impacts of HIV/AIDS; communicating prevention and behaviour change messages; providing treatment, care, and support to HIV-infected and -affected individuals; conducting HIV/AIDS research, surveillance, and monitoring and evaluation; mobilizing resources and funding to respond to the epidemic.

Even though the prevalence of HIV and AIDS in Ghana is quite low compared to other African countries, nevertheless stemming the HIV and AIDS epidemic could only be done via a multi-sectoral approach targeting vulnerable groups such as the rural poor in the society.

B. The research design and methodology

The general objectives of this study are to explore how rural households with HIV and AIDS in Ghana are employing home garden management strategies to enhance a number of important aspects of food and nutrition security. The study also examines the seasonal dimension of coping with food insecurity in rural households living with HIV and AIDS through the documentation of empirically based information on food-related coping behaviours adopted seasonally, particularly during periods of peak seasonal food shortages. Thus, the study assesses the home garden management strategies in rural households with HIV and AIDS; uncovers the effect of the interaction between household HIV status and gender of the household head on home garden biodiversity; explores the biodiversity in home gardens of rural households with HIV and AIDS when the primary aim in home garden cultivation is for cash income generation as well; and evaluates the food insecurity of farm households with HIV and AIDS during the post-harvest period and in the lean season through assessing the frequency and severity of food-related coping behaviours adopted by the households in the two different periods. This chapter presents an overview of the research design used in the study and the different methods employed in data collection and data analyses to answer the research questions. The first section of this chapter discusses the research design and methodological issues, followed by a description of the different phases of research. The next section describes the methods and techniques used in data collection, including specialized methods relevant to specific aspects of the study. This is followed by a discussion on the methods of data analysis and data management. The final section acknowledges and discusses the difficulties encountered in conducting the research.

3.2. Methodological considerations and research design

To answer research questions taking into consideration the limited time and resources, the research was designed as a comparative in-depth study with a multidisciplinary approach integrating social science, plant science and nutrition science studies. It was carried out to adequately answer the research questions. Consequently the methodology of the study was a mixed method approach combining qualitative and quantitative methods.

3.2.1. Quantitative versus qualitative approaches

A combination of quantitative and qualitative research methods was used because of their

complementarities (Scrimshaw, 1990). As every research method has its limitations and advantages a multiple research approach is more capable of disclosing diverse dimensions of behaviour. Several researchers emphasized the importance of combining qualitative and quantitative data collection methods in research (Ashley *et al*., 2003; Castro *et al*., 1996; Scrimshaw, 1990). Scrimshaw (1990) indicated that the methodological concepts of validity and reliability provide a common foundation for the integration of quantitative and qualitative techniques. Quantitative research has the objective to produce generalizations about causal relationships between aspects of the phenomenon of the study (Chapman and Maclean, 1990). In contrast, the qualitative research approach is directed towards gaining an understanding of the meaning of people's everyday lives from their own perspective. Therefore the qualitative research methods provide detailed descriptions of particular social settings under investigation as well as explanations of the behaviour that occurs (Narman, 1995). As indicated by Crabtree and Miller (1999) a qualitative approach in research explores meanings, perceptions, relationships, associations and patterns based on personal experience of the phenomenon being examined. Qualitative research also acknowledges that people do not construct meaning in a vacuum, but within a socio-cultural environment in which they live. Therefore they construct meanings through interaction and negotiation with others (Chapman and Maclean, 1990). In my opinion, quantitative methods are more accurate in terms of validity while qualitative techniques offer more reliability (Scrimshaw, 1990). Quantitative research was used to answer questions that were primarily based on the descriptive and theoretical objectives of the study. Qualitative method was used to provide an in-depth understanding of the HIV and AIDS epidemic's effects on home garden management strategies and household food security due to the stigma attached to HIV and AIDS illness. This is supported by several proponents of qualitative research, who argue that qualitative data preserves the chronological flow, assesses local causality and provides useful explanations that may not be arrived at by means of quantification methods (Crabtree and Miller, 1999; Miller, 2000; Strauss and Corbin, 1990).

In the mixed quantitative and qualitative approach of the study, I used a variety of research techniques appropriate for collection of different kinds of data to capture various aspects of home garden management strategies and the coping strategies adopted in response to food insecurity in HIV-positive and HIV-negative rural households. In all, data were gathered through key informant interviews, focus group discussions, semi-structured and structured interviews in surveys, together with in-depth interviews with selected cases of HIV-positive and HIV-negative rural households and participant observations.

3.2.2. Description of the research design

The research design consisted of four phases. There was an initial, exploratory, qualitative data collection and sample building; a survey was then conducted to assess management strategies in home gardens of HIV-positive and HIV-negative rural households; data was preliminary analyzed to identify relevant issues that required in-depth studies in order to adequately answer the research questions. In-depth studies were conducted with selected case households to uncover the effect of the interaction between household HIV status and gender of the home garden owner on biodiversity in home gardens; and to explore the differences and similarities in biodiversity in subsistence-oriented and commerce-oriented home gardens of HIV-positive and HIV-negative rural households and their significance in food security. A multiple round survey was then conducted to examine the seasonal dimension of coping with food shortages through the documentation of empirical information on the food-related coping behaviours adopted during the period of peak seasonal food shortages. The sequence of the study is presented in Tables 3.1, 3.2, 3.3.1, 3.3.2 and 3.4.

3.3. Phases of the field work

The first phase of the study involved an initial, exploratory, qualitative data collection. This included secondary data collection from published documents and grey cover reports as well key informants' interviews to gather data on HIV and AIDS prevalence; agriculture production; home garden surveys in the Eastern Region of Ghana; the general knowledge on the area and its people. The information generated was used to select a potential sample of HIV-positive and HIV-negative rural households to participate in the survey. Besides, the information obtained facilitated the selection of participants for focus group discussions to operationalize the concepts of the study and to determine the relevant variables that were included in the questionnaire for the household survey. Focus group discussions were also used to identify food-related coping behaviours adopted by local households to cope with food shortages and developed a ranking for the individual food-related coping behaviours based on their perceived security. Details are presented in Table 3.1.

In Phase 2 a survey was conducted during October 2005 to February 2006 to collect quantitative data on home garden management strategies in HIV-positive and HIV-negative rural households. This was followed by preliminary analyses of the survey data which helped to identify relevant issues that required in-depth studies to answer the research questions. The results from the survey also made it possible to develop selection criteria for cases for further study.

Table 3.1: Initial, exploratory, qualitative phase (Research Phase 1), answering the research question: What is the effect of HIV and AIDS on the management strategies in home gardens of rural households in the Eastern Region of Ghana?

Operational objectives	Expected outputs	Methods, instruments and strategies for data collection	Analysis
Research Phase 1: Initial, exploratory, qualitative phase Objective: Development of survey questionnaire			
A1: Secondary data collection	Information gathered on HIV and AIDS prevalence; agriculture production; home garden surveys; the area and people of the Eastern Region of Ghana, from various sources	Consult relevant books, reports, research articles, grey cover reports	Compare information from various sources
A3: Identify potential sample of households	• A sample of HIV-positive rural households cultivating a home garden and a distant field obtained • A sample of HIV-negative rural households cultivating a home garden and a distant field obtained • Selection of participants for focus group discussions • Selection and training of field assistants	• Key informant interviews • Consult Association of people living with HIV and AIDS • Consult CBO and NGOs • Informal discussions • Household visit • Home garden visits	Develop a list of HIV-positive and HIV-negative households
A3: Operationalize concepts of the study and determine relevant variables to include in questionnaire for survey	• Questionnaire for survey developed	• Key informant interviews • Focus group discussions (FGD) • Interview guide • Check list • Informal discussions • Household visits • Home garden visits	Compare information from FGDs and key informants

Phase 3 involved in-depth studies which focused on the use of in-depth interviews to investigate key process and relationships using case studies. The initial part of Phase 3 focused on uncovering the effect of the interaction between household HIV status and gender of the home garden owner on biodiversity in home gardens. The study used 12 selected case study households drawn from the groups of female-headed and dual-headed HIV-positive and HIV-negative rural households to provide a comprehensive insight into how home gardens are managed in the different household types. A series of in-depth interviews and informal discussions were conducted with these households and observations were made during the period to provide vivid information facilitating the comparison of household agricultural production (in fields and home gardens), home garden management practices, gender-specific tasks, and contribution of home garden produce to dietary diversity among the four categories

of households. The second part of the in-depth studies was conducted with 20 selected case study households to explore the differences and similarities in the biodiversity in subsistence-oriented and commerce-oriented home gardens of HIV-positive and HIV-negative rural households and the importance in household food security. Through semi-structured interviews more detailed information was obtained from these households on the choice of home garden crops, management inputs used in home garden cultivation, seasonal availability of home garden produce, uses of home garden produce, household dietary preferences and income generating activities. Chapters 5 and 6 provide more details.

The fourth and last phase of the study involved a multiple round survey to examine the seasonal dimension of coping with food shortages through the documentation of empirically based information on the food-related coping behaviours in rural households living with HIV and AIDS at peak periods of seasonal food shortages. Specifically the differences in frequency and severity of the food-related coping behaviours adopted; agricultural production; and income generating activities take on during the post-harvest period and in the lean season between HIV-positive and HIV-negative rural households were assessed. The objective was to highlight the magnitude of food insecurity experienced by these households at peak periods of seasonal food shortages. A detailed account is given in Chapter 7.

3.4. Methods, techniques and strategies of data collection

The research used both qualitative and quantitative data collection methods to generate the necessary data. This facilitated a deeper understanding and better interpretation of the data generated and increased validity in the research findings as one data collection method complemented the other. Secondary data were collected and reviewed. Primary data collection methods used included focus group discussions, interviews with key informants, questionnaire survey, in-depth interviews with case studies and participant observation. A selection of specialized methods was used in the dietary research component of the study and also to examine the seasonal dimension of households' coping strategies to food shortages. Data on the biophysical aspects of the home garden was obtained through a home garden survey.

3.4.1. Secondary data collection

A review of relevant reports and documents provided secondary data. These sources included

country reports and extensive and diverse literature by local and foreign researches, both published and unpublished. Other sources included World Bank reports; UNAIDS reports; and reports from national and international non-governmental organizations involved in the provision of HIV and AIDS related care and support. Most of the information reviewed focused on HIV/AIDS research in the country; a compilation of records or results of home garden surveys that has been conducted by other agencies; the profile of the study area: the agro-ecological zone, rainfall, temperature, type of soils, vegetation type, population density, agricultural practices, other production activities and market information on food crops. Information was also obtained on access to basic social services, such as health and education, and access to markets and infrastructure (roads, electrical network) in the study area.

3.4.2. Primary data

The following methods and techniques were used for primary data collection.

Key informants interviews. Different types of interviews are used in qualitative research (Fontana and Frey, 1994). These interviews may be informal or formal and may vary in-depth with their use depending largely on the information required. Key informants were effective sources of information for the study and were selected based on their knowledge experience and professional background. The key informants purposively selected for the study included 18 individuals, comprising medical officers, AIDS counsellors and nutritionists in the district hospitals and health centres and AIDS coordinators in the study areas. Others were district agricultural extension officers due to their expert knowledge of agricultural practices in the study areas and community health personnel based on their designation and provision of health service; representatives of community-based non-governmental organizations involved in provision of care or support based on their designation and activities, and village leaders by virtue of their position as leaders in the study areas. Interviews were conducted in a rather unstructured manner because the interview guides were not strictly followed in order to clarify relevant issues that were not clear. The key informants' interviews provided expert information on specific issues relevant to the study and covered sensitive subjects on HIV and AIDS. Information obtained facilitated sampling of the study population, recruitment of focus groups participants and research assistants and the designing of an appropriate interview guide for focus group discussions.

The study population and sampling procedure. The study population consisted of rural households with at least one member aged 15-49 years diagnosed with HIV and AIDS (HIV-positive); and households with no member diagnosed with HIV and AIDS (HIV-negative). Different sampling techniques were used to select the HIV-positive and HIV-negative households that participated in the study. Due to the difficulty in identifying HIV-positive households as a result of HIV and AIDS-related stigma a purposive sample of HIV-positive rural households was identified through a non-governmental association, the Association of Persons Living with HIV and AIDS (PLWHA) in hospitals in the Fanteakwa, West Akim and New Juaben districts of the Eastern Region of Ghana. The members of the Association of PLWHA comprised persons from different areas of Ghana who had tested positive for HIV. The purposive sample of HIV-positive households selected to participate in the study were located in 17 rural communities in 12 of the 21 districts of the Eastern Region of Ghana. From a list of HIV-negative rural households that resided in the same 17 communities as HIV-positive households complied with the assistance of district agricultural extension officers and village leaders a sample of three HIV-negative households were systematically selected from each community to participate in the study.

Focus group discussions. A focus group is an important tool for qualitative data collection. According to Morgan (1997) the aim of focus group discussion is to allow a group to interact, to compare thoughts and experiences based on topics that the researcher wants to explore. During a focus group discussion, individuals present their own opinions, perspectives and beliefs which are further sharpened and refined through group interactions and discussions (Finch and Lewis, 2003; Krueger and Casey, 2000). Focus groups can be used on their own as a source of data or information or in combination with other methods of data collection such as interviews and observations with each contributing something unique to the researchers' understanding (Hebbeler and Gerlach-Downie, 2002; Mitra, 1994). In this research, focus group discussions were used to inform the construction of the instrument for the survey and also provided qualitative data to enrich the analysis and interpretation of the quantitative data collected in the survey. Following the selection of the study population, focus group participants comprising heads of HIV-positive and HIV-negative rural households were selected to participate in focus discussions. A total of 12 focus discussions were conducted with 8 to 10 single sex participants in each session to ensure adequate coverage. Men and women participated in separate groups to provide a free environment for expression of thoughts. Two research assistants were trained to facilitate the discussions; one

kept the discussion on track by asking open–ended questions to stimulate the discussion and the other as a moderator recorded observations and non-verbal communication. Eight focus group discussions covered topics on agricultural production in fields and home gardens: resources available, choice of crops, domestic livestock and poultry species, gender roles and responsibilities in crop cultivation and domestic livestock and poultry rearing; income generating activities; constraints encountered and changes adopted and contribution of home garden produce to household dietary intake and income. Participants also provided a comprehensive list of food items that could be obtained from home gardens for dietary studies. Other issues discussed with appropriate groups included management strategies adopted by households in agriculture production in response to HIV and AIDS illness in the household in terms of changes in cultivated area, crop species cultivated and labour input in fields and home garden cultivation and domestic livestock and poultry rearing; kind of domestic livestock and poultry species reared; and household food availability and food diversity. Four focus group sessions also identified and discussed the local food-related coping behaviours adopted during the post-harvest period and lean season in response to food shortages; and developed rankings for these coping strategies based on their perceived severity. Other topics covered included agricultural production and income generating activities (agriculture related or not) undertaken during the post-harvest period and lean season; constraints encountered influencing household food availability and food diversity and changes adopted. Each focus group session lasted for about two hours.

Household survey. The survey method was used because of its appropriateness in answering the "what and how questions" with regard to household agricultural production in fields and home gardens; benefits of home garden cultivation; household dietary intake and changes that occur due to the effects of HIV and AIDS. A purposive selected sample of 32 HIV-positive and a random sample of 48 HIV-negative rural households participated in the household survey. These households cultivated a home garden which was located within the homestead or within a 10- minute walk from the homestead, continuously cultivated by and for household members, cultivated with a diverse mixture of annual and perennial plants and with domestic livestock and/or poultry. The household survey involved a single exercise in which the researcher administered a written questionnaire to all selected households through face to face interviews. A draft questionnaire was vdeveloped using focus group information and was refined through consultations with supervisors. The improved instrument was pre-

tested during field training of research assistants on a sample of five households to identify problems which might occur for both respondent and interviewer regarding question content; this also helped to estimate the time needed for each interview. The households interviewed were outside the sample group in order to avoid reporting bias. Pre-testing is essential in order to revise a questionnaire to maximize reliability and validity (Golafshani, 2003). Questions were amended and existing gaps were filled where necessary before the start of the actual household survey. The respondents in the survey were either the home garden owner or a member of the household who had expert knowledge on the home garden and could give reliable information. Both quantitative and qualitative data were gathered in the survey. The survey questionnaire consisted of both open and closed questions. Issues covered in the survey questionnaire included the basic characteristics of the households: socio-demographic and farming characteristics; sources of food supply; resources available for home garden cultivation (labour, land, tools, planting materials, etc.); household customs and culture; spheres of responsibility of household members in home garden cultivation and domestic livestock and poultry rearing; contribution of home garden produce to household dietary intake; and income and household dietary preferences. Each of these topics and subtopics were covered by a wide range of questions. The interview also aimed to document strategies employed by households in home garden cultivation to ensure household food availability and food diversity in the situation of decreasing available labour due to HIV and AIDS illness in the household. This entailed documenting in detail changes in: cultivated area and choice of crop species in fields and home gardens; selection of domestic livestock and poultry reared; labour input in home garden cultivation and animal husbandry work; other management inputs used in crop cultivation domestic livestock and poultry rearing; and household dietary intake. Several pertinent questions were designed for each topic with the aim of getting appropriate answers in relation to the objectives of the study. Each of these topics and subtopics was covered by a wide range of questions. As indicated earlier the household was the unit of analysis for the survey.

Home garden survey. Home gardens belonging to participants of the household survey were inspected to document the details of crop species, domestic livestock and poultry present and uses of these species. Observations were restricted to home gardens located within the homestead or within a 10-minute walk from the homestead. The informant went through the home garden with the researcher and a botanist, identifying cultivated plant species, and indicating uses. An inventory of these plant species were compiled together with botanical

names and local names; useful plant parts, growth habit and number of individual plants present were recorded. Plant species identified in the home garden were assigned to one or more of six broad use categories namely fruits, vegetables, root and tubers, spices, medicinal plants, and fodder. The different kinds and numbers of domestic livestock and poultry in each home garden were recorded.

Cultivated fields were also visited and information collected on the crop species present and crop species grown in other periods of the year and in previous years were documented.

Dietary studies. Dietary diversity is recognized by nutritionists as a key element of high quality diets. Studies conducted in developing countries have confirmed a positive relationship between dietary diversity and nutrient adequacy in diets that meet the requirements for essential nutrients (Hatløy *et al*., 1998; Ruel, 2003). Johns (2003) provided empirical evidence to support the hypothesis that biodiversity could be equated with dietary diversity. A number of approaches for dietary assessment are indicated in the nutrition literature; the method chosen depends on the purpose for reporting the measured outcome; the degree of accuracy required; the type of data needed to fulfill the purpose and the size of the study population (Ezzamel and Willmott, 1998; Mertz, 1992; Willett, 1998). The 24-hour qualitative dietary recall was used in the present study because it provides estimates comparable to more intensive methods like food records and requires relatively less time to administer (Yanek *et al*., 2001). Moreover it is easy to comprehend and could be used for illiterate populations and the interview could be conducted unannounced so that eating patterns are not altered. A single 24-hour recall was suitable for the survey because it is scientifically valid when used with a large group (McClelland *et al*., 2001); and the dietary intake of study households did not deviate from the traditional Ghanaian diet of a staple dish of either a cereal or a root and tuber crop accompanied by a sauce made from vegetables (Salm and Falola, 2002). The household member who prepared the previous day's meals was asked to recall the different food items that were consumed by the household in the previous 24 hours preceding the interview using the food list compiled at the initial qualitative phase of the study. Food items obtained from the home garden were specified.

Case studies. The case study was used to generate qualitative data to explore the dynamic and complex processes of home garden management strategies in female-headed and dual-headed HIV-positive and HIV-negative rural households; and in subsistence-oriented and commerce-

oriented home gardens of HIV-positive and HIV-negative rural households. Mitchell (1983) defines a case study as "a detailed examination of an event (or a series of related events) which the analyst believes exhibits the operation of some identified general theoretical principle." Case studies could therefore be used for both generating and testing hypotheses (Flyvberg, 2006). Yin (2003) argues that a case study is an empirical enquiry that investigates a phenomenon within its real life context when there is little control over events. Case studies were conducted to evaluate the differences and similarities in home garden management strategies in HIV-positive and HIV- negative female-headed (adult female) and dual-headed (both adult male and female present) rural households with HIV and AIDS; and to explore the biodiversity in home gardens of HIV-positive and HIV-negative rural households when the primary objective in home garden cultivation is cash income generation as well.

After the survey, households were stratified by household HIV status and gender of household head (female/dual-headed). Three households were purposively drawn from each group of female-headed and dual-headed HIV-positive and HIV-negative rural households to serve as case studies. Selection criteria were that the household reared both domestic livestock and poultry and had cultivated the home garden continuously for 5 or more years and had at least both a male and a female child aged 10-15 years, and was willing to share experiences with the researcher. Survey data was again stratified by household HIV status and primary aim in home garden cultivation (subsistence-oriented/commerce-oriented). Five case study households were purposively selected from each of the four groups, namely: HIV-positive and HIV-negative rural households with subsistence-oriented and commerce-oriented home gardens. Selection criteria were that the household was not part of the previous group of case study households and that the home garden had been cultivated continuously for a period of at least 5 years. Marshall and Rossman (1995) emphasized that designing a study in which multiple cases, multiple informants or more than one data gathering technique are used, can greatly strengthen the study's usefulness for other settings. Home garden management strategies are dynamic and historical processes have an influence on the current strategies that were adopted. The case study approach was therefore selected to provide this temporal perspective to home garden management strategies. In-depth interviews were conducted with case study households. The objectives were to explore the dynamics in home garden management strategies and the effect caused by HIV and AIDS. The flexible nature of in-depth interviews allowed the researcher to investigate issues with respondent through probing for clarity and interpretation to provide a deeper understanding of meanings (Legard *et al.*, 2003). There was a cumulative building of information on previous knowledge instead

of adherence to a fixed set of questions and answers. In-depth interviews conducted with case study households from female-headed and dual-headed HIV-positive and HIV-negative rural households focused on field cropping, cultural practices in the home garden, gender specific tasks and responsibilities and use of home garden produce. In-depth interviews with case study households from HIV-positive and HIV-negative rural households with subsistence-oriented and commerce-oriented gardens provided detailed information on the choice of home garden crops, management inputs used in home garden cultivation, seasonal availability of home garden produce and uses of home garden produce, household dietary preferences and income earning activities. The researcher delved into households' life history, challenges encountered and the strategies employed to enhance food availability and food diversity in in-depth interviews. Each subject area was introduced with an open-ended question guided by a checklist.

Observation. Another qualitative technique used to obtain information was direct observation. Observations provide a good opportunity to get detailed and real insight into actual situations including actions, conservations and physical descriptions (Gittelsohn *et al*., 1997). Thus, observation as a technique was used to get a better grasp of the processes of home garden management strategies and the impact due to HIV and AIDS; and specifically the processes that determine coping strategies households adopt in response to seasonal peak food shortages and the way HIV and AIDS influence these strategies. In addition the technique was used to triangulate information collected with other methods and/or obtained from different data sources, particularly regarding the choice of home garden crops, domestic livestock and poultry species, cultural practices in home gardens, animal husbandry practices, seasonal availability and use of home garden produce, agricultural production and income generating activities in households. A check list was used as a guide to look out for factors and processes on which the critical observations were necessary and observations were recorded in a field note book. During informal visits to case households, home gardens were inspected to observe what was present or to look at the state of the garden. Besides what was observed, listening to conversations and discussions between members of households, probing into household income activities and sources of food and food consumption patterns also provided information.

A multi-round survey. A multiple round survey data collection technique entails a return to the same respondent after the first contact (Campbell and Graham, 1996). Besides providing

opportunities to obtain new information in subsequent contact, inconsistencies in information supplied in previous contacts can be clarified by the interviewer using extensive probing to collect information. It is assumed that data collected by using frequent visits to each household may approach the level of completeness and accuracy (Chen and Feilden, 1984). The participants of the multiple-round survey comprised a purposive sample of ten HIV-positive households that were part of a sample that participated in a household survey conducted to assess the management strategies in home gardens of rural households with HIV (Akrofi *et al*., 2010) and a random sample of eight HIV-negative rural households. These households engaged in subsistence mixed farming and had at least two children (below age 15). HIV-positive and HIV negative rural households were selected from the same communities. Scheduled visits were made to these households at intervals of 6 to 7 days over a 30-day period during the post-harvest period and the lean season to collect adequate information in an attempt to construct a complete picture of the food security situation of these households. Data was collected during the post-harvest period and the lean season in order to show the seasonal variation in food shortages. The data from focus group discussions informed the development of the questionnaire. At each home visit during the post-harvest period and in the lean season the researcher conducted an interview with household heads using a questionnaire with structured and open-ended questions on household agricultural production in fields and home gardens: vegetable and staple crop species harvested, farm produce sold, domestic livestock and poultry owned, domestic livestock and poultry sold; sources of income (agriculture related or not); constraints encountered and changes adopted. The female household member who was responsible for household food preparation and distribution was asked to recall the frequency of use of the individual food related coping behaviours adopted in the 6 days prior each visit. Food related coping behaviours had been identified by focus groups at the initial qualitative phase of the research. Other data collected were household socio-demographic characteristics such as age and sex of household members and years of formal education. The data from focus group discussions supplemented the quantitative data collected.

3.5. Data management and analysis

Data management involves organization data into a form that is suitable for analysis. In data analyses raw data are evaluated and interpreted into meaningful and significant conclusions that other researchers and the public can understand and use. Data analysis involved both

qualitative and quantitative methods. The adoption of a multi-methodology strategy in data analysis in the research facilitated the interpretation and understanding of the research issues. Quantitative data was used to put figures on what existed and what was representative and provided a context for cases. Qualitative data analysis provided clarifications to the differences portrayed in the quantitative data thus producing a richer analysis.

3.5.1. Management of quantitative data

Questionnaires were checked by the researcher at the end of each day for unanswered questions or incomplete responses. Corrections were done on the spot or where necessary households were returned to, to effect corrections or to complete responses. A pre-coding system was designed for closed-ended questions and responses to open-ended questions were coded upon completion of the survey. The questionnaires were edited and re-checked by the researcher prior to data entry.

The quantitative data collected on home garden species were analyzed and the species diversity in home gardens estimated using the Shannon–Wiener index (H'). The Shannon–Wiener index (H') = $-\Sigma (\rho_i \log \rho_i)$, where ρ_i is the proportion of occurrence of the *i*th species in a home garden in a study population expressed as a proportion of total species occurrence (N) (Kent and Coker, 1992). From this, the evenness (E) of species will be calculated as E = H'/ H' max with H' max = log N to estimate the homogeneous distribution of crop species in home gardens of the two groups of households. For further details see Chapters 4-6.

A dietary diversity score (DDS) was estimated for each household as the sum of the number of different food items consumed over the previous 24 h preceding the interview with reference to the 16 food groups recommended for dietary studies (FAO, 2007). Foods consumed at breakfast, lunch and dinner were considered in the study and fruits which were eaten between meals were also included. Foods consumed on multiple occasions during the previous 24 h were counted only once. Dietary diversity score was calculated with food items from the home garden ($DDS_{(+HG)}$) and without food items from the home garden ($DDS_{(-HG)}$) home garden produce.

A separate coping strategies index (CSI) was estimated for the post-harvest period and for the lean season for each participating household from the multiple round survey data. The researcher initially gave severity weight to each of the coping behaviours adopted by the household based on the rankings assigned by the focus groups at the initial qualitative phase of the research. The mean frequency (number of days/week) of the individual coping behaviours adopted by the household over the 30 day was determined using the method of

Hoddinott (1999), where 4 = "often" (5 or more times/week); 3 = "sometimes" (4-2 times/week); 2 = "rarely" (once/week); and 0 = "never" (zero time/week). The numerical value representing the category of frequency was multiplied by the weighting factor assigned to the individual coping behaviours to generate a simple numeric score the coping strategies index (CSI) (Maxwell and Caldwell, 2008).

3.5.2. Analysis of quantitative data

Quantitative data were subjected to descriptive statistics, non-parametric statistics and correlation analysis to determine the empirical relationships between different variables. Percentages were used to determine and explain proportions, while means and medians were mainly used to determine differences in household socio-demographic characteristics, field and home garden characteristics and labour input in home garden cultivation practices and dietary diversity scores when distribution of the variable was normally distributed and medians for non-normally distributed data. The Superior Performance Statistical Software (SPSS 14.1 version) was used in quantitative data analyses. The Student *t*-test was used to compare mean values of variables concerning basic demographic and socio-economic characteristics; home garden species composition, domestic livestock and poultry reared; labour input in home garden cultural practices; domestic livestock and poultry rearing; and dietary diversity between HIV-positive and HIV-negative households. This was supplemented by Fisher's exact test for pair-wise comparisons. Pearson correlation analysis was used to quantify the association between home garden species diversity and household dietary diversity. Two-way-ANOVA tests were used to compare mean values of demographic and socio-economic characteristics; home garden species composition, domestic livestock and poultry reared; labour input in home garden cultural practices; domestic livestock and poultry rearing and dietary diversity across multiple groups of HIV-positive and HIV-negative female-headed and dual-headed rural households when the distribution of these individual variables was normal. This was supplemented with Fisher's protected LSD-tests used for pair-wise comparisons across the four groups. Comparisons across multiple groups of HIV-positive and HIV-negative rural households with subsistence-oriented and commerce-oriented home gardens were made using Kruskal-Wallis tests to compare median values of variables that described demographic and socio-economic characteristics; field and home garden characteristics; domestic livestock and poultry reared; labour input in home garden cultural practices; domestic livestock and poultry rearing and dietary diversity when distribution of the individual variable was symmetric, when the variable had non-normal

distribution or small sample sizes. Pair-wise comparisons were made using the Dunn's multiple comparison tests. The Chi-square test was used to evaluate the farming characteristics and consumption of a staple crop from the home garden among HIV-positive and HIV-negative rural households with subsistence-oriented and commerce-oriented home gardens (Fukuda and Ohashi, 1997; Motulsky, 1995; Olsen, 2003). Due to the small sample sizes descriptive statistics such as median values and frequencies were used to compare the demographic and socio-economic characteristics; CSI scores; proportions of HIV-positive and HIV-negative farm households that often adopted the individual food related coping behaviours; engaged in the individual agricultural and non-agricultural income activities; owned, sold domestic livestock; owned, sold poultry; harvested, sold staples; harvested, sold vegetable crops from home gardens; and fields of HIV-positive and HIV-negative farm households during the post-harvest period and in the lean season. The details are presented in Tables 3.1, 3.2, 3.3.1, 3.3.2 and 3.4.

3.5.3. Management and analysis of qualitative data

Interviews with key informants and observations were captured as extensive field notes and re-written as reports (Welman *et al*., 2005). Focus group discussions and in-depth interviews were recorded on audio tape and manually transcribed by the researcher. Information gathered from key informant interviews, focus group discussions, in-depth interviews and field notes was subjected to a process of careful and systematic analysis using content analysis. The qualitative data was comprehensively described for detailed text-based content analysis manually. The analysis of qualitative data was dialectic. The data was dissembled into elements, themes or components: these materials were examined for patterns and relationships, in connection to ideas derived from literature, existing theories or insights that emerged from field work. The data was reassembled to look for hidden new meanings or other explanations to existence or absence of certain themes. The resulting evidence was analyzed, evaluated and critically examined; it was accepted, or rejected entirely or with modifications. The process was repeated to test further the emergent theoretical conception and to expand its generality or otherwise its usefulness (Bernard, 2002). The data gathered from different categories of households in the case studies were treated independently of each other after which a comparative analysis of all categories of households was done. Flower and Hayes (1984) indicated that a case study is much more convincing and accurate when it is based on different sources of information and that using multiple sources of evidence increases reliability and validity of data.

3.6. Validity and reliability issues

Validity refers to the "degree to which scientific observations measure what they purport to measure" and reliability (also referred to as replicability) is the extent to which scientific observations can be repeated while obtaining the same results" (Scrimshaw, 1990). The validity and reliability of research depends on the methodological approach used. In order to avoid the limitations of surveys on the one hand and the case study approach on the other, the study strategy combined both methods. In the process of data collection, triangulation of information from different research methods, techniques and sources was done to enhance validity and reliability of research findings. The data collected from interviews, survey and informal conversations were cross checked, verified, tested, probed and confirmed as the study progressed. Cross checking data from multiple sources could provide a multidimensional profile of activities relevant to the phenomenon under investigation (Merriam, 1985). The study was an iterative set of processes whereby at all stages of the research, the data collection process, methods and actual information collected was systematically examined, synthesized and reflected upon by literature reviewing and elaboration.

3.7. Limitations of the study

The major limitation of this study is the identification of rural households with HIV and AIDS due to the stigma of HIV illness. Therefore HIV-positive rural households were identified through the Association of Persons Living with HIV and AIDS (PLWHA) in three district hospitals in the Eastern Region of Ghana by consultations with health officers and AIDS counselors. This implied that only the few HIV-positive individuals who attended these health institutions were included in the study and all other HIV-positive individuals were excluded. Consequently the survey population which was purposively chosen was small. Generalization of survey findings is limited as a result of this purposive method of sampling, therefore the findings of the study cannot be generalized; the aim was to describe the management strategies of households included in the survey. The survey was cross-sectional rather than longitudinal as subjects were interviewed once due to limited time and resources. As a result the survey provided an overview of the management strategies in home gardens rather than how the management strategies in home garden changed over time in households living with HIV and AIDS. This was, however, complemented by in-depth studies.

Information from dietary studies was self-reporting and the value depended on respondent's truthfulness and memory. Although the method used encouraged honest recall, nevertheless some under and over reporting were likely to occur.

The survey sample was not stratified into HIV-positive and HIV-negative households during data collection due to HIV and AIDS-related stigma. These two categories were marked out during data management and analysis. In two communities, where the research was conducted, it was not easy to ensure confidentially and protect the privacy of participants as members of the communities knew households with individuals with HIV and AIDS illness. However this was not a problem in most of the communities.

Table 3.2: Assessment of home garden management strategies among HIV-positive and HIV-negative rural households in Eastern Region of Ghana (Research Phase 2), with the objective: To assess the biodiversity in home gardens of HIV- positive and HIV-negative rural households in the Eastern Region of Ghana and its contribution to dietary diversity among these households.

Operational objectives	**Expected outputs**	**Methods, instruments and strategies for data collection**	**Analysis**
Research Phase 2: Survey Objective**:** Document differences in biodiversity in home gardens of HIV-positive and HIV-negative rural households and evaluate its contribution to dietary diversity in these households			
A1: Assess and compare field and home garden cultivation in HIV-positive and HIV-negative rural households	• Differences in: - field and cultivated home garden area; - number of adult household members (aged 15- 65) who contribute to home garden cultivation; - number of adult household members (aged 15-65) who contribute to livestock rearing; - proportions with farming as main occupation between HIV-positive and HIV-negative determined	• Household survey • Semi-structured interviews	Student's *t*-tests and Fisher's exact tests to uncover and explain similarities and differences
A2: Describe and compare biodiversity in home gardens of HIV-positive and HIV-negative rural households	• Difference in: - number of different categories of plants species cultivated; - plant species diversity; - kinds of domestic livestock and poultry reared between HIV-positive and HIV-negative households determined	• Home garden survey • Inventory of plant species • List of domestic livestock and poultry species in home gardens compiled • Structured questionnaire	• Shannon-Wiener index • Student's *t*-tests to uncover and explain similarities and differences
A3: Describe and assess contribution of home garden species to dietary diversity in HIV-positive and HIV-negative households	• Difference in: - proportions that consumed the individual food groups; - dietary diversity score with food items from home garden ($DDS_{(+HG)}$); - dietary diversity score without food items from home garden ($DDS_{(-HG)}$); - proportions that consumed food items from home garden between HIV- positive and HIV-negative households determined	• Household survey • Home garden survey • 24-hr qualitative dietary recall • Structured questionnaire	• Dietary diversity score (*DDS*) • Student's *t*-tests and Fisher's exact tests to uncover and explain similarities and differences
A4: Assess and evaluate the statistical association between household dietary diversity and home garden species diversity	The degree of the association between dietary diversity score and home garden species diversity established	• Home garden survey • Inventory of plant species • 24-hr qualitative dietary recall • Pearson correlation	• Dietary diversity score (*DDS*) • Shannon-Wiener index • Correlation coefficient

Table 3.3.1: Uncovering the effect of the interaction between household HIV status and gender of the home garden owner on biodiversity in home gardens (Research Phase 3a) with the objective: To evaluate the differences in the biodiversity in home gardens of female-headed and dual-headed HIV-positive and HIV-negative rural households and the effect on household dietary diversity.

Operational objectives	Expected outputs	Methods, instruments and strategies for data collection	Analysis
Research Phase 3a: In-depth studies Objective: Document and compare biodiversity in home gardens, labour input in home gardens and dietary diversity in female-headed and dual- headed HIV-positive and HIV-negative rural households			
A1: Describe and assess field and home garden cultivation in female-headed and dual headed HIV-positive and HIV–negative rural households	• Differences in: - field area cultivated; - number of field crops cultivated; - cultivated home garden area between the four households types determined	• Household survey • Case studies • In-depth interviews	• Survey data stratified by household HIV status and gender of household head (female/dual-headed) • Two-way ANOVA and Fisher's protected LSD-tests to uncover and explain similarities and differences
A2: Describe and assess the biodiversity in home gardens in female-headed and dual headed HIV-positive and HIV-negative rural households	• Differences in the number of: - annual crops; - perennial crops species; - categories of crops; - vegetable crop species; - root and tuber crop species; fruit species; - other crop species cultivated: - species diversity; - kinds of domestic livestock reared; - number of poultry reared; - number of domestic livestock reared in the home four garden types determined	• Household survey • Home garden survey • Shannon-Wiener index • Case studies • In-depth interviews	• Survey data stratified by household HIV status and gender of household head (female/dual-headed) • Two-way ANOVA and Fisher's protected LSD-tests to uncover and explain similarities and differences
A3: Describe and assess labour input in home gardens in female-headed and dual headed HIV-positive and HIV-negative rural households	• Differences in number of adult household members (aged between 15-65 years) who contributed to: - cultivating; - planting; - weeding; - harvesting crops in the four households types	• Household survey • Case studies • In-depth interviews	• Survey data stratified by household HIV status and gender of household head (female/dual- headed) • Two-way ANOVA and Fisher's protected LSD-tests to uncover and explain similarities and differences
A4: Compare dietary	Differences in dietary	• Household survey	• Survey data

diversity in female-headed and dual-headed HIV-positive and HIV–negative rural households	diversity scores of the four households types determined	• 24-hr qualitative dietary recall • Dietary diversity score • Case studies • In-depth interviews	stratified by household HIV status and gender of household head(female/dual-headed) • 2-way ANOVA and Fisher's protected LSD-tests to uncover and explain similarities and differences

Table 3.3.2: Exploring the biodiversity in subsistence and commercial home gardens of HIV-positive and HIV-negative rural households in the Eastern Region of Ghana (Research Phase 3b) with the objective: To explore the differences and similarities in subsistence-oriented and commerce-oriented home gardens of HIV-positive and HIV-negative rural households in the Eastern Region of Ghana and their significance in food security.

Operational objectives	**Expected outputs**	**Methods, instruments and strategies for data collection**	**Analysis**
Research Phase 3b: In-depth studies Objective: Describe and compare differences and similarities in biodiversity, management input used, seasonal availability of produce and consumption of home garden produce in subsistence-oriented and commerce-oriented home gardens of HIV-positive and HIV-negative households			
A1: Assess and compare field and home garden cultivation in HIV-positive and HIV-negative households with subsistence oriented and commerce oriented home gardens	• Differences and similarities in: - proportions that have farming as main occupation; - cultivated field area; - number of years of home garden cultivation; - cultivated home garden area in the four household types determined	• Household survey • Home garden survey • Case studies • In-depth interviews	• Survey data stratified by household HIV status and primary aim in home garden cultivation (subsistence-oriented/ commerce-oriented) • Chi-square tests to uncover and explain similarities and differences • Kruskal-Wallis and Dunn's multiple comparison tests to examine the differences across home garden types
A2: Describe and compare biodiversity in subsistence-oriented and commerce-oriented home gardens of HIV-positive and HIV-negative households	• Extent of similarity in crop composition in the four home garden types determined • Differences in: - number of individual plants; - total number of crop species; - number of annual	• Home garden survey • Inventory of crop species in home gardens compiled • Inventory of crop species in home gardens compiled • Case studies • In-depth interviews	• Survey data stratified by household HIV status and primary aim in home garden cultivation (subsistence oriented/ commerce oriented) • Species richness • Sørenson's index of similarity • Plant count

	food crop species; - number of perennial food crop species; - number of non-food crop species recorded in the four home garden types determined • Strength of the association between function of home garden and presence of the individual crop species established. • Differences in: - ecological indices; - species diversity; - evenness in the four home garden types determined		• Shannon-Wiener index • Kruskal-Wallis and Dunn's multiple comparison tests to examine the differences across home garden types • Fisher's exact tests to uncover and explain association between variables
A3: Assess the relationship between use of external inputs between subsistence-oriented and commerce-oriented home gardens of HIV-positive and HIV-negative households	Strength of the association between function of home garden and use of: - improved planting material; - chemical pesticides; - chemical fertilizers; - hired labour; - presence or absence of fences in the four home garden types established	• Household survey • Case studies • In-depth interviews	Fisher's exact tests to uncover association between variables
A4: Assess and compare seasonal availability of home garden produce in subsistence-oriented and commerce-oriented home gardens of HIV-positive and HIV-negative households	Differences in number of home garden crop species harvested in: - rainy season only; - dry season only; - both rainy and dry seasons in the four home garden types determined	• Household survey • Case studies • In-depth interviews	• Kruskal-Wallis and Dunn's multiple comparison tests to examine the differences across home garden types • Chi-square and Fisher's exact tests to uncover similarities and differences
A5: Assess the consumption of a staple crop cultivated in subsistence-oriented and commerce-oriented home gardens of HIV-positive and HIV-negative households	Differences in proportions that consumed a staple crop cultivated in the home garden 24-hr prior to the study determined in the four home garden types	• Household survey • 24-hr qualitative dietary recall • Case studies • In-depth interviews	Fisher's exact tests to uncover and explain similarities & differences

Table 3.4: Evaluating the seasonal dimension of coping with food shortages in farm households living with HIV and AIDS in the Eastern Region of Ghana (Research Phase 4), with the objective: To evaluate the food insecurity of HIV-positive and HIV-negative farm households in the Eastern Region of Ghana during the post-harvest period and in the lean season.

Operational objectives	**Expected outputs**	**Methods, instruments and strategies for data collection**	**Analysis**
Research Phase 3b: In-depth studies Objective: Describe and compare differences and similarities in biodiversity, management input used, seasonal availability of produce and consumption of home garden produce in subsistence-oriented and commerce-oriented home gardens of HIV-positive and HIV-negative households			
A1: Assess and compare field and home garden cultivation in HIV-positive and HIV-negative households with subsistence oriented and commerce oriented home gardens	• Differences and similarities in: - proportions that have farming as main occupation; - cultivated field area; - number of years of home garden cultivation; - cultivated home garden area in the four household types determined	• Household survey • Home garden survey • Case studies • In-depth interviews	• Survey data stratified by household HIV status and primary aim in home garden cultivation (subsistence-oriented/ commerce-oriented) • Chi-square tests to uncover and explain similarities and differences • Kruskal-Wallis and Dunn's multiple comparison tests to examine the differences across home garden types
A2: Describe and compare biodiversity in subsistence-oriented and commerce-oriented home gardens of HIV-positive and HIV-negative households	• Extent of similarity in crop composition in the four home garden types determined • Differences in: - number of individual plants; - total number of crop species; - number of annual food crop species; - number of perennial food crop species; - number of non-food crop species recorded in the four home garden types determined • Strength of the association between function of home garden and presence of the individual crop species established. • Differences in: - ecological indices; - species diversity; - evenness in the four home	• Home garden survey • Inventory of crop species in home gardens compiled • Inventory of crop species in home gardens compiled • Case studies • In-depth interviews	• Survey data stratified by household HIV status and primary aim in home garden cultivation (subsistence oriented/ commerce oriented) • Species richness • Sørenson's index of similarity • Plant count • Shannon-Wiener index • Kruskal-Wallis and Dunn's multiple comparison tests to examine the differences across home garden types • Fisher's exact tests to uncover and explain association between variables

	garden types determined		
A3: Assess the relationship between use of external inputs between subsistence-oriented and commerce-oriented home gardens of HIV-positive and HIV-negative households	Strength of the association between function of home garden and use of: - improved planting material; - chemical pesticides; - chemical fertilizers; - hired labour; - presence or absence of fences in the four home garden types established	• Household survey • Case studies • In-depth interviews	Fisher's exact tests to uncover association between variables
A4: Assess and compare seasonal availability of home garden produce in subsistence-oriented and commerce-oriented home gardens of HIV-positive and HIV-negative households	Differences in number of home garden crop species harvested in: - rainy season only; - dry season only; - both rainy and dry seasons in the four home garden types determined	• Household survey • Case studies • In-depth interviews	• Kruskal-Wallis and Dunn's multiple comparison tests to examine the differences across home garden types • Chi-square and Fisher's exact tests to uncover similarities and differences
A5: Assess the consumption of a staple crop cultivated in subsistence-oriented and commerce-oriented home gardens of HIV-positive and HIV-negative households	Differences in proportions that consumed a staple crop cultivated in the home garden 24-hr prior to the study determined in the four home garden types	• Household survey • 24-hr qualitative dietary recall • Case studies • In-depth interviews	Fisher's exact tests to uncover and explain similarities & differences

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CHAPTER 4

Home gardens contribute significantly to dietary diversity in HIV/AIDS afflicted households in rural Ghana

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Abstract

The study assessed the biodiversity in home gardens and evaluated its contribution to dietary diversity among HIV-positive and HIV-negative rural households in Eastern Region, Ghana. A cross-sectional survey of 32 HIV-positive and 48 HIV-negative households was conducted. Plant species cultivated in the home garden of each household and their abundance were documented. Shannon-Wiener index was estimated for each home garden. A dietary diversity score (*DDS* = a count of food groups consumed) was determined with $DDS_{(+HG)}$ and without $DDS_{(-HG)}$ home garden products for each household using a 24-hour qualitative dietary recall. HIV-positive and HIV-negative households were compared using Student's t–tests and Fisher's exact tests. HIV-positive households showed a significantly higher $DDS_{(+HG)}$ than HIV-negative households (6.8 vs. 6.0). The $DDS_{(-HG)}$ did not differ between groups but there was a significant difference between $DDS_{(+HG)}$ and $DDS_{(-HG)}$ within groups. A higher *DDS* in HIV-positive households was not associated with a higher Shannon-Wiener index. The contribution of food items from home gardens to *DDS* was significantly higher in HIV-positive (14.9%) than in HIV-negative households (9.1%). Home gardens contribute significantly to dietary diversity in HIV-positive rural households, although no significant change in plant species diversity was observed compared to HIV-negative households.

Key words: dietary, diversity score, Shannon-Wiener index, plant species diversity

4.1. Introduction

Household food security is defined as the ability of a household to secure, either from its own production or through purchase, adequate food to meet the dietary needs of its members for a healthy and active life (Egal and Valstar 1999). The detrimental effect of HIV illness on food security of afflicted rural households in Sub-Saharan Africa is well-known (Barnett and Whiteside 2002; United Nations 2008). HIV/AIDS morbidity impacts on labour, rural household fields are neglected, cultivated areas are reduced and there is a shift from cultivating labour intensive, yet highly nutritious crops to less labour demanding and less nutritious crops leading to a reduction in the quantity and quality of agricultural produce available to the household (de Waal and Tumushabe 2003). Although the rural poor have always relied on diversity of crops and domestic livestock species to meet their basic needs, the home garden with its associated biodiversity is a neglected resource in adapting to increased nutritional needs and labour constraint due to HIV illness (Garí 2003). Salick (1997) observed that home garden cultivation became especially important in female-headed households when labour was constrained for field production. In that study, a greater diversity of crop species consisting of both major and minor crops was cultivated to supplement and supply a significant portion of the household's diet.

Dietary diversity, i.e. the number of foods consumed across and within food groups over a reference period, is widely recognized as a key indicator of nutrient adequacy (Ruel 2003; Mirmiran et al. 2004). Studies show that the overall nutritional quality of the diet improves with increasing number of food groups (Torheim et al. 2003; Steyn et al. 2006; Kennedy et al. 2007). Furthermore, consuming diverse diets offers protection against chronic diseases (Cummings and Bingham 1998), and enhances the immune system in people living with HIV to combat AIDS opportunistic diseases (Soyiri and Laar 2004).

In a study carried out to assess the biodiversity in home gardens and evaluate its contribution to dietary diversity among HIV-positive and HIV-negative rural households, the following hypotheses and sub-hypotheses were formulated:

(1) A higher number of HIV-positive rural household members will contribute in home garden cultivation than in HIV-negative households when field production decreases as a result of frequent ill-health or labour demand for care of the ill household member.

(i) Field production in HIV-positive rural households will decrease when frequent ill health or labour demand for care of the ill household member increases.

(ii) A higher number of HIV-positive rural household members will contribute to home

garden cultivation than in HIV-negative households when field production decreases.

(2) HIV-positive rural households will have higher home garden species diversity than HIV-negative households when the number of household members who contribute to home garden cultivation increases.

(i) HIV-positive households will cultivate a greater number of categories of plant species in home gardens than HIV-negative rural households when the number of household members who contribute to home garden cultivation increases.

(ii) HIV-positive households will have higher home garden species diversity than HIV-negative households when a greater number of categories of plant species is cultivated in home gardens.

(3) HIV-positive rural households will have a higher dietary diversity compared with HIV-negative households when home garden species diversity increases.

(i) HIV-positive rural households will consume a higher number of food items from home gardens than HIV-negative households when home garden species diversity increases.

(ii) HIV-positive households will have a higher dietary diversity than HIV-negative households when they consume a higher number of food items from the home gardens.

The study used data from a 24-hour qualitative recall of a cross-section of HIV-positive and HIV-negative households in some rural areas in the Eastern region of Ghana to test the above hypotheses.

4.2. Methodology

The cross-sectional study used a multidisciplinary approach combining social, plant and nutrition sciences. Data collection was carried out from 26th October 2005 to 20th February 2006 (post-harvest season) in the Eastern Region, the administrative region in Ghana with the highest prevalence rate of HIV/AIDS (6.5% compared to 3.1% national rate; Ghana AIDS Commission 2006). The high HIV prevalence in the region is attributed to the return of some Ghanaian females involved in commercial sex trade in neighbouring West African countries with higher HIV prevalence (Oppong 1998). A home garden in this study is a small-scale supplementary food production system (Hoogerbrugge and Fresco 1993), located within the homestead or within 10 minutes walk from the homestead, continuously cultivated by and for household members, and comprising of a complex and diverse mixture of annual and perennial plants and livestock (Mohan et al. 2007). A household is defined as a group of persons who live together in the same house or compound and share the same house-keeping

arrangement and are catered for as one unit (Ghana Statistical Service 2002).

4.2.1. Subjects

A purposive sample of 32 HIV-positive households and a random sample of 48 HIV-negative households each with a home garden were selected from 17 rural communities located in 12 districts in the Eastern Region of Ghana. HIV-positive households were recruited purposively owing to the difficulty in locating individuals living with HIV illness as a result of stigmatization. An HIV-positive household in this study refers to a household where at least one member suffered from confirmed HIV illness, whilst in a HIV-negative household no member was known to have HIV illness (UNAIDS 2008). HIV-positive households were identified through a nongovernmental association, the Association of Persons Living with HIV and AIDS (PLWHA) in three district hospitals of the Eastern Region of Ghana. The members of PLWHA comprised individuals from different parts of the country who had tested positive for HIV. A sample of three HIV-negative households was randomly selected from each of the 17 communities where the selected HIV-positive households resided based on a list of households with home gardens compiled with the help of community leaders. Three households which did not meet the criteria for a home garden were excluded. Permission to conduct the research was obtained from the Eastern Regional Administration, the Regional Ministry of Health, Ministry of Agriculture and the Directors of Administration of the three hospitals. Household heads were asked for informed verbal consent for their household to participate in the study.

4.2.2. Study methods

Demographic, socio-economic and home garden information were collected during household interviews using a questionnaire administered by the researcher in the local language (Twi). The demographic characteristics comprised age and sex of household members, household size, dependency ratio (ratio of number of household members younger than 15 years or older than 65 years to number of household members aged between 15 and 65 years); household type (sex of household head) and educational level (years of formal education) of household head. Socio-economic information included farming characteristics of the household head (part time or full time), number of adult household members (between 15 and 65 years of age) who contribute to home garden cultivation and to domestic livestock rearing and sources of household income. For home gardens, an inventory of the cultivated plant species was compiled and the number of individual plants of each species documented.

The species diversity in each home garden was quantified using the Shannon-Wiener index $H' = -\Sigma (\rho_i \log \rho_i)$, where ρ_i is the relative abundance of occurrence of the *i*th species in the home garden calculated as the proportion of the number of individuals of the *i*th species to the total number of individuals (Kent and Coker 1992). The plant species were also categorized by way of use: human food (vegetables, roots and tubers, fruits and spices), medicine and animal feed. The different kinds of domestic livestock reared in each home garden were recorded.

Household food intake was assessed by a qualitative recall of foods consumed by the household during the 24 hours preceding the survey from the household member who prepared the previous day's meals. Foods were counted as the three main meals of the day; namely, breakfast, lunch and dinner, and fruits which were eaten between meals were also included. Foods consumed on multiple occasions during the previous 24 hours were counted only once. The dietary diversity score (*DDS*) was calculated as the number of food groups consumed using the following food groups: cereals, vitamin A-rich vegetables and tubers; white tubers and roots; dark green leafy vegetables; other vegetables; vitamin A-rich fruits; other fruits; organ meat (iron rich); flesh meats; eggs; fish; legumes, nuts and seeds; milk and milk products; oils and fats and red palm products (FAO 2007). Food items obtained from the home garden were specified and a dietary diversity score was calculated with $DDS_{(+HG)}$ and without $DDS_{(-HG)}$ home garden products.

4.2.3. Statistical analysis

The Statistical Package for Social Sciences (SPSS) version 14.0 was used for all statistical analyses. Descriptive analyses were used to summarize household and home garden characteristics; household consumption of food groups and household consumption of food items from home garden. HIV-positive and HIV-negative households were compared with regard to selected socio-demographic variables, home garden characteristics and dietary diversity scores using Student's *t*-tests. Not normally distributed data were log-transformed before analysis. The averages of the variables presented in the tables are based on back-transformed values (Philip and Cook 2000). Data pertaining to home garden management practices and household consumption of food groups were assessed in a descriptive manner by evaluating the proportion of each group of households using Fisher's exact test at $p < 0.05$ level of significance.

4.3. Results

4.3.1. Household characteristics

HIV-positive household heads were significantly older (61 years), more likely to be female, had less formal education (six or more years of schooling) (56%) and had a higher dependency ratio (0.8) than heads of HIV-negative households. They cultivated a smaller area of field crop (0.6 ha), but showed no significant differences in the size of household, engagement in subsistence farming as a primary occupation or sources of income compared with HIV-negative households (Table 4.1).

4.3.2. Home garden characteristics

Table 4.2 shows that HIV-positive households did not differ significantly from HIV-negative households with respect to the Shannon-Wiener index, number of categories of plant species, kinds of domestic livestock reared and home garden area. No significant difference was found between the two groups in the proportion of households that solely consumed home garden produce or had free use of the home garden land. In HIV-positive households a significantly higher number of adult household members contributed to crop cultivation and domestic livestock rearing compared with HIV-negative households (2.7 vs. 1.9; 2.2 vs. 1.5, respectively) (Table 4.2).

Table 4.1. Demographic and socio-economic profile of the households

Variables [a]	HIV-positive (n = 32)	HIV-negative (n = 48)	95% confidence interval of the difference	p-value †
Demographic information				
Age of household head (years)	60.50	53.72	3.65, 11.50	0.03
Household size (nr)	6.34	5.77	-0.43, 1.78	0.20
Dependency ratio [b]	0.83	0.60	0.04, 0.14	0.04
Formally educated household head (%) (six or more years of schooling)	56	71	-	0.18
Female-headed household (%)	66	31	-	0.00
Socio-economic information			-	
Full time farming (%)	50	48	-	0.86
Field crop area (ha)	0.62	0.88	-0.46, -0.06	0.01
Income sources (nr)	2.28	2.35	-0.45, 0.31	0.70

[a] Values are means or back-transformed from the means for log-transformed data unless mentioned otherwise.
[b] Values are mean ratio of number of household members aged below 15 years and above 65 years to number of household members between 15 and 65 years old.
† p-value of Student's *t*-test for difference between mean values and of Fisher's Exact test for difference between proportions.

Table 4.2: Description of home gardens of the households

Variables [a]	HIV-positive (n = 32)	HIV-negative (n = 48)	95% confidence interval of the difference	p-value †
Shannon-Wiener diversity index	1.19	1.30	-0.32, 0.09	0.30
Categories of plant species (nr)	3.31	3.38	-0.41, 0.39	0.60
Kinds of domestic livestock (nr)	1.69	2.01	-0.20, 0.23	0.59
Cultivated home garden area (ha)	0.19	0.18	-0.05, 0.05	0.93
Age of home garden (years)	8.47	8.63	-3.95, 3.63	0.94
Adult household members (aged between 15 and 65years) who contribute to home garden cultivation (nr)	2.66	1.85	0.06, 0.45	0.01
Adult household members (aged between 15 and 65 years) who contribute to domestic livestock rearing (nr)	2.21	1.53	0.01, 0.55	0.02
Free use of land (%)	94	94	-	1.00
Crop produce solely for household consumption (%)	38	27	-	0.33

[a] Values are means or back-transformed from the means for log-transformed data unless mentioned otherwise.
† p-value of Student's *t*-test for difference between mean values and *p*-value of Fisher's Exact test for differences between proportions.

4.3.3. Household consumption of food groups

HIV-positive households consumed a diet with a higher dietary diversity score (*DDS*) (6.8) compared with HIV-negative households (6.0) (Table 4.3). While HIV-positive households consumed food items from thirteen food groups, HIV-negative households consumed from twelve food groups (Table 4.4). None of the households in the groups (0%) consumed organ meat or milk and milk products. The majority of both HIV-positive and HIV-negative households consumed a cereal (84% and 73%, respectively), vitamin A-rich vegetables and tubers (81% and 77%, respectively), or white tubers and roots (94% in both groups) the day before the survey. All households consumed vegetables other than dark green leafy vegetables, and fish (the relatively less expensive source of animal protein). A relatively small proportion of households in both groups consumed flesh meat, and eggs which are relatively expensive sources of protein foods compared to legumes: 3% (meat) 13% (eggs) and 38% (legumes) for HIV-positive households and 4%, 4% and 23% for HIV-negative households. Some form of oil or fat was consumed by both groups: HIV-positive 16% and HIV-negative households 10%. A higher (but not significantly higher) proportion of HIV-positive households (47%) consumed red palm products as palm nut pulp soup or sauce or red palm oil compared with HIV-negative households (31%).

Table 4.3: Contribution of home garden produce to Dietary Diversity Scores (*DDS*) [a]

Dietary score	HIV-positive households (n = 32)	HIV-negative households (n = 48)	95% confidence interval of the difference	p-value †
$DDS_{(+HG)}$ [a]	6.75*	6.00*	0.22, 1.28	0.00
$DDS_{(-HG)}$ [a]	5.72	5.42	-0.17, 0.77	0.24
Contribution of home garden produce to *DDS* (%) [b]	14.90	9.14	0.96, 10.57	0.02

$DDS_{(+HG)}$ - dietary diversity score including food items from home garden.
$DDS_{(-HG)}$ - dietary diversity score excluding food items from home garden.
[a] Values are means.
[b] Contribution of home garden to *DDS:* $(DDS_{(+HG)}-DDS_{(-HG)}/DDS_{(+HG)})\times 100$.
† *p*-value of Student's *t*-test for difference between mean values.
* Significantly different from $DDS_{(-HG)}$ at $p< 0.001$.

4.3.4. Household consumption of food items from home garden

To clarify the contribution of home gardens to the dietary diversity score (*DDS*), the *DDS* including food items from the home garden $DDS_{(+HG)}$ and that without food items from the home garden *DDS*(*–HG*) were calculated (Table 4.3) and the percentages of households that consumed food from a food group obtained from the home garden were compared within and between the two groups. HIV-positive households showed a significantly higher $DDS_{(+HG)}$ (6.8) compared with HIV-negative households (6.0). The $DDS_{(-HG)}$ did not differ between groups, but there was a significant difference between $DDS_{(+HG)}$ and $DDS_{(-HG)}$ within groups. The contribution of food items from the home garden to the *DDS* was significantly higher in HIV-positive (14.9%) than in HIV-negative households (9.1%) (Table 4.4).

With regard to the specific food groups consumed (Table 4.4), there were no major differences in most food groups although a higher proportion of HIV-positive households consumed cereals, vitamin A-rich vegetables and tubers, dark green leafy vegetables, other fruits, eggs, legumes, nuts and seeds, oils and fats and red palm products. A significant proportion of HIV-positive households consumed vitamin A-rich fruits which were not consumed by any HIV-negative household (16% vs. 0%). A significantly larger proportion of HIV-positive households obtained the vitamin A-rich fruits and red palm products (60% and 31%, respectively) from the home garden compared with HIV-negative households (0% and 10%, respectively).

There was no correlation between the Shannon-Wiener index of home gardens and the dietary diversity score of the rural households studied ($r = 0.17$; $N= 80$; $p = 0.14$).

4.4. Discussion

The study assesses the biodiversity in home gardens of HIV-positive and HIV-negative households in rural areas in the Eastern Region of Ghana, and evaluates the contribution of food items from these gardens to dietary diversity. This provided an insight into the contribution of home garden produce to dietary diversity as part of a study to determine the effect of HIV illness on management strategies in home garden cultivation in a rural setting in Southern Ghana.

Table 4.4: Intake of food groups and food items from home garden by households

Food groups	**HIV-positive (n = 32)**		**HIV-negative (n = 48)**	
	Food group consumed [a]	Food item from home garden [b]	Food group consumed [a]	Food item from home garden [b]
Cereals	84.4	0	72.9	0
Vitamin A-rich vegetables and tubers	78.1	54.2	77.1	33.3
White tubers and roots	93.8	26.7	93.8	13.3
Dark green leafy vegetables	40.6	30.8	31.3	39.9
Other vegetables	100	3.1	100	12.5
Vitamin A-rich fruits	15.6*	60.2*	0	0
Other fruits	21.9	42.9	10.4	60.5
Organ meat (iron-rich)	0	0	0	0
Flesh meats	3.1	0	4.2	0
Eggs	12.5	75.2	4.2	43.8
Fish	100	0	100	0
Legumes, nuts and seeds	37.5	0	22.9	0
Milk and milk products	0	0	0	0
Oils and fats	15.6	0	10.4	2.1
Red palm products	46.9	31.3*	31.3	10.4

[a] Values represent proportion of households that consumed the corresponding food group.
[b] Values represent proportion of households that consumed the food group and obtained food item from home garden.
* Significant difference from HIV-negative households at $p < 0.05$.

4.4.1. Household characteristics

The results presented in this study indicate that HIV-positive household heads are older, more likely to be female, their households have a higher dependency ratio and they cultivated a smaller area of field crop compared with HIV-negative households. Migration to urban areas often draws away the more dynamic youthful members of rural areas in Ghana and so the elderly form a higher proportion of the rural population of which a higher percentage are females. In Ghana, women normally marry men older than themselves, and added to the fact that females live longer than males in most societies many elderly women survive their husbands and often find themselves as household heads (United Nations 2001; Mba 2004). Moreover women being society's traditional caregivers, often carry the physical burden of providing AIDS care (D'Çruz 2004). As in many developing countries, the extended family in Ghana is a source of support and care for most people during illness and this is also the situation with HIV illness (Mwinituo 2006). Results of the current study confirm the findings of Booysen et al. (2004) that a higher proportion of HIV-positive households consist of extended-family members, while a relatively smaller proportion belongs to the nuclear family of the household head. The extended-family members included the brothers, sisters, nieces, daughters-in-law of the household head and their young dependents. The majority of the adult extended-family members had come to assist in caring for the ill household member. The higher dependency ratio in HIV-positive households is due to the presence of these young dependents in the household. In HIV-positive households labour constraints due to HIV illness or taking time off to attend to the HIV ill household member could account for the smaller area of field crop cultivated (de Waal and Tumushabe 2003).

4.4.2. Home garden characteristics

The participation in home garden cultivation tasks by some extended family members who had moved into HIV-positive households to assist in care giving might have resulted in the significantly higher number of productive adult household members who contributed to crop cultivation in home gardens and domestic livestock rearing than in HIV-negative households. This may imply a higher labour input in home garden cultivation in HIV-positive rural households and could show the importance attached to home garden cultivation. The home garden is an essential part of the food production system in rural areas in Ghanaian supplementing household field production (Owusu et al. 1994).

Agro-ecological conditions are known to have great influence on plant species composition in home gardens (Shrestha et al. 2002). Most of these species characterize the

semi-deciduous forest zone of Ghana (Bennett-Lartey et al. 2001). Similar climatic conditions and farming practices across the 12 districts in the semi-deciduous forest zone where the home gardens were located may have contributed to the absence of a significant difference between HIV-positive and HIV-negative households in the Shannon-Wiener index and the number of categories of plant species in home gardens. The home gardens were rain fed and crops were cultivated mainly in the rainy season.

Vegetables cultivated in the home gardens were mainly consumed by households in both groups. In 62% of HIV-positive and 73% of HIV-negative households income obtained from the sale of chickens, sheep and goats reared and surplus home garden produce was used to purchase other food items not available in the home and also to provide other basic needs.

4.4.3. Household consumption of food groups

There was minimum variation in the diet consumed by HIV-positive and HIV-negative households. The traditional Ghanaian diet consists of a staple dish of either a cereal, or a root and tuber crop accompanied by a sauce prepared from vegetables and at times with oil. Red palm oil, an important source of vitamin A, was relatively easily available to households for cooking, since in the preparation of palm nut pulp soup the excess oil is skimmed off the surface of the soup and used for preparation of sauces. Vegetables such as tomato and onions are commonly used in preparing soups and sauces and leafy vegetables are sometimes added. The diet is often supplemented with some protein food source of either animal or plant origin. All households consumed fish in their diet as fish constitutes the major source of protein intake in Ghana (Plahar et al. 1997). Fish was consumed fried, smoked, dried or in a salted and fermented form as a condiment in sauces. Consumption of fish is particularly high among subsistence groups and other groups with low purchasing power. Among a broad section of people in southern Ghana, meat, eggs, milk and poultry are consumed mostly on festive occasions, or are used to prepare food for important guests (Essuman 1992). Fruits are consumed to provide vitamins and minerals, and fibre (Oniang'o et al. 2003).

4.4.4. Household consumption of food items from home garden

HIV-positive households consumed a diet with a higher dietary diversity score (*DDS*) compared with HIV-negative households (Table 4.3), which may indicate a better quality of diet (Kant et al. 2000). When measured at household level, Hoddinott and Yohannes (2002) showed that an increase in *DDS* is associated with an increase in household per capita energy intake, while studies in South Africa (Steyn et al. 2006), Kenya (Ruel 2003), and Mali

(Torheim et al. 2003) show positive and significant associations of *DDS* with micronutrient intake at the individual level. However, no consensus exists on what level of *DDS* represents risk of nutrient inadequacy (Kennedy et al. 2007). Although the present study did not investigate whether the increase of *DDS* was purposely done by the households, from a nutritional point of view an increase in energy intake would be beneficial to the individual living with HIV in view of the advice on 10% increase in energy intake (WHO 2003). Furthermore, the higher *DDS* in HIV-positive households is attributed to the relatively larger number of households that consumed fruit and vegetables, particularly vitamin A-rich fruits and red palm products as shown in Table 4.4. As part of an education programme to improve the health of persons living with HIV, the importance of vitamins in the diet is emphasized at monthly meetings of the PLWHA. Vitamin A is essential for individuals living with HIV to strengthen the immune system and to reduce the severity of opportunistic infections and HIV disease progression. For other household members, it enhances the general level of health and immunity and reduces vulnerability to HIV illness (WHO 2003). Studies have indicated that vitamin A supplementation shows positive benefits to HIV-positive individuals but findings are not conclusive (Austin et al. 2006). However, consumption of (orange-fleshed) fruits and vegetables provide a readily available and reliable source of vitamin A and its consumption ought to be encouraged (Talukder et al. 2000; Scrimshaw 2002; Bruce Fife 2004; Faber and Van Jaarsveld 2007).

The plant species cultivated in the home garden offered an important source of micro nutrients and vitamins and contributed significantly to *DDS* of HIV-positive households. The higher contribution of home garden produce to *DDS* in HIV-positive households is attributed to a relative higher proportion of households that consumed food items from the home garden (Table 4.4). This result supports the findings of Salick (1997) that female-headed households depend on home gardens much more than the average household when labour is constrained for field production.

The absence of a significant difference between HIV-positive and HIV-negative households in the Shannon-Wiener index of the home gardens contradicts our working hypothesis. In the study, we anticipated significantly higher species diversity in home gardens of HIV-positive households and consequently a high *DDS*, but the results showed that the higher Shannon-Wiener index did not reflect in a higher *DDS* in HIV-positive households. This implies that a rural household does not cultivate a greater diversity of plant species in the situation of HIV illness, but rather consumes more of the food items from the home garden. The study by Salick (1997) reported greater diversity in home gardens and a

corresponding higher intake of food items from home gardens based on home gardens cultivated by only female-headed households whilst the present study assessed plant diversity in home gardens of both male–headed and female–headed households.

Biodiversity is essential for food security as it provides a diverse range of edible species used as sources of food. A diversity of foods from plants and animals remains the best means to achieve a balanced diet. Johns (2003) provided empirical evidence which supports the hypothesis that biodiversity could be equated with dietary diversity, which in turn could be equated with health. In the current study there was no clear trend between Shannon-Wiener index and *DDS* which implies that household dietary diversity is not associated with home garden plant species diversity. This is, however, the first empirical study that has explored the link between biodiversity in terms of Shannon-Wiener index and dietary diversity.

4.4.5. Methodological issues

The identification and selection of HIV-positive households for the research posed a challenge due to the difficulty in identifying persons living with HIV because of the stigma attached to the disease (Agyeman 1993). Therefore, HIV-positive households were purposively sampled through an organization involved in AIDS counselling and care. A sample of 32 HIV-positive and 48 HIV-negative households located in 12 districts (out of the total number of 21) of the Eastern Region of Ghana was recruited for the survey. To ensure the representativeness of the sample, three HIV-negative households were randomly selected from a list of households compiled in each community where an HIV-positive resided. The selected HIV-negative households had no household member with confirmed HIV illness and had a home garden that satisfied the required criteria.

The study was conducted in the Eastern Region where 67% of its population lives in rural areas and the prevalence of HIV has consistently been higher since 1986 when the first cases of HIV illness were reported (Ghana Statistical Service 2002; Ghana AIDS Commission 2004).

The small sample studied is a limitation in generalizing the findings of this study. In addition trends in differences which fit the hypotheses could have been significant with larger samples. The geographical location and socio-economic diversities of the sample are however appropriate for the study.

Despite the report that the 24-hour dietary recall method relies on respondents' memory and does not take care of day to day variation in food intake (Witschi 1998), the

method was considered reliable to determine dietary diversity. This method is consistent with that used by Savy et al. (2006a) and Kennedy et al. (2007). The short recall period was expected to reduce recall bias which is likely to occur in a rural situation where the level of education is low (Swindale and Ohri-Vachaspati 1999). Savy et al. (2006b) also showed in a study in Burkina Faso the longer the recall period, the greater the likelihood of underreporting.

4.5. Conclusions

The results of this study indicated that HIV-positive rural households cultivated significantly smaller area of field crop but a significantly higher number of adult household members contributed to home garden cultivation than in HIV-negative households. This shows the importance given to home garden cultivation in rural households in situation of HIV illness. The increase in labour input in home garden cultivation in HIV-positive households did not present a higher Shannon-Wiener index of the home garden compared with HIV-negative households. HIV-positive households consumed a diet with a higher dietary diversity score compared with HIV-negative households. Vitamin A-rich fruits and red palm products from the home garden contributed to the higher dietary diversity score in HIV-positive households. This suggests that rural households do not cultivate a greater diversity of plant species in home gardens in the situation of HIV illness, but rather consume relatively more food items of the essential food groups from their home gardens.

The higher dietary diversity score implies a better nutrition in HIV-positive households. However, given that consumption of diverse foods does not imply a nutritionally adequate diet per se, the nutritional benefit of the higher dietary diversity score in HIV-positive households requires further investigation. The cultivation of fruits and vegetables in home gardens should be promoted as part of a nutrition-based intervention for rural communities. This will not only increase the availability and consumption of diverse foods, including vitamin A-rich foods but also enhance the health status of persons, particularly those living with HIV.

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CHAPTER 5

Interactive effects of HIV/AIDS and household headship determine home garden diversity in the Eastern Region of Ghana

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Abstract

Home gardens are important for enhancing food and nutritional security for HIV/AIDS-afflicted rural households through dietary diversity. Female-headed households may depend on home gardens more than average households to supply and supplement the household's diet when labour is constrained for field cropping. This paper compares household characteristics, dietary diversity, labour allocated to crop husbandry and home garden biodiversity amongst 22 HIV/AIDS-afflicted female-headed households, 15 non-HIV/AIDS-afflicted female-headed, 10 HIV/AIDS-afflicted dual-headed and 33 non-HIV/AIDS-afflicted dual-headed households in rural communities in the Eastern Region of Ghana. Information on household characteristics and labour allocation to home garden management was obtained through a cross-sectional survey and in-depth interviews. Dietary diversity score was estimated for each household based on a 24-hour qualitative dietary recall. Plant species in each home garden were recorded. HIV/AIDS affliction did not affect home garden diversity but afflicted households had more on-farm sources of income and a higher dietary diversity and allocated more adult labour to home garden activities than non-afflicted households. Dual-headed households had more diversity in the home garden and allocated more adult male labour to the home garden than female-headed households. Statistically significant interactions between HIV/AIDS affliction and headship were observed for Shannon-Wiener index, number of crop species, number of annual crop species and number of root and tuber crop species in the home gardens: there were no headship effects when households were afflicted whereas dual-headed households had higher values than female-headed households in non-afflicted households. HIV/AIDS-afflicted households had significantly more annual crop species and more root and tuber crop species than non-afflicted households for female-headed households, whereas there were no significant differences for dual-headed households. Faced with confinement to the homestead in caregiving and by the obligation to ensure household food and nutritional security, HIV/AIDS-afflicted households spent more (female) labour on home garden management than non-afflicted households to produce crops for sustenance and dietary diversity.

Keywords: biodiversity, dietary diversity, dual-headed households, female-headed households, household HIV/AIDS status

5.1. Introduction

Agricultural tasks of men and women in many farming communities in Africa differ due to the customary division of labour between gender (Stainer, 1982). Men are often responsible for land preparation and planting, whereas women perform most weeding, harvesting, post-harvest processing and storage tasks (Malena, 1995). Studies from West Africa showed that men are needed for land preparation and that lack of male labour results in a decline in crop production (Sillitoe, 1999). The impacts of labour constraints on crop production in HIV/AIDS-afflicted households and the subsequent limitation on food availability have been widely discussed (Balyamujura *et al*., 2000; Page, 2001; Drimie, 2002; Barnett &Whiteside, 2003). HIV/AIDS illness reduces available labour for on-farm activities; land preparation, planting, weeding and harvesting of crops are delayed, which subsequently reduces crop yields. Household food availability becomes threatened since rural households obtain the bulk of the food they consume through their own production (Du Guerny, 2002; Barnett & Whiteside, 2003). Labour constraints in HIV/AIDS-afflicted households can result in a decrease in the diversity of field crops cultivated and in abandoning the more labour-demanding yet more nutritional crops (De Waal & Tumushabe, 2003; Gari, 2003). A number of authors have emphasized the potential importance of home gardens for enhancing food and nutritional security for HIV/AIDS-afflicted households through dietary diversity (Gari, 2002; 2003; Abukutsa-Onyango, 2007; Faber & Van Jaarsveld, 2007). Evidence from across several countries indicates that women contribute significant amounts of labour to the production of subsistence food crops, more so than for non-food cash crops (Malena, 1995). Women therefore devote much of their time to care and management of the home garden (Asfaw, 2002; Trinh *et al.,* 2003) and play a prime role in ensuring food security and nutritional needs of their household members (Brown *et al*., 1995).

The impacts of HIV/AIDS on agriculture are not gender-neutral because land rights, labour allocation and entitlements are along gender lines in farming communities (Drimie & Mbaya 2001; Mbaya, 2002; Loevinsohn & Gillespie, 2003). Müller (2004) asserts that gender is the decisive factor in the impact of HIV/AIDS on agricultural production and food security. HIV/AIDS-afflicted female-headed households are expected to be among the poorest and most vulnerable for many reasons including the loss of male labour, loss of land or entitlements and additional burdens of providing care for the sick or dying and for displaced children, given that women are society's traditional caregivers (D'Cruz, 2004). These female-headed households face conflicts regarding the allocation of their scarce resources. For

example, they often face the decision of either allocating time to care for a sick household member or to farming activities such as weeding. Death of male members can also mean a loss of labour, particularly for agricultural tasks, such as land preparation (Balyamujura *et al*., 2000; Haddad & Gillespie, 2001; Page, 2001; Drimie, 2002; De Waal & Tumushabe, 2003). Salick (1997) observed that female-headed households depend on home gardens much more than the average household to produce crops to supply and supplement a significant proportion of the household's diet when labour is constrained for field cropping.

In this study we hypothesize that demands of caregiving limits labour for field cropping in HIV/AIDS-afflicted households, especially the female-headed ones. The reduced labour for field cropping will result in an increase in labour allocated to home garden cultivation resulting in greater plant species diversity in the home garden and a higher household dietary diversity.

This paper draws on the results of a study in which we investigated home garden species diversity in the context of HIV/AIDS in selected rural areas in the Eastern Region of Ghana between 2005 and 2006 to verify the above hypothesis. We compared household characteristics, dietary diversity, labour allocated to home garden management practices and home garden biodiversity in HIV/AIDS-afflicted female-headed households with those of non-afflicted female-headed households and HIV/AIDS-afflicted and non-afflicted dual-headed households (i.e., a household with a male and female head as married couple).

5.2. General methodology

5.2.1. Study area

The study was conducted in the Eastern Region of Ghana where the HIV/AIDS prevalence rate is the highest in the country (6.5% compared with 3.1% nationally) (Anon., 2004a), with 67% of the population being rural (Anon., 2002) and with 53% of the households being headed by females (Leite *et al*., 2000). The region is the sixth largest in Ghana in terms of land area, covering 19,323 km2 (8.1%) of the total land area of the country. The region lies within the moist semi-deciduous forest and the dry semi-deciduous forest zones of Ghana and is characterized by a bimodal rainfall pattern. The soils are suitable for the cultivation of staples such as cassava, yam, cocoyam, taro, maize and rice, vegetables like tomato, pepper, and eggplant, and a variety of tree crops including cocoa, kola, oil palm, citrus and mango (Benneh, 1973).

5.2.2. Definitions

A household is defined as a group of persons who live together in the same house or compound and share the same house-keeping arrangement and are catered for as one unit (Anon., 2002). A dual-headed household represents a household with a married adult male and female who together are responsible for the upkeep and maintenance of the household members. A female-headed household refers to a household where an unmarried/widowed/ divorced woman carries these responsibilities (Duncan *et al.,* 1998; Anon., 2002). An HIV/AIDS-afflicted household in this study refers to a household where at least one member suffered from confirmed HIV/AIDS infection, whereas a non-HIV/AIDS-afflicted household is one in which no member was known to have HIV/AIDS infection (Barnett & Blaikie, 1992). The home garden in this study represents a small-scale supplementary food production system (Hoogerbrugge & Fresco, 1993) located within the homestead or within a 10-minute walk from the homestead, continuously cultivated by and for household members, and comprising a complex and diverse mixture of annual and perennial plants and livestock (Fernandes & Nair, 1986).

5.2.3. Research approach

The data on which this paper is based were collected between October 2005 and September 2006 through household and home garden surveys that aimed to gather information on home garden species diversity in the context of HIV/AIDS in 17 selected rural communities in the Eastern Region of Ghana. In addition, in-depth interviews with selected case households were carried out after the survey. The study sample consisted of purposive samples of 10 HIV/AIDS-afflicted dual-headed and 22 HIV/AIDS-afflicted female-headed households and random samples of 33 non-HIV/AIDS-afflicted dual-headed and 15 non-HIV/AIDS-afflicted female-headed households selected from the communities. HIV/AIDS-afflicted households were recruited purposively owing to the difficulty in locating HIV/AIDS-infected individuals as a result of stigmatization (Safo, 1993). HIV/AIDS-afflicted households were identified through the association of People Living with HIV/AIDS (PLWHA) in three district hospitals of the Eastern Region of Ghana. The members of the association were individuals from different parts of the country who tested positive for HIV infection. A sample of three non-HIV/AIDS-afflicted households was randomly selected from each of the communities with selected HIV/AIDS-afflicted households based on a list of households with home gardens obtained from the community leader. All HIV/AIDS-infected individuals and household heads were asked for verbal consent from their households to participate in the study.

5.2.4. Study methods

Survey

Socio-economic information was collected from households in the survey through interviews using a questionnaire administered by the researcher in the local language (*Twi*). The information comprised age and sex of household members, household size, type of household headship, sources of household income, and household farming characteristics (area of crop land cultivated, field crops grown). Dependency ratio was computed as the ratio of number of household members younger than 15 or older than 65 years to number of household members aged between 15 and 65 years (Anon., 2004b). Household dietary diversity score was estimated based on a 24-hour qualitative dietary recall of the food consumed by the households prior to the survey, using the method of Hatløy *et al*. (1998). Methods for the dietary diversity scoring and the full results are available in Akrofi *et al*. (2010). Information gathered on home gardens included area of home garden, number of adult male and adult female household members (aged between 15 and 65 years) who contributed to cultivating, planting, weeding and harvesting crops in the home garden and of those who contributed to animal husbandry work. The names of the cultivated plant species in each home garden were established and the number of individual plants of each species recorded. The species diversity in each home garden was quantified using the Shannon–Wiener index, $H' = -\Sigma (\rho i \log \rho i)$, where ρi is the relative abundance of occurrence of the ith species in the home garden calculated as the proportion of the number of individuals of the ith species to the total number of individuals (Kent & Coker, 1992). The plant species were categorized into perennials and annuals. Each plant species was then assigned to one of the following four categories: vegetables, roots and tubers, fruits, and other species (spices, medicine, and fodder). The different kinds of domestic livestock reared in each home garden were recorded and their respective numbers assessed.

Case studies

After the survey, case studies were conducted in 12 purposively selected households to understand how home gardens are managed by the different household types. This information further guided the analysis and interpretation of the data collected in the survey. The interview guide focused on field and home garden cultural practices and gender-specific tasks.

5.2.5. Statistical analysis

Data were analysed by two-way ANOVA and, where necessary, were log-transformed before analysis in order to stabilize variances. When this was the case, the averages presented in Table 5.1 are based on back-transformed values (Philip & Cook, 2000). We present coefficients of variation (in %) for all variables as this statistical parameter is recommended to provide insight into variation of back-transformed values. Fisher's protected LSD-tests at $P < 0.05$ were used to establish statistically significant differences amongst averages of home garden characteristics when the interaction between HIV/AIDS affliction and headship was statistically significant at $P < 0.05$, using the Statistical Package for Social Sciences (SPSS) version 15.0.

5.3. Results

5.3.1. Variables showing a statistically significant effect of household HIV/AIDS affliction

Effects of HIV/AIDS status on household characteristics, labour allocated to home garden management practices and home garden biodiversity are summarized in Table 5.1. HIV/AIDS-afflicted households had a higher dependency ratio (0.9 vs. 0.6) and consumed a diet with a higher dietary diversity score (6.7 vs. 5.9). HIV/AIDS-afflicted households were engaged in more on-farm (1.8 vs. 1.4) but fewer off-farm income-generating activities (1.2 vs. 1.6) compared with non-HIV/AIDS-afflicted households. HIV/AIDS-afflicted households had more adult household members who contributed to cultivating the home garden (2.7 vs. 2.0), specifically in planting crops (2.7 vs. 2.0) and weeding (2.3 vs. 1.9), and had significantly more adult female household members who participated in planting home garden crops (1.6 vs. 1.1) compared with non-afflicted households (Table 5.1). In HIV/AIDS-afflicted households, more adult members contributed to animal husbandry work (1.9 vs. 1.2), especially adult female household members (1.2 vs. 0.7). HIV/AIDS affliction did not affect home garden diversity (Table 5.1).

The household members who contributed to cultivating home gardens or to animal husbandry work in HIV/AIDS-afflicted households comprised relations such as sons, sisters and daughters-in-law of the household head, or the sick household member. The availability of different food crops such as staples, green vegetables and fruits in the home garden enabled HIV/AIDS-afflicted households to obtain diversity in their diet even when the household was short of money to purchase these food items. Small livestock production of

sheep, goats and chickens was reported to be a major source of income that allowed households to satisfy their unforeseen financial needs. This enterprise, however, is threatened by the prevalence of livestock diseases such as diarrhea and Newcastle disease due to lack of veterinary care in the rural areas. Women indicated that rearing poultry served as a readily available source of eggs and meat for the household. Generally, poultry were kept free range whereas sheep and goats were tethered to graze around the homestead or kept in pens or enclosures. Poultry was mainly cared for by women, children and the elderly, whereas sheep and goats were the responsibility of mature boys (10 to 14 years) and adult male household members. Male household members contributed to male tasks such as cutting and carrying fodder for the animals, tethering the animals to graze in areas around the homestead, and building or repairing a pen or enclosure for the animals.

HIV/AIDS-afflicted households engaged in on-farm income-generating activities that were less labour-demanding, less time-consuming and that involved a relatively short-distance travel from the home due to the demand of household members having to look after a sick household member. These included raising small livestock, collecting fuel wood for sale, and selling agricultural produce within the village or at a weekly market not far from the village. HIV/AIDS-afflicted households did not engage in off-farm income activities that involved a big capital investment due to financial constraint. Petty trading and retailing items of everyday use such as cooked food and food items, post-harvest food processing and remittances were their main off-farm income sources. The business activities were physically located in and around the homestead and were conducted simultaneously with caregiving. Some HIV/AIDS-afflicted households had given up income-generating activities that involved cooked food, due to social stigmatization and discrimination shown by others.

5.3.2. Variables showing statistically significant effects of household headship

Effects of household headship on household characteristics, labour allocated to home garden management practices and home garden biodiversity are summarized in Table 5.1. Female-headed households cultivated a smaller field (0.5 vs. 0.7 ha) and had significantly fewer on-farm sources of income (1.3 vs. 1.9) than dual-headed households. Furthermore, in female-headed households significantly fewer adult male household members contributed to cultivating the home garden (0.8 vs. 1.4), specifically to planting (0.6 vs. 1.3) and weeding crops (0.7 vs. 1.3), and to animal husbandry work (0.4 vs. 0.9) than in dual-headed households. Dual-headed households planted more categories of crop species in the home

garden (3.6 vs. 2.9) and had more diversity in the home garden than female-headed households (Table 5.1).

The majority of the female-headed households (70%) lived in extended family homesteads and shared ownership of the home garden area with other members of the extended family, creating limitation in space available for cultivation (as in the case of subdividing the garden area). This puts restrictions on the categories of crop species that could be grown in the home garden. Female-headed households cultivated significantly fewer fruit species (1.7 vs. 2.7) in home gardens, especially perennial fruits due to the financial and labour requirements. Fruits species with a relatively short growing cycle such as pineapples and papaya were preferred for ease of management and regular availability of produce. Female-headed households engaged in relatively less tedious on-farm sources of income such as providing wage labour in planting, weeding, applying fertilizer and pesticides, harvesting, threshing and shelling of grains. On the other hand dual-headed households were involved in strenuous activities like land preparation and head porterage of harvested farm produce. Both, female- and dual-headed households engaged their children in on-farm income activities; female-headed households, however, tended to work relatively longer and more often with their children than dual-headed households. Limited access to land and lack of male labour to perform traditional male tasks such as land preparation, fence construction or planting hedges in the home garden to protect its crops from stray animals, and lack of financial resources to pay for these services and to buy planting materials were the problems reported by the female-headed households in home garden cultivation.

5.3.3. Variables showing statistically significant interactions between HIV/AIDS affliction and household headship

Statistically significant interaction was found between HIV/AIDS affliction and household headship for variables related to biodiversity in the home garden (Table 5.1). Significant interactions between HIV/AIDS affliction and headship were observed for Shannon-Wiener index, number of crop species, number of annual crop species and number of root and tuber crop species in the home gardens: there were no headship effects when households were afflicted whereas dual-headed households had higher values than female-headed households in non-afflicted households. HIV/AIDS-afflicted households had significantly more annual crop species and more root and tuber crop species than non-afflicted households for female-headed households, whereas there were no significant differences for dual-headed households. Annual crops cultivated in the home garden included vegetables, fruits, spices

and root and tuber species, the staples cassava, cocoyam, yams and taro. Cultivation of cassava was staggered to ensure continuous production throughout the year and also to avoid the problem of storage and post-harvest losses.

5.3.4. Variables not affected by HIV/AIDS affliction, household headship or their interaction

The results show that HIV/AIDS-afflicted female-headed households did not differ significantly from non-afflicted female-headed households or from dual-headed households whether afflicted or not, with regard to household size, number of field crops cultivated, home garden area cultivated, number of perennial crop species, vegetable species and other crop species in the home garden. Moreover, the kinds of domestic livestock and number of poultry raised in the home garden, the number of female household members who contributed to weeding the home garden, adult household members who contributed to harvesting home garden produce specifically both male and female household members were not significantly different from those of the other households types (Table 5.1).

5.4. Discussion

The study compares HIV/AIDS-afflicted female-headed households in terms of socioeconomic characteristics, home garden biodiversity and labour allocated to management practices with those of non-HIV/AIDS-afflicted female-headed, HIV/AIDS-afflicted and non-afflicted dual-headed households, and portrays the link between home garden biodiversity and dietary diversity for these households.

The major objectives of the household survey were quantifying the household characteristics, home garden biodiversity and labour allocated to home garden management practices. As a result, closed questions were asked, which made it difficult to probe into the questions of why and how. For this reason complementary qualitative in-depth interviews were held with selected case households, addressing the inherent weakness of the household survey.

Table 5.1. Characteristics of female-headed and dual-headed HIV/AIDS-afflicted and non-afflicted households. Values are averages with coefficients of variation (%) in parentheses. *P* values < 0.05 are marked in bold.

Variable	HIV/AIDS-afflicted		Non-HV/AIDS-afflicted		*P* value		
	Female-headed households (n = 22)	Dual-headed households (n = 10)	Female-headed households (n = 15)	Dual-headed households (n = 33)	HIV/AIDS (A)	Headship (B)	Interaction A × B
Household characteristics							
Household size (persons)	6.4 (36)	6.2 (42)	5.1 (49)	5.9 (42)	0.20	0.64	0.42
Dependency ratio	1.0 (41)	0.7 (26)	0.6 (39)	0.6 (41)	**0.04**	0.38	0.18
Field crop area (ha)	0.6 (33)	0.6 (26)	0.4 (34)	0.8 (31)	0.81	**0.02**	0.06
No. of field crops	2.3 (70)	2.4 (49)	1.4 (77)	2.8 (60)	0.43	0.08	0.12
Home garden area (ha)	0.1 (9)	0.2 (15)	0.1 (9)	0.2 (11)	0.32	0.06	0.49
On-farm sources of income (nr.)	1.5 (44)	2.1 (23)	1.0 (27)	1.7 (26)	**0.01**	**0.00**	0.73
Off-farm sources of income (nr.)	1.0 (32)	1.3 (42)	1.8 (26)	1.4 (47)	**0.03**	0.77	0.08
Dietary diversity score	6.6 (20)	6.8 (16)	6.0 (20)	5.8 (14)	**0.00**	0.60	0.46
Kinds of domestic livestock (nr.)	1.5 (58)	1.4 (52)	1.0 (54)	1.7 (51)	0.59	0.27	0.11
Domestic livestock (nr.)	2.4 (70)	3.9 (89)	0.9 (72)	2.6 (78)	0.06	**0.04**	0.58
Poultry (nr.)	5.4 (83)	4.9 (94)	4.9 (88)	9.8 (86)	0.39	0.37	0.26
Labour allocation adult household members							
Adult household members contributing to cultivating home garden (nr.)	2.6 (20)	2.8 (41)	1.7 (26)	2.3 (37)	**0.01**	0.37	0.34
Adult household members contributing to planting crops in home garden (nr.)	2.6 (19)	2.8 (47)	1.7 (28)	2.2 (34)	**0.00**	0.16	0.39
Adult household members contributing to weeding home garden (nr.)	2.0 (32)	2.5 (54)	1.9 (28)	1.8 (35)	**0.02**	0.63	0.35
Adult household members harvesting home garden crops (nr.)	2.1 (26)	2.2 (24)	2.4 (25)	2.4 (28)	0.12	0.68	0.77
Adult household members contributing to animal husbandry work (nr.)	1.7 (65)	2.0 (58)	0.7 (62)	1.6 (51)	**0.02**	**0.03**	0.25

Table 5.1 (cont'd)

Variable	HIV/AIDS-afflicted		Non-HV/AIDS-afflicted		*P* value		
	Female-headed households (n = 22)	Dual-headed households (n = 10)	Female-headed households (n = 15)	Dual-headed households (n = 33)	HIV/AIDS (A)	Headship (B)	Interaction A × B
Labour allocation adult male household members							
Adult male household members contributing to cultivating home garden (nr.)	0.9 (61)	1.4 (47)	0.6 (40)	1.3 (37)	0.23	**0.00**	0.44
Adult male household members contributing to planting crops in home garden (nr.)	0.8 (53)	1.4 (47)	0.4 (43)	1.1 (38)	0.07	**0.00**	0.74
Adult male household members contributing to weeding home garden (nr.)	0.7 (60)	1.4 (47)	0.6 (40)	1.1 (45)	0.36	**0.00**	0.74
Adult male household members harvesting home garden crops (nr.)	0.5 (50)	1.1 (38)	0.8 (49)	0.8 (55)	0.93	0.10	0.11
Adult male household members contributing to animal husbandry work (nr.)	0.4 (58)	1.0 (53)	0.3 (46)	0.8 (54)	0.10	**0.00**	0.87
Labour allocation adult female household members							
Adult female household members contributing to cultivating home garden (nr.)	1.6 (21)	1.3 (42)	1.2 (49)	1.1 (42)	0.10	0.16	0.73
Adult female household members contributing to planting crops in home garden (nr.)	1.7 (27)	1.4 (47)	1.2 (44)	1.0 (40)	**0.02**	0.25	0.59
Adult female household members contributing to weeding home garden (nr.)	1.2 (63)	1.1 (58)	1.1 (55)	0.5 (60)	0.11	0.13	0.21
Adult female household members harvesting home garden crops (nr.)	1.5 (28)	1.0 (49)	1.5 (27)	1.5 (30)	0.07	0.07	0.15
Adult female household members contributing to animal husbandry work (nr.)	1.3 (50)	1.1 (38)	0.6 (59)	0.8 (44)	**0.02**	0.96	0.40

Table 5.1 (cont'd)

Variable	HIV/AIDS-afflicted		Non-HV/AIDS-afflicted		*P* value		
	Female-headed households (n = 22)	Dual-headed households (n = 10)	Female-headed households (n = 15)	Dual-headed households (n = 33)	HIV/AIDS (A)	Headship (B)	Interaction A × B
Biodiversity in home garden [1]							
Crop categories (nr.)	3.1 (23)	3.5 (20)	2.8 (32)	3.6 (19)	0.49	**0.00**	0.27
Shannon–Wiener index	1.1 (32) bc [1]	1.2 (12) b	1.0 (31) c	1.5 (24) a	0.21	**0.01**	**0.01**
Crop species (nr.)	7.9 (48) ab	7.8 (31) ab	5.8 (50) b	9.7 (39) a	0.91	**0.04**	**0.03**
Perennial crop species (nr.)	3.6 (70)	4.0 (52)	3.4 (70)	6.0 (60)	0.62	0.10	0.33
Annual crop species (nr.)	3.2 (54) a	3.1 (52) a	1.4 (80) b	3.5 (66) a	0.06	**0.01**	**0.01**
Root and tuber crop species (nr.)	1.3 (46) a	1.2 (60) ab	0.5 (65) b	1.5 (50) a	0.23	**0.03**	**0.01**
Vegetable species (nr.)	2.5 (67)	2.2 (44)	2.0 (45)	2.6 (58)	0.67	0.52	0.11
Fruit species (nr.)	1.9 (80)	2.6 (47)	1.5 (75)	2.8 (69)	0.80	**0.02**	0.48
Other crop species (nr.)	0.7 (61)	0.6 (66)	0.4 (49)	1.0 (80)	0.81	0.16	0.19

[1] Means within the same row, followed by the same letter are not statistically different ($P < 0.05$).

The results of the study show that a lower endowment of productive resources such as land, labour and cash income in female-headed households hampers subsistence production in fields and home gardens. In Ghana, women have limited ability to acquire cropland through inheritance, purchases, renting or sharecropping. Women also lack financial resources to purchase cropland and certain customary laws linked to traditional and cultural norms often tend to discriminate against women. Local practices give males precedence in sharecropping contracts by land owners, as this often involves cash crop cultivation, which is considered a task too strenuous for women (Asenso-Okyere *et al*. 1993; Benneh *et al*. 1995; Woodman, 1996; Quisumbing, 2001). In our study, 12% of the female-headed households owned their cropland and 18% cultivated fields by share cropping, against 12% and 20%, respectively for dual-headed households. The government of Ghana and non-governmental organizations have introduced interventions such as laws regarding inheritance and micro-credit facilities to reduce these limitations. Unfortunately these interventions are yet to be implemented in most rural areas due to the non-enforcement of the legal provisions and limited access to the interventions (Rünger, 2006).

Female-headed households are constrained in male labour and consequently relatively fewer adult male household members contributed to planting and weeding home garden crops and to animal husbandry work than in dual-headed households. Extensive migration of males from rural to urban areas in search of employment and other income-generating opportunities (Mba, 2004; Coast, 2006) leaves few adult male household members in female-headed households to perform traditional male tasks in agriculture. Female-headed households engaged in the additional responsibility of taking on-farm sources of income besides managing traditional household tasks, although relatively less than dual-headed households. This supports findings by Ellis (2000) and Horell & Krishman (2006) that female-headed households have fewer productive members to engage in remuneration activities. In this study, female-headed households had a higher dependency ratio (0.8) than dual-headed households (0.7), which implies that female-headed households had relatively fewer productive house members (number of household members aged between 15 and 65 years) for on-farm income activities compared with dual-headed households.

HIV/AIDS-afflicted households accessed the extended family network in situations of sickness through the incorporation of adult members for assistance in caregiving and other household tasks including home garden cultivation. This finding confirms earlier reports by Ankrah *et al*. (1993), Booysen (2001) and Desmond *et al.* (2005). It is likely that some of

these family members may come in with younger children and therefore increase the dependency ratio of HIV/AIDS-afflicted households. More adult household members participated in cultivating the home garden and in animal husbandry work in HIV/AIDS-afflicted households, which indicates the importance given to home garden cultivation and raising small livestock. Women were able to combine their traditional household tasks to weeding the home garden due to the proximity of the home garden to the homestead (Okigbo, 1990; Gari, 2003). More women contributed to weeding and more men to animal husbandry work, the productive tasks in agriculture associated with these gender groups (Malena, 1995). Home garden cultivation and rearing small livestock and poultry requires low labour and capital input (Marsh, 1998) and was therefore suitable for HIV/AIDS-afflicted households where these resources were constrained.

Lack of time, labour and financial constraints hinder HIV/AIDS-afflicted household engagement in on-farm and off-farm income activities. In this study HIV/AIDS-afflicted households engaged mainly in on-farm sources of income generation that were relatively less strenuous and were limited in off-farm income activities by to lack of capital input. This is consistent with the report of Loevinsohn & Gillespie (2003) who indicated that HIV/AIDS-afflicted households are frequently forced to reduce their reliance on labour and to focus on activities that are of reduced scale but that also have lower output or provide less income. However, it contradicts reports by Haddad & Gillespie (2001) that the changes in available labour in HIV/AIDS-afflicted households' leads to more off-farm income activities.

Nutrition counselling received by participants at the regular meeting of PLWHA informed HIV/AIDS-afflicted households about the benefits of diversity in the diet. The biodiversity in home gardens played a significant role in contributing to the dietary diversity of HIV/AIDS-afflicted households. This reinforces the point that the home garden is a potential for household food security and dietary diversity in HIV/AIDS affliction (Gari, 2002; 2003, Abukutsa-Onyango, 2007; Faber & Van Jaarsveld, 2007).

Faced with confinement to the homestead due to caregiving and the obligation to ensure food security and nutrition needs of their household members (Brown *et al*., 1995), HIV/AIDS-afflicted female-headed households appear to depend on home gardens much more than non-afflicted female-headed households to produce crops for sustenance and dietary diversity. This was expressed in the cultivation of significantly more annual crops in home gardens; for example more staple crops such as root and tuber species than in non-afflicted households to ensure regular availability of home garden produce. The annual crops

were relatively early maturing and tended to be regularly available. Root and tuber crops were cultivated by vegetative propagation and planting materials were relatively easily available, cultivation was relatively less labour-demanding since management practices like weeding and harvesting did not require strict timing, and could be extended over time (Gari, 2003) and therefore better adapted to the labour constrained conditions of the HIV/AIDS-afflicted households. The absence of significant difference in the number of annual crops, for example root and tuber species cultivated in home gardens in HIV/AIDS-afflicted female-headed households compared with dual-headed households whether afflicted or not, disagrees with the report of Salick (1997) that female-headed households depend on home gardens much more than the average household when labour is constrained for field cropping. This may be due to relatively less male labour contribution to home garden cultivation in HIV/AIDS-afflicted female-headed households. A higher labour allocation in home garden cultivation in HIV/AIDS-afflicted female-headed households and consequently significantly higher plant species diversity in home gardens and a higher dietary diversity score was anticipated in the study. The findings of the study indicated significantly lower species diversity in home gardens cultivated in HIV/AIDS-afflicted female-headed households compared with HIV/AIDS-afflicted dual-headed households and no statistically significant difference was observed with HIV/AIDS-afflicted dual-headed and non-afflicted female-headed households, which opposes our working hypothesis. This implies that the greater number of annual crops cultivated in home gardens in HIV/AIDS-afflicted female-headed households, for example more root and tuber species was not reflected in a higher species diversity and could be attributed to lack of male labour in traditional male tasks in home garden cultivation or relatively less time spent in home garden cultivation due to caregiving in HIV/AIDS-afflicted female-headed households. The results of the study were also not reflected in the dietary diversity scores of the households as expected. It is uncertain whether the single 24-hour qualitative dietary recall used in the study was adequate in assessing the dietary intake of the study sample.

5.5. Conclusions

Although the study is not representative and cannot be generalized due to the purposive selection of HIV/AIDS-afflicted households and the small sample size as a result of stigmatization of persons infected with HIV/AIDS, important conclusions can be drawn from

our study. The results show that female-headed households cultivated a smaller field, had fewer on-farm sources of income, planted fewer categories of crop species in the home garden, had fewer adult male household members, who contribute to planting, and weeding of home garden crops and to animal husbandry work compared with the dual-headed households. This suggests that poor endowment of productive resources such as land, labour and cash income reduces subsistence production in fields and home gardens in female-headed households.

In HIV/AIDS-afflicted households more adult household members contribute to cultivating the home garden, specifically to planting and weeding home garden crops and to animal husbandry work than in non-HIV/AIDS-afflicted households, which indicates the importance given to home garden cultivation and small livestock rearing. HIV/AIDS-afflicted households consume a diet that has a higher dietary diversity score due to the availability of home garden produce, which confirms the potential of the home garden to enhance food and nutritional security.

HIV/AIDS-afflicted female-headed households cultivate significantly more annual crop species, for example more staple crops like root and tuber species in home gardens than in non-affliction to ensure regular availability of home garden produce. However, the number is not significantly different from that of dual-headed households whether HIV/AIDS-afflicted or not due to relatively lower male labour contribution to home garden cultivation in afflicted female-headed households. Faced with confinement to the homestead in caregiving and the obligation to ensure household food and nutrition security, HIV/AIDS-afflicted female-headed households depend on home gardens much more than afflicted households to produce crops for sustenance and dietary diversity. Species diversity in home gardens cultivated in HIV/AIDS-afflicted female-headed households is either significantly lower or no significant difference was observed compared with the other three household types due to lack of male labour in traditional male tasks in home garden cultivation or relatively less time spent in home garden cultivation due to caregiving in HIV/AIDS-afflicted female-headed households A multiple 24-hour qualitative dietary recall is suggested in further studies to ensure reliable dietary diversity scores. Assessment of the species diversity within the categories of crops cultivated in the home garden may be necessary to investigate the changes in species composition in HIV/AIDS-afflicted households.

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CHAPTER 6

HIV and orientation of subsistence and commercial home gardens in rural Ghana: Crop composition, crop diversity and food security

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Abstract

An empirical study was conducted to explore differences and similarities in biodiversity in subsistence and commercial home gardens of HIV-positive and HIV-negative rural households in the Eastern Region of Ghana and their significance in household food security. Data were obtained through a household and home garden survey of a purposive sample of 32 HIV-positive and a random sample of 48 HIV-negative rural households and through in-depth interviews. A higher proportion of species common to all four home garden types consisted of food crops: vegetables, staples and fruits. In HIV-positive households, commercial home gardens were significantly larger, had significantly more species and individual plants, more perennial food crops and more species that were harvested all year round and evenness was lower, but there was no significant difference in species diversity compared with subsistence home gardens. Significantly more HIV-positive and HIV-negative households with a commercial home garden consumed a staple crop cultivated in the home garden in the 24-h period prior to the survey than HIV-positive households with subsistence home gardens. Rural households with HIV that manage commercial home gardens cultivate a dual purpose home garden which supplies subsistence food and also provides cash income; such households may have better food security than households that cultivate subsistence home gardens.

Keywords: Shannon-Weiner index, dual purpose, home garden biodiversity, evenness.

6.1. Introduction

Home gardens can serve as an important source of both food and cash income for vulnerable households. In recent years a great deal of emphasis has been placed on the potential value of the home garden in providing subsistence food and additional income for households affected by HIV (Irwin and Parker 2004; Bukusuba et al. 2007; Murphy 2008). There are, however, no empirical studies on the differences between the biodiversity in home gardens cultivated for subsistence only or for commercial purpose as well by rural households affected by HIV illness. It is this intersection that this paper addresses.

The primary function of most home gardens, that is, providing subsistence food, has overshadowed their role of contributing to the cash income of rural households. The primary objective of home garden production, for either cash income generation or for household consumption, influences home garden biodiversity (Trinh et al. 2003). Lack of access to good planting materials, land and labour opportunities affect species composition in home gardens (Wiersum 2006). Research indicates that the mixture of home garden crops provides staples, fruits, vegetables, spices, and many non-food products for households (Gebauer 2005; Peyre et al. 2006). Other studies point out that home garden production is mostly supplementary to staple food production and mainly focuses on vegetables, fruits and condiments (Kumar and Nair 2004; Wiersum 2006). Nevertheless the wide range of products from trees, shrubs and herbaceous plants cultivated in home gardens offers diversity to the diet for rural households and also serves as an important source of cash income through sale of surplus produce and cash crops (High and Shackleton 2000; Murphy 2008).

Differences in biological cycles of home garden crops and the kind of desired produce enhance the availability of home garden products for harvest (Okigbo 1995). Conscious effort to improve yields for the market leads to intensification of home garden cultivation using external inputs such as chemical pesticides, fertilizers, labour from outside the home and purchased planting material (Yiridoe and Anchirinah 2005; Ntow et al. 2006; Gebreselassie et al. 2008). Abdoellah et al. (2006) pointed out that the introduction of cash crops in home gardens is accompanied by reduced species diversity. On the contrary, Trinh et al. (2003) argued that commercialization of home gardens does not lead to reduced diversity, but to more diversity in terms of total number of species.

In Ghana there are two main home garden types cultivated in the semi-deciduous forest zone of the country: (i) the extensively cultivated home gardens where emphasis is on

production of food crops for household consumption and (ii) the intensively managed commercial home gardens cultivated with cash crops (Asare et al. 1990). The choice of crops in these home gardens is influenced by the agroecological conditions, and by cultural and economic factors (Bennett-Lartey et al. 2002).

In rural households with HIV illness, household labour is constrained for field production due to frequent ill-health or the need to divert time to care for the individual who is ill. This labour constraint impacts availability and diversity of food consumed and threatens household food security (De Waal and Tumushabe 2003). Home garden cultivation assumes an important role in contributing to the variety in a household's diet and also in providing cash income due to its diversity in crop species, proximity to the homestead, and flexible labour requirements (Garí 2003; Akrofi et al. 2008). The cultivation of horticultural crops such as vegetables, medicinal plants, fruit crops and tuber crops in home gardens of HIV affected households to provide basic staple food, nutrition, medicine and cash income is encouraged by development agencies (ActionAid 2005; Nordin 2005).

Research on biodiversity in home gardens of rural households affected with HIV is limited. The aim of this study is to explore the differences and similarities in the biodiversity of subsistence oriented (products solely for own consumption) and commerce oriented (products also for sale) home gardens managed by rural households affected with HIV in the Eastern Region of Ghana and their significance in household food security. The study assessed the crop composition and diversity, availability of home gardens products and external inputs used in subsistence and commerce oriented home gardens of HIV-positive and HIV-negative rural households in the Eastern Region of Ghana and the consumption of a staple crop cultivated in these home gardens in the 24-h period prior to the survey. This study is relevant for the development of appropriate home garden management strategies that will enhance food security of rural households affected with HIV.

6.2. Material and Methods

6.2.1. Study area

The study was conducted in 17 rural communities in 12 out of the 21 districts of the Eastern Region of Ghana. These communities were located in the semi-deciduous forest zone of the region. The Eastern Region of Ghana has a population of about 2,000,000 and four main ethnic groups: Akan (52%), Ga-Adangbe (9%) Ewe (16%) and Guan (7%). The Ewe is the

only non-indigenous ethnic group among these. Other minor non-indigenous ethnic groups in the region are the Gurma, Grusi, Mole-Dagbane and the Mande-Busanga (GSS, 2002). The semi-deciduous forest zone of Eastern Region of Ghana is an important agricultural area of the country characterized by a semi-equatorial climate with average annual rainfall ranging between 1250 and 1800 mm. Temperatures are uniform throughout the year and the monthly mean is about 30 ^{o}C. The rainfall pattern is bimodal, with a major rainy season from April to July, a short dry season in August and a minor rainy season from September to November. The main dry season is from December-March. The soils are predominantly forest ochrosols and oxisols which support the cultivation of food crops such as maize (*Zea mays*), plantain (*Musa sapientum* spp.), cassava (*Manihot esculenta*), pepper (*Capsicum annuum*), eggplant (*Solanum aethiopicum*) and okra (*Abelmoschus esculentus*) and high-value cash crops such as cocoa (*Theobroma cacao*), oil palm (*Elaeis guineensis*) and citrus (*Citrus* spp.) (Adu 1992*)*. In some rural communities of the region where these agricultural crops are cultivated in home gardens for both food supply and cash income, HIV prevalence has consistently been higher than the average prevalence in the country (GAC 2004; Bennett-Lartey et al. 2002). Currently home gardens are evolving in ways associated with HIV positive status as their essential role in the nutrition of HIV households is emphasised (Bukusuba et al. 2004; Parker 2004; Murphy et al. 2006). Studies indicate that biodiversity in home gardens contributes significantly to dietary diversity in rural households with HIV (Akrofi et al. 2010).

6.2.2. Methodology

From October 2005 to February 2006, a household and home garden survey was conducted in 17 rural communities located in 12 districts in the semi-deciduous forest zone of the Eastern Region of Ghana. Participants consisted of a purposive sample of 32 HIV-positive households of which 12 households had subsistence oriented and 20 had commerce oriented home gardens; and a random sample of 48 HIV-negative households of which 13 had subsistence oriented and 35 had commerce oriented home gardens, respectively. An HIV-positive household was categorized as one that had at least one household member between 15 and 49 years old diagnosed with HIV while an HIV-negative household had no member known to be HIV-positive in the household. As a result of the stigma attached to people known to be HIV-positive there was difficulty in locating households with people living with HIV in them; these households were identified through the Association of People Living with HIV/AIDS (PLWHA) at three district hospitals in the region. HIV-negative households were

selected from the communities where HIV-positive households resided with the assistance of village elders. A home garden was described as "subsistence oriented" when crop produce was mainly for household consumption and as "commerce oriented" when one or more types of crop produce were cultivated also for cash income. A crop species classified as being cultivated for cash income had 50% or more of its produce sold. For convenience these home gardens were categorized as subsistence and commercial home gardens, respectively.

6.2.3. Data collection

A structured questionnaire was administered by the principal researcher to home garden owners during the survey. Household information gathered included ethnicity (native or non-indigenous tribe), number of years that the home garden had been cultivated by the current owner, benefits and constraints encountered in home garden cultivation, household farming characteristics (full time or part time), and household food consumption (24-h dietary recall). In the home garden survey, information on the local (vernacular) name of each cultivated species in the home garden, plant type (perennial or annual food crop or non-food crop species), major preferred human use (vegetable, staple, fruit, spice, medicinal or fodder plant), economic product (fruit, tuber, etc.) and the period of the year (rainy season, dry season or all year round) when each crop product was available for harvesting was obtained with the assistance of a botanist. The number of individual plants of each crop species was counted and the category of crop (subsistence or cash crop) noted. The cultivated area in each home garden was measured and the presence or absence of fences noted. The use or non-use of inputs from external sources (improved planting material, chemical pesticides and fertilizers and labour from outside the home) used in home garden cultivation was recorded. In-depth interviews were conducted with 20 home garden owners: five home garden owners purposively selected from each home garden type (representing 10 - 40% of each group) in their homes. Selection was based on the condition that the home garden owner had cultivated his/her home garden continuously for a period of at least five years. The assumption was that these home garden owners had adequate experience in managing their home gardens. The interviews explored in detail issues pertaining to the choice of home garden crops, use of extra-domestic labour, chemical pesticides and fertilizers used in home garden cultivation, main income earning activity of the household and household dietary preferences. Each interview lasted up to 60 minutes, was conducted in *Twi*, the most common local language in the study area, and audio-tape recorded.

6.2.4. Data analysis

The occurrence of each crop species was calculated as a proportion of each home garden type in which the species was recorded. This was used as a quantitative indicator of the presence of each crop species (Zaldivar et al. 2001). To quantify the diversity of home garden crops, ecological indices including species richness, species diversity, evenness and Sørenson's Index of Similarity were estimated (Magurran 1988). Species richness was determined for each home garden surveyed using cultivated crop species count (Gautam et al. 2008). The overall crop species diversity (number and distribution of cultivated plant species) in each home garden was estimated using the Shannon-Wiener and Pielou's evenness indices with the cultivated area of each home garden representing a sampling plot. The Shannon-Wiener index takes a value of zero when there is only one species in the home garden, and a maximum value when all species are present in equal abundance (Mohan 2004). Evenness represents a measure of relative diversity which presents the real distribution of species compared with the maximum distribution taking into account the number of species present in the home garden. Low evenness values indicate that one or a few species dominate in the home garden; values close to one reflect equitable species abundances (Schmitz 2004). Similarity in crop species composition between subsistence and commercial home gardens was estimated using the Sørenson's index of similarity (Magurran 1988).

Each crop species was assigned to one of the four categories of 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).

Data were summarized as medians and ranges for non-normally distributed quantitative variables and as percentages for categorical variables. The Kruskal-Wallis and Dunn's multiple comparison tests were used to examine the differences across the four home gardens types with regards to non-normally distributed quantitative variables (Philip and Cook 2000). Fisher's exact tests were used to test whether there was any relationship between the function of home garden (subsistence or commerce) and the ethnicity of the household (native or non-indigenous tribe), presence or absence of each individual species recorded in home gardens, and the use or non-use of external inputs (chemical pesticides and fertilizers and labour from outside the home). Chi-square tests were conducted to compare the proportions of HIV-positive and HIV-negative households with subsistence/commercial

home gardens that engaged in full time farming; and consumed a staple crop cultivated in the home garden (based on 24-h dietary recall). Pair-wise comparison of proportions was performed using Fisher's exact tests when Chi-square tests showed significance. The level of statistical significance was set at $P<0.05$ for all data analyses.

In-depth interviews were transcribed into English. Transcripts were analyzed by arranging responses according to the key issues and themes indicated above. Explanations and range of opinions expressed by informants were grouped according to these themes.

6.3. Results

6.3.1. Crop species composition in the home gardens

A total of 75 crop species belonging to 40 botanical families were recorded across the surveyed home gardens. Table 6.1 shows the botanical, common and local names, types of plant, parts of the plant which are of economic use and the harvest seasons of the crop species. Fifty–five species (73%) were food crops (vegetables, staples, spices, fruits trees) and 20 (27%) were non-food crop species (medicinal plants and fodder plants). Among these about 39% were trees, 11% shrubs and 51% herbaceous plants. Home garden owners offered various explanations for the crop composition in their home gardens. Some indicated that staple and vegetable crops, medicinal and fodder plants cultivated in the homestead were convenient and enhanced access to food, availability of medicinal plants to treat common ailments and fodder plants to feed domestic livestock. Others pointed out that the availability of food crops from the home garden enabled households to save money for other food items not available in the home. Besides, labour required for home garden cultivation was reduced by maintaining shrubs and trees which grow continuously in the home gardens. Some informants from HIV-positive households with commercial home gardens emphasized that although they were not able to cultivate a lot of crops in distant fields due to frequent health problems or the need to offer care to the ill household member, their household members never went to bed hungry because their home garden produce served a dual purpose in providing food and cash income.

Table 6.1: Inventory of crop of species identified in home gardens, their botanical, common and local names, plant type, use, economic produce and harvest season

Botanical name	Family	Common name	Local name	Plant type/Economic produce	Harvest season
Annual food crops					
Vegetables					
Abelmoschus esculentus	Malvaceae	Okra	Nkruma	Herbaceous/fruit	Year round
Amaranthus spp.	Amaranthaceae	African spinach	Aleefu	Herbaceous /leaf	Year round
Arachis hypogaea	Papilionaceae	Groundnut	Nkate	Herbaceous/kernel	Rainy season
Capsicum annuum	Solanaceae	Chilli pepper	Meko	Herbaceous/fruit	Year round
Corchorus olitorius	Tiliaceae	Jew's mallow	Ayooyo	Herbaceous/leaf	Year round
Cucurbita spp.	Cucurbitaceae	Pumpkin		Herbaceous/fruit	Rainy season
Hibiscus cannabinus	Malvaceae	Kenaf		Herbaceous/leaf	Year round
Solanum lycopersicum	Solanaceae	Tomato	Ntoso	Herbaceous/fruit	Rainy season
Luffa acutangula	Cucurbitaceae	Ridged gourd		Herbaceous/fruit	Rainy season
Solanum aethiopicum	Solanaceae	Eggplant	Aworowo	Herbaceous/fruit	Rainy season
Talinum triangulare	Portulacaceae	Waterleaf	Boroboro	Herbaceous/ leaf	Year round
Trichosanthes cucumerina	Cucurbitaceae	Snake gourd	Krobonko	Herbaceous/fruit	Rainy season
Vigna unguiculata	Fabaceae	Cowpea	Adua	Herbaceous/grain	Rainy season
Staples					
Dioscorea spp.	Dioscoreaceae	Yam	Bayerè	Herbaceous vine/tuber	Rainy season
Manihot esculenta	Euphorbiaceae	Cassava	Bankye	Herbaceous/tuber	Year round
Zea mays	Poaceae	Maize	Abro	Herbaceous/fruit	Rainy season
Spice					
Ocimum basilicum	Lamiaceae	Basil sweet	Eme	Herbaceous/leaf	Year round
Fruit					
Ananas comosus	Bromeliaceae	Pineapple	Abrobè	Herbaceous/fruit	Year round
Perennial food crops					
Vegetables					
Bombax costatum	Bombacaceae	Red kapok tree	Akokonre	Tree/flower	Dry season
Cajanus cajan	Papilionaceae	Pigeonpea		Shrub/grain	Rainy season
Canavalia ensiformis	Fabaceae	Jack bean		Herbaceous vine/grain	Rainy season
Elaeis guineensis	Arecaceae	African oil palm	Abè	Palm tree/fruit	Year round

Table 6.1: Cont'd

Phaseolus lunatus	Fabaceae	Lima bean	Adua	Herbaceous/grain	Rainy season
Solanum macrocarpon	Solanaceae	African eggplant	Gboma	Herbaceous/fruit	Year round
Solanum melongena	Solanaceae	Aubergine	Ntorobabayin	Herbaceous/fruit	Year round
Solanum torvum	Solanaceae	Prickly solanum	Saman-ntoroba	Herbaceous/fruit	Year round
Vernonia amygdalina	Asteraceae	Bitterleaf	Bonwen	Shrub/leaf	Year round
Staples					
Colocasia esculenta	Araceae	Taro	Kookoo	Herbaceous/corm	Rainy season
Ipomoea batatas	Convolvulaceae	Sweet potato	Ntrumõõ	Herbaceous/tuber	Rainy season
Musa sapientum	Musaceae	Plantain	Brodie	Herbaceous/fruit	Year round
Xanthosoma sagittifolium	Araceae	Cocoyam	Mankani	Herbaceous/corm	Year round
Spices					
Aframomum melegueta	Zingiberaceae	Grains of paradise	Famu-wisa	Herbaceous/fruit, seed	Rainy & Dry seasons
Curcuma longa	Zingiberaceae	Tumeric	Akakadrum kökõõ	Herbaceous/rhizome	Year round
Monodora myristica	Annonaceae	Calabash nutmeg	Ayerew-amba	Tree/seed	Rainy season
Piper guineense	Piperaceae	Guinea blackpepper	Soro-wisa	Herbaceous vine/fruit	Dry season
Zingiber officinale	Zingiberaceae	Ginger	Akakaduro	Herbaceous/rhizome	Year round
Fruits					
Anarcadium occidentale	Anacardiaceae	Cashew	Atea	Tree/fruit	Dry seaton
Annona muricata	Annonaceae	Soursop	Adobo	Tree/fruit	Rainy season
Annona squamosa	Annonaceae	Sweetsop	Nŋawie	Tree/fruit	Rainy season
Artocarpus communis	Moraceae	Bread fruit	Dziiball	Tree/fruit	Dry season
Artocarpus heterophyllus	Moraceae	Jack fruit		Tree/fruit	Rainy & Dry seasons
Carica papaya	Caricaceae	Pawpaw	Brõfrè	Tree/fruit	Year round
Chrysophyllum albidum	Sapotaceae	Star apple	Alatsa	Tree/fruit	Dry season
Citrus aurantifolia	Rutaceae	Lime	Ankaatwaree	Tree/fruit	Rainy & Dry seasons
Citrus limon	Rutaceae	Lemon		Tree/fruit	Rainy & Dry seasons
Citrus sinensis	Rutaceae	Sweet orange	Akutu	Tree/fruit	Rainy & Dry seasons
Cocos nucifera	Palmae	Coconut	Kube	Tree/fruit	Year round
Mangifera indica	Anacardiaceae	Mango	Mango	Tree/fruit	Rainy & Dry seasons
Musa × paradisiaca	Musaceae	Banana	Kwadu	Herbaceous/fruit	Year round
Pachira aquatica	Bombacaceae	Saba nut		Tree/fruit	Rainy season
Persea americana	Lauraceae	Avocado pear	Peya	Tree/fruit	Dry season
Psidium guajava	Myrtaceae	Guava	Oguava	Tree/fruit	Rainy & Dry seasons
Saccharum officinarum	Poaceae	Sugar cane	Ahwidie	Grass/stem	Year round
Terminalia catappa	Combretaceae	Tropical almond	Abrofo nkate	Tree/fruit	Dry season
Theobroma cacao	Sterculiaceae	Cocoa	Chocolate tree	Tree/fruit	Rainy & Dry seasons

Table 6.1: Cont'd

Annual non-food crops					
Medicinal plants					
Catharanthus roseus	Apocynaceae	Madagascar periwinkle		Herbaceous/leaf, flowers, roots	Year round
Cassia occidentalis	Fabaceae	Negro coffee	Mofra brode	Herbaceous/leaf, seed	Year round
Nicotiana tabacum	Solanaceae	Tobacco	Tawa	Herbaceous/leaf	Rainy season
Perennial non-food crops					
Medicinal plants					
Alchonea cordifolia	Euphorbiaceae	Christmas bush	Gyamma	Shrub/leaf, stem, bark, root, fruits	Year round
Alstonia boonei	Apocynaceae	Alstonia	Sinduro	Tree/bark	Year round
Azadirachta indica	Meliaceae	Neem	Kintwo	Tree/leaf	Year round
Cola nitida	Sterculiaceae	Kola nut	Bese	Tree/fruit	Dry season
Cymbopogon citratos	Poaceae	Lemon grass	Sèrè	Grass/leaf	Year round
Eucalyptus globulus	Myrtaceae	Blue gum		Tree/leaf	Year round
Gossypium hirsutum	Malvaceae	Cotton	Asaawa	Shrub/boll	Rainy & Dry seasons
Jatropha curcas	Euphorbiaceae	Physic nut	Nkrangyedua	Shrub/seed	Year round
Morinda lucida	Rubiaceae	Brimstone tree	Kankroma	Tree/bark, leaf	Year round
Newbouldia laevis	Bignoniaceae	Sweet Newbouldia	Sasanemasa	Tree/bark, leaf	Year round
Ocimum gratissimum	Lamiaceae	Fever plant	Nunum	Herbaceous /leaf	Year round
Paullinia piñata	Sapindaceae	Nistmal	Toa-ntini	Shrub/root	Year round
Rauvolfia vomitoria	Apocynaceae	Swizzle stick	Kakapenpen	Tree/root	Year round
Thevetia peruviana	Apocynaceae	Milkbush		Shrub/leaf	Year round
Voacanga Africana	Apocynaceae	Voacanga	Ofuruma	Shrub/bark, leaf	Rainy season
Fodder plants					
Ficus exasperata	Moraceae	Sandpaper tree	Onyankerere	Tree/leaf	Year round
Gliricidia sepium	Fabaceae	Mother of Cocoa		Tree/leaf	Year round

6.3.2. Occurrence of crop species in the home garden types

Cocoa (*Theobroma cacao*) and oil palm trees (*Elaeis guineensis*), the major cash crops in the study area, were found in a significantly higher proportion of commercial home gardens compared with subsistence home gardens (27% vs. 4%, and 60% vs. 12%, respectively) (P = 0.000, Fisher's exact test). Most of these trees were not planted by the current home garden owner; they were components of the cocoa and oil palm plots which had previously occupied the home garden area. A commercial home garden owner pointed out that those cocoa and oil palm trees which had become unproductive were gradually being replaced with food crops that had better market prices. Another informant expressed that, although the oil palm trees in her home garden were tall and difficult to harvest, they were maintained as garden crops because the palm oil and palm kernel oil extracted from the fruits and the brooms and baskets made from the palm fronds provided a source of cash income. A subsistence home garden owner indicated that the single row of old cocoa on the boundary of her home garden had no economic value, but was useful in providing a wind break for young plants in her home garden and also provided fuel wood for her household.

Sixteen species out of the 17 crop species common to the four home garden types were food crops. These included major food crops such as plantain (*Musa sapientum*), a staple crop locally known as *Brodie*, which was the most common species and present in 80% or more of all four home garden types. Others were yam (*Dioscorea* spp.), a staple crop locally known as *Bayerè*, and pineapple (*Ananas comosus)* a fruit known as *Abrobè*. These were present in at least 50% of all home garden types with the exception of subsistence home gardens of HIV-positive households. Informants reported that planting materials like yam setts, plantain and pineapple suckers were obtained locally from mature crops harvested in their own home gardens and farms, acquired from neighbours, relatives and friends, or purchased from other farmers. Other informants indicated that the choice of home garden crops was limited by unavailability of planting material, unfavourable weather conditions or unintended destruction of crops by strayed domestic livestock and poultry which often brought conflict between neighbours. HIV-positive households emphasized that lack of funds to purchase local materials or to pay for labour to construct a perimeter fence to protect garden crops from strayed domestic animals influenced the choice of garden crops.

Eighteen food and ten non-food crops species were found solely in only one home garden type. Among these, 11 species found only in commercial home gardens of HIV-positive households included the food crops: vegetables such as African eggplant (*Solanum*

macrocarpon) locally called *Gboma*, Jack bean (*Canavalia ensiformis*), fruits such as Tropical almond *(Terminalia catappa*) known as *Abrofo nkate*, Jackfruit (*Artocarpus communis*), and non-food crops such as the medicinal plants blue gum (*Eucalyptus globulus*) and swizzle stick (*Rauvolfia vomitoria*) known as *Kakapenpen*, and the fodder plant common fig (*Ficus capensis*), locally known as *Onyankyere.* Some informants indicated that some of these species were not deliberately planted, but were retained during the initial clearing of the home garden area owing to their use as food, medicinal plant, fodder plant, shade trees or as fuel wood.

6.3.3. Crop diversity and other characteristics of home gardens

Table 6.2 shows the differences and similarities in the ecological indices and other characteristics of the subsistence and commercial home gardens managed by HIV-positive and HIV-negative households. In HIV-positive households commercial home gardens cultivated were significantly larger (2140 m^2 vs. 1246 m^2), had significantly more species (8.5 vs. 5.0), more individual plants (234 vs. 70), and more perennial food crop species (2.0 vs. 1.0) and species that were harvested all year round (6.5 vs. 3.0) than subsistence home gardens. There was no significant difference in species diversity between subsistence and commercial home gardens but evenness was lower in commercial than in subsistence home gardens (0.42 vs. 0.57) (Table 6.2). On the contrary, there was no significant difference between subsistence and commercial home gardens of HIV-negative households in any of the parameters studied. Within the category of commercial home gardens, HIV-positive households cultivated significantly more individual plants, but there was no significant effect of household HIV illness within the category of subsistence home gardens (Table 6.2). Informants from HIV-positive households with commercial home gardens pointed out that they were able to cultivate a larger home garden area and plant new crops because they had access to land and additional labour from other household members or from some extended family members who had come to assist in care giving. Moreover, by cultivating significantly more perennial crops which did not require re-planting each year, time was available for them to engage in cash crop production.

Comparison of the similarity in crop species composition between subsistence and commercial home gardens showed a moderately high Sørensen's index (HIV-positive households: 62.2% and HIV-negative households: 65.9%) (Table 6.2). Informants pointed out that both food and cash crop production in home gardens was rain fed. Short duration crops such as vegetables when cultivated for cash income were planted at the beginning of the

major rains for early harvest and a better market price, while those for home consumption were planted at any time during the rainy season. Crops of relatively longer duration such as staples like plantain, yam and cocoyam were planted at the end of the dry season or just before the major rains to obtain enough moisture for growth. Seedlings of fruit trees like orange (*Citrus* spp.), mango (*Mangifera indica*) and avocado pear (*Persea americana*) were planted at the beginning of the major rains to obtain enough moisture for establishment.

There was no significant effect of household HIV illness on the home gardens with regard to the number of years the home garden had been cultivated by the current owner, the number of annual food crops and non-food crop species, species richness and the number of species harvested from the home garden in either the rainy or dry season only or in both seasons.

6.3.4. Management aspects

Improved planting material was much more often used in commercial home gardens than in subsistence home gardens, both in HIV-positive households (100% vs. 0%, $p = 0.002$) and in HIV-negative households (90% vs. 10%, $p = 0.022$) (Fisher's exact tests). Chemical pesticides and labour from outside the home were used in a higher proportion of commercial home gardens in both HIV-positive and HIV-negative households but these were not significantly different compared with the proportion of subsistence home gardens (chemical pesticide use: 86% vs. 14%, $p = 0.212$ in HIV-positive and 84% vs. 17%, $p = 0.370$ in HIV-negative households; external labour use: 80% vs. 20%, $p = 1.000$ in HIV-positive and 93% vs. 7%, $p = 0.073$ in HIV-negative households; Fisher's exact tests). All commercial home gardens of both HIV-positive and HIV-negative households and none of their subsistence home gardens received chemical fertilizer application (HIV-positive households: 100% vs. 0%, $p = 0.029$; HIV-negative households: 100% vs. 0%, $p = 0.044$; Fisher's exact tests). In HIV-negative households a significantly higher proportion of commercial home gardens were fenced compared with subsistence home gardens (74% vs. 31%, $p = 0.01$; Fisher's exact test), but there was no significant difference between these home garden types with regard to fencing of home gardens of HIV-positive households, (70% and 67%, respectively). Commercial home garden owners stressed that although fencing, hired labour, improved planting materials, chemical pesticides and fertilizers purchased from agro-chemical shops increased cost of home garden production, they were sure of good harvests for the market. Adults were hired for land clearing, making of mounds, weeding, planting, chemical fertilizer

and pesticide application, harvesting of produce and establishing home garden fences and payment was in the form of money. Subsistence home garden owners indicated that herbicides were the most common chemical pesticide used, because controlling weeds in home gardens with herbicides reduced the amount of time spent in manual weeding. A small proportion of these home gardens owners reported that children between 10 - 14 years from outside the home were engaged in situations of acute shortage of domestic labour for weeding and planting of garden crops. Remuneration for these children was in the form of some home garden produce or occasional gift.

6.3.5. Cash crops cultivation

Pepper (*Capsicum annuum*), a vegetable crop, was cultivated as a cash crop in HIV-positive households only and in none of the HIV-negative households (100 % vs. 0%, $p = 0.043$; Fisher's exact test). Informants pointed out that pepper (*Capsicum annuum*) was the most preferred cash crop, because the stored harvest fetches a higher market price than the other food crops in the dry season. Moreover the relatively short maturity period (120 days) enables the cultivation of more than one crop per year. Cash crops common to both groups included eggplant, cocoa, oil palm and oranges in 15%, 10%, 15% and 5% of HIV-positive households and in 9%, 14%, 22% and 6% of HIV-negative households, respectively. It was noted during field observations that not more than two crops were cultivated for cash income in any of the commercial home gardens.

6.3.6. Characteristics of the households

In both HIV-positive and HIV-negative households, the ethnicity of the household did not influence the type of home garden cultivated. In the group of HIV-positive households 67% natives and 33% from non-indigenous tribes cultivated a commercial home garden and 85% natives and 15% from non-indigenous tribes cultivated a subsistence home garden ($p = 0.38$; Fisher's exact test). Sixty-three percent natives and 37% from non-indigenous tribes cultivated a commercial home garden in the group of HIV-negative households and 31% natives and 62% from non-indigenous tribes cultivated a subsistence home garden ($p = 0.19$; Fisher's exact test). HIV-positive and HIV-negative households differed in proportions that engaged in full time farming with regard to the type of home garden cultivated ($X^2 = 9.43$, d.f. = 3, $p = 0.024$). Pair-wise comparison revealed that both HIV-positive households with either commercial or subsistence home gardens were more likely to engage in full time farming

compared with HIV-negative households with a subsistence home garden (83% vs. 17%, p = 0.005; 73% vs. 27%, p = 0.047 respectively; Fisher's exact test). However, there was no significant difference in the field area cultivated by the different households studied (Table 6.2). Informants from HIV-positive households indicated that farming was their main occupation due to lack of funds to take on non-farm income activities or time constraints owing to frequent bouts of illness or the need to take time off to care for the ill household member. Others expressed that major non-farm income generating activities such as cooked-food vendoring and processing of agricultural products had been given up due to *the* stigma attached to HIV illness and labour constraints, respectively.

There was significant difference in the proportion of both HIV-positive and HIV-negative households that consumed a staple crop cultivated in the home garden 24-h prior to the survey with regard to the type of home garden cultivated (X^2 = 9.15, d.f. = 3, p = 0.026). Pair-wise comparison showed that a significantly higher proportion of both HIV-positive and HIV-negative households with a commercial home garden consumed a staple crop that was cultivated in the home garden 24-h prior to the survey (88% and 91%, respectively) than in HIV-positive households with a subsistence home garden (12% and 9%, respectively). An HIV-positive household with a commercial home garden emphasized that, although she did not grow a lot of field crops anymore because she could not work long hours in the field, her children never slept with hunger because she harvested plantain and cocoyam regularly from her garden for own consumption and the cash crops provided money for other food items not available in the home. Another indicated that it was very convenient to grow food and cash crops in his compound because it saved his household the problem of going to fetch food produce from the distant field on rainy days. HIV-negative counterparts on the other hand, indicated that by maintaining a variety of food crops regularly consumed in their home gardens besides cash crops, household food supply was sustained during the off-season when food crops are scarce and in situations when they do not have money to purchase this produce.

6.4. Discussion

6.4.1. Crop species composition in the home gardens

This study explored the differences and similarities in crop species composition and diversity, availability of products and external inputs used in subsistence and commerce

oriented home gardens managed by HIV-positive and HIV-negative rural households and assessed the consumption of a staple food crop from the home gardens during the 24 h period prior to the survey.

Crop species recorded across the home gardens consisted of vegetables, staples, fruits, spices, medicinal and fodder plants. This confirms that the surveyed home gardens serve as a source of food and non-food necessities to households (Gebauer 2005; Peyre et al. 2006). Similar species were documented in previous studies by Asare et al. (1990) and Bennett-Lartey et al. (2002). Relatively fewer crop species (75 species) were recorded in the current study compared with the 104 species reported by Bennett-Lartey et al. (2002). The present study focused on home gardens in rural areas in the semi-deciduous agro-ecological zone whereas that of Bennett-Lartey et al. (2002) covered urban, peri-urban and rural home gardens in the same agroecological zone. In contrast, relatively more species were recorded in the current study compared with the 41 species reported by Asare et al. (1990) from urban and peri-urban home gardens. In urban and peri-urban home gardens, crop species are selected to meet a consumption pattern or a market demand, whereas in the rural areas they provide a wide range of uses besides food, such as medicine, fodder, construction and craft materials (Drescher 1997).

6.4.2. Occurrence of crop species in the home garden types

The surveyed home gardens were highly variable with regards to the occurrence of individual crop species. This is attributed to the fact that home garden crops consisted of deliberately planted food crops species, such as plantain, cassava, pepper eggplant, African spinach, pineapple and banana, food and medicinal plants species that grew volunteer plants such as pawpaw and the fever plant and species that had been maintained from the previous vegetation such as cocoa and oil palm.

Major food crops such as the staples plantain and yam and the fruit pineapple were common to all four home gardens due to their importance in Ghanaian diet (Salm and Falola 2002*)*. It is evident that cocoa and oil palm trees found in commercial home gardens of either HIV-positive and HIV-negative households were planted or retained in these home gardens due to the high financial value of their main products. Castinẽiras et al. (2001) pointed out that agrarian policy could influence biodiversity in home gardens. Currently, cocoa is the main foreign exchange earner to the Ghanaian economy and contributes about 29% to the GPD and oil palm is a major source of edible oil and a key agro-industrial crop. These crops

have a readily available market and a good market price is always assured (Amanor and Diderutuah 2001; GIPC 2002).

The high level of species similarity between commercial and subsistence home gardens indicated by the moderately high Sørenson's index could be attributed to similar climatic and environmental conditions across the districts where the surveyed home gardens were located (Bennett-Lartey et al. 2002). Major food crops like plantain, yam and pineapple propagated by vegetative means were widely cultivated in almost all the different home garden types due to availability of planting materials, ease of cultivation, minimum care in management and availability of products all year round (Gautam et al. 2008). Lack of access to good planting materials, or inability to cultivate these species possibly due to unintended destruction of these crops by domestic animals could be the reason why these species were not found in more than half of the subsistence home gardens of HIV-positive households. A higher proportion of the species common to the four home garden types included vegetables, staples and fruits. This could suggest similar food habits between the studied households which comprised 65% native and 35% non-indigenous ethnic groups. The influence of agroecological factors and households' dietary habits on home garden species composition has been emphasized by several authors (Shrestha et al. 2002; Wezel and Bender 2003; Kehlenbeck and Maass 2004; Kehlenbeck et al., 2007).

Crop species found solely in one home garden type had either been deliberately planted or had been retained in home gardens due to their food and non-food uses. This supports the report of Eyzaguirre and Linares (2004) that home gardens could serve as a conservation unit for agrobiodiversity.

6.4.3. Crop diversity and other characteristics

The proximity of the home garden to the homestead and its flexible labour requirement offered a suitable intervention for rural households with HIV illness which require more food security, better nutrition and lower labour-investment incentives (Garí 2003; Loevinsohn and Gillespie 2003). Consequently, available land and extra domestic labour enabled HIV-positive households to cultivate significantly larger commercial home gardens with a significantly higher species richness compared with subsistence home gardens. In maintaining significantly more perennial food crop species that did not require yearly re-planting in commercial home gardens, HIV-positive households with commercial home gardens were able to cultivate subsistence crops and also engage in cash crop production to

enhance household income (Murphy 2008). Cultivating together monocultures of cash crops with a variety of food crops for own consumption could account for the significantly greater number of individual plants present in commercial than in subsistence home gardens. Murphy (2008) asserts that as a result of information sharing, home garden owners who tapped into HIV/AIDS networks are more likely to have improved gardens: semi-permanent and irrigated by hand to overcome poor rain, with a greater diversity of plants and with newer varieties that are hard to procure. The surveyed home gardens could be regarded as semi-permanent production systems having been cultivated for a period of two to forty years (Table 6.2). In many rural areas of Ghana use of domestic water supply for home garden crops is limited and most garden owners rely entirely on rainfall for crop cultivation (Obuobie et al. 2006). The bimodal rainfall distribution in the study area enabled home garden owners to cultivate both food crops and cash crops throughout the growing seasons.

In comparison with previous studies on home gardens in Ghana (Asare et al. 1990; Bennett-Lartey et al. 2002), the current study focused on only cultivated species and so the availability of different varieties of the home garden crops was not considered.

HIV-positive households were identified through the association of PLWHA, where they had received nutrition education from health care officers. There was no significant difference in species diversity between subsistence and commercial home gardens of HIV-positive households, but there was a higher level of diversity with regard to the total number of species cultivated in the commercial home garden type. This is consistent with the statement of Trinh et al. (2003) that commercialization of home gardens reduces species diversity, but disagrees with that of Abdoellah et al. (2006) that commercialization causes no significant change in the number of species cultivated. This is supported by the fact that only cultivated crop species were considered in the present study; other types of plants such as useful weeds were not included. Unequal access to good planting material, land or labour could have contributed to the variation in number of species found in commercial and subsistence home gardens of HIV-positive households (Wiersum 2006). Evenness was significantly lower in the commercial than in the subsistence home gardens. This could be attributed to the fact the few species cultivated as cash crops by HIV-positive commercial home garden owners were maintained in relatively higher numbers compared with other species present. Similar findings were reported by Bernholt et al. (2009) and Abdoellah et al. (2006). The findings of this study support that of Mendez et al. (2001), Abdoellah et al. (2006), and Perrault-Archambault and Coomes al. (2008) in their studies on the influence of a

range of household socio-economic characteristics on home garden species composition and diversity.

6.4.4. Management aspects

Improved seeds of vegetables such as pepper, eggplants and okra, and chemical fertilizers such as NPK, ammonium sulphate and urea were used much more in commercial home gardens than in subsistence home gardens in both HIV-positive and HIV-negative households to enhance yields for local markets. It is a common practice among garden owners in Ghana who cultivate non-tree crops for cash income to use improved seeds chemical fertilizers and to establish fences around home gardens (Gerken et al. 2001; Yiridoe and Anchirinah 2005; Ntow et al. 2006). The absence of significant difference between commercial and subsistence home gardens in chemical pesticides use in both HIV-positive and HIV-negative could be explained by the fact that some subsistence home garden owners, who use herbicides on distant fields, applied these herbicides in home gardens as well to control weeds. This is because farmers perceive that herbicide use is able to suppress weeds for a longer time than manual weeding with the hoe and cutlass even though this reduces the diversity in other plant forms present. It was noted that garden owners did not follow the recommendations for the safe use of chemical pesticides and this has both environmental and health implications which give cause for concern (Ntow et al. 2006; Asante and Ntow 2009). It is apparent that lack of local fencing materials in both HIV-positive and HIV-negative households together with lack of funds to hire labour to construct these fences in HIV-positive households may have limited the establishment of a perimeter fence in some home gardens to protect home garden crops from destruction by domestic animals. Yiridoe and Anchirinah (2005) pointed out that live fences or hedges of species like milk bush (*Thevetia peruviana*) were the commonly used fencing material in the moist areas of the current study area due to all year round moisture conditions which is suitable for hedge growth. It was observed in this study that fences made from local materials like tree branches and bamboo stakes were commonly practiced in both commercial and subsistence home gardens. This could be due to the versatility of fences made from local materials compared with live fences. Studies report that domestic labour used in home garden cultivation occasionally include children (Mendez et al. 2001); this study emphasizes the engagement of children from outside the home in garden work.

6.4.5. Cash crop cultivation

It is evident that a significantly higher proportion of HIV-positive households were motivated to cultivate pepper as a cash crop because of its financial value. Access to ready market is a major determining factor for cash crop production in home gardens (Michon and Mary 1994). Routine markets organized on weekly basis in rural areas of the study area offered garden owners the opportunity to sell their produce (Owusu 2004). Cocoa (*Theobroma cacao*) was the only cash crop that was not utilized directly by households; the beans were sold to the state through local buying agents.

6.4.6. Characteristics of the households

In both HIV-positive and HIV-negative households the proportions of natives and those from non-indigenous tribes that cultivated either subsistence or commercial home gardens were comparable. Household's ethnic affiliation may not have influenced the type of home garden cultivated (Bennett-Lartey et al. 2002; Bernholt et al. 2009; Kusumaningtyas et al. 2006). The specific needs and preferences of the household and availability of market for garden produce could be the main factors that influenced the type of home garden cultivated (Abdoellah et al. 2006; Trinh et al. 2003).

The majority of HIV-positive households engaged in full time farming owing to constraints for non-farm income activities. Consequently, cash earnings from the sale of home garden produce may represent an important income for those with commercial home gardens given that crop farming is their main source of income. This supports the report that useful income-generating activities for rural households experiencing HIV illness are those based around local biodiversity and skills (World Bank, 2005). HIV-positive households with commercial home gardens had access to significantly more species and more perennial food crops with products in the form of leaves, corms, rhizomes, flowers and fruits all year round for household consumption.

A significantly larger proportion of HIV-positive households with commercial home gardens consumed a staple crop cultivated in the home garden during the 24–h period prior to the survey compared with their counterparts with subsistence home gardens. This evidence may suggest that HIV-positive households with commercial home gardens cultivate a dual-purpose home garden that supplies subsistence food and also provides cash income.

A household has food security when it has the ability to secure, either from its own production or through purchases, adequate food to meet the dietary needs of its members so

that they can lead a healthy and active life (Egal and Valstar 1999). HIV-positive households with commercial home gardens expressed the benefits of cultivating both food and cash crops in home gardens. The emphasis was that the home garden provided an importance source of household food. Moreover, food and cash crops cultivated in home gardens provided households' access to a diversity of foods from their own environment as well as cash income to purchase other food needs. This was on the advice of health care officers that intake of a variety of foods promotes good health. HIV-positive households with commercial home gardens have direct access to food from their home gardens and indirectly through purchases with cash earnings from their gardens. This may indicate a better food security for HIV-positive households with commercial home gardens compared with HIV-positive households with subsistence home gardens; this is in contrast to the general opinion that rural households with HIV illness are food insecure (De Waal and Whiteside, 2003; Loevinsohn and Gillespie, 2004). In the current study, besides available resources such as land and extra domestic labour, the nutrition education given to PLWHA may have been the additional factor that contributed to the cultivation of both subsistence and cash crops in commercial home gardens of HIV-positive households.

6.5. Conclusions

The findings presented in this study indicate that a higher proportion of the species common to the subsistence and commercial home gardens of HIV-positive and HIV-negative rural households consisted of vegetables, staples and fruits. HIV-positive households cultivated significantly larger commercial home gardens with significantly more species and individual plants, significantly more perennial food crops and significantly more species that were harvested all year round and evenness was lower, but there was no significant difference in species diversity compared with subsistence home gardens. Improved planting material was used more in commercial home gardens of both HIV-positive and HIV-negative households than in subsistence home gardens. Chemical fertilizer was only used in commercial home gardens of both HIV-positive and HIV-negative households and not in subsistence home gardens. HIV-positive households were more likely to engage in full time farming compared with HIV-negative households with subsistence home gardens. Significantly more HIV-positive and HIV-negative households with commercial home gardens consumed a staple crop cultivated in the home garden during the 24–h period prior to the survey compared with

HIV-positive households with subsistence home gardens. These findings may imply that rural households experiencing HIV illness in cultivating commercial home gardens adapt the structure, species composition and management of home gardens to suit their needs. They cultivate a dual purpose home garden that provides cash income and also supplies subsistence food. HIV-positive households with commercial home gardens may have better food security than HIV-positive households with subsistence home gardens.

In the development of home garden management strategies to improve food security in rural households with HIV more focus should be given to HIV-positive households that cultivate subsistence home gardens. Provision of extension support services to address production constraints such as access to good planting materials, efficient use of inputs and unintended destruction of home garden crops by domestic animals could improve home garden production and subsequently enhance rural household food security.

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CHAPTER 7

HIV and severity of seasonal household food-related coping behaviours in rural Ghana

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Abstract

In-depth research was conducted to evaluate the seasonal food insecurity of HIV-positive and HIV-negative farm households in the Eastern Region, Ghana. A Coping Strategy Index (CSI) was used to assess household food-related coping behaviours. HIV-positive farm households often relied on both less severe and more severe coping behaviours, had a higher CSI, cultivated a smaller field area, harvested fewer food species from farms and gardens, and obtained income from fewer sources than HIV-negative farm households in both the post-harvest and lean seasons. We conclude that food insecurity is more severe in HIV-positive than in HIV-negative farm households in both seasons.

Key words: HIV, farm household, coping behaviour, food security, post-harvest season, lean season.

7.1. Introduction

Food availability, food access and food use comprise the three pillars of food security. Resource poor farming households are extremely vulnerable to food insecurity, as they tend to fall short in agricultural production, have seasonal food shortages and insufficient income earning opportunities (IFAD, 1996). The very poverty of farm households can also make them more vulnerable to other environmental, social and economic factors that exacerbate food insecurity (DFID, 2002; Gillespie and Kadiyala, 2005). The most widely accepted definition of food security is that adopted at the 1996 World Food Summit with food security existing "when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences, for an active and healthy life." (FAO, 1996).

Food security among households impacted by HIV and AIDS is of great international concern. The latest epidemiological trends show that an estimated 22.4 million adults and children are living with HIV in Sub-Saharan Africa (UNAIDS, 2010). HIV and AIDS are linked to increases in rural household poverty, declines in agricultural production, reductions in income earning activities and opportunities, and deterioration of household food security (FAO, 2005; Gillespie and Kadiyala, 2005; Loevinsohn and Gillespie, 2003; Niehof and Price, 2008). This paper examines the seasonal dimension of coping with food shortages through the documentation of the frequency and severity of food–related coping behaviours adopted by farm households living with HIV and AIDS in the Eastern Region of Ghana.

Households with HIV and AIDS change food sources and consumption patterns in an attempt to smooth food shortfalls and improve food security (Haddad and Gillespie, 2001). One way this change has been measured is through the use of the Coping Strategies Index (CSI). The CSI is calculated based on household reports of how often they apply a given coping measure (coping measure severity and frequency). The CSI can be used as an early warning indicator of food security, to gauge the short term impact of food aid, and to assess the longer-term impact of food interventions (CARE/World Food Program, 2003). The CSI has been used often as a rapid proxy measure of food security throughout Africa and assessing food security and coping with food shortages in the context of HIV and AIDS (Alemu and Bezabih, 2008; Maxwell and Caldwell, 2008; Senefeld and Polsky, 2006).

Strategies to cope with food shortages are many and the evidence points to households in poverty and with chronically ill household members making use of most of

them. Bukusuba *et al*. (2007) studied the strategies used to cope with food shortages of a cross-section of 144 households of persons living with HIV and AIDS (PLWHA) in Jinja, Eastern Uganda. They found that 95% of the households ate less preferred foods; 82.6% reduced portion sizes served to all household members; 77.0% borrowed money or food; 62.3% skipped meals and 21.5% skipped eating for the whole day. The SADC FANR (2003) survey confirmed that skipping meals was not only typical in all rural areas in countries in Southern Africa but was also more usual in households with a chronically ill adult. Similarly, poor urban households in Accra, Ghana, when faced with food insecurity shifted to less expensive and less preferred foods, purchased food on credit, purchased street food, limited portion size at meal times, reduced the number of meals per day and some refrained from eating during the whole day (Maxwell, 1999; Maxwell *et al*., 2000). Hesselberg and Yaro (2006) observed that households in some deprived areas of the Upper East Region of Ghana reduced the number of meals eaten per day from the normal three meals a day to cope with food insecurity in the lean season when food reserves declined and local income opportunities dwindled. In a base line study in rural Zambia (Caldwell, 2003) researchers estimated the coping strategies index (CSI) of households with or without a chronically ill member to assess their food security status. The results showed that households with a chronically ill member had a significantly higher CSI; these households skipped meals the entire day significantly more often compared to households without a chronically ill member. He concluded that households with a chronically ill member had greater food insecurity situation than other vulnerable groups. A farm household's inability to ensure an adequate nutritional intake may impact the health of household members and lead to frequent and more severe opportunistic infections for the individual with HIV and consequently hasten the progression of AIDS (ACC/SCN, 1998; Gillespie, 2006).

There are a number of reasons why rural households suffering from HIV and AIDS are more vulnerable to food insecurity. One of the primary reasons is labour constraint due to morbidity and mortality of productive age adults and this in turn impacts agricultural production resulting in a decrease in crop yields and an overall reduction in food availability and security (Shah *et al*., 2002; Topouzis, 1999). Farm households in Africa with HIV and AIDS tend to reduce the number of crops cultivated; shift from cultivating commercial crops to subsistence crops; and change from growing labour intensive to less labour demanding crops. Consequently, valuable and nutritious crops that are labour-intensive are replaced with crops that are less labour demanding, fast-maturing but are less nutritious and less profitable

(Garí, 2003; Gillespie *et al*., 2001; Jayne *et al*., 2004). Households with HIV also appear to generally experience a reduction in income generation opportunities compared with non-HIV households (Bachmann and Booysen, 2003). For example, women no longer have time for non-farm activities such as food processing, artisan crafts and other activities that previously contributed to the household income when they are overburdened with care-giving due to chronic illness in the household or are ill themselves (Cornia and Zagonari, 2002; Du Preez and Niehof, 2010; Rugalema, 1999). There is also evidence that households with HIV and AIDS withdraw from marketing activities in favour of home-based pure subsistence activities (van Liere, 2002). Overall, households with HIV experience reduced income opportunities compared with non-infected households which affects access to resources and reduces food security (Bachmann and Booysen, 2003).

The effect of frequent illness due to HIV and AIDS in farm households, the possible lack of labour at the crucial periods of crop production, the reduction of crop yields, and the subsequent impact on rural household food security are well studied (Casale and Whiteside, 2006; De Waal and Tumushabe, 2003). However, empirically based information on the food-related coping behaviours adopted by farm households with HIV and AIDS in response to food insecurity seasonally, particularly during the period of peak seasonal food shortages, is still insufficient (Boto *et al*., 2004; Gillespie and Drimie, 2009). Such information is vital to understanding when and how interventions can best be made to reduce suffering and take action based on an understanding of the magnitude of coping behaviours and ensuring that coping does not shift into an inability to ever recover. The existence of acute food insecurity in the context of HIV may precipitate a downward spiraling into complete destitution bringing about what De Waal and Whiteside (2003) hypothesized to be the 'new variant famine' (De Waal, 2007; De Waal and Whiteside, 2003). The current study evaluates the food insecurity of HIV-positive and HIV-negative farm households in the Eastern Region of Ghana during the post-harvest period and in the lean season through assessing the differences in severities of the food related coping behaviours adopted by the households in the two periods.

7.2. Methodology

7.2.1. Study area

The study was conducted in six communities in three districts in the Eastern Region of Ghana; the Fanteakwa, Manya Krobo and Yilo Krobo. The Eastern Region was selected for the study because it covers major agricultural zones of the country; in addition HIV prevalence rates have been consistently higher than in other administrative regions of Ghana (NACP, 2007). The Eastern Region covers a geographical area of approximately 19,323 km^2 (8%) of the total land area of Ghana. It is the third most populous region with an estimated population of about two million of whom about 67% reside in rural areas. About 55% of the adults in rural areas of the region are subsistence farmers. Rain-fed agriculture is predominantly practiced, and is associated with the cultivation of food crops such as maize, cassava, plantain, yam and some vegetables on mixed crop farms primarily for home consumption and the local market (Awanyo, 2007).

Household incomes are generally low and the poverty level is high (GPRS, 2003). HIV prevalence rates recorded in major agricultural areas of the Eastern region have been higher (>5.0%) than in most areas of Ghana (Ampofo *et al*., 2006; Fobil and Soyiri, 2006; NACP, 2005). This is ascribed to women from these areas predominating in the commercial sex work in neighbouring West African countries with higher HIV prevalence rates (Oppong, 1998). Moreover, many migrant urban dwellers return to their rural communities to receive care from relatives at the advanced stages of HIV illness (Boto *et al*., 2004; Haour-Knipe, 2008).

Food availability in farm households in the Eastern Region is influenced by the cropping calendar which is linked to the rainfall regime of the area. The major and minor cropping seasons coincide with the rainy seasons from April to July and from September to October, respectively. In the main harvest season from October to December, food is in abundance as farm households harvest the bulk of food crops for own consumption and for sale. In the lean season of agricultural production, from July to August, there is a shortage of food as the majority of households have exhausted their previous year's crop harvest and major food crops have been planted. Farm households that are unable to earn enough money to purchase sufficient food after their own food stocks have run out are threatened by hunger (Dei, 1988).

7.2.2. Research design

The study was designed as a comparative in-depth study of the food security situation of HIV-positive and HIV-negative farm households. An HIV-positive household in this study has at least one household member diagnosed with HIV and an HIV-negative household has no member with HIV. The research assessed the difference in food insecurity of HIV-positive and HIV-negative farm households by examining the differences in the food-related coping strategies adopted, agricultural production, and income sources in the post-harvest and lean seasons. A combination of qualitative research (focus group discussions) and quantitative research (a multiple round household survey) methods was used. The importance of combining qualitative and quantitative data collection methods is emphasized by several researchers because it improves the accuracy and validity of the research findings (Ashley *et al*., 2003; Castro, 2005).

7.2.3. Qualitative research

An initial qualitative exploratory investigation was conducted in April 2005 to inform questionnaire development and to provide context and meaning for survey data. Four separate focus group discussions (FGDs) were conducted with five to eight rural household heads per group stratified according to household HIV status and sex of household head. A household head in this study is a person who provides most of the needs of the household and is familiar with the activities and occupation of household members (GSS, 2008). Participants of FGDs cultivated both a distant field and a home garden and were willing to participate in the interviews. Open-ended semi-structured interview guides were used and discussions concentrated on constraints encountered that impact food security and changes adopted in the post-harvest and lean seasons. Focus group members specifically discussed household food shortage-related coping behaviour, agricultural production, and income. Interviews were conducted in the most common local language in the Eastern Region of Ghana Twi, audio recorded and transcribed into English.

7.2.4. Quantitative research

The survey instrument developed was tested in a pilot study and based on the study results, the instrument was revised appropriately. Due to the difficulty in identifying HIV-positive households as a result of HIV and AIDS-related stigma a purposive sample of ten HIV-positive farm households was selected to participate in the study. HIV-positive households

were identified through a non-governmental association, the Association of Persons Living with HIV/AIDS (PLWHA) in three district hospitals of the Eastern Region of Ghana. The inclusion criteria were that the farm households engaged in subsistence mixed farming and had at least two children (below age 15). The HIV-positive farm households were part of a sample that participated in a study conducted to assess the management strategies in home gardens of rural households with HIV (Akrofi *et al*., 2010). A random sample of ten HIV-negative farm households was selected from a list of households with characteristics similar to HIV-positive farm households located in the same communities where HIV-positive farm households resided. The study sample might not be representative for the entire country, however, the geographical location and socioeconomic characteristics of the households included in the sample were appropriate for the study. Five HIV-positive and seven HIV-negative households had male household heads and five HIV-positive and three HIV-negative households had female household heads. The study was approved by the Ministry of Health (MOH), Eastern Region Directorate. Informed consent was obtained from each household head for his/her household to participate in the study. Data were collected on households by the researcher in five home visits over a period of 30 days at six to seven day intervals in the post-harvest (January 2006) and lean (July 2006) seasons. The questionnaire had structured and open-ended questions on household food-related coping behaviours adopted, agricultural production (farm and home garden, poultry and domestic livestock), sources of income (agricultural, non-agricultural), constraints encountered and changes adopted in the post-harvest and lean seasons. Other information obtained were the socio-demographic characteristics of households. These included age and sex of household members and years of formal education attained by household head. The dependency ratio was estimated for each household as the ratio of number of household members younger than 15 years or older than 65 years to number of household members aged between 15 and 65 years. Two HIV-negative farm households, each with a female household head were excluded from the study after multiple attempts to collect the lean season data failed leaving a sample of eight HIV-negative farm households, three households with a female head and five with a male household head.

7.2.5. Household food security and the coping strategies index

The coping strategies index (CSI) is an indicator of household food security (Maxwell, 1996). It is a variable that measures the frequency and severity of a household's short-term food-

related coping strategies used in a particular context to mitigate shortfalls in food supply (C-SAFE, 2004). The CSI is estimated as an aggregate of the weighted scores assigned to individual food related coping strategies identified by focus groups as commonly adopted by households when faced with short-term food and money insufficiency. The weighted scores assigned to the individual food-related coping behaviours reflect the frequency and perceived severity of the individual behaviours among households. The CSI is an inverse measure, whereby the higher the value, the greater the coping, and hence the higher the level of food insecurity (Maxwell *et al*., 2008). Comparing CSI values gives a good assessment of the overall household food security status (Maxwell *et al*., 1999). The CSI has been found useful in monitoring changes in food security within a population (C-SAFE, 2004; Senefeld and Polsky, 2006). As CSI is constructed on the basis of asking questions about locally applicable coping behaviours, it has been found useful as a context-specific measure of food insecurity, with application in situations where there is a premium on rapid data collection and analysis. Comparative studies have shown coping strategy indexes to be good proxies for other indicators of food security such as food intake (energy adequacy), food budget shares, food frequency, and income status (CARE/WFP, 2003; Christiansen and Boisvert, 2000; C-SAFE, 2004; Maxwell *et al*., 1999; Maxwell *et al*., 2008).

7.2.6. Assessing the severity of food insecurity among HIV-positive and HIV-negative households

The difference in food insecurity between HIV-positive and HIV-negative farm households was assessed by the coping strategies index which represents the severity of the food-related coping behaviours adopted. Five food-related coping strategies were identified and ranked by focus groups as commonly used by households in the study area to cope with shortfalls in food for consumption. These coping behaviours in order of increasing severity are: eating less preferred food; reducing portion size served to all household members per meal; purchasing street food; purchasing food on credit; and skipping meals (all household members). A severity weight was given to the individual coping behaviours by the researchers based on the rankings assigned by the focus groups (Table 7.1). Two of the coping behaviours: reducing portion size served to all household members per meal and purchasing street food received the same weights from the researchers because these two coping behaviours were given similar ranking for severity by the focus groups.

At each home visit in the post-harvest and lean seasons, the female household member who was responsible for household food preparation and distribution was asked to recall the frequency of use of the individual coping behaviours adopted in the six days prior to each visit. The mean frequency of the individual coping behaviours adopted by the household was determined. To estimate the CSI for each household, the mean frequencies of the individual coping behaviours adopted were categorized using the method of Hoddinott (1999): 4 = "often" (5 or more times/week); 3 = "sometimes" (4-2 times/week); 2 = "rarely" (once/week); and 0 = "never" (zero time/week). The numerical value representing the category was multiplied by the weighting factor assigned to the individual coping behaviours; these were summed up to give a simple numeric score of the coping strategies index (CSI) for each household (Table 7.1) (Maxwell *et al*., 1999). The CSI was calculated for each household separately for the post-harvest and the lean seasons. The CSI varied from 12 to 48 in the current study; the higher the cumulative score the more severe household food insecurity.

Table 7.1: Household food-related coping behaviours and coping strategies index

Coping behaviours	Frequency	Weight	Minimum cumulative weight	Maximum cumulative weight
Eat less-preferred food	1-4	1	1	4
Reduce portion size served to all household members	1-4	2	2	8
Purchase street food	1-4	2	2	8
Purchase food on credit	1-4	3	3	12
Consume fewer meals per day	1-4	4	4	16
Coping strategies index			Minimum: 12	Maximum: 48

7.2.7. Data analysis

Focus group data were analyzed manually by grouping words, phrases, and quotes together based on similarity of themes with regard to the objectives of the study. Similar concepts were summarized and formed into categories, which were evaluated for differences between groups.

Quantitative data were non-normally distributed and were summarized in a descriptive manner using medians and ranges (Lang and Secic, 2006). Data pertaining to the household socio-demographic data, agricultural production, individual food-related coping behaviours adopted at frequencies categorized as “often” (i.e. 5 or more times/week), coping

strategies index (above the respective median) and individual sources of income were analyzed as proportions of each household group (indicated as percentages). The results of the study are presented in Table 7.2 and in Figures 7.1 to 7.5.

7.3. Results

7.3.1. Household characteristics

The age of household head was between 55-71 years; 50% of HIV-positive and 37.5% of HIV-negative households were older than the median of 62 years. Farm household size ranged from 4 to 11 among the sample of HIV-positive and HIV-negative (N = 18) with a median of six people in a household for the two groups. Eighty percent of HIV-positive farm households and 12.5% of HIV-negative farm households had a household size greater than the median. The dependency ratio of the HIV-positive and HIV-negative farm households ranged from 0.3-2.3 with a median of 0.8 for the two groups. Sixty percent of HIV-positive and 37.5% of HIV-negative farm households had a dependency ratio higher than the median. The number of years that household heads in the study spent in school ranged from 0 to 16 years with a median of 9.5 years for the two groups. Seventy five percent of the HIV-negative farm households (the majority having a male head) and only 30% of the HIV-positive farm households attained a higher number of years of formal education above the median. The cultivated field and home garden areas in HIV-positive and HIV-negative farm households ranged from 0.3-0.9 and 0.1-0.4 hectares respectively with a median of 0.5 and 0.2 hectares, across the two groups respectively.

7.3.2. The severity of food insecurity among HIV-positive and HIV-negative households in the post-harvest season

In the post-harvest season both HIV-positive and HIV-negative farm households relied on less preferred food, reduced portion size at meal times, consumed street foods, purchased food on credit, and consumed fewer meals per day in the post-harvest season, but to a relatively different extent. Of the HIV-positive households, 70% often relied on less preferred food, 70% reduced portion size at meal times, and 50% purchased street food compared with 25%; 25% and 12.5% of the HIV-negative households (Fig. 7.1), while the HIV-positive households had income from fewer sources (Fig. 7.2). Although none of the HIV-negative households often purchased food on credit (0%) or often consumed fewer meals per day

(0%), 50% and 40% of HIV-positive farm households often adopted these two coping behaviours respectively (Fig. 7.1). Consequently, 70% of the HIV-positive and none of the HIV-negative (0%) farm households had a higher coping strategies index (above the median) (Fig. 7.3).

Figure 7.1. Proportion of HIV-positive and HIV-negative households that adopted often (≥ 5 or more times/week) the individual food-related coping behaviour in the post-harvest season

7.3.3. Agricultural production and agricultural income sources in the post-harvest season

A relatively smaller proportion of HIV-positive (30%) compared with HIV- negative (75%) farm households cultivated a field area larger than the median of 0.5 ha across the two groups. Consequently, all the HIV-negative (100%) farm households and the majority (75%) harvested higher numbers (above the respective medians) of staple and vegetable crop species from the farm, while only 30% and 10% of the HIV-positive farm households respectively did likewise (Table 7.2). Sales of farm produce provided a relatively higher proportion of HIV-negative farm households (62.5%) with income compared with 20% of HIV-positive farm households (Fig. 7.4). A relatively higher proportion of HIV-positive (60%) than HIV-negative (20%) farm households cultivated home garden areas that were smaller than the median of 0.2 hectares across the two groups. However, 50% and 10% of HIV-positive farm

households harvested higher numbers (above the respective medians) of staple and vegetable crops species respectively from home gardens compared with 12.5% and 0% of the HIV-negative households respectively (Table 7.2). While none of the HIV-positive households obtained income from the sale of home garden produce, 50% of HIV-negative farm households obtained income from this source (Fig. 7.4). Higher numbers (above the respective medians) of domestic livestock and poultry were owned by relatively higher proportions of the HIV-negative (62.5% and 87.5%, respectively) compared with HIV-positive farm households (30% and 20%, respectively) (Table 7.2). However, whereas 70% of HIV-positive farm households obtained income from the sales of domestic livestock and poultry only 12.5% of HIV-negative farm households obtained income from this source. A comparable proportion of HIV-positive (20%) and HIV-negative (25%) farm households obtained income from agricultural wage-labour (Fig. 7.4).

7.3.4. Nonagricultural income sources in the post-harvest season

A relatively higher proportion of HIV-positive (60%) compared with HIV-negative (25%) farm households received remittances in the post-harvest season (Fig. 7.4). Income from petty trading was obtained in relatively smaller proportion of HIV-positive (10%) compared with HIV-negative (87.5%) farm households. Only 10% of the HIV-positive farm households obtained income from non-agriculture wage-labour while 62.5% of HIV-negative farm households obtained this income (Fig. 7.4).

Table 7.2: Agricultural production characteristics of households

		Post-harvest season			Lean season	
Variable		**HIV-positive households[a]**	**HIV-negative households[a]**		**HIV-positive households[a]**	**HIV-negative households[a]**
Crop species harvested (nr.)	**Median (range)**			**Median (range)**		
Farm						
Staple	2 (1-4)	30.0	100.0	2 (0-2)	10.0	62.5
Vegetable	1 (0-3)	10.0	62.5	0 (0-1)	0.0	12.5
Home garden						
Staple	1 (1-2)	50.0	12.5	1 (1-2)	50.0	10.0
Vegetable	1 (0-2)	10.0	0.0	1 (0-1)	0.0	0.0
Poultry and domestic livestock owned (nr.)						
Poultry	12 (0-100)	20.0	87.5	10 (0-115)	30.0	75.0
Domestic livestock	6 (0-12)	30.0	62.5	5 (0-20)	0.0	62.5

[a] Values represent proportion of households above the listed median (%).

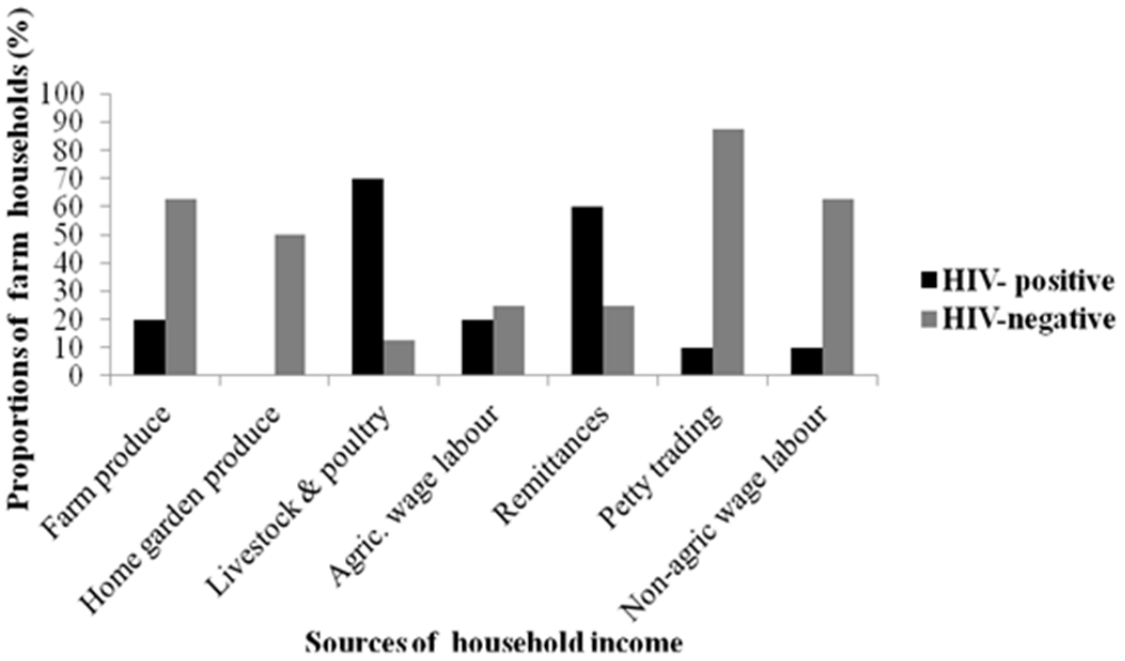

Figure 7.2. Proportions of HIV-positive and HIV-negative farm households that obtained income from individual sources in the post-harvest season

7.3.5. The severity of food insecurity amongHIV-positive and HIV-negative households in the lean season

In the lean season comparable proportions of HIV-positive and HIV-negative farm households often relied on less preferred food (90% and 87.5%, respectively) and reduced portion size at meal times (80% and 75%). Purchasing street food was common in both groups during this period; 100% of HIV-positive and 75% of HIV-negative farm households often adopted this coping behaviour (Fig. 7.3). Relatively higher proportions of HIV-positive farm households (70%) often purchased food on credit and consumed fewer meals per day (60%) than HIV-negative households (12.5% and 12.5%, respectively) (Fig. 7.3). Consequently, the coping strategies index in 90% of HIV-positive households and only 37.5% of HIV-negative households was higher than the median (Fig. 7.4).

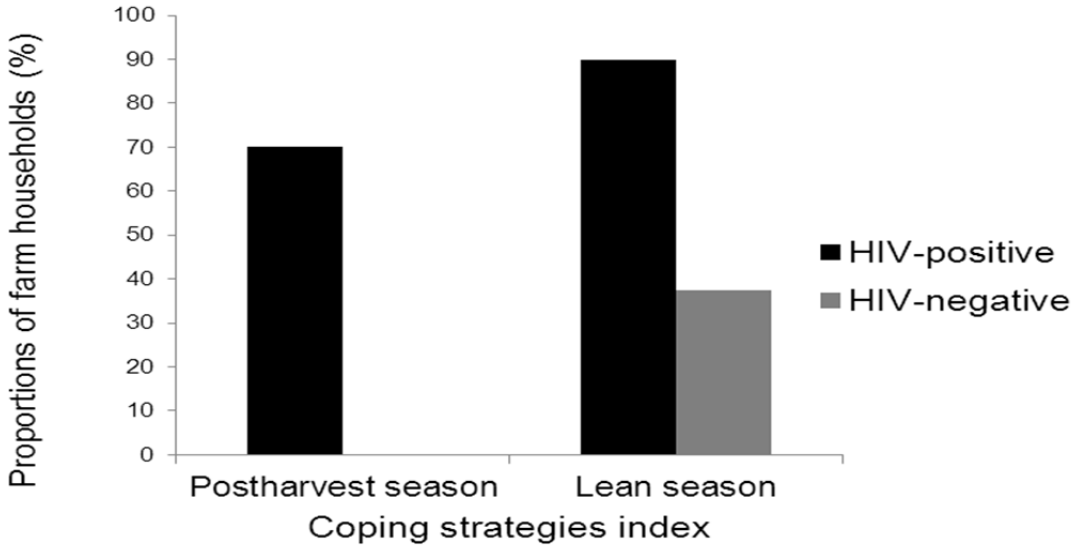

Figure 7.3. Proportions of HIV-positive and HIV-negative farm households that had coping strategies index values higher than the medians of the post-harvest and lean seasons

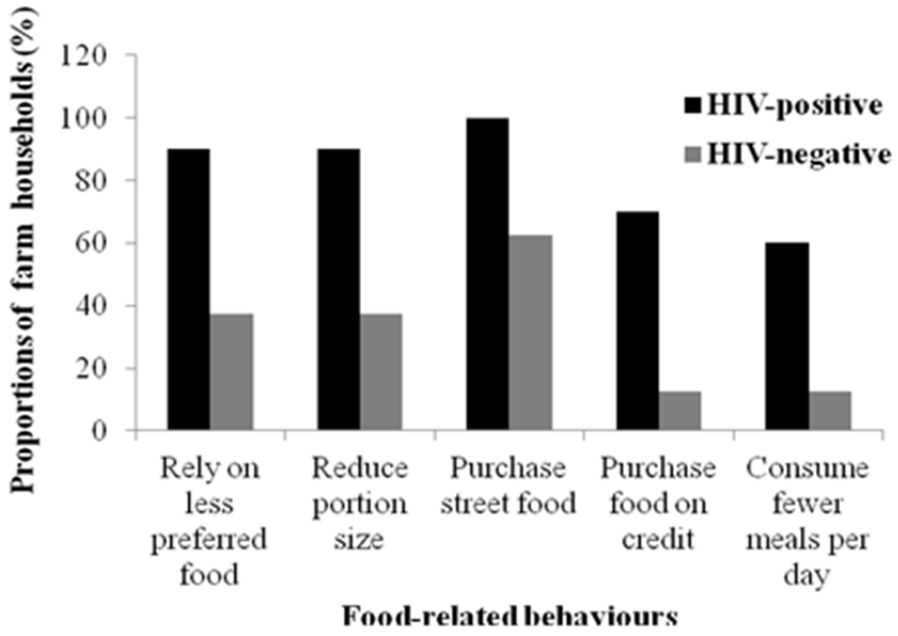

Figure 7.4. Proportions of HIV-positive and HIV-negative households that adopted often (≥5 or more times/week) the individual food-related coping behaviours in the lean season

7.3.6. Agricultural production and agricultural income sources in the lean season

In the lean season only 10% of HIV-positive farm households compared with 62.5% of HIV-negative farm households harvested a higher number (above the median) of staple crop species from the farm. None of the HIV-positive farm households (0%) harvested a higher number (higher than the median) of vegetable crop species from the farm whereas a small proportion of HIV-negative farm households (12.5%) harvested this much (Table 7.2). Similarly a relatively smaller proportion of HIV-positive (10%) harvested higher numbers (above the median) of staple crop species from the home garden compared with HIV-negative (50%) farm households; but none of the households in the two groups harvested a higher number (above the median) of vegetable crop species (Table 7.2). Consequently, a relatively higher proportion of HIV-negative (25%) obtained income from the sale of farm produce compared with HIV-positive (0%) farm households, but 30% of HIV-positive and none of the HIV-negative (0%) farm households obtained income from the sale of home garden produce during this period (Fig. 7.5). Relatively smaller proportions of HIV-positive farm households (0% and 30% respectively) compared with HIV-negative (62.5% and 75% respectively) owned higher numbers (above the medians) of small domestic livestock and poultry respectively (Table 7.2). Subsequently 62.5% of HIV-negative farm households obtained income from the sales of domestic livestock and poultry whereas none of the HIV-positive (0%) farm households obtained income from this source. None of HIV-positive (0 %) compared with 50% of HIV-negative farm households obtained income from agricultural wage labour (Fig. 7.5).

7.3.7. Nonagricultural income sources in the lean season

Petty trading was a relatively common source of cash income in HIV-negative (70%) households while none of the HIV-positive (0%) farm households obtained income from this source (Fig. 7.5). Comparable proportions of HIV-positive (60%) and HIV-negative (50%) farm households obtained income from remittances but a relatively higher proportion of HIV-negative (50%) and none of the HIV-positive (0%) farm households obtained income from non-agriculture wage-labour (Fig. 7.5).

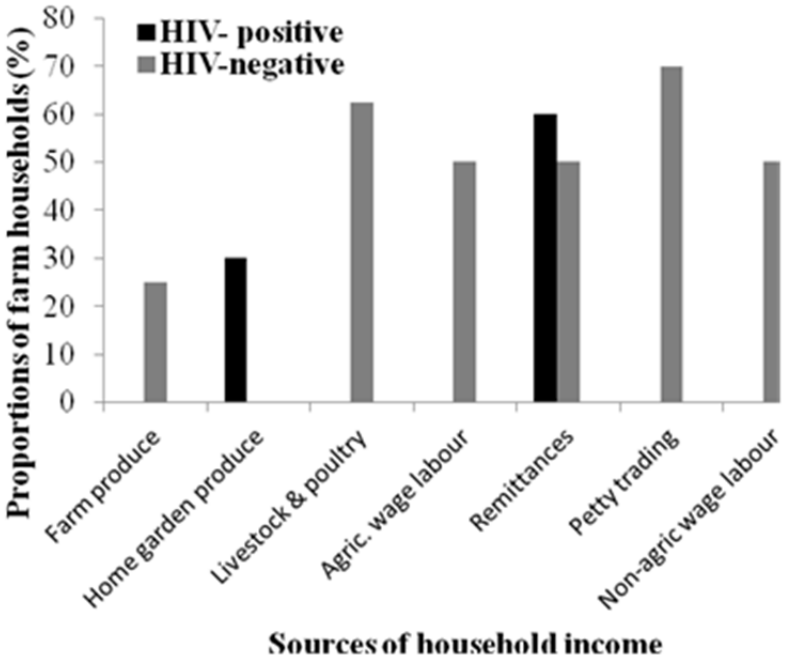

Figure 7.5. Proportions of HIV-positive and HIV-negative households that obtained income from the individual sources in the lean season

7.4. Discussion

7.4.1. Household characteristics

The study evaluated the food insecurity of HIV-positive relative to HIV-negative farm households in the Eastern Region of Ghana by assessing the seasonal differences in the frequency and severity of the food-shortage related coping behaviours adopted by the households in the post-harvest season and in the lean season. The results from this study showed that the HIV-positive farm households, of which the majority had a female head, were relatively older, had a relatively larger household size and higher dependency ratio compared with HIV-negative farm households. These characteristics of the HIV-positive farm households being female headed, older and with high dependency ratios may impact the food security of these households since relatively more household members would need to be fed compared with HIV-negative households. As in other countries in Sub-Saharan Africa, women in Ghana mostly carry the responsibility of caring for the sick. Moreover, it is the elderly that are left behind in rural areas to take care of the sick when the young and economically active adults migrate in search of better livelihoods elsewhere (Mba, 2004).

Women in rural areas of Ghana generally tend to have lower levels of formal educational attainment compared with men due to discriminatory access to formal education as children (Safo-Kantanka *et al*., 2006). The lower attainment in formal education in HIV-positive farm households is likely to impact income earning opportunities and influence household food security (Maxwell *et al*., 2000). Higher education in rural communities enhances peoples' ability to participate in off-farm income activities which is likely to increase household income and subsequently enhance access to food (Dose, 2007).

7.4.2. The difference between HIV-positive and HIV-negative households in the severity of food-related coping behaviours adopted in the post-harvest season

In the post-harvest season when food produce was relatively more available both HIV-positive and HIV-negative farm households adopted all the five food-related coping behaviours to maintain food security. However relatively higher proportions of HIV-positive farm households often relied on less preferred food; reduced portion size at meal times and purchased street food, purchased food on credit, consumed fewer meals per day than HIV-negative farm households (Fig. 7.1). Consequently the severity of food-related coping behaviours was higher in a relatively higher proportion of HIV-positive than HIV-negative farm households (as indicated in Fig. 7.3). The diet of HIV-positive farm households was monotonous and lacked variety compared with HIV-negative farm households. There was an increase in consumption of maize and cassava-based dishes such as "*banku*" (fermented maize meal cooked into a soft mash) and "*fufu*" (a pounded mash of boiled cassava with plantain) in a relatively higher proportion of HIV-positive farm households because these were the major staple crops available on their farms. The need for money to purchase other staples not cultivated by the households may have compelled HIV-positive farm households to constantly consume only these two staple crops. Inadequate diversity in the diet may cause micronutrient deficiencies. Individuals with HIV could be susceptible to opportunistic infections as a result of immune dysfunction. A relatively higher proportion of HIV-positive farm households often reduced the portion size of food in order for the limited food stock to last longer compared with HIV-negative households. WHO (2003) has documented the critical importance of maintaining adequate food and nutrition intake levels by people living with HIV. Malnutrition can worsen the effects of HIV and hasten AIDS-related illnesses (Gillespie and Kadiyala, 2005).

Street foods such as "*kenkey*" (dumplings made from fermented maize dough) with fried fish and pepper sauce and boiled rice with tomato stew were purchased during the day in a relatively higher proportion of HIV-positive compared with HIV-negative farm households because these foods were relatively cheaper and facilitated savings on time and fuel compared with home-prepared food. Although street foods offer suitable alternative meal sources, the nutritional adequacy of these meals is questionable, as most sellers select less than the best quality raw ingredients so that they can maximize profit (Opare-Obisaw *et al*., 2000). However, the possibility of obtaining credit was a major incentive for HIV-positive farm households to purchase street food since cash was limited. Relatively higher proportions of HIV-positive farm households purchased food items such as fish, vegetable and staples regularly, due to inadequate source of a regular income. In addition relatively higher proportions of HIV-positive farm households often skipped breakfast in a day compared with HIV-negative farm households and ate two meals: at mid-morning and in the evening. Although purchasing food on credit cushioned HIV-positive farm households from going to bed on an empty stomach, these households emphasized that the decision to purchase food on credit was hindered by the associated social perception that it is a lazy household that often buys food on credit.

HIV-positive farm households purchased food and food items on credit only when some cash income was expected such as a remittance. This confirms a report by CARE/WFP (2003) that purchasing food on credit by rural households to maintain food security is not sustainable over a long period. In HIV-positive farm households the leftover food from the evening meal was saved for the next morning and so household members ate nothing when there was no food left from the previous evening meal. The evening meal which was regarded as the most important meal consisted of "*banku*" or "*fufu*" with soup; and was prepared in a substantial amount to enable all HIV-positive household members to consume adequately. In Ghana eating three meals (breakfast, lunch, and supper) in a day is considered as normal for nutritional security (Hesselberg and Yaro, 2006). These food-consumption practices may have contributed to the more severe food insecurity in a relatively higher proportion of the HIV-positive than HIV-negative farm households in the post-harvest season.

Similar food-related coping behaviours have been observed and reported by Maxwell *et al*. (2000) in their studies on how urban households in the Greater-Accra region of Ghana sustained food security. However, in the current study no household refrained from eating for an entire day. The reason could be that for farm households (this study) their own food

production provided a significant part of their daily food intake and so farm harvests are purposely stored for household consumption at later date whilst in urban households most of the food consumed is mainly purchased when needed.

7.4.3. Agricultural production and sources of income in the post-harvest season

In the post-harvest season a relatively higher proportion of HIV-positive farm households had access to relatively less food produce and obtained income from relatively fewer agricultural and non-agricultural sources than HIV-negative farm households (Table 7.2; Fig. 7.2). Relatively higher proportions of HIV-positive farm households cultivated relatively smaller field areas. Moreover, a relatively higher proportion of HIV-positive farm households harvested only maize, cassava and pepper from their farms. Other major staples such as plantain, yam and cocoyam and vegetables such as eggplant and tomatoes were also harvested from the farms of a relatively higher proportion of HIV-negative than HIV-positive farm households (Table 7.2). A relatively smaller proportion of HIV-positive obtained income from the sale of farm produce than HIV-negative farm households (Fig. 7.2).These findings corroborate the reports of Jayne *et al.* (2004) and Shah *et al*. (2002) that labour constraints in terms of persons, time or strength in rural households with HIV and AIDS results in less land being cultivated, fewer crops being cultivated and fewer surpluses, if any, to sell to the market for cash income.

Rural households make choices on how much of their field harvest to store and how much to sell depending on their consumption needs and the need for immediate cash (Latham, 1997). Farm produce was sold in bulk immediately after harvest in HIV-positive farm households to provide cash to supplement food needs while HIV-negative farm households retailed farm produce from time to time in order to provide a regular source of income and also to benefit from increasing food prices. HIV-positive farm households were unable to take advantage of these opportunities to obtain maximum profit from farming since cash was urgently required to purchase additional food. Major staples such as plantain, cassava, cocoyam and yam and vegetable crops such as pepper, eggplant and the green leafy vegetable "*nkontomire"* (*Xanthosoma saggitifolium* leaves) were harvested from home gardens by relatively higher proportions of HIV-positive farm households than HIV-negative farm households (Table 7.2). None of the HIV-positive farm households sold home garden produce whereas a smaller proportion of HIV-negative farm households obtained income from the sale of home garden produce (Fig. 7.2). This could suggest that home garden

produce was solely consumed in HIV-positive farm households. This is inconsistent with the report of Shackleton *et al*. (2008) that produce harvested from home gardens buffer households during times of stress.

A relatively larger proportion of HIV-positive farm households kept relatively fewer chickens, ducks, goats and sheep and relatively higher proportions of HIV-positive farm households obtained income from the sale of poultry and domestic livestock compared with HIV-negative farm households (Table 7.2 and Fig. 7.2). Rearing poultry and domestic livestock provided meat and eggs to households in both groups. Although prices of poultry and domestic livestock were very low in the post-harvest season, the sale of poultry provided HIV-positive farm households a reliable source of petty cash for additional food needs. It was necessary for HIV-positive farm households to sell off poultry in the post-harvest season even though prices were very low since they could not afford the cost of the veterinary treatment required to prevent loss of chickens due to the usual outbreak of Coccidiosis and Newcastle diseases in the dry season. Income obtained from the sale of domestic livestock in the post-harvest season enabled HIV-positive farm households to raise cash for food and occasionally also provided money to pay for medical expenses for the sick individual. On the other hand, in HIV-negative farm households this income provided cash for unexpected expenses such as paying for maintenance work in the homestead or raising funds to improve an income generating activity. This is in agreement with the report of Hesselberg and Yaro (2006) that for rural households who do not possess sufficient cash the normal response to crises of many kinds is the sale of livestock.

There was little opportunity for agricultural-wage labour in both household groups in the post-harvest season; household members provided casual wage labour in the harvesting of fields, de-husking and shelling of farm produce for other farmers. While HIV-negative farm households demanded cash for such work done, HIV-positive households requested for payment in kind such as tubers of cassava and maize grain.

In the post-harvest season remittances were received from migrant relatives in a relatively higher proportion of HIV-positive than HIV-negative farm households (Fig. 7.2) to cater for household food. Remittances obtained in HIV-negative farm households augmented household income and served as a source of income for savings or was added to funds for an income generating enterprise. Statistics suggest that migrant remittances form an important part of income in Ghanaian households (GSS, 2008). Petty trading in HIV-positive farm households involved selling food produce and other items of everyday use such as salt, soap

and kerosene from the homestead which provided relatively meagre earnings. This is consistent with the report of Van Liere (2002) that households with HIV and AIDS withdraw from marketing activities in favour of home-based pure subsistence activities due to labour constraint. On the contrary, HIV-negative farm households took on small businesses outside the home that were relatively labour and time intensive but which fetched relatively higher earnings.

Women in HIV-negative farm households operated shops outside the home and participated in the sale of food stuffs to markets. Women from peri-urban and urban centres engaged in post-harvest food processing activities such as the making of "*gari*" (roasted fermented cassava meal) and "*agbelima*" (fermented cassava dough) or the extraction of edible oils from palm fruits which provided cash income as well as food items for their households. The men in HIV-negative farm households engaged in brewing "*akpeteshie*", a local gin, or provided labour in the loading of trucks that conveyed food stuff to market outlets. HIV-positive farm households emphasized that besides labour and time, financial constraints limited their engagement in relatively lucrative income activities. The relatively smaller proportion of HIV-positive farm households who obtained income from non-agricultural wage labour engaged in menial jobs such as offering services as "chop bar" (local roadside bar/restaurant) attendants or as head-porters at local markets due to lack of artisan skills. On the other hand, HIV-negative farm households obtained income from non-agricultural wage labour by providing services as a dressmaker, repairer of bicycles or household utensils (Fig. 7.2). The limited sources of income and relatively less lucrative characteristics of the income activities taken on by HIV-positive farm households may have limited their ability to obtain cash income to purchase additional food in the post-harvest season. These could have contributed to more food insecurity in a relatively higher proportion of HIV-positive than HIV-negative farm households in the post-harvest season (Fig. 7.3).

7.4.4. The difference between HIV-positive and HIV-negative farm households in the severity of food-related coping behaviours adopted in the lean season

In the lean season when food produce was relatively less available comparable proportions of HIV-positive and HIV-negative farm households often relied on less preferred food; reduced portion size and purchased street food; but relatively higher proportions of HIV-positive farm households purchased food on credit and consumed fewer meals per day than HIV-negative farm households (Fig. 7.4). As a result of this, the severity of food-related coping behaviours

was higher in a relatively higher proportion of HIV-positive than HIV-negative farm households (as indicated in Fig. 7.3). In the lean season both HIV-positive and HIV-negative farm households substituted into their diets easily available staples obtained from farms and home gardens and from local markets.

Due to limited cash availability in HIV-positive farm households there was increased consumption of immature food crops harvested from farms and home gardens as well as cassava-based dishes such as "*bankye ampesi"* (boiled cassava), "*agbelima*" (cooked meal of fermented cassava dough) and "*konkonte*" (cooked meal of dried cassava flour), as cassava is a low-labour intensive crop and is the relatively cheaper staple crop available during this period. These food consumption practices could lead to problems of under nutrition in HIV-positive farm households since immature food crops may have lower nutritional content and cassava with its low protein content is less nutritious compared with other staples such as plantain and yam (FAO, 1990).

The portion size of food was reduced in HIV-positive and HIV-negative farm households to enable food stocks to last longer since food harvested had dwindled and prices of farm produce were at their highest. All HIV-positive farm households and a higher proportion of HIV-negative farm households often consumed street foods such as "*waakye*" (rice and beans and a spicy sauce of pepper, fish and tomatoes), "*gari*" and beans, and "*kenkey"* and fried fish with pepper sauce in the lean season supposedly to provide a wide range of nutrients in the household diet at a cheaper cost. Essential food items such as vegetables, fish and staples were purchased on credit in relatively higher proportion of HIV-positive farm households due to inadequate income. In addition, lunch was often skipped and food was eaten only twice daily by a relatively higher proportion of HIV-positive compared with HIV-negative farm households. The common breakfast dish in HIV-positive farm households was a light maize porridge known as "*kooko*" or boiled fresh maize eaten at mid-morning and a staple dish of "*konkonte*" accompanied by soup was eaten in the evening as the heaviest meal for the day. HIV-positive households reported that although these foods were not satisfying due to the demands of the laborious farm activities carried out during the day, they could do nothing because those were the only foods available to them.

7.4.5. Household agricultural production and sources of income in the lean season

In the lean season a relatively larger proportion of HIV-positive households had access to relatively less food produce and obtained income from relatively fewer agricultural and non-

agricultural sources than HIV-positive farm households. Major staples such as cocoyam and yam and the green leafy vegetable "*nkontomire*" were harvested from farms in addition to plantain and cassava by relatively higher proportions of HIV-negative than HIV-positive farm households. Most of the vegetable crop species had just been planted and were thus not available for either household consumption or for sale. It was equally rare for HIV-positive farm households to sell food produce from farms and for HIV-negative farm households to sell food produce from home gardens during this period when food stocks were diminished (Fig. 7.3). However, HIV-positive farm households were compelled to sell bunches of plantain and tubers of cassava harvested from the home garden to provide money to purchase other essential food items such as fish and salt. Hesselberg and Yaro (2006) observed that the cultivation of small gardens in the lean season provided food and cash income for farm households in some deprived communities in northern Ghana. HIV-negative farm households on the other hand emphasized that selling home garden produce in the lean season was not a good option in view of the limited food stock. Moreover, this could necessitate buying the same farm produce at much higher prices from other farmers.

A relatively smaller proportion of HIV-positive compared with HIV-negative farm households owned a greater numbers of chickens, ducks, sheep and goats (Table 7.2) and none of the HIV-positive households obtained income from the sale of chickens, goats or sheep while a relatively larger proportion of HIV-negative farm households obtained income from livestock (Fig. 7.5). HIV-negative farm households emphasized that they took advantage of the prevailing high prices of domestic livestock in the lean season to earn a favourable income from domestic livestock rearing. In most rural areas of Ghana, the accumulation of livestock is considered a form of savings (Oppong–Anane *et al*., 2008). Hesselberg and Yaro (2006) noted that rearing of domestic livestock such as goats and sheep was the most important source of income which prevented rural households in some areas of northern Ghana from acute food insecurity in the lean season. However, in this study HIV-positive farm households had sold off most of the poultry and domestic livestock owned in the post-harvest season to provide additional food.

A relatively larger proportion of HIV-negative farm households obtained income from agricultural wage-labour while none of the HIV-positive farm households obtained this income (Fig. 7.5). The demand for agricultural-wage labour was high in the lean season since farming activities were at their peak. While a relatively larger proportion of HIV-negative farm households engaged in farm activities that required physical strength such as land

preparation and planting as agricultural-wage labour to supplement household income. HIV-positive farm households were unable to participate in these activities due to labour constraints. Hesselberg and Yaro (2006) observed that availability of non-farm income opportunities during the lean season reduced the number of food insecure households in some farming communities in northern Ghana.

Remittances were an important source of income for households in both groups since available cash was relatively limited during this period. In HIV-positive farm households remittances facilitated the provision of food daily for household members since own food produce was exhausted and income generated from other sources was limited. On the other hand, remittances enabled HIV-negative farm households to provide variety in household diet. The report by Mazzucato *et al*. (2005) emphasizes that remittances serve as crucial financial resources to many households in low-income developing countries such as Ghana.

None of the HIV-positive farm households engaged in petty trading due to labour and financial constraints whereas petty trading was the common source of income for the relatively larger proportion of HIV-negative farm households (Fig. 7.5). HIV-negative farm households retailed various food and non-food items in local and district markets which brought in considerable earnings. Moreover, lack of artisan skills and labour constraints did not permit HIV-positive farm households to engage in any non-agricultural wage labour to supplement household income. The little labour available in HIV-positive farm households was allocated to the household's on-farm work and provision of care for the sick individual. On the contrary, a relatively larger proportion of the HIV-negative farm households continued to engage in the skilled wage labour work reported in the post-harvest season (Fig. 7.5). The relatively fewer sources of income of HIV-positive farm households may have reduced their ability to provide for additional food needs in the lean season. Therefore, food insecurity was greater in a larger proportion of HIV-positive relative to HIV-negative farm households in the lean season.

7.5. Conclusions

The results from the study show that a relatively greater proportion of HIV-positive farm households often relied on less preferred food, reduced portion size, purchased street food, purchased food on credit and consumed fewer meals per day than HIV-negative farm households in both the post-harvest and lean seasons. The more severe food related coping

behaviours adopted by a relatively larger proportion of HIV-positive in comparison to HIV-negative farm households resulted in a higher coping strategies index for the HIV-positive farm households in both seasons. Thus, food insecurity was more severe in HIV-positive farm households in both the post-harvest and lean seasons.

Female headed households among the HIV-positive farm households are likely to be more food insecure due to their higher dependency ratio in their households and their limited attainment in formal education and their limited access to resources in comparison to male headed HIV-positive farm households. HIV-positive farm households cultivated smaller areas, harvested fewer staples and vegetable crop species from farms and home gardens than HIV-negative farm households in the post-harvest and lean seasons. This suggests that HIV-positive farm households have access to relatively limited food they produce themselves compared to HIV-negative farm households in the post-harvest season of relative food abundance as well as during the lean season of food shortage.

HIV-positive farm households obtained less income and from fewer sources compared with HIV-negative farm households in the post-harvest and lean seasons. This suggests that HIV-positive farm households have a limited ability to purchase additional food in both the traditional season of post-harvest food abundance and during the lean season of food shortage.

Ultimately, the results of this study clearly indicate that HIV-positive households are more vulnerable to food insecurity in both the post-harvest and lean season and that this vulnerability is also reflected in their poverty, family care burdens (larger number of dependents and ill persons), lower education level and meagre income earning opportunity. In light of these findings, on-going efforts should be made to empower rural households with HIV and AIDS in terms of capacity building, access to livelihoods assets and finance to maintain food security and to avoid distress sales of assets.

7.6. Limitations and future research

As with any study, the results from this study should be interpreted in light of some limitations. First, the study utilized a small sample size, and a purposive selected sample of HIV-positive farm households which limits the generalization of the results. Future research can investigate a larger sample size and a random sample of HIV-positive farm households. Secondly, data was collected only over a 30-day period in each season; this might have

influenced the results obtained. Future research should investigate a larger sample of households over a longer time period in order to reveal the entire differences.

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CHAPTER 8

8. General discussion and Conclusions

8.1. Introduction

Several studies emphasize the potential of home gardens in coping with labour constraints and enhancing the food and nutrition security in rural households with HIV and AIDS (Bukusuba *et al*., 2007; Garí, 2003; Keatinge and Amoaten, 2006; Murphy 2008; Murphy *et al*., 2006). Other studies also lay emphasis on the possibility that rural households living with HIV and AIDS face acute food insecurity during periods of seasonal food shortages; these households may descend into destitution and not be able to recover due to the negative consequences of coping strategies adopted a situation that is hypothesized as the "new variant famine" (De Waal 2007; De Waal and Whiteside, 2003; Gillespie and Drimie, 2009). Nevertheless, all these researches have focused on predictions, empirical evidences are lacking.

This study has made an effort to provide some empirical evidences by exploring how rural households with HIV and AIDS in the Eastern Region of Ghana employ home garden management strategies to enhance a number of important aspects of food and nutrition security. It also examines the seasonal dimension of coping with food shortages through the documentation of the frequency and severity of food–related coping behaviours adopted by farm households living with HIV and AIDS in the Eastern Region of Ghana during periods of peak seasonal food shortages. From this context we have assessed the biodiversity in home gardens of HIV-positive and HIV-negative rural households and evaluated its contribution to dietary diversity; uncovered the effect of the interaction between household HIV status and gender of the household head on home garden biodiversity; examined the similarities and differences in biodiversity in home gardens of HIV-positive and HIV-negative rural households where the primary objective in home garden cultivation is either to provide subsistence food only; and to generate cash income as well and the influence on food security. In addition, we evaluate the food insecurity of HIV-positive and HIV-negative farm households in the Eastern Region of Ghana during the post-harvest period and in the lean season through assessing the differences in the frequencies and severities of the food related coping behaviours adopted by the households in the two periods.

This Chapter 8 presents a discussion of the main findings and conclusions drawn from the studies. The first section of this chapter presents the main findings and discussions with regards to research questions that this study sought to answer. This is followed by a section that discusses the main implications for intervention efforts that can be drawn from the theoretical and empirical results. The final section presents the main limitations of the study indicating potential areas for further research.

8.2. Answering the research questions

8.2.1. Difference in the biodiversity in home gardens and its contribution to dietary diversity among HIV-positive and HIV-negative rural households

In Chapter 4 we assessed the biodiversity in home gardens and evaluated its contribution to dietary diversity among HIV-positive and HIV-negative rural households. An HIV-positive household refers to a household where at least one member suffered from confirmed HIV illness, whilst in a HIV-negative household no member was known to have HIV illness (UNAIDS, 2008). Biodiversity refers to the complex and diverse mixture of annual and perennial plant species cultivated and the kinds of domestic livestock reared in home gardens. The mixture of plant species in each home garden was quantified by the plant species diversity which was estimated using the Shannon-Wiener index $H' = -\Sigma (\rho_i \log \rho_i)$, where ρ_i is the relative abundance of occurrence of the *i*th species in the home garden calculated as the proportion of the number of individuals of the *i*th species to the total number of individuals (Kent and Coker, 1992). Dietary diversity was represented by the dietary diversity score (*DDS*) which refers to the number of food groups consumed by household members 24-hour preceding the study using 16 food groups recommended by (FAO, 2007) for dietary studies. Information from a cross-sectional data on HIV-positive and HIV-negative rural households collected through a household and home garden survey and a 24-hour qualitative dietary recall complemented with qualitative information from focus group discussions were analysed. Household socio-demographic characteristics; home garden crops cultivated; number of adult household members who contribute in home garden crop cultivation; and to domestic livestock rearing; and the contribution of food items from home gardens to household dietary diversity score were the characteristics compared between HIV-positive and HIV-negative rural households included.

Differences in household and home garden cultivation characteristics among HIV-positive and HIV-negative households

The study shows that in the situation of HIV and AIDS rural households cultivated significantly smaller fields but significantly more adult household members contributed to home garden cultivation compared with rural households without HIV and AIDS due to the importance given to home garden cultivation. However, the increase in labour input in home garden cultivation did not produce higher species diversity in home gardens compared with rural households without HIV and AIDS. HIV-positive household heads were older, more likely to be female, and their households had a higher dependency ratio. The cultivated home garden areas; the numbers of categories of plant species cultivated; species diversity in home gardens; and the kinds of domestic livestock reared in HIV-positive households were not significantly different compared with those in HIV-negative households. In the current study extended-family members including the brothers, sisters, nieces, daughters-in-law of the household head and their young dependents have moved into HIV-positive households to assist in care giving and other household tasks. Given that females live longer than males in most societies, many elderly Ghanaian women survive their husbands and often find themselves as household heads (Mba, 2004; UN, 2001). As in many developing countries, the extended family in Ghana is a source of support and care for most people during illness and this is also the situation with HIV illness (Mwinituo, 2006). Moreover, women being society's traditional caregivers, often carry the physical burden of providing AIDS care (D'Çruz, 2004). Consequently, in Ghana it is the elderly consisting of a higher percentage of females that are left behind in rural areas to provide care to the sick when the young and economically active adults migrate to urban areas in search of better livelihoods (Mba, 2004). HIV-positive households are likely to be labour constrained due to lack of productive adult household members as indicated by the higher dependency ratio compared with HIV-negative households; care giving by other household members to the HIV ill household member; or even frequent ill-health of the individual with HIV. The reduction in field area cultivated in HIV-positive rural households means less food. Consequently, HIV-positive rural households are likely to face food insecurity. Kwaramba (1998) notes that reduction in agricultural production due to the shortage of adult labour in farm households affected by AIDS in Zimbabwe impacts negatively on household food security. The proximity of the home garden to the homestead and its flexible labour requirement facilitates home garden cultivation to enhance household food security. This result is consistent with the findings

from previous studies in Ghana which show that the home garden is an essential part of the food production system in rural areas in supplementing household field production (Bennett-Lartey *et al*., 2002; Owusu *et al*., 1994). The participation in home garden crop cultivation and domestic livestock rearing by the adult extended-family members who have moved into HIV-positive households resulted in the significantly higher number of productive adult household members who contributed to home garden crop cultivation in HIV-positive households compared with HIV-negative rural households. This suggests a higher labour input in home garden cultivation in HIV-positive than in HIV-negative rural households; and might show the importance attached to home garden cultivation in HIV-positive households. The lack of significant differences in the numbers of categories of plant species cultivated, species diversity in home gardens and the kinds of domestic livestock reared in HIV-positive and HIV-negative rural households might be due to the similar climatic conditions and farming practices across the 12 districts in the semi-deciduous forest zone where the home gardens are located. Home gardens in the semi-deciduous forest zone of Ghana are rain-fed; crops are planted in both the major and minor rainy seasons and so produce are available for harvest year-round either on a daily basis or seasonally (Asare *et al*., 1990). The plants species identified in the home gardens are species typical of the semi-deciduous forest zone of Ghana. Asare *et al*. (1990) and Bennett-Lartey *et al*. (2002) recorded similar crop species and domestic livestock species in home gardens in peri-urban and other rural areas in the same agro-ecological zone of Ghana.

The findings of this study are in contrast to our expectations; increased labour input in home garden cultivation in HIV-positive households is expected to increase species diversity in home gardens, but the results show that increasing labour input in home garden cultivation in a rural household with HIV and AIDS does not necessarily increase the species diversity in home gardens. Other factors might be involved such as the ecological and climatic conditions at the locations of the home gardens. The findings of this study suggest that labour input in home garden cultivation and species diversity in home gardens in rural households with HIV and AIDS are not causally related.

Difference in contribution of home garden produce to dietary diversity among HIV-positive and HIV-negative rural households

The results show that home gardens offered an important source of micro-nutrients and vitamins and contribute significantly to dietary diversity in HIV-positive rural households. HIV-positive rural households consumed a diet with a higher dietary diversity score (*DDS*) compared with households without HIV. The contribution of food items from the home garden to the *DDS* was significantly higher in HIV-positive than in HIV-negative rural households. A significant proportion of HIV-positive households consumed vitamin A-rich fruits which were not consumed by any HIV-negative household. A significantly larger proportion of HIV-positive households obtained the vitamin A-rich fruits and red palm products from the home garden compared with HIV-negative households. The higher *DDS* in HIV-positive households might be due to the relatively larger numbers of households that consumed fruit and vegetables, particularly vitamin A-rich fruits and red palm products from the home garden. The nutrition counselling from health care officers to members of the association of People Living with HIV/AIDS (PLWHA) might have informed HIV-positive households on the benefits of consuming diverse diets since HIV-positive households were recruited through this association. The results from this study confirm the findings of Bukusuba *et al*. (2007) on the practice of agriculture and the dietary diversity of persons living with HIV and AIDS (PLWHA) in Uganda. They found that the consumption of a diverse diet is significantly associated with the practice of agriculture which involves growing food crops such as fruits, vegetables, and the raising of animals, poultry, bees, rabbits and other livestock within and around near the home.

The absence of a significant difference in species diversity in the home garden between HIV-positive and HIV-negative households contradicts our working hypothesis. In the current study, we anticipated significantly higher species diversity in home gardens of HIV-positive households and consequently a high *DDS*, but the results showed that the Shannon-Wiener index did not show a higher *DDS* in HIV-positive households. This implies that a rural household does not cultivate a greater diversity of plant species in the situation of HIV illness, but rather consumes more of the food items from the home garden. This is in contrast to the findings of Salick (1997) that when field cultivation is limited female-headed rural households cultivate greater diversity in home gardens which corresponds to a higher intake of food items from home gardens. The higher dietary diversity score might imply a better nutrition in HIV-positive households than in HIV-negative households. However,

given that consumption of diverse foods does not imply a nutritionally adequate diet *per se*, there is the need to determine from the level of DDS whether the diet of HIV-positive households is nutritionally adequate or whether it is at risk of nutrient inadequacy.

I conclude from the results of this study that when labour constraint reduces field cultivation in rural households due to HIV and AIDS illness, labour input in home garden cultivation significantly increases; there is no significant change in plant species diversity but rather relatively more food items of the essential food groups are consumed from home gardens which contribute to a significantly higher dietary diversity. Consequently this finding indicates that the home garden as an agricultural resource is a potential to mitigate labour constraint and enhance the dietary diversity of rural households with HIV and AIDS.

8.2.2. Effect of the interaction between HIV and AIDS and household headship on home garden biodiversity

In Chapter 5 we investigated the differences in biodiversity in home gardens and dietary diversity in female-headed and dual-headed HIV-positive and HIV-negative rural households to uncover the effect of the interaction between household HIV status and gender of the household head on biodiversity in home gardens. The quantitative data in Chapter 4 were stratified by household HIV status and gender of household head and supplemented with in-depth studies of 12 case households to provide an in-depth understanding of the variation and similarities in the plant species composition in home garden of female-headed, dual-headed rural households with and without HIV and AIDS. A female-headed rural household in this study refers to a rural household headed by an adult female and a dual-headed rural household is headed by an adult male and female.

Effect of the interaction between household HIV and AIDS status and headship type

Empirical data revealed a significant influence of the interaction between household HIV and AIDS status and headship type on a number of variables related to the biodiversity in home gardens. Plant species diversity in home gardens of HIV-positive female-headed rural households was significantly lower than in HIV-negative dual-headed rural households; but there was no significant difference with HIV-negative female-headed and HIV-positive dual-headed rural households. The number of crops species cultivated in home gardens of HIV-positive female-headed rural households was not significantly different from that of the other households. On the other hand, HIV-positive female-headed rural households cultivated

significantly more annual crop species and more root and tuber crop species in home gardens compared with HIV-negative female-headed households, but there were no significant differences with dual-headed households. Annual crops cultivated in home gardens comprised food crops such as vegetables, spices, fruit and root and tuber crop species. However, the dietary diversity score did not differ significantly between HIV-positive female-headed and other households. HIV-positive female-headed households might have cultivated significantly more annual crop species and root and tuber crop species compared with HIV-negative female-headed households; and planted similar species diversity in home gardens as compared with HIV-negative female-headed and HIV-positive dual-headed rural households having been educated on the advantages in the consumption of diverse diet through nutritional counselling of the members of the Association of PLWHA by health care officers. These findings are consistent with Murphy's (2008) observation on AIDS and kitchen gardens in Western Kenya that that networks spread information about home garden crops and their nutritional needs but that HIV/AIDS less visibly increases the diversity of plant species in home gardens. The annual crop species cultivated in home gardens of HIV-positive female-headed households consisted of vegetables, spices and fruits which are food crops rich in protein and vitamins and of root and tuber crops species which are energy-rich staples. These food crop species are relatively early maturing and produce tends to be regularly available compared with perennial food crops; the root and tuber crops species are cultivated by vegetative propagation and so planting materials are relatively easily available; cultivation is relatively less labour-demanding since management practices like weeding and harvesting does not require strict timing, and could be extended over time and therefore better adapted to the constrained labour conditions of households with HIV and AIDS (Garí, 2003). The results suggest that when faced with confinement to the home in giving care and the obligation to ensure household food and nutrition security, HIV-positive female-headed rural households depend more on the home garden to produce crops for sustenance and dietary diversity. This finding supports the report of Steiner *et al*. (2004) that female-headed households with HIV and AIDS adopt innovative survival strategies in agricultural production to enhance food security. This study goes a step further by revealing that HIV-positive female-headed rural households cultivate specifically significantly more annual food crops comprising crops rich in protein and vitamins in the form of vegetables, spices and fruits; and energy-rich staples in the form of root and tuber crop species in home gardens to provide sustenance and dietary diversity.

The findings of this study contradict our working hypothesis that a higher labour input in home garden cultivation in HIV-positive female-headed households will lead to significantly higher species diversity in home gardens and consequently a higher dietary diversity score. Moreover, the results show no significant differences in dietary diversity score between HIV-positive female–headed households and other households. This might imply that the significantly greater numbers of annual food crops and root and tuber crop species cultivated in home gardens of HIV-positive female-headed households did not result in a higher dietary diversity score. This finding is contrary to Salick's (1997) observation that female-headed households depend on home gardens much more than the average household in supplementing and supplying a significant proportion of the households' diet when field cultivation is constrained. An in-depth analysis of the household dietary diversity score is necessary in the current study to access the nutritional adequacy of households' diet. Moreover, it is uncertain whether the single 24-hour qualitative dietary recall used in the current study is adequate in assessing the dietary intake of the study sample. Multiple 24-hr qualitative dietary recalls which allows for diverse dietary practices could provide excellent detail (Tucker, 2007). Besides, it might be necessary to evaluate fully the changes in plant species diversity in the situation of HIV and AIDS by assessing the species diversity within the different categories of crops cultivated in home gardens.

In conclusion, I would argue that when faced with confinement to the home in giving care and the obligation to ensure food and nutrition security of household members, female-headed households with HIV and AIDS cultivate significantly more annual crops and more root and tuber crops species in home gardens than female-headed households without HIV and AIDS. Female-headed households with HIV and AIDS depend much more on home gardens than female-headed households without HIV and AIDS for sustenance and dietary diversity.

8.2.3. Exploring the differences and similarities in the biodiversity in subsistence-oriented and commerce-oriented home gardens of HIV-positive and HIV-negative rural households and their significance in household food security

In Chapter 6 an empirical study was conducted to explore the differences and similarities in the biodiversity in subsistence-oriented and commerce-oriented home gardens of HIV-positive and HIV-negative rural households and the significance in household food security. Subsistence-oriented home garden refers to a home garden where products are solely for

household consumption and commerce-oriented home garden has products also for cash income. The study employed the quantitative data in Chapter 4 stratified by household HIV status and primary aim in home garden cultivation and supplemented with in-depth study of 20 case households to assess household characteristics (which includes farming characteristics; consumption of a staple from the home garden); crop species composition and crop diversity in home gardens; seasonal availability of produce at four different periods (rainy season only, dry season only, both rainy and dry seasons and all year round) in subsistence-oriented and commerce-oriented home gardens of HIV-positive and HIV-negative rural households. Crop species composition refers to the plant type (perennial or annual food crop or non-food crop species); major preferred human use (vegetable, staple, fruit, spice, medicinal or fodder plant); economic product (fruit, tuber, etc.). Crop species composition and crop diversity were evaluated using the ecological indices species richness, species diversity, evenness and species similarity. Species richness refers to the count of cultivated crop species, crop species diversity (number and distribution of cultivated plant species) is estimated using the Shannon-Wiener and Pielou's evenness indices with the cultivated area of each home garden representing a sampling plot. The similarity in crop species composition between home gardens of households with the different primary aim in home garden cultivation was estimated using the Sørenson's index of similarity.

Differences and similarities in crop species composition in home gardens

The study shows that rural households aim to obtain food and non-food necessities from home gardens regardless of the primary aim in home garden cultivation and the household HIV-and AIDS status. The crop species recorded in the subsistence-oriented and commerce-oriented home gardens of both HIV-positive and HIV-negative rural households consisted of food crops and non-food crops. Seventy-three percent of the total of 75 cultivated crop species identified in the home gardens consisted of vegetables, staples, fruits and spices while 27% were medicinal plants and fodder plants. Home garden owners indicated that staples, vegetable crops, fruits trees, medicinal plants and fodder plants cultivated in the homestead were convenient and enhanced access to food, availability of medicinal plants to treat common ailments and fodder plants to feed domestic livestock. Others informants pointed out that the availability of food crops from the home garden enabled households to save money for other food items not available in the home. Even informants from HIV-positive households with commerce-oriented home gardens emphasized that their household members

never went hungry despite the reduced field production as a result of HIV illness because their home gardens served a dual purpose in providing food and cash income.

Occurrence of crop species in the home garden types

The home gardens were highly variable with regard to the occurrence of individual crop species. Cocoa and oil palm trees; the major cash crops in the study area were the only crops that were present in a significantly higher proportion of commerce-oriented compared with subsistence-oriented home gardens. A commerce-oriented home garden owner pointed out that those cocoa and oil palm that had become unproductive were gradually being replaced with food crops. Eighteen food crops and ten non-food crops species were found solely in only one home garden type. Among these, 11 food crop species were found only in commerce-oriented home gardens of HIV-positive households. Case study information indicated that home garden plants consisted of deliberately planted species; species that grew as volunteer plants and species that had been saved from the previous vegetation due to their nutritional, non-food or economic value. It is obvious that the cocoa and oil palm trees were retained in commerce-oriented home gardens due to the high economic value of their main products in the country. Currently, cocoa is the main foreign exchange earner to the Ghanaian economy and contributes about 29% to the GPD and oil palm is a major source of edible oil and a key agro-industrial crop. Both crops have a readily available market and a good market price is always assured (Amanor and Diderutuah, 2001; GIPC, 2002). These findings agree with Castinêiras *et al*. (2001) observation that commercial coffee production is carried out in home gardens in the mountainous zones of Cuba due to the economic importance of coffee to the State. Historical account indicate that in the Eastern Region of Ghana initial plantations of oil palm that are later cultivated with cocoa are increasingly being planted with food crops by the rural population both for their own subsistence and for cash income when cocoa production decline due to diseases and reduced soil fertility (Amanor, 1994).

Agro-ecological conditions and cultural factors influence crop species composition in home gardens regardless of the primary aim in home garden cultivation and household HIV and AIDS status. Comparison of the similarity in crop species composition between subsistence-oriented and commerce-oriented home gardens in both HIV-positive and HIV-negative rural households showed a moderately high Sørensen's index; this indicates a high similarity in species composition. Both food and cash crop cultivated in the home gardens in the semi-deciduous forest zone are rainfed; annual crops with relatively shorter maturity

periods when cultivated for cash income are planted at the beginning of the major rains for early harvest and a better market price, while those for home consumption are planted in either in the major or minor rainy seasons or in both rainy seasons. Annual crops with relatively longer maturity periods are planted at the end of the dry season or just before the major rains to obtain enough moisture for growth. Seedlings of perennial species are planted at the beginning of the major rainy season to ensure adequate moisture for establishment. Sixteen out of the 17 crop species common to the four home garden types consisted of vegetables, staples and fruits. Similar climatic conditions and farming practices across the areas where the home gardens are located may have contributed to the similarity in species composition between commerce-oriented and subsistence-oriented home gardens of both HIV-positive and HIV-negative rural households. This is supported by the fact that the current study analysed the home gardens for cultivated species only; species such as useful weeds which grow spontaneously in home gardens were not included due to the inconsistency in their use as medicinal plants even within the same home garden type. The Wezel and Bender (2003) study on the Cuban home garden system provided similar evidence of the effects of agro-ecological conditions and dietary habits on home garden species composition. They observed a relative high similarity in species composition between home gardens located in the humid areas and irrigated home gardens in the semiarid areas when these home gardens were analysed for cultivated plants only of which majority were food crop species. However, the differences in the climatic conditions were evident in the medicinal plant species which consisted of weeds and ruderal plants that mostly grow spontaneously in home gardens. Similar food crop species identified in the home gardens included plantain (*Musa sapientum*), a major staple crop locally known as *Brodie*, which is the most common species and present in 80% or more of all four home garden types; yam (*Dioscorea* spp.), a staple crop locally known as *Bayerè*, and pineapple (*Ananas comosus*), a major fruit known as *Abrobè* were present in at least 50% of all home garden types with the exception of subsistence home gardens of HIV-positive households. Informants reported that planting materials such as yam setts, plantain and pineapple suckers were obtained locally from mature crops harvested in their own home gardens and farms, acquired from neighbours, relatives and friends, or purchased from other farmers. However, others indicated that besides unfavourable weather conditions, the choice of home garden crops was limited by unavailability of planting material, or unintended destruction of crops by strayed domestic livestock and poultry which often brought conflict between neighbours. HIV-positive

households emphasized that lack of funds to purchase local materials or to pay for labour to construct a perimeter fence which to protect garden crops from strayed domestic animals influenced the choice of garden crops. These findings suggest that inability to obtain inputs which are endogenous to rural household's environment may be constraint to the cultivation of major food crops in home gardens in HIV-positive rural households.

Differences and similarities in crop diversity and other characteristics

Empirical data revealed that available land and extra domestic labour enabled HIV-positive households to cultivate significantly larger commerce oriented home gardens; with higher species richness but species diversity is not significantly different compared with subsistence oriented home gardens. HIV-positive households cultivated significantly larger commerce-oriented home gardens, with significantly more species, more individual plants, more perennial food crop species and species that are harvested all year round than subsistence-oriented home gardens. There was no significant difference in species diversity between subsistence-oriented and commerce-oriented home gardens but evenness was lower in commerce-oriented than subsistence-oriented home gardens. In contrast, there was no significant difference between subsistence-oriented and commerce-oriented home gardens of HIV-negative households in any of the parameters studied. Household HIV illness had no significant effect on the number of annual food crops species; non-food crop species; species richness; or the number of crop species harvested from the home garden in either the rainy or dry season only or in both seasons. The significantly higher species richness in commerce oriented home gardens of HIV-positive households could be due to the cultivation of cash crops together with food crops species in home gardens to enhance access to food. This may be attributed to the nutrition education given to PLWHA by health care officers. Maintaining monocultures of cash crops together with food crops in commerce-oriented home gardens may account for the significantly greater number of individual plants in commerce-oriented than in subsistence-oriented home gardens of HIV-positive households. Furthermore, the significantly higher number of perennial crop species cultivated in commerce-oriented home gardens with products in the form of leaves, corms and fruits might have contributed to the significantly greater number of species harvested all year round compared with subsistence-oriented home gardens. By cultivating significantly more perennial crops which do not require re-planting each year, time is available for cash crop production in HIV-positive households. There was no significant difference in species diversity between subsistence-

oriented and commerce-oriented home gardens of HIV-positive households, but there was a higher level of diversity with regard to the total number of species cultivated in the commerce-oriented home gardens. The significantly lower evenness in commerce-oriented compared with subsistence-oriented home gardens of HIV-positive households could be due to the fact the few species cultivated as cash crops in commerce-oriented home gardens were maintained in relatively higher numbers compared with other species present in the home garden. The results are consistent with previous findings by Trinh *et al*. (2003) and Bernholt *et al*. (2009) on commercial and non-commercial home gardens in Vietnam and Niger, West Africa respectively, but disagree with the results of other researchers who assessed the impact of commercialization on the structure of home gardens in other environments. In contrast to our findings, Abdoellah *et al*. (2006) observed that commercialization of home gardens in West Java, Indonesia caused no significant change in the number of species cultivated but a reduction in species diversity in home gardens. Bernholt *et al*. (2009) also noted that non-commercial home gardens had only slightly higher species diversity and species richness was not different compared with commercial gardens; but non-commercial home gardens had a significantly higher evenness than commercial home gardens. In the current study an estimation of the summed dominance ratio (SDR; Numata, 1966) of each home garden crop species could have revealed the most dominant species in each home garden type to provide a better understanding of the crop diversity present in the different home garden types (Abdoellah *et al*., 2006). The results of this study might suggest that the proximity of the home garden to the homestead and its flexible labour requirement offer a suitable intervention for rural households with HIV illness which require more food security, better nutrition and lower labour-investment incentives (Garí, 2003; Loevinsohn and Gillespie, 2003). These findings are evident since the benefits of home gardens are not static; the composition and management of home gardens gradually evolve in response to the changes in households' socioeconomic characteristics (Peyre *et al*., 2006). However, given that the cultivation of monocultures of cash crops could create ecological instability, which might lead to an increased incidence of pests and diseases. It is necessary that comprehensive investigations are conducted into the common plant associations in home gardens in the study area to provide a better understanding of the ecological and economic compatibility these species.

Management aspects

The results show that there was increased intensity of home garden cultivation with the cultivation of cash crops regardless of household HIV and AIDS status. Improved planting material was used much significantly more often in commerce-oriented than in subsistence-oriented home gardens in both HIV-positive and HIV-negative households. Commerce-oriented home gardens of both HIV-positive and HIV-negative households and none of their subsistence home gardens received chemical fertilizer application. However, though chemical pesticides and labour from outside the home were used in a relatively higher proportion of commerce-oriented home gardens in both HIV-positive and HIV-negative households these are not significantly different compared with the proportions of subsistence-oriented home gardens. Adults were hired for land clearing, making of mounds, weeding, planting, chemical fertilizer and pesticide application, harvesting of produce and establishing home garden fences in commerce-oriented home gardens. A significantly higher proportion of commerce-oriented home gardens of HIV-negative households were fenced to protect crops from destruction by domestic animals compared with subsistence-oriented home gardens but there were no significant differences between these home garden types with regard to HIV-positive households. It is observed that fences made from local materials such as tree branches and bamboo stakes were used in both commerce-oriented and subsistence-oriented home gardens. Subsistence-oriented home garden owners pointed out that herbicides were the most common pesticide used, because controlling weeds in home gardens with herbicides reduced the amount of time spent in manual weeding. A small proportion of these home gardens owners reported that children between 10 - 14 years from outside the home were engaged in situations of acute shortage of domestic labour for weeding and planting of garden crops. Remuneration for these children was in the form of some home garden produce or occasional gift. The absence of significant difference in chemical pesticide use between commerce-oriented and subsistence-oriented home gardens might be due to the fact that some owners of subsistence-oriented home garden, who use herbicides on distant fields, also applied these herbicides in home gardens as well to control weeds. This is because farmers perceived that herbicide use was able to suppress weeds for a longer time than manual weeding with the hoe and cutlass even though this reduced the diversity in other plant forms present. Moreover, it was noted that garden owners did not follow the recommendations for the safe use of chemical pesticides and this has both environmental and health implications which gives cause for concern (Asante and Ntow, 2009; Ntow *et al*., 2006). The absence of significant

differences in the proportions of commerce-oriented and subsistence-oriented home gardens of HIV-positive households that used hired labour might be due to the engagement of children from outside the home in the weeding and planting of crops in subsistence-oriented home gardens of HIV-positive households. The use of children in home garden cultivation is not unique to this study; Méndez *et al*. (2001) in their study on the socioeconomic importance of home gardens in Nicaragua pointed out that domestic labour used in home garden cultivation occasionally included children. The important role of home gardens in the livelihoods of rural households with HIV and AIDS by providing food security and nutrition, medicinal relief and for income generation which is supported by the nutrition counselling given to the PLWHA by health care officers might have contributed to the increase in intensity in home garden cultivation in HIV-positive households which was indicated by similar proportions of commerce-oriented and subsistence-oriented home gardens that were fenced to protect crops from destruction by strayed domestic animals; and the lack of significant differences in the proportions of commerce-oriented and subsistence–oriented home gardens that received chemical pesticides and used external labour. These results are consistent with the findings of Murphy (2008) on AIDS and kitchen gardens in Western Kenya that links with HIV and AIDS networks creates subtle changes in the intensity of home garden cultivation techniques and not only in the diversity of plants.

Household characteristics

HIV-positive rural households engage in full time farming owing to constraints due to HIV and AIDS illness. Both HIV-positive households with either commerce-oriented or subsistence-oriented home gardens were more likely to engage in full time farming compared with HIV-negative households with subsistence-oriented home gardens. However, there was no significant difference in the field area cultivated by the different households. Informants from HIV-positive households indicated that farming was their main occupation due to lack of funds to take on non-farm income activities or time constraints owing to frequent bouts of illness or the need to take time off to care for the ill household member. Others expressed that major non-farm income generating activities which involved post-harvest food processing and food vendoring had been given up due to the labour constraint and HIV and AIDS related stigma, respectively. Limitation in available labour in HIV-positive households and lack of adequate land among HIV-negative households may have contributed to the non-significant differences in the field areas cultivated. Given that crop farming was the main source of

income for HIV-positive households cash earnings from the sale of home garden produce might represent an important income for those with commerce-oriented home gardens. This supports the report of the World Bank (2005) that useful income-generating activities for rural households experiencing HIV illness are those based around local biodiversity and skills.

HIV-positive households that cultivated commerce-oriented home gardens cultivated a dual purpose home garden that supplied subsistence food and also provided cash income. Significantly larger proportion of HIV-positive households with a commerce-oriented home garden consumed a staple crop cultivated in the home garden in the 24-h period prior to the survey compared with HIV-positive households with a subsistence-oriented home garden. An HIV-positive household head with a commerce-oriented home garden emphasized that, although she did not grow a lot of field crops anymore because she could not work long hours in the field, her children never went to sleep hungry because she harvested plantain and cocoyam regularly from her garden for the family's own consumption and the cash crops provided money for other food items not available in the home. Another indicated that it was very convenient to grow food and cash crops in his compound because it saved his household the problem of going to fetch food produced from the distant field on rainy days. A household has food security when it has the ability to secure, either from its own production or through purchases, adequate food to meet the dietary needs of its members so that they can lead a healthy and active life (Egal and Valstar, 1999). Consequently HIV-positive households with commerce-oriented home gardens had direct access to food from their home gardens and indirectly through purchases with cash earnings from their gardens, which might suggest greater food security for HIV-positive households with commerce-oriented home gardens relative to HIV-positive households with subsistence-oriented home gardens. However, this is in contrast to the general opinion that rural households with HIV illness are food insecure (De Waal and Whiteside, 2003; Loevinsohn and Gillespie, 2003).

We can conclude from all these findings that rural households experiencing HIV illness in cultivating commerce-oriented home gardens adapt the crop species composition, crop diversity and management of home gardens to suit their specific needs. They cultivate a dual purpose home garden that provides cash income and also supplies subsistence food. Rural households with commerce-oriented home gardens may have better food security than their counterparts with subsistence-oriented home gardens.

8.2.4. Evaluating the differences in food insecurity of HIV-positive and HIV-negative farm households in the Eastern Region of Ghana during the post-harvest period and in the lean season by assessing the frequencies and severities of the food related coping behaviours adopted by the households in the two periods.

In Chapter 7 we evaluated the food insecurity of HIV-positive and HIV-negative farm households in the Eastern Region of Ghana during the post-harvest period and in the lean season by assessing the differences in the severities of the food related coping behaviours adopted by the households in the two periods. The magnitude of food insecurity in HIV-positive and HIV-negative farm households was evaluated using the Coping Strategy Index (CSI), which was estimated as an aggregate of the weighted scores assigned to individual food related coping behaviours adopted by households in the local area when they don't have enough food. The weighted scores assigned to the individual food-related coping behaviours reflect the frequency and perceived severity of the individual behaviours among households. Using qualitative information from focus group discussions and descriptive statistics from a multiple round survey the study assessed the differences in the frequency and severity of the food–related coping behaviours adopted; agricultural production; and income generating activities taken on during the post-harvest period and in the lean season between HIV-positive and HIV-negative farm households to evaluate the severity of food insecurity.

Household characteristics

The results from this study showed that female-headed households among the farm households with HIV and AIDS were likely to be more food insecure due to the higher dependency ratio in their households; their limited attainment in formal education and their limited access to resources in comparison to male-headed farm households with HIV and AIDS. As in other countries in Sub-Saharan Africa, women in Ghana mostly carry the responsibility of caring for the sick. Moreover, it is the elderly that are left behind in rural areas to take care of the sick when the young and economically active adults migrate in search of better livelihoods elsewhere (Mba, 2004). Women in rural areas of Ghana generally tend to have lower levels of formal educational attainment compared with men, due to discriminatory access to formal education as children (Safo-Kantanka *et al*., 2006). These characteristics of the HIV-positive farm households being female headed, older and with high dependency ratios may impact the food security of these households since relatively more household members would need to be fed compared with HIV-negative households.

Moreover, the lower attainment in formal education in HIV-positive farm households is likely to impact income earning opportunities and influence household food security (Maxwell *et al*., 2000). Higher education in rural communities enhances peoples' ability to participate in off-farm income activities which is likely to increase household income and subsequently enhance access to food (Dose, 2007).

Difference between HIV-positive and HIV-negative farm households in the severity of food-related coping behaviours during the post-harvest period and in the lean season

The results from the study showed that food insecurity was more severe in HIV-positive farm households in both the post-harvest and lean seasons. In the post-harvest season when food produce was relatively more available both HIV-positive and HIV-negative farm households adopted all five food-related coping behaviours to maintain food security. However relatively higher proportions of HIV-positive farm households often relied on less preferred food; reduced portion size at meal times and purchased street food, purchased food on credit, consumed fewer meals per day than HIV-negative farm households. In the lean season when food produce is relatively less available comparable proportions of HIV-positive and HIV-negative farm households often relied on less preferred food; reduced portion size and purchased street food; but relatively higher proportions of HIV-positive farm households purchased food on credit and consumed fewer meals per day than HIV-negative farm households. The more severe food related coping behaviours adopted by a relatively larger proportion of HIV-positive in comparison to HIV-negative farm households in both the post-harvest and lean season resulted in a higher coping strategies index for the HIV-positive farm households in both seasons.

Qualitative information indicated that in the post-harvest period the diet of HIV-positive farm households was monotonous and lacked variety compared with HIV-negative farm households. There was an increase in consumption of maize and cassava-based dishes such as "*banku*" (fermented maize meal cooked into a soft mash) and "*fufu*" (a pounded mash of boiled cassava with plantain) in a relatively higher proportion of HIV-positive farm households because these were the major staple crops available on their farms. The need for money to purchase other staples not cultivated might have compelled HIV-positive farm households to constantly consume only these two staple crops. Inadequate diversity in the diet may cause micronutrient deficiencies and individuals with HIV are likely to be susceptible to opportunistic infections as a result of immune dysfunction. WHO (2003) has

documented the critical importance of maintaining adequate food and nutrition intake levels by people living with HIV. Malnutrition can worsen the effects of HIV and hasten AIDS-related illnesses (Gillespie and Kadiyala, 2005). A relatively higher proportion of HIV-positive farm households often reduced the portion size of food compared with HIV-negative households in order for the limited food stock to last longer. Street foods such as "*kenkey*" (dumplings made from fermented maize dough) with fried fish and pepper sauce and boiled rice with tomato stew were purchased during the day in a relatively higher proportion of HIV-positive compared with HIV-negative farm households because these foods were relatively cheaper and facilitated savings on time and fuel compared with home-prepared food. Although street foods offer suitable alternative meal sources, the nutritional adequacy of these meals may be questionable, since most sellers select less than the best quality raw ingredients in the preparation of street foods so that they can maximize profit (Opare-Obisaw *et al*., 2000). However, the possibility of obtaining credit was a major incentive for HIV-positive farm households to purchase street food since cash is limited. Relatively higher proportions of HIV-positive farm households purchased essential food items such as fish, vegetable and staples on credit regularly due to inadequate source of a regular income. Although purchasing food on credit cushioned HIV-positive farm households from going to bed on an empty stomach, these households emphasized that the decision to purchase food on credit was hindered by the associated social perception that it is a lazy household that often buys food on credit. HIV-positive farm households purchased food items on credit only when some cash income was expected such as a remittance. This confirms a report by CARE/WFP (2003) that purchasing food on credit by rural households to maintain food security is not sustainable over a long period. Furthermore, relatively higher proportions of HIV-positive farm households often skipped breakfast in a day during the post-harvest period compared with HIV-negative farm households and ate two meals: at mid-morning and in the evening. In HIV-positive farm households the leftover food from the evening meal was saved for the next morning and so household members ate nothing when there was no food left from the previous evening meal. The evening meal which was regarded as the most important meal consisted of "*banku*" or "*fufu*" with soup; and was prepared in a substantial amount to enable all HIV-positive household members to consume adequately. Reducing the number of meals eaten in a day by a household could suggest that the household is nutritionally insecure. In Ghana eating three meals (breakfast, lunch and supper) in a day is considered as normal for nutritional security (Hesselberg and Yaro, 2006). Similar food-related coping behaviours

have been observed and reported by Maxwell *et al*. (2000) in their studies on how urban households in the Greater-Accra region of Ghana sustained food security. However, in the current study no household refrained from eating for an entire day. The reason could be that for farm households (this study) their own food production provided a significant part of their daily food intake and so farm harvests are purposely stored for household consumption at later date whilst in urban households most of the food consumed is mainly purchased when needed.

In-depth study indicated that in the lean season both HIV-positive and HIV-negative farm households substituted into their diets easily available staples. There was increased consumption of immature food crops harvested from farms and home gardens as well as cassava-based dishes such as "*bankye ampesi"* (boiled cassava), "*agbelima*" (cooked meal of fermented cassava dough) and "*konkonte*" (cooked meal of dried cassava flour), as cassava is a low-labour intensive crop and is the relatively cheaper staple crop available during this period. These food consumption practices could lead to problems of under nutrition in HIV-positive farm households since an immature food crops may have lower nutritional content and cassava with its low protein content is less nutritious compared with other staples such as plantain and yam (FAO, 1990). The portion size of food was reduced in comparable proportions of HIV-positive and HIV-negative farm households since food harvest had dwindled and prices of farm produce were at their highest. This coping behaviour may have been adopted to enable food stocks to last longer. All HIV-positive farm households and a higher proportion of HIV-negative farm households often consumed street foods in the lean season supposedly to provide a wide range of nutrients in the household diet at a cheaper cost. Essential food items such as vegetables, fish and staples were purchased on credit in relatively higher proportion of HIV-positive farm households. In addition, lunch was often skipped and food was eaten only twice daily by a relatively higher proportion of HIV-positive compared with HIV-negative farm households. The common breakfast dish in HIV-positive farm households was a light maize porridge known as "*kooko*" or boiled fresh maize eaten at mid-morning and a staple dish of "*konkonte*" accompanied by soup was eaten in the evening as the heaviest meal for the day. HIV-positive households reported that although these foods were not satisfying due to the demands of the laborious farm activities carried out during the day, they could do nothing because those were the only foods available to them. Quaye (2008) observed similar food-related coping behaviours in poor households in the Upper East Region of Ghana during food shortage in the lean season of crop production.

Differences between HIV-positive and HIV-negative farm households in agricultural production and sources of income during the post-harvest period and in the lean season

HIV-positive farm households had access to relatively limited food they produced themselves and engaged in relatively limited agricultural and non-agricultural sources of income generation compared to HIV-negative households during the post-harvest season of relative food abundance as well as in the lean season of food shortage. HIV-positive farm households cultivated smaller fields, harvested fewer staples and vegetable crop species from farms and home gardens than HIV-negative farm households during the post-harvest period and in the lean season. In-depth study revealed that HIV-positive farm households cultivated relatively smaller field areas, harvested only maize, cassava and pepper from their farms compared with HIV-negative farm households. Other major staples such as plantain, yam and cocoyam and vegetables such as eggplant and tomatoes were also harvested from the farms of a relatively higher proportion of HIV-negative compared with HIV-positive farm households. However, major staples such as plantain, cassava, cocoyam and yam and vegetable crops such as pepper, eggplant and the green leafy vegetable "*nkontomire*" (*Xanthosoma saggitifolium* leaves) were harvested from home gardens by relatively higher proportion of HIV-positive farm households than of HIV-negative farm households. These results corroborate the findings of Jayne *et al*. (2004), Shah *et al*. (2002) and Kaijsa *et al*. (2003) that labour constraints in terms of persons, time or strength in rural households with HIV and AIDS results in less land being cultivated, fewer crops being cultivated and fewer surpluses, if any, to sell to the market for cash income.

A relatively smaller proportion of HIV-positive farm households obtained income from the sale of farm produce than HIV-negative farm households. Rural households make choices on how much of their field harvest to store and how much to sell depending on their consumption needs and the need for immediate cash (Latham, 1997). Farm produce was sold in bulk immediately after harvest in HIV-positive farm households to provide cash to supplement food needs while HIV-negative farm households retailed farm produce from time to time in order to provide a regular source of income and also to benefit from increasing food prices. HIV-positive farm households were unable to take advantage of these opportunities to obtain maximum profit from farming since cash was urgently required to purchase additional food. None of the HIV-positive farm households sold home garden produce whereas a smaller proportion of HIV-negative farm households obtained income from the sale of home garden produce. This could suggest that home garden produce was

solely consumed in HIV-positive farm households which had limited access to own cultivated crop produce from the farm. This is inconsistent with the report of Shackleton *et al*. (2008) that harvest from home gardens buffer households during times of stress. Relatively larger proportions of HIV-positive farm households kept relatively fewer chickens, ducks and goats and obtained income from the sale of poultry and domestic livestock compared with HIV-negative farm households. Rearing poultry and domestic livestock provided meat and eggs as well as income for households in both groups. Although prices of poultry and domestic livestock were very low in the post-harvest season, the sale of poultry provided HIV-positive farm households a reliable source of petty cash for additional food needs. It was necessary for HIV-positive farm households to sell off poultry in the post-harvest season even though prices were very low since they could not afford the cost of the veterinary treatment required to prevent loss of chickens due to the usual outbreak of Coccidiosis and Newcastle diseases in the dry season. Income obtained from the sale of domestic livestock in the post-harvest season enabled HIV-positive farm households to raise cash for food and occasionally also provided to money pay for medical expenses for the sick individual. On the other hand, in HIV-negative farm households this income provided cash for unexpected expenses such as paying for maintenance work in the homestead or raising funds to improve an income generating activity. These results may suggest that rearing domestic livestock is a form of saving in rural communities. Hesselberg and Yaro (2006) observed among rural households in deprived communities in Northern Ghana who did not possess sufficient cash the sale of domestic livestock was their normal response to crises of many kinds. There was little opportunity for agricultural-wage labour in both household groups in the post-harvest season; household members provided casual wage labour in the harvesting of fields, de-husking and shelling of farm produce for other farmers. While HIV-negative farm households demanded cash for such work that was done, HIV-positive households requested for payment in kind such as tubers of cassava and maize grain. Payment in food could be essential for HIV-positive households to attain food security. Remittances were received from migrant relatives in a relatively higher proportion of HIV-positive than of HIV-negative farm households to cater for household food. Remittances obtained in HIV-negative farm households augmented household income and served as a source of income for savings or were added to funds for an income generating enterprise. Statistics suggest that migrant remittances form an important part of income in Ghanaian households (GSS, 2007). Petty trading in HIV-positive farm households involved selling food produce and other items of everyday use such as salt, soap

and kerosene from the homestead which provided relatively meagre earnings. HIV-positive farm households emphasized that besides labour and time, financial constraints limited their engagement in relatively lucrative income activities. On the contrary, HIV-negative farm households took on small businesses outside the home that were relatively labour and time intensive but which fetched relatively higher earnings. Women in HIV-negative farm households operated shops outside the home, participated in the sale of food stuffs to market women from peri-urban and urban centres or engaged in post-harvest food processing activities such "*gari*" (roasted fermented cassava meal) and "*agbelima*" (fermented cassava dough) making or the extraction of edible oils from palm fruits which provided cash income as well as food items for their households. The men in HIV-negative farm households engaged in brewing "*akpeteshie*", a local gin, or provided labour in the loading of trucks that conveyed food stuff to market outlets. HIV-positive farm households were limited to home based off-farm income activities probably due to labour constraint. This is consistent with the report of Van Liere (2002) that households with HIV and AIDS withdrew from marketing activities in favour of home-based pure subsistence activities due to labour constraint. The relatively smaller proportion of HIV-positive farm households who obtained income from non-agricultural wage labour engaged in menial jobs such as offering services as "chop bar" (local roadside bar/restaurant) attendants or as head-porters at local markets due to lack of artesian skills. On the other hand, HIV-negative farm households obtained income from non-agricultural wage labour by providing services as a dressmaker, repairer of bicycles or household utensils. The limited sources of income and relatively less lucrative characteristics of the income activities taken on by HIV-positive farm households might have limited their ability to obtain cash income to purchase additional food in the post-harvest season. These could have contributed to more food insecurity in a relatively higher proportion of HIV-positive than HIV-negative farm households during the post-harvest period.

In the lean season major staples like cocoyam and yam and the green leafy vegetable "*nkontomire*" were harvested from farms in addition to plantain and cassava by relatively higher proportions of HIV-negative than HIV-positive farm households. Most of the vegetable crop species had just been planted and were thus not available for either household consumption or for sale. It was equally rare for HIV-positive farm households to sell food produce from farms and for HIV-negative farm households to sell food produce from home gardens during this period when food stocks have diminished. However, HIV-positive farm households were compelled to sell bunches of plantain and tubers of cassava harvested from

the home garden to provide money to purchase other essential food items such as fish and salt. Hesselberg and Yaro (2006) documents that the cultivation of small gardens in the lean season in deprived communities in northern Ghana provide food and cash income for farm households. HIV-negative farm households on the other hand emphasized that selling home garden produce in the lean season was not a good option in view of the limited food stock. Moreover, this could necessitate buying the same farm produce at much higher prices from other farmers. A relatively smaller proportion of HIV-positive compared with HIV-negative farm households owned a greater numbers of chickens, ducks, sheep and goats and none of the HIV-positive households obtained income from the sale of chickens, goats or sheep while a relatively larger proportion of HIV-negative farm households obtained income from livestock. HIV-negative farm households emphasized that they took advantage of the prevailing high prices of domestic livestock in the lean season to earn a favourable income from domestic livestock rearing. In most rural areas of Ghana, the accumulation of livestock was considered a form of savings (Oppong–Anane *et al*., 2008). Hesselberg and Yaro (2006) noted that in some areas of northern Ghana rearing of domestic livestock was the most important source of income which prevented rural households from acute food insecurity in the lean season. Quaye (2008) observed that in the Upper East Region of Ghana where seasonal food shortage covers six months of the year the selling of livestock to obtain money for household food purchases is predominant. More than 90% of the 200 households studied indicated that rearing of livestock was crucial in building household resilience to food insecurity. However, in the current study HIV-positive farm households had sold off most of the poultry and domestic livestock in the post-harvest season to provide additional food. A relatively larger proportion of HIV-negative farm households obtained income from agricultural wage-labour while none of the HIV-positive farm households obtained this income. The demand for agricultural-wage labour was high in the lean season since farming activities were at their peak. A relatively larger proportion of HIV-negative farm households engaged in farm activities that required physical strength as agricultural-wage labour to supplement household income. HIV-positive farm households were unable to participate in these activities due to labour constraints. Hesselberg and Yaro (2006) noted that in farming communities in northern Ghana the engagement in non-farm income opportunities during the lean season reduced the number of food insecure households. Remittances were important source of income for households in both groups since available cash was relatively limited during this period. In HIV-positive farm households remittances facilitated the provision of

food daily for household members since own food produce was exhausted and income generated from other sources was limited. On the other hand, remittances enabled HIV-negative farm households to provide variety in household diet. Mazzucato *et al*. (2005) emphasizes that remittances served as crucial financial resources to many households in low-income developing countries such as Ghana. None of the HIV-positive farm households engaged in petty trading due to labour and financial constraints whereas petty trading was the common source of income for the relatively larger proportion of HIV-negative farm households. HIV-negative farm households retailed various food and non-food items in local and district markets which brought in considerable earnings. Moreover, lack of artesian skills and labour constraints did not permit HIV-positive farm households to engage in any non-agricultural wage labour to supplement household income. The little labour available in HIV-positive farm households was allocated to the household's on-farm work and provision of care for the sick individual. On the contrary, a relatively larger proportion of the HIV-negative farm households continued to engage in the skilled wage labour work reported in the post-harvest season. The relatively fewer sources of income and income opportunities in HIV-positive farm households may have reduced their ability to provide for additional food needs in the lean season.

The consumption of cheaper, less nutritious and fewer meals in a day in relatively higher proportions of HIV-positive compared with HIV-negative farm households during the post-harvest period and the lean season may be attributed to the limited availability of own cultivated farm produce; limited sources of income and the relatively less lucrative characteristics of the income activities taken on by HIV-positive farm households to obtain cash income to purchase additional food during the post-harvest period and in the lean season due to household labour shortages. A relatively higher proportion of HIV-positive than HIV-negative farm households experience more food insecurity in both the post-harvest period and the lean season. These characteristics may suggest that HIV-positive farm households could experience the "new variant famine" (De Waal 2007; De Waal and Whiteside, 2003; Gillespie and Drimie, 2009).

From these findings we may conclude that farm households with HIV and AIDS are more vulnerable to food insecurity in both the post-harvest period and in the lean seasons and that this vulnerability is also reflected in their poverty, family care burdens (larger number of dependents and ill persons), lower education level and meagre income earning opportunity.

Farm households with HIV and AIDS are more likely to experience the "new variant famine".

8.3. Considerations for intervention

The findings of this thesis point to areas were intervention strategies can respond to the labour and nutritional needs of vulnerable rural households living with HIV and AIDS. Findings from Chapter 4 show that when labour constraint reduces field cultivation in rural households in the situation of HIV illness; labour input in home garden cultivation significantly increases; rural households do not cultivate a greater diversity of plant species in home gardens, but rather relatively more food items of the essential food groups are consumed from home gardens which contribute significantly to dietary diversity. First, because labour constraint limits field cultivation in rural households in the situation of HIV illness the promotion of labour saving, yield enhancing and environmentally friendly farming technologies as well as the provision of inputs to enhance farm production are relevant. Improving farm production is in line with meeting the Millennium Development goal of halving the proportion of people suffering from hunger by 2015 (World Bank and IFPRI, 2006). Second, because home gardens offer an important source of micro-nutrients and vitamins and contribute significantly to dietary diversity in rural households in the situation of HIV and AIDS, promotion of nutrition gardens is crucial to improve the diet of PLWHA to enhance the quality of life and prolong their productive life. Promotion of nutrition gardens is consistent with the Ghanaian Government strategy to improve the quality the diet of people living with HIV and AIDS (PLWHA) through dietary diversity (Soyiri and Laar, 2004). Moreover, adequate dietary intake is of vital importance for the adherence and treatment outcomes for antiretroviral therapy (ART) in view of the declaration of commitment by the United Nations General Assembly to a universal access to comprehensive prevention programmes, treatment, care and support for HIV and AIDS (WHO, 2007).

Empirical evidence in Chapter 5 shows that female-headed households with HIV and AIDS depend more on home gardens than their counterparts without HIV and AIDS to produce crops for sustenance and dietary diversity. These findings call for interventions that can offer female-headed households with HIV and AIDS maximum benefits from home gardens. These may include the provision of relevant information on the nutritional value of crops and technical assistance in the management of relevant crop mixtures that can enhance

household food and nutrition security. Improving household nutrition through home garden production contributes to achieving the Millennium Development goal of reducing morbidity and mortality rates and improving health (ACC/SCN, 2004).

Based on the evidence in Chapter 6 that rural households experiencing HIV illness in cultivating commerce-oriented home gardens cultivate a dual purpose home garden that provides cash income and also supplies subsistence food, extension and education programmes and other agricultural support services are imperative to enhance production and quality of crops and domestic livestock raised in home gardens without destroying the ecological stability of the home garden system. These interventions should also include improvement in techniques for food handling, preparation, processing, and storage to minimize nutrient loss and to maintain the food value.

Nutrition counselling of PLWHA enhances home garden production and subsequently contributes to improved food and nutrition security in rural households with HIV and AIDS as indicated in Chapters 4, 5 and 6 has implication for intervention. Nutrition education should be integrated with treatment, care and support programmes for PLWHA to enhance the effectiveness of such interventions (Gillespie *et al*., 2001). This is in agreement with the UNAIDS/WHO (2006) recommendations that HIV and AIDS mitigation efforts should include intervention on nutritional assistance by focusing on affected individuals and households.

Although it is clear that findings of Chapter 7 need to be confirmed with a larger sample size the results show that farm households with HIV and AIDS are more vulnerable to food insecurity in both the post-harvest and lean season and that this vulnerability is also reflected in to their poverty, family care burdens (larger number of dependents and ill persons), lower education level and meagre income earning opportunity. In the light of these findings, it is essential that concerted efforts should be made to improve the general well-being of farm households with HIV and AIDS by empowering rural households with HIV and AIDS in terms of capacity building, access to livelihood assets and finance. The integrated package of long-term development programmes should be complemented with food assistance programmes since the findings of this thesis shows that food insecurity is a persistent phenomenon in farm households with HIV and AIDS. Improving the general well-being of farm households with HIV and AIDS is crucial for the attainment of the Millennium Development Goals (UN, 2006).

Even though it may be possible to target PLWHA with these specific interventions, deploying such interventions for those most vulnerable in the entire population will have the effect of not supporting asymptomatic PLWHA, whether or not they know their status or choose to identify themselves but also will reduce the risk of HIV and AIDS related stigma (FANTA, 2004; Piwoz and Preble, 2000).

8.4. Limitations and recommendations for future research

Due to logistical reasons, the population of this study sample was obtained from only one of the ten Administrative regions zone in Ghana; the Eastern Region. The Eastern Region of Ghana has consistently shown a high prevalence of HIV and AIDS infection since the disease was first identified in 1986 which makes this location appropriate for the study. However, more than half of the total land area (60%) of the Eastern Region of Ghana region falls within the semi-deciduous forest belt of the Ghana which is characterized by a bi-modal rainfall pattern that permits two growing seasons in a year and a relatively short dry season. Consequently, in Chapter 4 assessing the biodiversity in home gardens of HIV-positive and HIV-negative rural households did not reveal significant difference in species diversity as anticipated. Moreover, Chapter 6 which presented the differences and similarities in the biodiversity in subsistence- oriented and commerce- oriented home gardens of HIV-positive and HIV-negative households neither captured significant differences in plant species composition. These were also supported by the fact the home gardens were analyed for only cultivated species. Future research may include; locations in different agro-ecologies of Ghana particularly areas with a unimodal rainfall pattern, one growing season and relatively longer dry season; a broad scale survey of useful plant species in home gardens; and an evaluation of plant species diversity within the different categories of cultivated plants species in the home gardens. Moreover, since the findings from Chapter 6 show that rural households experiencing HIV illness in cultivating commerce-oriented home gardens cultivate a dual purpose home garden that provides cash income and also supplies subsistence food in order to avoid the adverse effects of full commercialization of home gardens due to heavy dependence on external inputs detailed analysis of the plant associations in a typical home garden is required so as to inform the cultivation of ecologically and economically compatible plant species.

In Chapter 7 data collection on household coping strategies covered only a 30-day period in the post-harvest and in the lean seasons, which might have influenced the results obtained. In future studies data collection on household coping strategies may be carried out over a longer time period in both the post-harvest and in the lean seasons in order to reveal complete differences.

The difficulty of identifying and selecting HIV-positive households for the research posed a major challenge because of the stigma attached to HIV and AIDS infection. Therefore, HIV-positive households were purposively sampled through an organization involved in AIDS counselling and care and a small sample size was studied which limits the generalization of the findings of this study. Future research may investigate a larger sample size and a random sample of households.

In assessing household diets in Chapters 4 and 5 the study did not measure the nutritional adequacy of the diet. However, given that consumption of diverse foods does not imply a nutritionally adequate diet per se; future studies may include in-depth analysis of the level of dietary diversity to assess the nutritional adequacy of household diets.

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Summary

The effects of reduced labour availability in rural households with HIV and AIDS and its subsequent limitation on agricultural production, income earning opportunities and the implications in household food and nutrition security are well known. Researchers argue that rural households with HIV and AIDS adopt coping strategies to alleviate labour loss and to improve food security. Several studies emphasize the potential of home gardens in coping with labour constraints and enhancing the food and nutrition security in rural households with HIV and AIDS. Rural households with HIV and AIDS adopt various strategies to cope with food insufficiency and improve food security. In a situation of seasonal food shortages the already resource poor farm households with HIV and AIDS may face acute food insecurity; coping strategies adopted may lead to complete destitution state; a situation that is hypothesized as the "new variant famine".

To understand when and how interventions can best be made and promoted to reduce suffering in rural households with HIV and AIDS, it is vital to know and understand the magnitude of food insecurity these households experience during periods of peak seasonal food shortages. The objectives of this study were to explore how rural households with HIV and AIDS in Ghana employ home garden management strategies to enhance a number of important aspects of food and nutrition security. The study also examined the seasonal dimension of coping with food shortages through the documentation of the frequency and severity of the food-related coping behaviours adopted in rural households living with HIV and AIDS. To this effect, this study assesses the biodiversity in home gardens of rural households with HIV and AIDS in the Eastern Region of Ghana and evaluates its contribution to dietary diversity. It uncovers the effect of the interaction between household HIV status and gender of household head on biodiversity in home gardens; and explores the biodiversity in home gardens of rural households with HIV and AIDS when the primary aim in home garden cultivation is cash income generation. In addition the study evaluates the food insecurity of farm households with HIV and AIDS in the Eastern Region of Ghana during the post-harvest period and in the lean season through assessing the frequency and severity of the food-related coping behaviours adopted by the households in the two different periods.

Given the complexity of the processes that determine home garden management strategies and those which indicate the severity of coping strategies that households adopt in

response to peak seasonal food shortages, the research adopted a multi-methodology approach. The research was conducted in 17 rural communities in 12 districts in the Eastern Region of Ghana and the household was the unit of analysis.

A comparative in-depth study with a multidisciplinary approach that integrated social science, plant science and nutrition science studies was carried out to adequately answer the research questions. The methodology of the study was a mixed method approach using key informant interviews, focus group discussions, cross-sectional survey, direct observation and in-depth interviews conducted with HIV-positive and HIV-negative rural households during 2005/2006 in the Eastern Region of Ghana. A selection of specialized methods was used in the dietary research component and also in the assessment of the magnitude of food security experience by households in the study; a 24-h qualitative dietary recall and the coping strategy index were used to assess the severity of household food-related coping, respectively. Data on the biophysical aspects of the home garden was obtained through a home garden survey.

Chapter 4 assesses the biodiversity in home gardens and evaluates its contribution to dietary diversity among HIV-positive and HIV-negative rural households. HIV-positive households cultivated significantly smaller field areas and significantly higher numbers of adult household members contributed to crop cultivation in home gardens and to domestic livestock rearing compared with HIV-negative households. However, the cultivated home garden areas, the numbers of categories of plant species cultivated, species diversity in home gardens; and the kinds of domestic livestock reared in HIV-positive were not significantly different compared with HIV-negative households. Increasing labour input in home garden cultivation in a rural household with HIV and AIDS did not necessarily increase the species diversity in home gardens. Labour input in home garden cultivation and species diversity in home gardens in rural households with HIV and AIDS were not causally related.

HIV-positive households consumed a diet with a higher dietary diversity score (*DDS*) compared with HIV-negative households. The contribution of food items from the home garden to the *DDS* was significantly higher in HIV-positive than in HIV-negative households. A significant proportion of HIV-positive households consumed vitamin A-rich fruits which were not consumed by any HIV-negative household. A significantly larger proportion of HIV-positive households obtained the vitamin A-rich fruits and red palm products from the home garden compared with HIV-negative households.

The results of this study bring to light that when labour constraint reduces field

cultivation in rural households due to HIV and AIDS illness, labour input in home garden cultivation significantly increases; there is no significant change in plant species diversity but rather relatively more food items of the essential food groups are consumed from home gardens which contribute to a significantly higher dietary diversity.

Chapter 5 investigates the differences in biodiversity in home gardens and dietary diversity in female-headed and dual-headed HIV-positive and HIV-negative rural households to uncover the effect of the interaction between household HIV status and gender of the household head on biodiversity in home gardens. Plant species diversity in home gardens of HIV-positive female-headed rural households was significantly lower than in HIV-negative dual-headed households; but there was no significant difference with HIV-negative female-headed and HIV-positive dual-headed rural households. The number of crops species cultivated in home gardens of HIV-positive female-headed rural households was not significantly different from that of the other households. On the other hand, HIV-positive female-headed rural households cultivated significantly more annual crop species and more root and tuber crop species in home gardens compared with HIV-negative female-headed households, but there were no significant differences with dual-headed households. Annual crops cultivated in home gardens comprised vegetables, spices, fruit and root and tuber crop species such as cassava, cocoyam, yams and taro. However, there were no significant differences in the dietary diversity score between HIV-positive female-headed and other households.

This study revealed that when faced with confinement to the home in giving care and the obligation to ensure food and nutrition security of household members, female-headed households with HIV and AIDS cultivated significantly more annual crops and more root and tuber crops species in home gardens than in female-headed households without HIV and AIDS to provide sustenance and dietary diversity.

Chapter 6 empirically explores the differences and similarities in the biodiversity in subsistence-oriented and commerce-oriented home gardens of HIV-positive and HIV-negative rural households and the significance in household food security. Rural households aim to obtain food and non-food necessities from home gardens regardless of the primary aim in home garden cultivation and the household HIV-and AIDS status. The crop species recorded in the subsistence-oriented and commerce-oriented home gardens of both HIV-positive and HIV-negative rural households consisted of food crops and non-food crops. Seventy-three percent of the total of 75 cultivated crop species identified in the home gardens

consisted of vegetables, staples, fruits and spices, while 27% were medicinal plants and fodder plants. Home garden owners indicated that staples, vegetable crops, fruits trees, medicinal plants and fodder plants cultivated in the homestead were convenient and enhanced access to food, availability of medicinal plants to treat common ailments and fodder plants to feed domestic livestock. Even informants from HIV-positive households with commerce-oriented home gardens emphasized that their household members never went hungry despite the reduced field production because their home gardens served a dual purpose in providing food and cash income.

Agro-ecological conditions and cultural factors influenced crop species composition in home gardens regardless of the primary aim in home garden cultivation and household HIV and AIDS status. Comparison of the similarity in crop species composition between subsistence-oriented and commerce-oriented home gardens in both HIV-positive and HIV-negative rural households showed a moderately high Sørensen's index indicating a high similarity in species composition.

Empirical data revealed that available land and extra domestic labour enabled HIV-positive households to cultivate significantly larger commerce-oriented home gardens with higher species richness, but species diversity was not significantly different compared with subsistence-oriented home gardens. HIV-positive households cultivated significantly larger commerce-oriented home gardens, with significantly more species, more individual plants, more perennial food crop species and species that were harvested all year round than subsistence-oriented home gardens. There was no significant difference in species diversity between subsistence-oriented and commerce-oriented home gardens but evenness was lower in commerce-oriented than subsistence-oriented home gardens. On the contrary, there was no significant difference between subsistence-oriented and commerce-oriented home gardens of HIV-negative households in any of the parameters studied. Household HIV illness had no significant effect on the number of annual food crops species; non-food crop species; species richness; or the number of crop species harvested from the home garden in either the rainy or dry season only or in both seasons.

There was increased intensity of home garden cultivation with the cultivation of cash crops regardless of household HIV and AIDS status. Improved planting material was used significantly more often in commerce-oriented than in subsistence-oriented home gardens in both HIV-positive and HIV-negative households. Commerce-oriented home gardens of both HIV-positive and HIV-negative households and none of their subsistence home gardens

received chemical fertilizer application. However, though chemical pesticides and labour from outside the home were used in a relatively higher proportion of commerce-oriented home gardens in both HIV-positive and HIV-negative households these were not significantly different compared with the proportions of subsistence-oriented home gardens. Adults were hired for land clearing, making of mounds, weeding, planting, chemical fertilizer and pesticide application, harvesting of produce and establishing home garden fences in commerce-oriented home gardens. A significantly higher proportion of commerce-oriented home gardens of HIV-negative households were fenced to protect crops from destruction by domestic animals compared with subsistence home gardens but there were no significant differences between these home garden types with regard to HIV-positive households.

HIV-positive rural households engaged in full time farming owing to constraints due HIV and AIDS illness. Both HIV-positive households with either commerce-oriented or subsistence-oriented home garden were more likely to engage in full time farming compared with HIV-negative households with subsistence-oriented home garden. However, there was no significant difference in the field area cultivated by the different households. Informants from HIV-positive households indicated that farming was their main occupation due to lack of funds to take on non-farm income activities or time constraints owing to frequent bouts of illness or the need to take time off to care for the ill household member and HIV and AIDS related stigma. HIV-positive households that cultivated commerce-oriented home gardens cultivated a dual purpose home garden that supplied subsistence food and also provided cash income. Significantly larger proportion of HIV-positive households with a commerce-oriented home garden consumed a staple crop cultivated in the home garden in the 24-hr period prior to the survey than of HIV-positive households with a subsistence-oriented home garden. An HIV-positive household head with a commerce-oriented home garden emphasized that, although she did not grow a lot of field crops anymore because she could not work long hours in the field, her children never slept with hunger because she harvested plantain and cocoyam regularly from her garden for own consumption and the cash crops provided money for other food items not available in the home. Another indicated that it was very convenient to grow food and cash crops in his compound because it saved his household the problem of going to fetch food produce from the distant field on rainy days.

We can conclude from the findings of this study that rural households experiencing HIV illness in cultivating commerce-oriented home gardens adapt the crop species composition, crop diversity and management of home gardens to suit their specific needs.

They cultivate a dual purpose home garden that provides cash income and also supplies subsistence food. Rural households with commerce-oriented home gardens may have better food security than their counterparts with subsistence home gardens.

Chapter 7 evaluates the food insecurity of HIV-positive and HIV-negative farm households in the Eastern Region of Ghana during the post-harvest period and in the lean season by assessing the differences in the frequency and severity of the food related coping behaviours adopted by the households in the two periods.

The results showed that female headed households among the farm households with HIV and AIDS were likely to be more food insecure due to their higher dependency ratio in their households and their limited attainment in formal education and their limited access to resources in comparison to male headed farm households with HIV and AIDS.

Food insecurity was more severe in HIV-positive farm households in both the post-harvest and lean seasons. In the post-harvest season when food produce was relatively more available both HIV-positive and HIV-negative farm households adopted all five food-related coping behaviours to maintain food security. However, relatively higher proportions of HIV-positive farm households often relied on less preferred food; reduced portion size at meal times and purchased street food, purchased food on credit, or consumed fewer meals per day than HIV-negative farm households. In the lean season when food produce was relatively less available comparable proportions of HIV-positive and HIV-negative farm households often relied on less preferred food; reduced portion size and purchased street food; but relatively higher proportions of HIV-positive farm households purchased food on credit and consumed fewer meals per day than HIV-negative farm households. The more severe food related coping behaviours adopted by a relatively larger proportion of HIV-positive in comparison to HIV-negative farm households in both the post-harvest and lean season resulted in a higher coping strategies index for the HIV-positive farm households in both seasons.

Qualitative information indicated that in the post-harvest period the diet of HIV-positive farm households was monotonous and lacked variety compared with HIV-negative farm households. A relatively higher proportion of HIV-positive farm households often reduced the portion size of food compared with HIV-negative households in order for the limited food stock to last longer. Street foods were purchased during the day in a relatively higher proportion of HIV-positive compared with HIV-negative farm households because these foods were relatively cheaper and facilitated savings on time and fuel compared with home-prepared food. The possibility of obtaining credit was a major incentive for HIV-

positive farm households to purchase street food since cash was limited. Relatively higher proportions of HIV-positive farm households purchased essential food items such as fish, vegetable and staples on credit regularly due to inadequate source of a regular income. HIV-positive farm households purchased food items on credit only when some cash income was expected such as a remittance. Furthermore, relatively higher proportions of HIV-positive farm households often skipped breakfast in a day during the post-harvest period compared with HIV-negative farm households and ate two meals: at mid-morning and in the evening. In HIV-positive farm households the leftover food from the evening meal was saved for the next morning and so household members ate nothing when there was no food left from the previous evening meal.

In-depth study indicated that in the lean season both HIV-positive and HIV-negative farm households substituted into their diets easily available staples. The portion size of food was reduced in comparable proportions for HIV-positive and HIV-negative farm households since food harvest had dwindled and prices of farm produce were at their highest. All HIV-positive farm households and a higher proportion of HIV-negative farm households often consumed street foods in the lean season supposedly to provide a wide range of nutrients in the household diet at a cheaper cost. Essential food items such as vegetables, fish and staples were purchased on credit in relatively higher proportion of HIV-positive farm households. In addition, lunch was often skipped and food was eaten only twice daily by a relatively higher proportion of HIV-positive compared with HIV-negative farm households.

HIV-positive farm households had access to relatively limited food they produced themselves and engaged in relatively limited agricultural and non-agricultural sources of income compared to HIV-negative households during the post-harvest season of relative food abundance as well as in the lean season of food shortage. HIV-positive farm households cultivated smaller fields, harvested fewer staples and vegetable crop species from farms and home gardens than HIV-negative farm households during the post-harvest period and in the lean season. In-depth study revealed that HIV-positive farm households cultivated relatively smaller field areas, harvested only maize, cassava and pepper from their farms compared with HIV-negative farm households. Other major staples such as plantain, yam and cocoyam and vegetables such as eggplant and tomatoes were also harvested from the farms of a relatively higher proportion of HIV-negative than HIV-positive farm households. However, major staples were harvested from home gardens by relatively higher proportion of HIV-positive farm households than HIV-negative farm households.

A relatively smaller proportion of HIV-positive farm households obtained income from the sale of farm produce than HIV-negative farm households. Farm produce was sold in bulk immediately after harvest in HIV-positive farm households to provide cash to supplement food needs while HIV-negative farm households retailed farm produce from time to time in order to provide a regular source of income and also to benefit from increasing food prices. HIV-positive farm households were unable to take advantage of these opportunities to obtain maximum profit from farming since cash was urgently required to purchase additional food. None of the HIV-positive farm households sold home garden produce whereas a smaller proportion of HIV-negative farm households obtained income from the sale of home garden produce. Relatively larger proportions of HIV-positive farm households kept relatively fewer chickens, ducks and goats and obtained income from the sale of poultry and domestic livestock compared with HIV-negative farm households. Although prices of poultry and domestic livestock were very low in the post-harvest season; the sale of poultry provides HIV-positive farm households a reliable source of petty cash for additional food needs. Income obtained from the sale of domestic livestock in the post-harvest season enabled HIV-positive farm households to raise cash for food and occasionally also provided money to pay for medical expenses for the sick individual. There was little opportunity for agricultural-wage labour in both household groups in the post-harvest season; household members provided casual wage labour in the harvesting of fields, de-husking and shelling of farm produce for other farmers. While HIV-negative farm households demanded cash for such work that was done, HIV-positive households requested for payment in kind such as tubers of cassava and maize grain. Remittances were received from migrant relatives in a relatively higher proportion of HIV-positive than HIV-negative farm households to cater for household food. Petty trading in HIV-positive farm households involved selling food produce and other items of everyday use such as salt, soap and kerosene from the homestead which provided relatively meagre earnings. HIV-positive farm households emphasized that besides labour and time, financial constraints limit their engagement in relatively lucrative income activities. On the contrary, HIV-negative farm households took on small businesses outside the home that were relatively labour and time intensive but which fetched relatively higher earnings. HIV-positive farm households were limited to home based off-farm income activities probably due to labour constraint. The relatively smaller proportion of HIV-positive farm households which obtained income from non-agricultural wage labour engaged in menial jobs while HIV-negative farm households obtained income from non-agricultural

wage labour by providing services as a dressmaker, repairer of bicycles or household utensils. The limited sources of income and relatively less lucrative characteristics of the income activities taken on by HIV-positive farm households may have limited their ability to obtain cash income to purchase additional food in the post-harvest season. These could have contributed to more food insecurity in a relatively higher proportion of HIV-positive than HIV-negative farm households during the post-harvest period.

In the lean season major staples and some leafy vegetables were harvested from farms in addition by relatively higher proportions of HIV-negative than HIV-positive farm households. Most of the vegetable crop species had just been planted and were thus not available for either household consumption or for sale. It was equally rare for HIV-positive farm households to sell food produce from farms and for HIV-negative farm households to sell food produce from home gardens during this period when food stocks have diminished. However, HIV-positive farm households were compelled to sell bunches of plantain and tubers of cassava harvested from the home garden to provide money to purchase other essential food items such as fish and salt. A relatively smaller proportion of HIV-positive compared with HIV-negative farm households owned a greater numbers of chickens, ducks, sheep and goats and none of the HIV-positive households obtained income from the sale of chickens, goats or sheep while a relatively larger proportion of HIV-negative farm households obtain income from livestock. HIV-negative farm households emphasized that they took advantage of the prevailing high prices of domestic livestock in the lean season to earn a favourable income from domestic livestock rearing. However, in the current study HIV-positive farm households had sold off most of the poultry and domestic livestock owned in the post-harvest season to provide additional food. A relatively larger proportion of HIV-negative farm households obtained income from agricultural wage-labour while none of the HIV-positive farm households obtained this income. The demand for agricultural-wage labour was high in the lean season since farming activities were at their peak. A relatively larger proportion of HIV-negative farm households engaged in farm activities that required physical strength as agricultural-wage labour to supplement household income. HIV-positive farm households were unable to participate in these activities due to labour constraints. Remittances were an important source of income for households in both groups since available cash was relatively limited during this period. In HIV-positive farm households remittances facilitated the provision of food daily for household members since own food produce was exhausted and income generated from other sources is limited. On the other

hand, remittances enabled HIV-negative farm households to provide variety in household diet. None of the HIV-positive farm households engaged in petty trading due to labour and financial constraints whereas petty trading was the common source of income for the relatively larger proportion of HIV-negative farm households. HIV-negative farm households retailed various food and non-food items in local and district markets which brought in considerable earnings. Moreover, lack of artesian skills and labour constraints did not permit HIV-positive farm households to engage in any non-agricultural wage labour to supplement household income. The little labour available in HIV-positive farm households was allocated to the household's on-farm work and provision of care for the sick individual. On the contrary, a relatively larger proportion of the HIV-negative farm households continued to engage in the skilled wage labour work reported in the post-harvest season. The relatively fewer sources of income and income opportunities in HIV-positive farm households may have reduced their ability to provide for additional food needs in the lean season.

The consumption of cheaper, less nutritious and less meals in a day in relatively higher proportions of HIV-positive compared with HIV-negative farm households during the post-harvest period and the lean season might be attributed to the limited availability of own cultivated farm produce; limited sources of income and the relatively less lucrative characteristics of the income activities taken on by HIV-positive farm households to obtain cash income to purchase additional food during the post-harvest period and in the lean season due to household labour shortages. A relatively higher proportion of HIV-positive than HIV-negative farm households experienced more food insecurity in both the post-harvest period and the lean season. These characteristics might suggest that HIV-positive farm households experienced the "new variant famine".

To conclude these findings suggest that farm households with HIV and AIDS are more vulnerable to food insecurity in both the post-harvest period and in the lean seasons and that this vulnerability is also reflected in their poverty, family care burdens (larger number of dependents and ill persons), lower education level and meagre income earning opportunity.

This research is significant due to the persistently high prevalence of the HIV and AIDS epidemic in rural communities, the consequences of HIV and AIDS on household labour and food security and the important contribution of home gardens to household's food and nutritional security**.** In addition, this thesis identifies strategies that can respond to the labour and nutritional needs of vulnerable rural households living with HIV and AIDS. The findings of the study could be integrated into programmes and projects which put emphasis

on using labour-management technologies to eradicate food insecurity and improve nutrition which are key forces in combating AIDS-related diseases and health problems in the progression of HIV and AIDS.

Samenvatting

De effecten van verminderde beschikbaarheid van arbeid in plattelandshuishoudens met HIV en AIDS en de daaruit voortvloeiende afname van de landbouwproductie en mogelijkheden om inkomen te verwerven, en de gevolgen voor de zekerheid van voedsel en voeding zijn genoeglijk bekend. Onderzoekers stellen dat plattelandshuishoudens met HIV en AIDS bepaalde strategieën ontwikkelen om het verlies aan arbeid op te vangen en de voedselzekerheid te verbeteren. Verschillende studies wijzen op de mogelijkheden van moestuinen in het omgaan met tekort aan arbeid en in het verbeteren van de zekerheid van voedsel en voeding in huishoudens met HIV en AIDS op het platteland. De rurale huishoudens met HIV en AIDS ontwikkelen verschillende strategieën teneinde om te gaan met voedseltekort en de voedselzekerheid te vergroten. In een situatie van seizoensgebonden voedseltekorten kunnen de boerenhuishoudens die toch al arm zijn en ook nog getroffen worden door HIV/AIDS tegen acute voedselschaarste oplopen; hun strategieën om met deze situatie om te gaan kunnen zelfs leiden tot een staat van absolute verarming, een situatie die kan worden aangeduid als de "nieuwe variant hongersnood".

Om te begrijpen wanneer en hoe het best geïntervenieerd kan worden teneinde het lijden in plattelandshuishoudens met HIV en AIDS te verlichten, is het belangrijk om te weten en te begrijpen hoe groot de voedselonzekerheid is die deze huishoudens ervaren tijdens seizoensgebonden perioden van pieken in het voedseltekort. Deze studie stelde zich ten doel te onderzoeken hoe de huishoudens met HIV en AIDS op het platteland van Ghana het beheer van hun moestuinen aanpassen als onderdeel van een strategie om een aantal belangrijke aspecten van voedsel en voeding veilig te stellen. De studie onderzocht ook de seizoengebondenheid van het omgaan met voedseltekorten door de frequentie en de ernst van gedragsveranderingen vast te leggen die een weerspiegeling zijn van de voedselschaarste in rurale huishoudens die leven met HIV en AIDS. Om dit te realiseren, werd de biodiversiteit in de moestuin van plattelandshuishoudens met HIV en AIDS van de Oostelijke Regio van Ghana vastgesteld en werd de bijdrage ervan aan de diversiteit in het dieet bepaald. De studie toont de interactie aan tussen HIV-status van het huishouden en het geslacht van het gezinshoofd op de biodiversiteit in de moestuin, en verkent de biodiversiteit in de moestuinen van plattelandshuishoudens met HIV en AIDS als functie van de primaire doelstelling van het onderhouden van een moestuin. Daarnaast evalueert de studie de voedselonzekerheid voor boerenhuishoudens met HIV en AIDS in de Oostelijke Regio van Ghana tijdens de periode na

de oogst en in het seizoen van schaarste door de frequentie en de ernst te beoordelen van gedragsveranderingen gericht op het omgaan met voedseltekort zoals huishoudens die in deze twee verschillende perioden lieten zien.

Vanwege de complexiteit van de processen die de beheersstrategieën van moestuinen bepalen en die de ernst bepalen van de strategieën die huishoudens ontwikkelen in reactie op de grootste voedseltekorten tijdens het seizoen, werden er in het onderzoek verschillende methoden gebruikt. Het onderzoek werd uitgevoerd in 17 plattelandsgemeenschappen in 12 districten in de Oostelijke Regio van Ghana; het huishouden was daarbij de eenheid van analyse.

Er werd een diepgaande, vergelijkende studie met een multidisciplinaire aanpak uitgevoerd, waarin sociale wetenschappen, plantenwetenschapen en voedingswetenschappen werden geïntegreerd om een adequaat antwoord te vinden op de onderzoeksvragen. De studie omvatte een mix van benaderingen met daarin interviews met sleutelinformanten, discussies met focusgroepen, cross-sectioneel onderzoek, directe observatie en diepte-interviews met HIV-positieve en HIV-negatieve plattelandshuishoudens in de Oostelijke Regio van Ghana in de periode 2005/2006. Specifieke methoden werden gebruikt voor het dieetonderzoek en bij de beoordeling van de perceptie van de voedselzekerheid door de huishoudens; bij het onderzoek naar wat de mensen aten werd hen gevraagd op te sommen wat ze gedurende het laatste etmaal hadden gegeten. Om de ernst van de voedselproblematiek vast te stellen werd gewerkt met de zogenaamde coping index. De moestuinen werden middels een survey aan een biofysisch onderzoek onderworpen.

In Hoofdstuk 4 wordt de biodiversiteit van de moestuinen beoordeeld en wordt nagegaan in hoeverre deze bijdraagt aan de diversiteit in de voeding bij HIV-positieve en HIV-negatieve rurale huishoudens. HIV-positieve huishoudens beteelden een aanzienlijk kleiner akkerareaal en significant meer volwassen gezinsleden droegen bij aan de plantaardige productie in de moestuin en aan het houden van landbouwhuisdieren in vergelijking met HIV-negatieve huishoudens. Er werden evenwel geen significante verschillen tussen HIV-positieve en HIV-negatieve huishoudens gevonden voor de variabelen beteeld areaal in de moestuin, het aantal categorieën van geteelde plantensoorten, soortenrijkdom in de moestuinen, en de soorten landbouwhuisdieren. Het verhogen van de inzet van arbeid voor het onderhouden van de moestuin van een ruraal huishouden met HIV en AIDS leidde niet per se tot een verhoging van de soortenrijkdom in de moestuin. De inzet van arbeid voor het onderhouden van een moestuin en de soortendiversiteit van de

moestuinen in plattelandshuishoudens met HIV en AIDS vertoonden geen causaal verband.

HIV-positieve huishoudens consumeerden voeding met een hogere diversiteit dan de HIV-negatieve huishoudens. De bijdrage van voedingsmiddelen uit de moestuin aan de dieetdiversiteitsscore (*DDS*) was significant hoger bij HIV-positieve dan bij HIV-negatieve huishoudens. Een belangrijk deel van de HIV-positieve huishoudens consumeerde vitamine A-rijke vruchten die niet werden gegeten door HIV-negatieve huishoudens. Een aanzienlijk groter deel van de HIV-positieve huishoudens verkregen de vitamine A-rijke vruchten en rode palmproducten uit de moestuin dan het geval was bij de HIV-negatieve huishoudens.

De resultaten van deze studie brengen aan het licht dat wanneer een beperking in de arbeid leidt tot een kleiner akkerareaal in rurale huishoudens met HIV en AIDS, de inzet van arbeid in het onderhouden van de moestuin aanzienlijk toeneemt; er is geen significante verandering in de plantendiversiteit, maar er worden relatief meer voedingsmiddelen uit de essentiële voedselgroepen geconsumeerd die afkomstig zijn uit de moestuin. Dit draagt bij aan een significant grotere diversiteit in het dieet.

In Hoofdstuk 5 worden de verschillen onderzocht in biodiversiteit in de moestuin en in de diversiteit in het dieet tussen de huishoudens met een vrouw aan het hoofd en de huishoudens waar zowel een man als een vrouw aan het hoofd staan, zowel bij HIV-positieve als bij HIV-negatieve rurale huishoudens. Hiermee werd gepoogd het effect te ontdekken van de interactie tussen HIV-status van het huishouden en het geslacht van het gezinshoofd op de biodiversiteit in moestuinen. De diversiteit aan plantensoorten in moestuinen van HIV-positieve, rurale huishoudens met een vrouw aan het hoofd was significant lager dan bij HIV-negatieve huishoudens met zowel een man als een vrouw aan het hoofd (tweehoofdige huishoudens), maar er werd geen significant verschil gevonden met HIV-negatieve huishoudens met een vrouw aan het hoofd of met HIV-positieve rurale huishoudens met zowel een man als een vrouw aan het hoofd. Het aantal soorten gewassen die in de moestuin werden verbouwd, was voor de HIV-positieve, rurale huishoudens met een vrouw aan het hoofd niet significant verschillend van het aantal voor de andere typen huishoudens. HIV-positieve, rurale huishoudens met een vrouw aan het hoofd teelden evenwel beduidend meer soorten eenjarige gewassen en wortel- en knolgewassen in hun moestuinen dan HIV-negatieve huishoudens met een vrouw aan het hoofd, maar er waren geen significante verschillen met tweehoofdige huishoudens. Eenjarige gewassen, die in moestuinen geteeld werden, bestonden uit groenten, kruiden, fruit en wortel- en knolgewassen, zoals cassave, cocoyam, yams en taro. Er waren echter geen significante verschillen in de DDS-score tussen

HIV-positieve huishoudens met een vrouw aan het hoofd en de andere huishoudens.

Deze studie toonde aan dat, wanneer zij aan huis gekluisterd worden teneinde zorg te verlenen en de verplichting op zich te nemen om voedsel en voeding zeker te stellen voor de leden van het huishouden, de huishoudens met HIV en AIDS en een vrouw aan het hoofd aanzienlijk meer soorten eenjarige gewassen en meer soorten wortel- en knolgewassen in moestuinen teelden dan huishoudens met een vrouw aan het hoofd maar zonder HIV en AIDS.

In Hoofdstuk 6 werden op empirische wijze de verschillen en overeenkomsten in biodiversiteit onderzocht tussen huishoudens waarvan de moestuin op eigen voedselvoorziening was gericht en de huishoudens die tevens teelden voor de markt, zowel voor HIV-positieve als voor HIV-negatieve rurale huishoudens. Tevens werd de betekenis van de moestuinen voor de voedselzekerheid van de huishoudens onderzocht. Rurale huishoudens streven er naar in hun voedsel en andere behoeften te voorzien middels hun moestuinen, ongeacht het primaire doel van de moestuin en ongeacht de HIV en AIDS status van het huishouden. Voor zowel de moestuinen die voor de eigen voedselvoorziening bedoeld waren als voor de meer markt georiënteerde moestuinen gold dat de soorten gewassen die werden verbouwd door zowel HIV-positieve als HIV-negatieve rurale huishoudens bestonden uit voedselgewassen en non-food gewassen. Drieënzeventig procent van de in totaal 75 geteelde gewassoorten in de moestuinen bestond uit groenten, hoofdvoedselgewassen, fruit en kruiden, terwijl de overige 27% bestond uit geneeskrachtige planten en voedergewassen. Moestuineigenaren gaven aan dat hoofdvoedselgewassen, groenten, fruitbomen, geneeskrachtige planten en voedergewassen gekweekt op het erf gemakkelijk en beter toegang tot voedsel gaven, maar tegelijk ook medicinale planten beschikbaar maakten om algemeen voorkomende kwalen te bestrijden en voedergewassen gaven om het vee mee te voeren. Zelfs de informanten uit de HIV-positieve huishoudens die meer op de markt gerichte moestuinen onderhielden, benadrukten dat hun huisgenoten nooit honger hadden, ondanks de lagere opbrengsten van de akkers, omdat hun moestuin een tweeledig doel diende: het verstrekken van voedsel en een bron van contante inkomsten.

Agro-ecologische omstandigheden en teeltfactoren beïnvloedden de soorten-samenstelling van de moestuingewassen, ongeacht het primaire doel van de moestuin en ongeacht de HIV en AIDS status van de huishoudens. Vergelijking van de overeenkomsten in de soortensamenstelling van de gewassen tussen moestuinen gericht op voedselvoorziening en moestuinen die ook voor de markt produceerden in zowel de HIV-positieve als de HIV-

negatieve rurale huishoudens liet een tamelijk hoge Sørensen index zien, hetgeen er op wijst dat de soortensamenstelling vergelijkbaar was.

Uit empirische gegevens bleek dat het beschikbare land en de extra arbeid bij huis HIV-positieve huishoudens in staat stelden significant grotere marktgeoriënteerde moestuinen te bewerken met ook een grotere soortenrijkdom dan HIV-negatieve huishoudens, maar dat de soortenrijkdom niet significant verschillend was ten opzichte van moestuinen voor de eigen voedselvoorziening. HIV-positieve huishoudens onderhielden significant grotere marktgeoriënteerde moestuinen, met aanzienlijk meer soorten, meer individuele planten, meer meerjarige voedselgewassen en meer soorten die werden geoogst gedurende het hele jaar dan het geval was bij moestuinen die voor de eigen voedselvoorziening werden benut. Er was geen significant verschil in soortenrijkdom tussen de moestuinen voor de eigen voedselvoorziening en de marktgeoriënteerde moestuinen, maar de zogenaamde evenness was lager in de marktgeoriënteerde moestuinen dan in de moestuinen voor de eigen voedselvoorziening. Daarentegen was er voor geen van de onderzochte variabelen een significant verschil tussen moestuinen voor de eigen voedselvoorziening en marktgeoriënteerde moestuinen bij de HIV-negatieve huishoudens. De aanwezigheid van HIV in het huishouden had geen significant effect op het aantal eenjarige soorten voedselgewassen, soorten non-food gewassen, totale soortenrijkdom, of het aantal soorten gewassen geoogst uit de moestuin, hetzij alleen in het regenseizoen, hetzij alleen in het droge seizoen of in beide seizoenen.

Wanneer er marktgewassen werden geteeld, nam de intensiteit van de teelt op de moestuinen toe, ongeacht de HIV en AIDS status van de huishoudens. Verbeterd plantmateriaal werd significant vaker gebruikt in de marktgeoriënteerde moestuinen dan in de moestuinen die voor eigen voedselvoorziening werden bewerkt. Dat gold zowel voor de HIV-positieve als voor de HIV-negatieve huishoudens. Marktgeoriënteerde moestuinen van zowel HIV-positieve als HIV-negatieve huishoudens ontvingen kunstmest, maar dat gold voor geen van de moestuinen voor eigen voedselvoorziening. Hoewel chemische bestrijdingsmiddelen en arbeid van buiten het eigen huishouden werden ingezet in een relatief groter aandeel van de marktgeoriënteerde moestuinen van zowel HIV-positieve als HIV-negatieve huishoudens, waren deze aandelen niet significant verschillend van die voor de op eigen voedselproductie gerichte moestuinen. Volwassenen werden ingehuurd voor het schonen van het land, het maken van ruggen, wieden, planten, het toedienen van kunstmest en pesticiden, het oogsten van de producten en het aanleggen van omheiningen rond de marktgeoriënteerde moestuinen.

Een significant groter aandeel van de marktgeoriënteerde moestuinen van HIV-negatieve huishoudens werden omheind om de gewassen te beschermen tegen vernieling door huisdieren dan het geval was voor de moestuinen die er waren voor de eigen voedselvoorziening, maar er waren geen significante verschillen tussen deze typen moestuinen voor de HIV-positieve huishoudens.

Rurale, HIV-positieve huishoudens hielden zich full-time bezig met landbouw als gevolg van beperkingen opgelegd door de aanwezigheid van HIV en AIDS. Het was waarschijnlijker dat HIV-positieve huishoudens, hetzij die met een marktgeoriënteerde moestuin hetzij die met een moestuin voor de eigen voedselvoorziening, zich fulltime met landbouw bezighielden dan het geval was voor HIV-negatieve huishoudens met een moestuin voor eigen gebruik. Er was echter bij deze vergelijking net geen significant verschil tussen de verschillende huishoudens in het areaal dat ze akkerbouwmatig bewerkten. Informanten van HIV-positieve huishoudens gaven aan dat de landbouw hun hoofdberoep was als gevolg van gebrek aan financiële middelen om niet-agrarische activiteiten op te pakken waarmee ze geld konden verdienen of als gevolg van tijdgebrek vanwege frequente aanvallen van ziekte of de noodzaak om vrijaf te nemen om te zorgen voor het zieke lid van het huishouden, maar ook vanwege het stigma dat met HIV en AIDS gepaard gaat. HIV-positieve huishoudens, die marktgerichte moestuinen onderhielden, hadden in feite een moestuin met een tweeledig doel: voedsel voor eigen gebruik en producten voor de verkoop, zodat contant geld werd verdiend. Een aanzienlijk groter deel van de HIV-positieve huishoudens met een marktgeoriënteerde moestuin consumeerde een hoofdvoedselgewas geteeld in de moestuin gedurende de 24 uur voorafgaand aan het onderzoek dan het aandeel van HIV-positieve huishoudens met een moestuin die voor de eigen voedselproductie was. Een HIV-positief gezinshoofd met een marktgeoriënteerde moestuin benadrukte dat, hoewel ze minder akkerbouwgewassen was gaan telen omdat ze niet meer de lange uren kon werken in het veld, haar kinderen nooit met honger sliepen, omdat ze regelmatig voor eigen consumptie pisang en cocoyam oogstte uit haar moestuin en omdat de marktgewassen voor het geld zorgden om andere voedingsmiddelen te kopen die niet beschikbaar waren in het huishouden. Een ander gezinshoofd gaf aan dat het erg handig was om gewassen voor voedsel en contant geld te telen in zijn compound omdat dit zijn huishouden verloste van het probleem om op regenachtige dagen voedselproducten te gaan halen uit het verre veld.

Er kan uit de resultaten van deze studie worden geconcludeerd dat rurale huishoudens met HIV bij het telen van gewassen in marktgerichte moestuinen de soortensamenstelling van

de gewassen, de diversiteit van gewassen en het beheer van moestuinen aan hun specifieke behoeften aanpassen. Ze telen op hun moestuin gewassen met een tweeledig doel: ze telen gewassen voor het eigen levensonderhoud en ze telen gewassen die ze voor klinkende munt kunnen verkopen. Huishoudens op het platteland met marktgerichte moestuinen hebben wellicht een grotere voedselzekerheid dan de huishoudens met moestuinen uitsluitend voor eigen gebruik.

In Hoofdstuk 7 wordt de voedselonzekerheid van HIV-positieve en HIV-negatieve boerenhuishoudens in de Oostelijke Regio van Ghana tijdens de periode na de oogst en in het seizoen van schaarste geëvalueerd door de verschillen in frequentie en ernst van het voeding-gerelateerde aanpassingsgedrag van de huishoudens in deze twee periodes te beoordelen.

De resultaten toonden aan dat de boerenhuishoudens met een vrouw aan het hoofd waarin HIV en AIDS heerste waarschijnlijk meer voedselonzeker waren vanwege de hogere afhankelijkheidsratio in hun gezinnen en hun beperkte toegang tot formeel onderwijs en hun beperkte toegang tot hulpbronnen in vergelijking met de boerenhuishoudens waarin mannen aan het hoofd stonden en waar ook HIV en AIDS heerste.

Voedselonzekerheid was ernstiger bij HIV-positieve boerenhuishoudens in zowel het seizoen na de oogst als in het seizoen met schaarste. In het seizoen na de oogst, wanneer voedsel relatief in grotere mate beschikbaar was, ontwikkelden zowel de HIV-positieve als de HIV-negatieve boerenhuishoudens alle vijf vormen van aangepast gedrag die verband houden met het behouden van voedselzekerheid. Echter, relatief hogere aandelen van de HIV-positieve agrarische huishoudens deden vaak een beroep op voedsel dat minder hun voorkeur had, verminderden de grootte van de porties tijdens de maaltijden en kochten eten op straat, kochten voedsel op de pof, of gebruikten minder maaltijden per dag dan HIV-negatieve boerenhuishoudens. In het seizoen van schaarste, wanneer voedsel relatief minder rijkelijk beschikbaar was, deden vergelijkbare aandelen van HIV-positieve en HIV-negatieve boerenhuishoudens vaak beroep op voedsel waarvoor ze een geringere voorkeur hadden of verkleinden ze de portie-grootte en aten ze voedsel dat op straat gekocht was. Daarentegen kocht een relatief groter aandeel van de HIV-positieve boerenhuishoudens voedsel op krediet en gebruikten ze minder maaltijden per dag dan HIV-negatieve boerderij huishoudens. De gedragsveranderingen in reactie op voedseltekort waren extremer en werden aangetroffen bij een relatief groter aandeel van de HIV-positieve dan bij de HIV-negatieve boeren-huishoudens, zowel in de periode na de oogst als in het seizoen van schaarste. Derhalve was de zogenaamde coping strategies index in beide seizoenen hoger voor HIV-positieve

boerenhuishoudens.

Kwalitatieve informatie gaf aan dat in de periode na de oogst het dieet van de HIV-positieve boerenhuishoudens eentonig was en variatie miste in vergelijking met HIV-negatieve boerenhuishoudens. Een relatief groter deel van de HIV-positieve boeren-huishoudens verminderde vaak de portiegrootte van voedsel dan voor HIV-negatieve huishoudens het geval was, zodat de beperkte voedselvoorraad langer meeging. Straatvoedsel werd overdag gekocht in een relatief groter deel van de HIV-positieve dan van de HIV-negatieve boerenhuishoudens. Dergelijke voedingsmiddelen zijn immers relatief goedkoper en maken het mogelijk te besparen op tijd en brandstof in vergelijking met zelfbereid voedsel. De mogelijkheid om een lening te krijgen was een belangrijke stimulans voor HIV-positieve boerenhuishoudens om op straat eten te kopen, omdat contant geld beperkt was. Relatief grotere aandelen van de HIV-positieve boerenhuishoudens kochten regelmatig essentiële voedingsmiddelen zoals vis, groente en hoofdvoedselgewassen op krediet omdat ze onvoldoende konden beschikken over een regelmatige bron van inkomsten. HIV-positieve boerenhuishoudens kochten alleen voedsel op krediet wanneer ze uitzicht hadden op wat contant inkomen, bijvoorbeeld als een overmaking werd verwacht. Verder sloegen relatief grotere aandelen van HIV-positieve boerenhuishoudens vaak het ontbijt over gedurende de periode na de oogst dan het geval was voor HIV-negatieve boerenhuishoudens en at men vaker slechts twee maaltijden: halverwege de ochtend en 's avonds. Bij HIV-positieve boerenhuishoudens werd het overgebleven voedsel van de avondmaaltijd bewaard voor de volgende ochtend en dus aten de leden van het huishouden niets als er geen voedsel meer over was van de vorige avondmaaltijd.

Uit diepgaande studie bleek dat in het seizoen van schaarste zowel HIV-positieve en HIV-negatieve boerenhuishoudens in hun dieet gemakkelijk beschikbaar hoofdvoedsel opnamen. De portiegrootte tijdens de maaltijden werd in de zelfde mate verkleind in de HIV-positieve en de HIV-negatieve boerenhuishoudens, omdat de voedseloogst was geslonken en de prijzen van de agrarische producten op hun hoogst waren. Alle HIV-positieve boerenhuishoudens en een groter deel van de HIV-negatieve boerenhuishoudens consumeerden vaak straatvoedsel gedurende het seizoen van schaarste, vermoedelijk om zo een breed scala aan voedingsstoffen in het dieet van het huishouden te bieden tegen een lagere prijs. Essentiële voedingsmiddelen zoals groenten, vis en hoofdvoedsel werden op krediet gekocht in een relatief groter deel van de HIV-positieve boerenhuishoudens. Daarnaast werd de lunch vaak overgeslagen en werd er slechts twee keer per dag gegeten

door een relatief groter deel van de HIV-positieve dan van de HIV-negatieve boerenhuishoudens.

HIV-positieve boerenhuishoudens hadden toegang tot relatief weinig voedsel dat ze zelf produceerden en hielden zich in relatief geringe mate bezig met het verkrijgen van agrarische en niet-agrarische bronnen van inkomsten in vergelijking met HIV-negatieve huishoudens tijdens de periode na de oogst waarin het voedselaanbod relatief overvloedig was; hetzelfde gold voor het seizoen van voedselschaarste. HIV-positieve boerenhuishoudens teelden op een kleiner akkerareaal, oogsten kleinere aantallen hoofdvoedselgewassen en groentegewassen van hun velden en moestuinen dan HIV-negatieve boerenhuishoudens tijdens de periode na de oogst en in het seizoen van schaarste. Een diepgaande studie toonde aan dat HIV-positieve boerenhuishoudens een relatief kleiner landbouwareaal bewerkten dan HIV-negatieve boerenhuishoudens, en daarbij slechts maïs, cassave en peper oogstten van hun bedrijf. Andere belangrijke hoofdvoedselgewassen, zoals pisang, yam en cocoyam, en groenten zoals aubergine en tomaten werden eveneens geoogst van het eigen bedrijf, voor een relatief groter deel van de HIV-negatieve dan van de HIV-positieve boerenhuishoudens. Er werden echter belangrijke hoofdvoedselgewassen geoogst van de moestuin door een relatief groter deel van HIV-positieve boerenhuishoudens dan van HIV-negatieve boerenhuishoudens.

Een relatief kleiner deel van HIV-positieve agrarische huishoudens verwierven inkomsten uit de verkoop van landbouwproducten dan van HIV-negatieve boerenhuishoudens. Producten van de boerderij werd in bulk verkocht, onmiddellijk na de oogst bij de HIV-positieve boerenhuishoudens om met het geld aanvullend te kunnen voorzien in de voedselbehoeften, terwijl de HIV-negatieve boerenhuishoudens agrarische producten van tijd tot tijd verhandelden om zo een regelmatige bron van inkomsten te hebben en om ook te profiteren van stijgende voedselprijzen. HIV-positieve boerenhuishoudens waren niet in staat om te profiteren van deze mogelijkheden om maximale winst te verkrijgen uit het bedrijven van landbouw omdat contant geld dringend nodig was om extra voedsel te kopen. Geen van de HIV-positieve boerenhuishoudens verkocht producten uit de moestuin, terwijl een tamelijk klein deel van de HIV-negatieve boerenhuishoudens inkomsten behaalde uit de verkoop van producten uit de moestuin. Relatief grotere aandelen van HIV-positieve boerenhuishoudens hielden relatief minder kippen, eenden en geiten en verwierven inkomsten uit de verkoop van pluimvee en vee in vergelijking met HIV-negatieve boerenhuishoudens. Hoewel de prijzen van pluimvee en vee erg laag waren in het seizoen na

de oogst, bood de verkoop van pluimvee HIV-positieve boerenhuishoudens een betrouwbare bron van kleine hoeveelheden cash om extra voedsel te kopen. Inkomsten verkregen uit de verkoop van vee in het seizoen na de oogst maakte het voor HIV-positieve boerenhuishoudens mogelijk om geld te genereren voor voedsel en zo nu en dan ook wat geld te hebben om medische kosten te betalen voor de zieke. Er was weinig gelegenheid om in het seizoen na de oogst loonarbeid in de landbouw te verrichten voor beide groepen huishoudens; leden van de huishoudens waren beschikbaar voor losse arbeid in loondienst van andere boeren om te helpen met de oogst, of het schillen en pellen van landbouwproducten. Hoewel HIV-negatieve boerenhuishoudens geld verlangden voor dergelijk werk, vroegen HIV-positieve huishoudens om betaling in natura, zoals cassaveknollen of maïsgraan. Geld om voedsel te kopen kwam ook binnen via overschrijvingen van gemigreerde familieleden in een relatief groter deel van de HIV-positieve dan van de HIV-negatieve boerenhuishoudens. Kleinschalige handel vanaf het eigen erf in HIV-positieve landbouwhuishoudens betrof de verkoop van voedselproducten en van voorwerpen voor dagelijks gebruik, zoals zout, zeep en kerosine, maar dergelijke handel leverde betrekkelijk weinig op. HIV-positieve boerenhuishoudens benadrukten dat er naast arbeid en tijd, financiële beperkingen waren om in te stappen in relatief lucratieve inkomsten genererende activiteiten. Daarentegen gingen HIV-negatieve boerenhuishoudens kleinschalig buitenshuis zaken doen hetgeen niet alleen relatief arbeidsintensief en tijdrovend was, maar ook relatief hogere inkomsten opleverde. HIV-positieve boerenhuishoudens moesten zich beperken tot het aan huis gebonden verwerven van een neveninkomen, waarschijnlijk als gevolg van een tekort aan arbeid. Het relatief kleinere aandeel van HIV-positieve boerenhuishoudens die inkomsten verkregen uit niet-agrarische loonarbeid had baantjes als dienstmeid of knecht, terwijl de HIV-negatieve boerenhuishoudens inkomsten haalden uit niet-agrarische loonarbeid door het verlenen van diensten als naaister of hersteller van fietsen of huisraad. De beperkte bronnen van inkomsten en de relatief minder lucratieve aard van de inkomsten leverende activiteiten die HIV-positieve boerenhuishoudens op zich namen, kunnen hun vermogen hebben beperkt om contante inkomsten te krijgen om extra voedsel te kopen gedurende het seizoen na de oogst. Deze situatie zou kunnen hebben bijgedragen aan meer voedselonzekerheid in een relatief groter deel van de HIV-positieve dan van de HIV-negatieve boerenhuishoudens tijdens de periode na de oogst.

In het seizoen van schaarste werden belangrijke hoofdvoedselgewassen en sommige bladgroenten aanvullend geoogst van het land door een relatief hoger aandeel van HIV-

negatieve dan van HIV-positieve boerenhuishoudens. De meeste soorten groenten waren net geplant en waren dus niet beschikbaar voor eigen consumptie of voor de verkoop. In deze periode van afnemende voedselvoorraden, was het even zeldzaam voor HIV-positieve boerenhuishoudens om voedsel te verkopen dat op de boerderij was geproduceerd als het was voor HIV-negatieve boerenhuishoudens om eten te verkopen dat in hun moestuin was geproduceerd. De HIV-positieve boerenhuishoudens werden echter gedwongen om uit de moestuin geoogste trossen pisang en cassaveknollen te verkopen om geld beschikbaar te krijgen voor het kopen van andere essentiële voedingsmiddelen, zoals vis en zout. Een relatief kleiner deel van HIV-positieve dan van HIV-negatieve boerenhuishoudens bezat een relatief groot aantal kippen, eenden, schapen en geiten en geen van de HIV-positieve huishoudens haalde inkomsten uit de verkoop van kippen, geiten of schapen, terwijl een relatief groter deel van de HIV-negatieve boerenhuishoudens inkomsten verkreeg uit vee. HIV-negatieve boerenhuishoudens benadrukten dat zij gebruik maakten van de heersende hoge prijzen van vee in het schaarsteseizoen om goed geld te verdienen aan het fokken van landbouwhuisdieren. Echter, in de huidige studie hadden de HIV-positieve boeren-huishoudens het grootste deel van het pluimvee en vee dat ze bezaten verkocht tijdens het seizoen na de oogst om zich van extra voedsel te voorzien. Een relatief groter deel van HIV-negatieve boerenhuishoudens verkreeg inkomen uit loonarbeid in de landbouw, terwijl geen van de HIV-positieve boerenhuishoudens dit soort inkomsten verwierf. De vraag naar loonarbeid in de landbouw was hoog in het seizoen van schaarste omdat de landbouwactiviteiten op hun hoogtepunt waren. Een relatief groter deel van de HIV-negatieve boerenhuishoudens hielden zich bezig met fysieke kracht vergende landbouwactiviteiten in loondienst om het inkomen van het huishouden aan te vullen. HIV-positieve boerenhuishoudens waren niet in staat om deel te nemen aan deze activiteiten als gevolg van een tekort aan arbeid. Overboekingen van geld waren een belangrijke bron van inkomsten voor huishoudens in beide groepen, omdat in deze periode er slechts in beperkte mate contanten beschikbaar waren. Bij HIV-positieve boerenhuishoudens maakten dit soort overboekingen het makkelijker om het dagelijks voedsel voor de leden van het huishouden beschikbaar te hebben, omdat het zelf geproduceerde voedsel was uitgeput en inkomsten uit andere bronnen beperkt waren. Aan de andere kant maakten overboekingen het voor HIV-negatieve boerenhuishoudens mogelijk diversiteit te bieden in het dieet. Geen van de HIV-positieve boerenhuishoudens hielden zich bezig met kleinschalige handel vanwege beperkingen in de beschikbare arbeid en financiën terwijl de kleinschalige handel een

algemene bron van inkomsten was voor een relatief groter deel van de HIV-negatieve boeren-huishoudens. HIV-negatieve boerenhuishoudens verkochten verschillende voedselproducten en non-food artikelen op de lokale markten en op de districtmarkten, hetgeen een aanzienlijke bron van inkomsten was. Bovendien maakte het gebrek aan handwerkvaardigheid en arbeid het niet mogelijk dat HIV-positieve boerenhuishoudens deelnamen aan loonarbeid buiten de landbouw om het inkomen van het huishouden aan te vullen. De weinige arbeid die beschikbaar was in de HIV-positieve boerenhuishoudens werd besteed op het boerenbedrijf van het huishouden en aan het verlenen van zorg aan de zieke. Daarentegen bleef een relatief groter deel van de HIV-negatieve boerenhuishoudens deelnemen aan geschoolde loonarbeid in het seizoen na de oogst. Het relatief kleiner aantal bronnen van inkomsten en mogelijkheden om inkomsten te verwerven bij HIV-positieve boerenhuishoudens kan hun vermogen om te voorzien in extra voedsel nodig in het seizoen van schaarste hebben verminderd.

De consumptie van goedkoper, minder voedzaam voedsel en het minder frequent gebruiken van maaltijden op een dag bij een relatief hoger aandeel van HIV-positieve dan van HIV-negatieve boerenhuishoudens tijdens de periode na de oogst en gedurende het seizoen van schaarste zouden kunnen worden toegeschreven aan de beperkte beschikbaarheid van producten van de eigen boerderij, het beperkt aantal bronnen van inkomsten en de relatief minder lucratieve aard van inkomsten genererende activiteiten die door HIV-positieve boerenhuishoudens werden ontwikkeld om aan geld te komen teneinde extra voedsel te kunnen kopen tijdens de periode na de oogst en in het seizoen van schaarste als gevolg van tekorten aan arbeid binnen het huishouden. Een relatief groter deel van de HIV-positieve dan van de HIV-negatieve boerenhuishoudens had te maken met meer voedselonzekerheid gedurende zowel de periode na de oogst als tijdens het seizoen van schaarste. Deze kenmerken zouden kunnen suggereren dat HIV-positieve boerenhuishoudens de "nieuwe variant hongersnood" ervoeren.

Tenslotte suggereren de bevindingen dat boerenhuishoudens met HIV en AIDS kwetsbaarder zijn voor voedselonzekerheid in zowel de periode na de oogst als in het seizoen van schaarste en dat deze kwestbaarheid ook wordt weerspiegeld in hun armoede, de zorglasten in het gezin (groter aantal afhankelijke en zieke personen), een lagere opleiding en geringe kansen om een inkomen te verwerven.

Dit onderzoek is van belang vanwege de aanhoudend hoge prevalentie van de HIV en AIDS epidemie op het platteland, de gevolgen van HIV en AIDS voor arbeid op het niveau

van het huishouden en de voedselzekerheid, en vanwege de belangrijke bijdrage van moestuinen aan de zekerheid van voedsel en voeding van de huishoudens. Bovendien identificeert dit proefschrift strategieën die kunnen inspelen op de arbeids- en voedingsbehoeften van kwetsbare plattelandshuishoudens die leven met HIV en AIDS. De bevindingen van de studie zouden kunnen worden geïntegreerd in programma's en projecten die de nadruk te leggen op het gebruik van technologieën op het gebied van het beheer van arbeid teneinde voedselonzekerheid uit te roeien en voeding te verbeteren, de sleutels in de strijd tegen AIDS-gerelateerde ziekten en gezondheidsproblemen wanneer HIV en AIDS voortschrijden.

AWLAE

African Women Leaders in Agriculture and the Environment

The present thesis is one of a series. It represents the fruits of a collaboration between African Women Leaders in Agriculture and the Environment (AWLAE), Winrock International (WI), and Wageningen University and Research Centre (WUR). AWLAE is a pan-African program that aims at training women professionals in the fields of agriculture and environment, to redress the existing gap between male and female representation in professions relating to these fields. AWLAE was initiated by Winrock International in 1989. Its headquarters are in Nairobi, Kenya.

Between AWLAE, WI, and WUR a project was formulated that was submitted for funding to the Minister for Development Cooperation of the Netherlands Ministry of Foreign Affairs. The goal of the project was to build a cadre of well-trained African women professionals working in agriculture, environment and related sectors to enhance their academic standing and capacity to contribute to gender-relevant research and policy-making on the role of women in food systems and the gendered impacts of HIV/AIDS on food security and rural livelihoods in sub-Saharan Africa. In April 2002 the project was granted. The Ministry agreed to fund twenty PhD scholarships at Wageningen University and the additional leadership-in-change training for twenty women from eleven African countries, ranging from East to West and Southern Africa. In June 2002 an agreement was signed between AWLAE, represented by its Regional Director, and the Director of the WUR Social Sciences Group, after which implementation of the project could start. The participating scholars were carefully selected from a large number of applications. The scholarships were widely advertised in relevant media in countries with AWLAE chapters, and the chapters concerned were actively involved in the recruitment and selection of the candidates.

The following women participate(d) in the AWLAE scholarship project:

Susana Akrofi (Ghana)
Hirut Bekele (Ethiopia)
Mariame Maiga (Ivory Coast)
Lydia Ndirangu (Kenya)

Namizata Binaté Fofana (Ivory Coast)
Joyce Challe (Tanzania)
Fatimata Dia Sow (Senegal)
Stephanie Duku (Ghana)
Rose Fagbemissi (Benin)
Kidist Gebreselassi (Ethiopia)
Monica Karuhanga (Uganda)
Doris Kakuru (Uganda)
Aifa Fatimata Ndoye Niane (Senegal)
Faith Nguthi (Kenya)
Carolyne Nombo (Tanzania)
Regina Ntumngia Nchang (Cameroon)
Daisy Onyige (Nigeria)
Gaynor Paradza (Zimbabwe)
Corrie du Preez (South Africa)
Ekaete Udong (Nigeria)

Curriculum vitae

Susana Akrofi was born in Accra, Ghana, on 30th September, 1959. She studied at the University of Ghana, Legon from 1982-1986 obtaining a B.Sc. (Hons) degree in Crop Science. In 1988 she was employed as an Assistant Research Officer by the Council for Scientific and Industrial Research (CSIR) and was stationed at the Nyankpala Agricultural Experiment Station, now Savanna Agricultural Research Institute (SARI), Tamale, Ghana. From 1992-1993 she pursued a MPhil. degree with a scholarship from the German Academic Exchange Programme (DAAD) at the Imperial College Silwood Park, University of London, where she specialized in Plant Pathology. Since then she has been working as a Plant Pathologist with the CSIR-Plant Genetics Resources Research Institute (PGRRI) Bunso, Ghana.

In 2003 she was awarded the African Women Leaders in Agriculture and the Environment scholarship, a programme of the Winrock International in partnership with Wageningen University to a PhD study at the PE&RC Graduate School of Wageningen University. As a component of the award, she attended the Leadership for Change workshop in Nairobi, Kenya, from the 17th-22nd February 2003. The current PhD thesis presents studies carried out in Ghana to explore how rural households with HIV and AIDS employ home garden management strategies to enhance a number of important aspects of food and nutrition security and examines the seasonal dimension of coping with food shortages in farm households living with HIV and AIDS.

PE&RC PhD Education Certificate

With the educational activities listed below the PhD candidate has complied with the educational requirements set by the C.T. de Wit Graduate School for Production Ecology and Resource Conservation (PE&RC) which comprises of a minimum total of 32 ECTS (= 22 weeks of activities)

Review of literature (6 ECTS)

- Biodiversity and ecology (2003)
- Gender and biodiversity (2003)

Writing of project proposal (4.5 ECTS)

- Effect of HIV/AIDS affliction on management strategies in home gardens in southern Ghana with special reference to biodiversity (2003)

Post-graduate courses (17.5 ECTS)

- Ceres Summer School "Faces of poverty capabilities, mobilisation and institutional transformation"; Ceres Research School (2003)
- Livelihood analysis and poverty reduction strategies; CERES Research School (2003)
- HIV/AIDS and rural livelihoods in Sub-Saharan Africa; Mansholt Graduate School of Social Sciences (2003)
- Socio-cultural field research methods; Mansholt Graduate School of Social Sciences (2004)
- Gender, food, agriculture and development; Mansholt Graduate School of Social Sciences (2004)
- Food policy for developing countries: governance, institution and markets in global, national and local food systems; Mansholt Graduate School of Social Sciences (2007)

Deficiency, refresh, brush-up courses (12 ECTS)

- Rural gender studies (2004)
- Technology and ecology of crop production (2004)
- Capita Selecta Biosystematics (2005)

Competence strengthening / skills courses (7 ECTS)

- Field research methods; Institute of Social Studies (2003)
- Project and time management; DVL Academy (2004)

PE&RC Annual meetings, seminars and the PE&RC weekend (1.5 ECTS)

- Introduction weekend (2003)
- Annual meeting (2004 and 2005)

Discussion groups / local seminars / other scientific meetings (4.5 ECTS)

- Scientific meetings local seminars Bunso, Elmina, Kumasi, Accra (2003-2012)
- Gender group seminar (MGS) (2009)

International symposia, workshops and conferences (3.1 ECTS)

- INREF CoS Conference; Elmina, Ghana (2005)
- Presentation at TROPENTAG: Conference on Biophysical and socio-economic frame conditions for the sustainable management of natural resources; University of Hamburg, Hamburg, Germany (2009)