Tropentag 2008
University of Hohenheim, October 7-9, 2008
Conference on International Research on Food Security, Natural Resource Management and Rural Development

Interlinks between cash crops, food crops, food security and smallholder farming in Western Kenya: Disentangling the old rural development fashion?

Jumba Idalinya[a*], Siegfried Bauer[a], Ingrid-Ute Leonhäuser[b].
[a]Justus Liebig Universität Giessen; Institut für Betriebslehre der Agrar- und Ernährungswirtschaft
[b]Justus Liebig Universität Giessen; Institut für Ernährungswissenschaft

Abstract

With farm household data from Western Kenya, the major objective of the research was to examine the interlinks between cash crops, food crops, food security and smallholder farms in a region characterised by continuous decline and subdivision of farm size. The data comprising of two equal groups of both tea farmers and non-tea farmers from 2007 production year was analysed by Tobit and log linear models for participation in cash crop farming, food security and household income determination. According to the findings, households that engage in both on-farm and off-farm activities are less likely to experience food insecurity, compared to those engaging in only on-farm work. Such households are also likely to experience less intensity of food insecurity irrespective of the crop mix. Participation in cash crop farming is also likely to be undertaken by farm households also practicing off-farm work. Moreover, households engaging in both on-farm and off-farm activities achieve higher per area yields of the maize staple and/or the tea cash crop. In the same vein, declining farm size in Western Kenya has a strong correlation to intensifying food insecurity. As a policy recommendation, the research points out that the induced approach of considering agriculture as the engine and prerequisite for the transformation of rural economies on which other sectors should be systemically built needs urgent revisiting.

Introduction

The point of departure in discussing food in/security is the recognition that poverty and food insecurity are birds of the same feather. Indeed it is pointed out in the District Development Plan of Vihiga District, the focal point of this research, that "…the state of poverty is so severe in some of these areas that a meal is hard to come by." (GOK 2002).

Poverty is the state of a part of the population without the basic human needs stipulated according to the socio-economic development level and local habits of a country. According to UNESCAP (2007), two types of poverty lines are identifiable namely; (a) the high poverty line encompassing both food and non-food poverty and (b) the low poverty line entailing only food poverty. It is therefore clearly discernible that a household that is food poor is not preoccupied with aspects of poverty in the higher poverty line. Thus, the definition of food insecurity by the World Bank (1986) is still valid for this study as the " access by all people at all times to enough food for an active, healthy life. Its essential elements are the availability of food and the ability to acquire it. Food insecurity in turn is the lack of access to enough food." The validity of studying food insecurity is justified by the 800 million people who suffer globally from chronic hunger (FAO, 2008). Last decade the number in Africa increased from 168 million to 200 million with 194 million situated in Sub-Saharan Africa (SSA). In SSA the figure is expected to increase to 205 million in 2010 (FAO, 2008). The scenario is not different in Kenya where more than 50% of the population at the national level is food poor (GOK, 2002). In Western Kenya, 62% of the population lives in absolute poverty with about 60% languishing in food poverty (GOK 2002).

* Corresponding author. E-mail: Jumba.Idalinya@agrar.uni-giessen.de

Livelihood from agriculture caters for more than 75% of the population. Implicitly meager productivity translates into endangered entitlements and proneness to food insecurity. Consequently the rapid integration of a cash crop such as tea in the smallholder farming system amidst reducing land size is questionable especially due to the indispensability of smallholder vulnerability given world market price fluctuations (DREZE and SEN, 1989). Within five years from 2002 to 2006, the production of maize reduced from 23 300 ha (37 280 tonnes) to 20 700 ha (28 930 tonnes) whereas that of tea has increased from 1 840 ha (9 050 tonnes) to 2 349 ha (11 860 tonnes). The reaction of farmers to world cash crop prices is best exemplified by the hectarage of coffee in the District which has reduced from 1 204 ha to less than 100 ha in the last five years.

In contrast the area under cassava increased from 368 ha (423 tonnes) to 560 ha (7 280 tonnes) in the same period. Vihiga District (Area 563 Km^2) in Western Kenya is characterized by high population density of close to 1 200 persons per Km^2 with an average farm size of 0,6 ha per family. Additionally poor soil quality results in low production and productivity of cash and food crops (GOK 2002). Therefore the study offers answers to the following questions: (1) What is the role of cash crops in contributing to household income? (2) What factors influence the food security status of smallholder cash and staple crop farmers of Western Kenya? Based on these the major objective is to analyse the interlinks between food security and cash crop production on smallholder farms in Western Kenya. The Specific Objectives are to analyse the role of cash crops in contributing to household income; examine the role played by cash crops farming in contributing to food security and investigate as well as explain the existence or otherwise of a comparative advantages of tea crop vis-à-vis food crops.

Methodology

The study is based on primary data of 183 Smallholder farm households for 2006/2007 production season in Vihiga District of Western Kenya. The survey was carried out in two parts: preliminary field visit to Kenya from August 2006 to September 2006 and the second field visit from June 2007 to September 2007**.** Two random samples of 90 cash crop farmers (tea and maize) and 93 staple crop farmers (maize) were identified. Tea is the main cash crop grown in the District for nearly all farmers have gotten rid of their coffee plants and replaced them with the former. The farmers were clustered into four different groups depending on their marketing orientation with regard to farm produce. F1 refers to only cash crop sellers, F2 to cash and staple crop seller, F3 are growers of staple crop meant only for subsistence whereas F4 are staple crop growers for subsistence and for sell.

Gross Margin analysis was used in the juxtaposition of staple and cash crop farmers supported by a linear function for determining the contribution of the tea cash crop to household income. The log-linear equation was formulated thus:

$$In(Y) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \varepsilon$$

Where *ln(Y)* is the natural logarithm for total annual income, X_1 is age of household head, X_2 education level of household head, X_3 main occupation of household head, X_4 farm Size (acres), X_5 extension participation (dummy), X_6 dependency ratio, X_7 family labour (annual man days), X_8 hired labour (annual man days), X_9 tropical livestock unit, X_{10} cash crop index (ratio to total farm size), X_{11} food crop index (ratio to total farm size) while ε is the error term. Another centrepiece of the study is the Tobit food insecurity analysis with awareness of the various food in/security measurement methods. This study adopted the self-assessment method where farmers were able to gauge their own acceptable food security situation based on the societal practice of eating the equivalent of two meals of Ugali (maize bread) per day corresponding to a per capita consumption of 1025 Kcal per meal (MIGOTTO ET AL., 2005). The two meals together with breakfast of tea or maize/millet porridge correspond to the WHO recommended per capita Kcal per day. The Tobit model was censored at zero to give an above zero Tobit score for food insecure households portraying the intensity of food insecurity. The study suggests that the self assessment method offers insights of capturing food insecurity intensity especially with regard to its longevity during an annual period. Such an approach could prove profitable not only in the targeting of needy households during emergencies but also in the formulation of policy antidotes for long term food security.

The Tobit model took the following form:

$$Y = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} \ldots\ldots + \mu_i$$

Y is the index of food insecurity months per year, X_1 is age of household head (years); X_2 is dummy for gender of household head; X_3 is education level of household head; X_4 is size of farm (Acres); X_5 is number of household residents; X_6 is dummy for tea cultivation; X_7 is dummy for extension; X_8 is dummy for credit; X_9 is off-farm earnings; X_{10} is cash crop index; X_{11} is tropical livestock unit; X_{12} is distance to market (km) and μ is the error term .

Results

The mean age of the tea growing farmers was 59.94 years (F1 farmers) and 61.4 years (F2 farmer) indicating the relatively longer period required to invest and establish a mature tea plant (Table 1). Most of the tea farmers were either pensioners or in employment and nearing retirement age pointer to the role tea plays as a provider of livelihood security during old age. For the maize staple growing farmers, the mean age was 53.2 years (F3 farmers) and 52.9 years for (F4 farmers).

Table 1: Demographic, education and landholding characteristics of households (mean)

Type of Farm	*Age of household head*	*Education Level of head*	*Household Residents*	*Dependency ratio*	*Farm size (acres)*
F1 (N =33)	59.94 (17.59)	8.88 (4.88)	4.36 (2.55)	0.59 (0.31)	5.47 (2.91)
F2 (N = 57)	61.44 (15.16)	5.79 (4.30)	5.09 (2.31)	0.55 (0.28)	3.19 (2.14)
F3 (N = 57)	53.26 (15.16)	6.89 (3.94)	4.79 (2.29)	0.50 (0.29)	2.50 (1.41)
F4 (N = 36)	52.97 (15.68)	9.08 (4.19)	3.97 (2.49)	0.59 (0.33)	3.06 (1.75)
Total (N =183)	56.96 (16.08)	7.34 (4.46)	4.64 (2.40)	0.55 (0.30)	3.36 (2.27)
ANOVA (F)	3.75*	6.10**	1.84	0.92	15.41***

F1= Only cash crop seller; F2 = Cash & staple crop seller
F3= Staple grower only for subsistence farmer; F4 = Staple grower for subsistence and sell
**** denotes significance at 1%, ** at 5% and * at 10% Figures in parenthesis are Standard Deviations*

The mean education level in years was evenly spread among all the farming categories with 7.34 years. The tea growing farmer exhibited a fairly higher farm acreage of 5.47 acres (F1 farmers) and 3.19 acres (F2 farmers) while that of staple growers was 2.50 acres (F3 farmers) and 3.36 acres (F4 farmers). The relatively smaller size in acreage of the staple growers is a pointer to the propensity of farm size to diminish with decrease in age due to the farm inheritance factor that is coupled to land subdivision. The mean household member size was 7.3 for all categories of households while that of members residing in the household for most part of the year was 4.64 portraying a mean dependency ratio of 0.55.

Tea gross margin analysis

The farmer in Western Kenya is economically operating within certain constraints which are limited fertile land and labour and thus has to choose to grow certain crops and not others. Essentially, this enterprise choice revolves around growing either maize or tea. The enterprise choice is among others determined by output-output relationship, the ratio of output prices, opportunity cost and comparative advantage (UPTON 1996). A gross margin analysis is used here to compare the role of various variable costs of tea and maize farming in Western Kenya.

Due to the relatively larger mean farm size and the higher cash crop index among the F1 farmers, the gross margin for tea is arguably higher than that of F2 farmers (Table 2). There is also a higher return per unit

hired labour and per unit family labour for F1 farmers compared to F2 farmers. The tea gross margin per unit variable cost is nearly identical for both categories of farmers; 1.88 for F1 and 1.83 for F2 farmers for every shilling invested. This factor is quite decisive in tea farming but it should be considered together with farm size as the analysis seems to suggest that the gross margin per unit variable cost reduces with decreasing farm size. This is indicated in the ratio of cash crop to total farm size (cash crop index) of 0.41 for F1 and 0.43 for F2 farmers respectively.

Table 2: Tea Gross Margin 2006/2007 (KSH)

Type of farmer	*F1 (N = 33)*		*F2 (N = 57)*		*ANOVA*
Activity	Mean	STD	Mean	STD	F
Tea acreage	2.21	1.85	1.06	0.57	19.302***
GM Tea	47478.33	52045.08	20405.82	15597.09	13.439***
GM per Variable cost	1.88	0.77	1.83	1.46	0.031
GM per hired labour (KSH/MD)	187.16	62.80	177.82	56.86	0.497
GM per family labour (KSH/MD)	3236.87	1764.71	2779.44	1807.70	0.777

F1= Only cash crop seller F2 = Cash & staple crop seller
**** denotes significance at 1%, ** at 5% and * at 10%; Stand 2007: KSH 80 = 1 EURO*

Maize gross margin analysis

The cash crop farmers apportion a smaller piece of their land to maize and beans farming compared to staple crop growers at the ratio of 0.28 for F1 and 0.29 for F2 farmers. The staple growers allocate nearly half of their land to maize and beans farming; ratio of 0.47 and 0.46 for F3 and F4 farmers respectively. The higher maize and beans gross margin for F1 appears to be commensurate with the higher mean of farm size in contrast to F2 cash crop farmers and the staple F3 and F4 farmers (Tables 3 and 4).

Table 3: Maize gross margin for cash crop growers 2006 (KSH)

Farming system	*F1 (N = 33)*		*F2 (N = 57)*		*ANOVA*
Activity	Mean	STD	Mean	STD	F
Acreage	1.53	1.27	0.88	0.77	4.627**
GM Maize and Beans	8104.72	12692.35	5664.32	8204.32	3.214*
GM per variable capital	1.00	1.31	1.78	3.54	3.207*
GM per hired labour (KSH/MD)	129.57	166.83	166.25	300.50	2.439*
GM per Family Labour (MD/Acre)	2595.44	3292.96	2788.21	5717.11	4.236**

F1= Only cash crop seller F2 = Cash & staple crop seller
**** denotes significance at 1%, ** at 5% and * at 10%*

Nonetheless the F1 farmers have a higher mean variable cost investment in maize farming getting back one shilling for the same one shilling they invest while F2 farmers receive KSH 1.78. The gross margin per unit hired labour for F2 farmers is higher compared to the other three categories of farmers.The F3 farmers have a lower farm resource endowment and experience a negative gross margin when the return per unit hired labour is factored in the analysis. Such negative results of small farms are problematised in the current debate about the non-viability of small farms in SSA (ELLIS 2005). The gross margin per invested unit variable cost among the F3 and F4 staple growers is short 0.34 cents and 0.38 cents respectively indicating comparative advantage in beans and maize growing of the F1 and F2 farmers.

Table 4: Maize gross margin for staple oriented growers 2006 (KSH)

Farming system	*F3 (N = 57)*		*F4 (N = 36*		*ANOVA*
Activity	Mean	STD	Mean	STD	F
Acreage	1,10	0,61	1,37	0,93	4,627**
GM Maize and Beans	3129,27	3620,80	4019,24	5498,22	3,214*
GM per variable capital	0,66	1,17	0,62	0,81	3,207*
GM per hired labour (KSH/MD)	-60,33	735,82	56,07	88,25	2,439*
GM per Family Labour (KSH/MD)	553,87	912,18	776,97	1413,72	4,236**

F3= Staple grower only for subsistence; F4 = Staple grower for subsistence and sell;
**** denotes significance at 1%, ** at 5% and * at 10%*

Determinants of household income

From the foregoing analysis, it is apparent that tea plays an important role in household income. A closer econometric analysis is, however, warranted to closely look at the factors determining household income besides tea in order to specify tea farming's exact contribution. The so-called Mincerian log model was fruitfully used by McCULLOCH and OTA (2002) as well as AFARI-SEFA (2006) to study horticultural farming in East Africa and Ghana respectively. The same analysis is used in this current study to capture the various determinants of household income in Western Kenya. As indicated in Table 5 education plays a positively high significant role in influencing total household income. *Ceteris paribus* an additional year of education increases household income by a four percentage point. It is useful to read this variable together with the main occupation of the household head which also has a positive and significant sign. Under the same circumstances, higher education is associated with the likelihood of getting better off-farm employment, which is a direct source of household income. Surprising, however, is the negative sign though insignificant of farm size in influencing household income. This too should be interpreted together with the cash crop index which is positive but also insignificant.

Table 5: Determinants of household income

Variable	*Coefficients*	*Standard Error*	*T-Statistics*
(Constant)	7.5062***	0.4872	15.4076
Age of HH[1] head	0.0045	0.0060	0.7471
Education Level of HH head	0.0468**	0.0199	2.3550
Main Occupation of HH head	1.4005***	0.1553	9.0158
Farm Size (Acres)	-0.0177	0.0559	-0.3164
Extension Participation (Dummy)	0.6385***	0.1769	3.6093
Dependency ratio	0.2472	0.2739	0.9024
Family Labour (Man Days)	-0.0042	0.0040	-1.0571
Hired Labour (Man Days)	0.0017*	0.0009	1.8887
Tropical Livestock Unit	0.0954*	0.0490	1.9471
Cash crop index	0.1236	0.3396	0.3638
Food crop index	-0.8238*	0.4184	-1.9687

R Square = 0,54; Adjusted R Square = 0,51; N = 183;
F = 17,92; Probability >F= 0,000; Number of observations 183
**** denotes significance at 1%, ** at 5% and * at 10% ; [1] = Household head*

Large sizes of farms as indicated in the gross margin analysis are associated with older respondents (59.94 years), who in spite of partially comprising of farmers receiving pension, are not actively engaged in off-farm work, thus indicating the strength of the combination of both off-farm and on-

farm income in influencing total household income. On its own, off-farm income has a very highly significant influence on total household income.
Participation in extension is highly associated with input use and also a proxy for education. Extension, which essentially entails the provision of information, is part of the policy instruments of the interlocked package delivery to farmers the others being control of prices and input delivery. Granted, some extension services have proved successful such as the training and visit system (T&V), but most as in Kenya are supply-led and target specific farmers (ELLIS 1992). In our study, 70% of the farmers had met a member of the extension cadre in the previous one year the majority of whom were tea farmers. As seen from Table 5 extension has a positive and significant sign indicating, other things being equal, its potential to combine with other factors like inputs to improve household income by as much as 60% per year. The positive significance of extension is also a pointer to the incomplete market nature of the Western Kenyan agriculture environment where farmers must rely on the organisation of markets by others rather than themselves in order to safeguard their livelihood.
Hired labour as noted from gross margin analysis is an important variable in tea farming, hence its positive sign and significance in the linear model results. However, hired labour leads to decreasing margins with decreasing farm size for staple crop farmers.
Directly, livestock are a symbol of farmers wealth as well as a household bank. Lactating cattle are a source of milk hence income for the farmers and indeed seem to play a more positive significant role than tea as an influential factor on total household income. One TLU increase would *Ceteris paribus* improve the household income by 9%. On the contrary increasing the area under food crop, in a region of smaller infertile farm sizes like Western Kenya portrays a negative and significant sign where the econometric model predicts a more than 80% reduction in household income per unit acreage increment. However, this variable interpretation requires the recognition that most larger farms are associated with older generation who do not take part in off-farm employment and also the results in negative gross margin of maize and beans farming when hired labour is engaged by households. Also the scope of farm size increase per household is only hypothetical due to the high population density with very minimal alternative sources of employment limiting the scope of applying the Pareto criterion (JUST ET AL. 2004).

Food security analysis

The discussion about the factors influencing food security as is now apparent requires information about the factors determining household income. The dependent variable in the Tobit model is the index of food insecurity months per year. As in the income model, the Tobit results in Table 6 indicate the seemingly non-significant influence of the household head's age on the food security situation of the household. The gender of the household head, however, is positively significant at 10 degrees of freedom with the probability of a household being headed by a male decreasing the annual intensity of food insecurity by a third of a month annually. Taking into consideration the finding that 22% of the household heads respondents were female and mostly widows seems to suggest a gender dimension of food poverty occurrence in Western Kenya. This is irrespective of whether the farmers were cash crop or staple crop growers. Also the mean age of the female households heads at 67.5 years was higher compared to the 54.0 mean year of male household heads. This could be one of the factors hindering the engagement of female household heads in off-farm employment thus limiting their income that would be spent on purchasing household foodstuffs.
Indeed off-farm earnings play an important role in reducing household food insecurity. Higher education possibly translates into better chances of gaining salaried off-farm employment. Farm size on the other hand has a negative and expected sign and thus supports the result that the larger the farm size the higher the likelihood of household income increasing. This finding corresponds to the food security results in Ghana (AFARI SEFA 2006). However, the significance and marginal effect level of the role farm size plays in averting food insecurity in Western Kenya are far lower than those reported from Ghana. The large number of household residents is associated with more mouths that need feeding and its positive sign and significance are not unexpected.

Table 6: Tobit function of influencing factors on food insecurity intensity

Variable	*Coefficient*	*Standard error*	*Marginal effect*
Constant	0.508***	0.155	
Age of household head	-0.000	0.001	-0.000
Gender of household head (dummy 1 = Male)	-0.063*	0.034	-0.038
Education level of household head	-0.010**	0.004	-0.007
Size of farm	-0.016**	0.007	-0.010
Number of household residents	0.021***	0.006	0.013
Tea farming (dummy 1 = Tea farming)	0.137**	0.049	0.085
Extension (dummy 1 = Extension)	-0.060	0.040	-0.037
Credit (dummy 1 = Credit)	0.039	0.032	0.024
Off-farm earning	-0.019*	0.011	-0.012
Cash crop index (Cash crop ratio to total farm)	-0.094	0.071	-0.058
Tropical Livestock Unit	-0.019	0.013	-0.012
Distance to market	-0.008	0.008	-0.005
Sigma	0.161	0.012	
**** denotes significance at 1%, ** at 5% and * at 10%*			
Log-L = 147.1913			
Number of observations 183; Log likelihood function -6.880357			
Model test: F[12, 170] = 3.98, Probability value = .00002			

Surprising though was the finding about the frequency of households with youths above 18 years who some household heads intimated were neither contributors to household income, including on-farm labour provision nor attendees of any training institution. As one respondent put it, ”irrespective of the household age composition, if parents do not work it is problematic for the family to find food eat”.Though insignificant, the number of livestock kept by households also contribute to reducing food insecurity. Similarly the longer the distance to the nearest market the lower the intensity of food insecurity. This is connected to the size of farms where larger farm sizes are further away from the market centres. Access to credit on the other hand reveals an insignificant but positive sign indicating the detrimental effect of credit in a region suffering from food poverty. Credit appears to be an indication of poverty vulnerability rather than a source of capital for investment in productive on-farm activities.

Surprising though was the positive sign and high significance of the tea farming variable implying that tea farming worsens the food insecurity situation in the household. Apparently this outcome is not in tandem with the expectations from the household income where proxies of tea farming would have suggested a strong contribution of tea farming to reducing food insecurity. In the income analysis, the cash crop index has a significant contribution in improving household income but in the Tobit results the same cash crop index has an insignificant contribution in reducing food insecurity.

The questions that are not answered in the Tobit model results therefore are: How is household income expended and what is the impact of tea income on this expenditure? Why does the food security situation of the household worsen (one additional month of insecurity per year) when tea farming is factored in the analysis? The answer to these questions will be pursued in a forthcoming publication.

Conclusions

Cash crop farming generally has a significant contribution in increasing household income. However, cash crop farming seemingly does not significantly contribute to the reduction of household food insecurity intensity although food insecurity reduction is realised with increasing farm size. The explanation of this conflicting outcome requires further intra-household income expenditure analysis. However, the findings suggest that increasing level of education coupled with off-farm employment plays a significant role in reducing food insecurity. In the juxtaposition of the cash crop and staple food crop, the findings reveal a relatively superior gross margin per variable cost of tea farming with increasing farm size compared to the maize staple. In fact, maize farming exhibits a negative gross margin of hired labour with reducing farm size a pointer to the economic non-viability of the continuous small farm subdivision. Credit availability is not necessarily an antidote for food insecurity. Its consumption in this findings is a proxy for vulnerability. Lastly due to reduced farm size in Western Kenya the assumption that agriculture is the engine and prerequisite for the transformation of the rural economy needs urgent revisiting in terms of future research.

References

AFARI SEFA, V. ((2006) Agricultural Export Diversification, Food Security and Livelihood Linkages of Farmers in Southern Ghana: A Household Modelling Application Margraf: Publishers: Weikersheim.

DREZE, J. and SEN, A. (1989) Hunger and Public. Action. Oxford: Clarendon Press

ELLIS, F. (2005)Small-Farms, Livelihood Diversification and Rural-Urban Transitions: Strategic Issues in Sub-Saharan Africa Withersdane Conference Centre, Wye, Kent, UK

ELLIS, F. (1992) Agricultural Policies in Developing Countries. Cambridge: Cambridge University Press.

FAO (2008) http://www.fao.org/WAICENT/OIS/PRESS_NE/PRESSENG/2001/pren0156.htm

GOK (2007) Vihiga District Development Plan. Kenya Government Printer: Nairobi

JUST, R.E. HUETH D. L. AND SCHMITZ A. (2004) Welfare Economics of Public Policy: A Practical Approach to Project and Policy Evaluation. Edward Elgar Publishing: Northampton.

MIGOTTO, M., DAVIS, B., CARLETTO, G., AND BEEGL, K: (2005) Measuring Food Security Using Respondents' Perception of Food Consumption Adequacy Agricultural and Development Economics Division. The Food and Agriculture Organization of the United Nations. ESA Working Paper No. 05-10. Rome: Italy.

UNESCAP (2007) http://www.unescap.org/stat/meet/povstat/pov7_vnm.asp

UPTON, M. (1996) The Economics of Tropical Farming SystemsWye Studies in Agricultural and Rural Development. Cambridge University Press: Cambridge UK

WORLD BANK (1986). Poverty and hunger: issues and options for food security in developing countries: The International Bank for Reconstruction and Development: Washington DC: The World Bank