

MSU International Development Paper

Interactions between the Agricultural Sector
and the HIV/AIDS Pandemic: Implications for
Agricultural Policy

by

Thom S. Jayne, Marcela Villarreal, Prabhu Pingali, and
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MSU International
Development Paper No. 25
2004



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INTERACTIONS BETWEEN THE AGRICULTURAL SECTOR AND THE HIV/AIDS PANDEMIC: IMPLICATIONS FOR AGRICULTURAL POLICY

by

T. S. Jayne, Marcela Villarreal, Prabhu Pingali, and Günter Hemrich

May 2004

This paper is co-published by the Department of Agricultural Economics and the Department of Economics, Michigan State University (MSU), and by The Food and Agricultural Organization of the United Nations (ESA Working Paper #04-06, at www.fao.org/es/esa).

This report was initiated and funded by the FAO/Sustainable Development Department and the Agriculture and Development Economics Division, while much of the reported empirical analysis builds on research funded by the Food Security III Cooperative Agreement (GDG-A-00-000021-00) between Michigan State University and the United States Agency for International Development, through the Bureau for Economic Growth, Agriculture and Trade's Office of Agriculture and Food Security (EGAT/AFS) with supplemental funding from Africa Bureau's Office of Sustainable Development. The authors also draw from analysis supported by USAID/Kenya in collaboration with Tegemeo Institute/Egerton University.

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ISSN 0731-3438

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Published by the Department of Agricultural Economics and the Department of Economics,
Michigan State University, East Lansing, Michigan 48824-1039, U.S.A.

ACKNOWLEDGEMENTS

This study has benefited from the comments of Clare Bishop, Cynthia Donovan, Natasha Mesko, James Shaffer, John Staats, Michael Weber, and Kim Witte. The other authors acknowledge Marcela Villarreal's role in initiating this study.

EXECUTIVE SUMMARY

This paper considers how the design of agricultural policies and programmes might be modified to better achieve policy objectives in the context of severe HIV epidemics and underscores the central role of agricultural policy in mitigating the spread and impacts of the epidemic. Based on projections of future demographic change in the hardest-hit countries of eastern and southern Africa, HIV/AIDS is likely to have the following effects on the agricultural sector: (1) increased rural inequality caused by disproportionately severe effects of AIDS on relatively poor households; (2) a reduction in household assets and wealth, leading to less capital-intensive cropping systems for severely affected communities and households; and (3) problems in transferring knowledge of crop husbandry and marketing to the succeeding generation of African farmers. It is argued that -- even though the absolute number of working age adults in the hardest-hit countries is projected to remain roughly the same over the next two decades -- the cost of labour in agriculture may rise in some areas as increasing scarcity of capital (notably, animal draft power for land preparation and weeding) will increase the demand for labour in agricultural production or shift agricultural systems to less labour- and capital-intensive crops.

The paper suggests that the most effective means for agricultural policy to respond to HIV/AIDS will entail focusing on: (1) investing in agricultural research to generate improved technologies capable of raising the productivity of crop and livestock systems; (2) rehabilitating agricultural extension services; (3) instituting crop and input marketing systems that contribute to small scale farmers productivity and food security. Finally, the paper provides some elements of a framework for governments and donors to assess and potentially modify existing agricultural programmes, policies, and investment strategies for achieving their agricultural and rural development objectives after factoring in the impacts of HIV/AIDS on the rural socio-economy.

Key Words: agricultural policy; HIV/AIDS; structural transformation; production factors.

JEL: Q18 - Agricultural Policy; Food Policy; J43 - Agricultural Labour Markets; O12 - Microeconomic Analyses of Economic Development.

The authors have drawn from many sources in preparing this report, including the research conducted under the Food Security III Cooperative Agreement, funded by USAID; and the Tegemeo Agricultural Monitoring and Policy Analysis Project, funded by USAID/Kenya. This draft has benefited from the comments of Cynthia Donovan, James Shaffer, John Staatz, and Michael Weber. The comments of Clare Bishop and Natasha Mesko, FAO, on an earlier draft are also gratefully acknowledged.

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CONTENTS

ACKNOWLEDGEMENTS	iii
EXECUTIVE SUMMARY	v
LIST OF TABLES	viii
LIST OF FIGURES.....	viii
1. BACKGROUND.....	1
1.1. Scope of the Paper.....	1
1.2. Multiple Objectives of Agricultural Policy.....	2
1.3. Effects of AIDS on Future Demographic Changes.....	2
2. THE EFFECTS OF HIV/AIDS ON AGRICULTURE AND RURAL LIVELIHOODS: CURRENT UNDERSTANDING	7
2.1. Incorporating HIV/AIDS into Structural Transformation Models.....	7
2.2. Potential Changes in Labour Markets Due to AIDS	8
2.3. Impacts of AIDS on the Use of Capital in Agriculture	9
2.4. Empirical Studies: Effects of Adult Mortality on Agriculture	9
2.4.1. Effects on Agricultural Production and Productivity.....	10
2.4.2. Effects on Crop Cultivation and Production Systems.....	11
2.4.3. Effects on Land Distribution.....	14
2.5. Anticipated Impact of AIDS on Shifts in Agricultural Technologies.....	15
2.5.1. Factors Rendering Agricultural Systems Vulnerable to the Effects of HIV/AIDS.....	18
2.6. Summary	20
3. POTENTIAL IMPLICATIONS OF HIV/AIDS FOR AGRICULTURAL POLICY.....	22
3.1. Elements of a Framework for Assessing the Potential of Agricultural/Rural Development Policies and Programmes to Contribute to AIDS-related Goals	23
3.2. Potential Sectoral Recommendations for Consideration in Light of AIDS	28
3.2.1. Policies and Programmes Affecting Factor Use and Input Markets	29
3.2.2. Policies and Programmes Affecting Agricultural Research and Extension Systems.....	30
3.2.3. Policies and Programmes Affecting Commodity Marketing Systems.....	32
3.2.4. Policies and Programmes Affecting Gender-differentiated Allocation of Resources	32
4. CONCLUSIONS.....	34
REFERENCES.....	37

LIST OF TABLES

<u>Table</u>	<u>Page</u>
1. Comparison of Total Population Size for the Seven Hardest-hit Countries, 2000 vs. 2025	5
2. Smallholder Land Distribution in Selected African Countries	16
3. Conjectured Impacts of AIDS on Use and Cost of Factors of Production in Agriculture	21
4. Elements of a Framework for Factoring in the Effects of HIV/AIDS in the Review of Agricultural Programmes and Policies	26

LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
1a. Population in the Medium Variant (“with AIDS”) and in the No-AIDS Scenario (“without AIDS”), By Sex and Age Group, 7 Most Highly Affected Countries, 2000	3
1b. Projected Population in the Medium Variant (“with AIDS”) and in the No-AIDS Scenario (“without AIDS”), By Sex and Age Group, 7 Most Highly Affected Countries, 2025	4
2. Changes in Percentage Area Distribution among Maize and Competing Major Crops, Malawi 1982-2000	12
3a. Production Value of Maize and Major Substitute Crops, 1992/93-1997/98, Northern Province, Zambia	12
3b. Production Value of Maize and Major Substitute Crops, 1992/93-1997/98, Luapula Province, Zambia	13
4. Concept of Factor Substitutability in Crop Production.....	18
5. Percentage Change in Land Cultivated, Selected Cash and Food Crops, Selected Sites in Uganda, 1996-2002	22
6. Zambia: Household Membership in Cooperative	23

1. BACKGROUND

This paper is intended to respond to the need to better understand the implications of the AIDS pandemic for government ministries responsible for agricultural and rural development in eastern and southern Africa. There is now widespread recognition that HIV/AIDS is not simply a health issue. A coordinated approach will be necessary to effectively combat the epidemic and its consequences, one that cuts across many sectors of the economy and many government ministries. While many in the agricultural sector embrace the idea of playing a role to combat HIV/AIDS, there has been very little analysis by agricultural policy analysts to guide them. Moreover, despite the fact that the pandemic is now in its third decade in Africa, available analysis to date provides a very murky picture as to how HIV/AIDS is affecting the agricultural sector – its structure, cropping systems, relative costs of inputs and factors of production, technological and institutional changes, and levels of production and marketed surplus. Until these issues are clarified, policy makers will be inadequately prepared to forecast anticipated changes to the agricultural sector and respond proactively. For reasons presented later in the paper, anticipation of future impacts and proactive policy responses are likely to make a critical difference in averting future crises and chronic poverty among the countries hardest-hit by HIV/AIDS.

1.1. Scope of the Paper

The paper was prepared as a background document for an International Workshop on Agricultural Policy and HIV/AIDS: Addressing the Linkages, organised by FAO's Gender and Population and Agricultural and Development Economics Divisions in Maputo, Mozambique, in November 2003. In Section 2, it reviews the empirical evidence concerning the effects of AIDS on the agricultural and rural sectors, with a focus on those factors that influence agricultural production, such as land, labour, capital, and technology and discusses potential policy implications. Its geographic focus is placed on the hard-hit countries of eastern and southern Africa, where HIV prevalence rates among the general population exceed 10 percent.¹ It concludes that the AIDS epidemic will have such fundamental effects on agriculture and rural livelihoods in the next several decades among the seven to ten hardest-hit countries of eastern and southern Africa that some rural development strategies previously considered uneconomic or inappropriate for other reasons may deserve serious reconsideration.

Section 3 presents some elements of a framework for governments and donors to assess and potentially modify existing agricultural programmes, policies, and investment strategies for achieving their agricultural and rural development objectives after factoring in the likely impacts of HIV/AIDS on the rural socio-economy. In addition, some broad steps for mainstreaming HIV/AIDS concerns into agricultural policy and programming are outlined.

¹ Seven countries in the eastern and southern Africa region have an estimated (15-49 year) HIV prevalence exceeding 20 percent: Botswana, Lesotho, Namibia, South Africa, Swaziland, Zambia, and Zimbabwe (U.S. Census Bureau 2003). Five other countries, Cameroon, Central African Republic, Kenya, Malawi, and Mozambique, have HIV prevalence rates exceeding 10 percent. For shorthand, we hereafter refer to these countries as the "hardest hit" countries.

The chapter closes with illustrative practical examples of how HIV/AIDS could be integrated into specific agricultural policy considerations.

It is important to note that the paper does not attempt to cover all aspects relevant to mainstreaming HIV/AIDS concerns into agricultural and food security policy. Particularly measures for ensuring food access of both urban and rural population groups, such as safety nets and social protection, including linkages between food aid and agricultural policy are not discussed in detail as these are dealt with elsewhere in the literature². Similarly, while some impacts of HIV/AIDS on institutions at meso-level and macro-level are highlighted, the focus of the paper is placed on those policy implications which can be drawn directly from the analysis of AIDS' impact on factors of production.

1.2. Multiple Objectives of Agricultural Policy

Agricultural policy has always been designed to meet a number of objectives. In eastern and southern Africa, for example, agricultural policy for the past several decades has been aimed at raising incomes for smallholder farmers, producing enough basic foodstuffs to meet national consumption requirements, placating politically important interest groups, raising foreign currency through cash crop exports, and reducing the cost of delivering basic food items to consumers' tables in order to enhance household food security, all within the budget constraints imposed by scarce treasury resources (e.g., Government of Uganda 1998; Government of Kenya 2002; Government of Mozambique 2001; Government of Zambia 2001; Bates 1981; Jayne and Jones 1997).

The onset of the AIDS pandemic has added yet another dimension to agricultural policy. It is widely accepted that HIV/AIDS will affect many aspects of the rural economy in the hardest-hit countries of Africa, although the particular pathways, impacts, and magnitudes remain unclear and continue to be debated. The challenge for analysts, agricultural policy makers, and donors is to understand with greater precision how the rural socio-economy is being affected by the disease, and consequently how agricultural and rural development policy should be modified to better achieve national agricultural sector objectives.

1.3. Effects of AIDS on Future Demographic Changes

In most of eastern and southern Africa, where HIV prevalence rates generally exceed 10 percent, there will be many fewer adults in the coming decades compared to a "no-AIDS" scenario (U.S. Census Bureau 2003).³ By the year 2010, five countries in the region will be

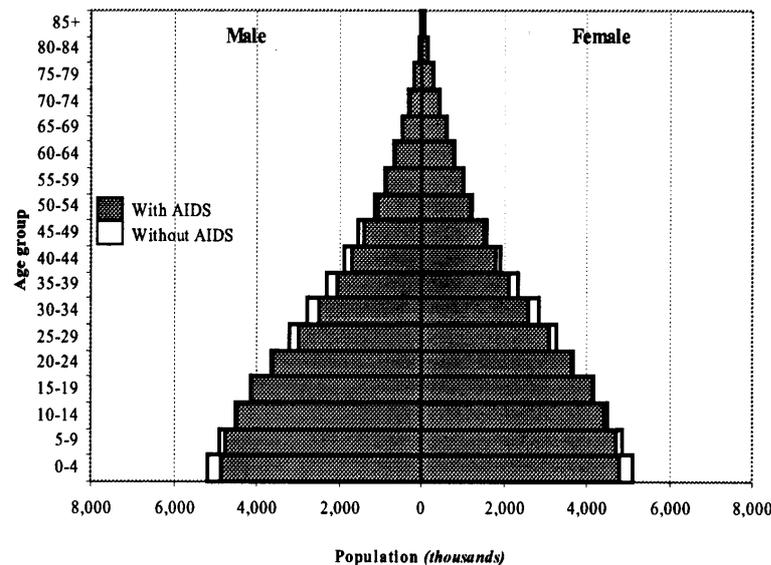
² See for example: Holzman, Robert and Steen Jørgensen (2000): Social Risk Management: A new conceptual framework for social protection, and beyond. Social Protection Paper No. 6, The World Bank; Botswana Institute for Development Policy Analysis (2000): Impact of HIV/AIDS on Poverty and Income Inequality in Botswana; Kaddiyala, Suneetha and Stuart Gillespie (2003): Rethinking Food Aid to Fight AIDS; WFP (2002): Food Security, Food Aid and HIV/AIDS: A Five Country Case Study. Internal Draft Report prepared by Tango International.

³ While it is not our goal here to explain why HIV prevalence rates are so high in these countries compared to elsewhere in Africa, we note that these countries share unique structural features of their economies that exacerbated the spread of the disease. Migration, mostly by men, from their rural farms to urban areas, mines, and commercial farms for employment has been a fundamental economic and social feature of most of these

experiencing negative population growth rates: Botswana (-2.1 percent per year), Mozambique (-0.2 percent), Lesotho (-0.2 percent), Swaziland (-0.4 percent), and South Africa (-1.4 percent) (U.S. Census Bureau, as reported in Way 2003, p. 5). By 2020, AIDS mortality will produce population pyramids in these countries never been seen before (Figure 1).

By 2025, summing across the seven countries where HIV prevalence exceeds 20 percent, there will be roughly 20 million men in the working age years between 20 and 59 years as opposed to 31.5 million if AIDS had not existed. By contrast, there will be only 18 million women in the 20 to 59 year age range as opposed to 32 million in the “no-AIDS” case. And because of the early death of so many adults of reproductive age, there will also be many fewer children born, also indicated in Figure 1. Population pyramids in 5-6 other countries will have similar shapes, though less extreme than those shown in Figure 1.⁴

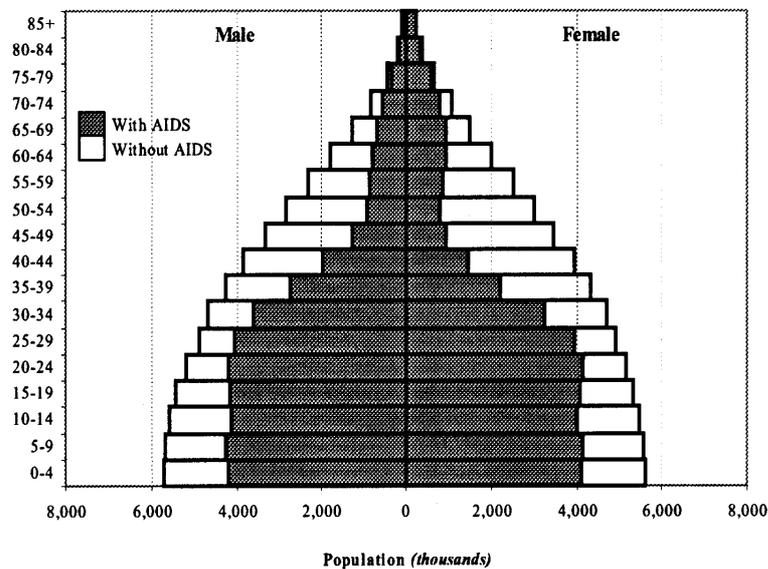
Figure 1a. Population in the Medium Variant (“with AIDS”) and in the No-AIDS Scenario (“without AIDS”), By Sex and Age Group, 7 Most Highly Affected Countries, 2000



countries. The separation of husband and wife, coupled with the concentration of men in housing complexes for long periods of time gave rise to social and sexual risk behavioral responses that have contributed to a much more rapid spread of the disease in these countries than elsewhere (Epstein 2003). See also Chin (2003) for related epidemiological-based explanations of regional differences in the spread of the disease.

⁴ This assumes that current projections by UNAIDS and U.S. Census Bureau are correct. Bennell (2003) argues that in some cases, official HIV prevalence is probably overstated and that advocacy is getting in the way of objective assessments.

Figure 1b. Projected Population in the Medium Variant (“with AIDS”) and in the No-AIDS Scenario (“without AIDS”), By Sex and Age Group, 7 Most Highly Affected Countries, 2025



Source: U.S. Census Bureau 2003

However, it is also important to compare future projected population to current population. Notwithstanding the catastrophic death toll that is projected to occur over time in these countries, the absolute numbers of adults projected to be alive in 2025 is roughly similar to what it is today. This is because the momentum of population growth would have produced much greater population sizes in the coming decades. While AIDS is projected to erode population growth to roughly zero in the seven hardest-hit countries, the net result is a roughly stable number of working age adults over time. Table 1 presents population figures in 2000 for selected age/sex categories and compares this to projected population estimates in 2025.

Table 1. Comparison of Total Population Size for the Seven Hardest-hit Countries,* 2000 vs. 2025

Sex/age categories		2000	2025	2025
		estimated	forecasted “no-AIDS” scenario	forecasted “with AIDS”
		----- Projected Population (millions) -----		
Males	< 20 years	18.6	22.9	16.8
	20-59 years	17.5	32.1	18.6
	> 59 years	2.1	4.7	3.2
Females	< 20 years	18.9	23.0	16.4
	20-59 years	17.7	32.6	17.8
	> 59 years	2.3	5.4	3.5

* Botswana, Lesotho, Namibia, South Africa, Swaziland, Zambia, and Zimbabwe
Source: U.S. Census Bureau 2003

According to these demographic projections, there will be a slight increase in the number of men between 20 and 59 years of age between 2000 and 2025, and virtually no change in the number of women. The projections indicate a decline in the number of males and females below 20 years of age by 2025. Because AIDS will particularly influence the number of people under 20, both through the impact of increased child mortality and fewer adults living long enough to have children, dependency ratios may actually become slightly more favourable over time.

These projections are consistent with those of the United Nations (2003). According to its projections, countries with HIV prevalence above 20 percent will register annual population growth rates of roughly +0.2 percent between 2000 and 2025. Countries with HIV prevalence between 10 and 20 percent (Cameroon, Central African Republic, Kenya, Malawi, and Mozambique) will have population growth rates of +1.33 percent per year.

However, not reflected in these figures are the losses of labour availability due to poor health prior to death, care-giving for those afflicted with the disease, and mourning periods after a death. Moreover, it is quite different to achieve stability in population sizes due to avoiding unwanted births by curbing fertility, than through the loss of adults. Curbing population growth through the death of adults creates myriad social disruptions, for example through the long-term difficulties faced by children of deceased parents (e.g., Gertler, Levine, and Martinez 2003; Yamano and Jayne 2003). People who survive into adulthood in poor food scarce societies, have already received substantial social investments (education, skills, food production). Their death translates into a loss to society of existing knowledge and skills as well as the transfer of knowledge to succeeding generations.

Overall, the picture that emerges is that the domestic labour force is unlikely to grow in the hardest-hit countries over the next several decades, but it will not shrink either. The quality of the labour force is likely to be adversely affected by AIDS. In the event that labour shortages do arise, it may be envisioned that migration outflows may increase in areas where

HIV prevalence is relatively low and where population pressures are already intense (parts of east Africa such as Burundi and Rwanda).

Future mortality rates in these countries are driven by current HIV prevalence rates. Thus there may be limits to what can be done to alter mortality rates from AIDS in the near future. But over the longer run, adult mortality and the shape of population pyramids can be influenced by policy and other initiatives, such as new treatments and success in behaviour change. This is likely to offer the most effective approach to addressing many of the looming problems facing the agricultural sector in the long run (15-20 years and greater).

2. THE EFFECTS OF HIV/AIDS ON AGRICULTURE AND RURAL LIVELIHOODS: CURRENT UNDERSTANDING

2.1. Incorporating HIV/AIDS into Structural Transformation Models

For four decades since the pioneering work of Bruce Johnston and John Mellor (1961), the foundation of rural development paradigms has been the structural transformation process. Every major country that has achieved substantial growth in real incomes over a long-term period has done so through a *structural transformation* of its economy involving:

- A process by which increasing proportions of employment and output of the economy are accounted for by sectors other than agriculture. The economy becomes less agriculturally oriented in a *relative* sense, although agriculture and, more broadly, the food system continue to grow absolutely and generate important growth linkages to the rest of the economy. Structural transformation thus involves *a net resource transfer from agriculture to other sectors of the economy, over the long term.*
- Movement of the economy away from subsistence-oriented household-level production towards an integrated economy based on greater specialization, exchange, and the capturing of economies of scale. Many functions formerly conducted on the farm, such as input production and output processing, are shifted to off-farm elements of the economy.
- Labor migration is a critical feature of the structural transformation process. Over time, rural labor migrates from agricultural activities to employment opportunities in the rural and urban non-farm sectors, in response to the rising demand for non-farm goods and services fueled by agricultural income growth.

Agricultural growth is generally the catalyst for structural transformation. Because such a large share of the population in most African countries reside in rural areas and earn the bulk of their incomes from agriculture, raising agricultural incomes will be critical to raising the demand for off-farm jobs associated with the demographic transition.

There are many other important features of the structural transformation process, but our point here is to highlight the catalytic role of agricultural growth in starting these processes, and the need for agricultural surpluses and labor to be transferred in tandem for structural transformation to progress. Agricultural productivity growth and the surpluses generated from it drive migration of labor from rural to urban areas and from agriculture to non-agricultural activities, as greater purchasing power of farm households stimulates demand for non-farm jobs and businesses (Mellor 1976; Johnston and Kilby 1975).

How is HIV/AIDS affecting countries' ability to generate these structural transformation processes? The most obvious question posed by the information in Figure 1 concerns how the decline in the growth of the labour force will affect migration, the costs of labour, the competitiveness of labour-intensive sectors such as agriculture, the underlying farming systems, and the structural transformation process. These are complex issues, and unfortunately we have little empirical evidence to guide us. Moreover, because of the long-wave nature of the AIDS epidemic, the full impact of the disease will not manifest until the

next several decades (Barnett and Whiteside 2002). For this reason, assessments of what is happening now do not provide a reliable picture of what will be happening in the future. The following section discusses these issues in conceptual terms, incorporating applied evidence where available.

2.2. Potential Changes in Labour Markets Due to AIDS

According to the demographic projections in Figure 1, AIDS will increasingly rob rural and urban communities of adult labour that would have otherwise contributed to agricultural production, off-farm jobs, home maintenance activities such as child rearing, care-giving, food processing and cooking, and various intangible contributions to household livelihoods (Topouzis 1998; Topouzis and du Guerny 1999; Barnett and Whiteside 2002). On the other hand, as shown in Table 1, the absolute numbers of working age adults is envisioned to remain roughly the same over the next two decades, even in the countries hit hardest by the disease.

The impact of AIDS on labour costs depends on how the disease affects the supply and demand for labour in agriculture and the broader economy. Factors affecting the supply of labour would include deaths from AIDS, care-giving, and mourning periods after a death.⁵ Thus, the “effective” labour pool in the economy is likely to be overestimated if consideration is given only to changes in the absolute numbers of adults shown in Table 1. The demand for labour is also likely to be affected by AIDS after incorporating economy-wide impacts of the disease on purchasing power and effective demand for food and other goods. This makes the net effect on the cost of labour very difficult to predict. However, as is argued below, there are strong reasons for anticipating that AIDS will progressively decapitalize highly-afflicted rural communities – meaning a loss of savings, cattle assets and draft equipment, and other assets. The loss of capital assets that often substitute for labour in the production process may indeed raise the demand for labour. If a rising demand for labour can be met by attracting family labour from the informal sector, then this may not translate into labour shortages and rising labour costs. For many decades, excess demand for relatively unskilled labour has been dampened by regional migration. Malawi, for example, has historically served as a labour pool for commercial farms and mines in Zimbabwe and South Africa. Mozambique, Lesotho and Swaziland have played similar roles for South Africa. Since these countries are all hard hit, excess demand for labour may draw forth different patterns of regional migration, perhaps involving densely populated areas of east Africa, though this is somewhat speculative.

Therefore, while there are too many unknowns about future conditions, it is not clear that the loss of adult labour of the magnitude shown in Figure 1 will drive up the real cost of unskilled labour. Costs may indeed rise over time for skilled and semi-skilled labour, which is already highly constrained. These effects will be less severe in countries where HIV prevalence is under 10 percent, but even here, real wages of skilled labour may rise over time, both in agriculture and the informal sector.

⁵ A Government of Uganda study (2003) found that the cultural practice of observing mourning for the deceased impinged on agricultural production and fishing. After incurring the loss of a family member, 70.8% of household respondents spent 1-2 days without working, while 32.0% revealed that they spent a week away from gardens and fishing activities. With regard to the loss of a community member who was not a member of the family, 59.0% of respondents spent 2-4 days without attending to their crops.

2.3. Impacts of AIDS on the Use of Capital in Agriculture

Agriculture-led structural transformation has almost always involved increased intensification of capital in the farm production process (Mellor 1976; Johnston and Kilby 1975). The main types of capital-led intensification have featured fertilizers, improved hybrid seed, chemicals, and draft power. These technologies have also featured prominently in the brief “smallholder green revolution” successes of eastern and southern Africa (see Eicher 1995, for the case of Zimbabwe during the 1980s; Hassan and Karanja 1997, for Kenya during the 1965-1980 period; and Howard and Mungoma 1997 for Zambia during the second half of the 1980s).

Farm households tend to utilize remittance and off-farm income as a primary means to afford expensive assets such as oxen, ploughs, and fertilizer, which are used to capitalize farm production (Reardon, Crawford, and Kelly 1995; Marenja et al. 2003). These sources of income are often jeopardized among AIDS-afflicted households, particularly those that are asset-poor and vulnerable to begin with (e.g., Mushati et al. 2003; FASAZ 2003; Yamano and Jayne 2004; Donovan et al. 2003). Cash constraints on farm intensification are compounded during illness and after a death, when medical and funeral expenses rise and care-giving by other members reduces their income earning potential as well. Evidence indicates that households attempt to first sell off small animals and other assets with the least impact on long-term production potential. Cattle and productive farm equipment are sold in response to severe cash requirements after incurring a death in the family (Yamano and Jayne 2004). To the extent that afflicted households shed assets and are forced to reduce their usage of cash inputs in agriculture, the cumulative effect may be a narrowing of the strata of farmers able to produce a marketable surplus from farming.

Afflicted households face a multifaceted loss of labour, capital, and knowledge. Unlike the loss of labour and knowledge, which represent a loss to entire communities, capital assets lost by afflicted households are generally re-distributed within the rural economy rather than lost entirely. This may exacerbate rural inequality over time, and particularly deplete the productive potential of relatively poor households.

Men and women tend to own assets and money separately, and tend to have separate income-earning activities. Yet because care giving usually falls on women, it appears that the rise of prolonged sickness and care due to AIDS has reduced the time available for women to engage in income-earning activities more so than for men (Opiyo 2001), and this trend is likely to become even more pronounced in future decades in the hardest-hit countries as the casualties of the disease escalate.

2.4. Empirical Studies: Effects of Adult Mortality on Agriculture

Most rigorous household-level studies have measured the effects of death *in their households* on household-level outcomes, typically over a 2-5 year time frame. Given the dearth of longitudinal household data over a long time period and methodological limitations, the longer-term effects of AIDS, and particularly the community-level effects, have yet to be rigorously measured. This is especially the case when considering inter-generational effects such as the inability of deceased adults to pass along accumulated knowledge to future

generations and the less tangible benefits that children receive from their parents (Bell, Devarajan, and Gersbach 2003; Gertler, Levine, and Martinez 2003). It is with these caveats in mind that we should view available empirical studies on the effects of HIV/AIDS on the agricultural sector and rural economy.

2.4.1. Effects on Agricultural Production and Productivity

Notwithstanding these caveats, most longitudinal empirical studies nevertheless show often dramatic effects over the short-run on household welfare. For example, a study in Kenya found that rural households suffering a prime-age death between 1997 and 2000 generally incurred a decline in agricultural production relative to non-afflicted households, but the magnitude and statistical significance of this finding depending greatly on the sex, age, and position in the household of the person who died, as well as the household's initial (pre-death) level of wealth (Yamano and Jayne 2004). The only statistically significant effects were observed in the case of male head-of-household death, but these effects were very severe. Households in this case suffered a 68 percent reduction in the value of net agricultural output (after deducting costs of inputs). Moreover these results were robust to the year of death, suggesting that households who suffered a death in 1997 did not show any recovery compared to households that incurred a more recent death, e.g., in 1999 or 2000.

By contrast, other studies have documented that afflicted households in study areas in Tanzania and Uganda tend to at least partially compensate for the death of a family member by bringing back to the farm another member residing off the farm, and that there was little or no impact on labour devoted to agricultural activities (Ainsworth, Ghosh, and Semali 1995; Menon et al. 1998; Beegle 2003). Yamano and Jayne (2004) found that households suffering the death of head-of-household or spouse were largely unable to replace the labour lost through the death, whereas households suffering the death of another adult (other than the head or spouse) were largely able to attract new household members. This at least partially stabilizes the supply of family labour for agriculture, but implies that off-farm and remittance incomes may in some cases be reduced, exacerbating capital constraints in agriculture.

The few available empirical studies on the impacts of prime-age adult mortality on agricultural production and incomes indicate that the effects are more severe on households that were relatively poor to begin with (Drimie 2002; Knodel and Im-em 2002; Yamano and Jayne 2004). Relatively poor households appear to suffer the most after incurring an AIDS-related death in the household because they are less able to cope with the economic and social shocks that it generates. These results carry obvious implications for household food security and nutrition for the poor in particular.⁶

A different set of studies have documented the adverse effects of worker HIV/AIDS on the commercial agricultural sector. For example, Fox et al. (2003) found a significant decline in

⁶ Yamano and Jayne did not find significant losses in cultivated land or net crop output among households in the upper half of the asset distribution. Possible reasons for the significant loss in crop output among relatively poor households include (a) they are less capable of paying hired labor to compensate for lost family labor; and (b) they have less savings to spend down and are hence more vulnerable to selling off productive assets to pay for immediate cash needs.

labour productivity among HIV positive tea pluckers in Kenya, while Rugalema (1999) found that agricultural companies reliant on hired labour are suffering from rising costs and falling profits due to the disease.

2.4.2. Effects on Crop Cultivation and Production Systems

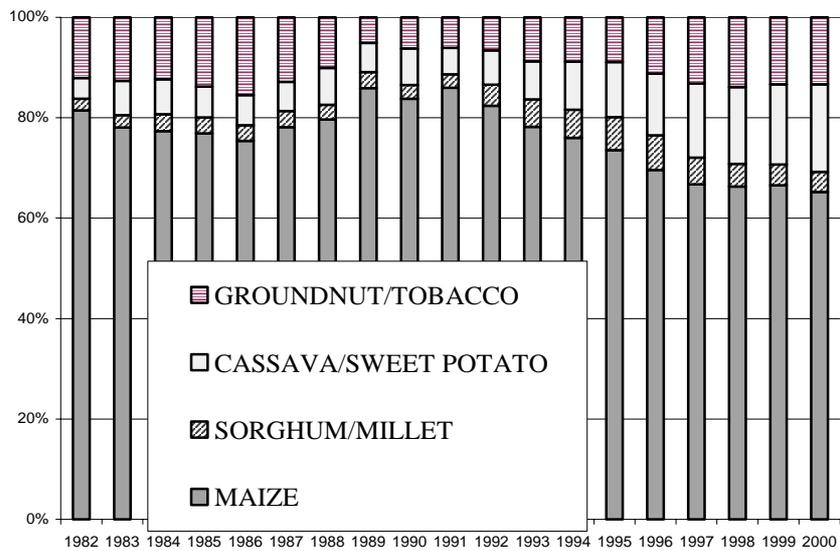
Some studies have conjectured that HIV/AIDS is bringing about important changes in farming systems. Particular emphasis has been put on the recent shift in area cultivated from maize to roots and tubers, which has been observed in several countries the region. For example, the proportion of crop area devoted to cassava and sweet potato in Malawi has risen from 4 percent to 10 percent over the past two decades (Figure 2). In the northern parts of Zambia, cassava production has also risen dramatically in recent years (Figures 3a, 3b).

It is possible that AIDS has contributed to these shifts in crop area. However, it is important to acknowledge that other major changes in agricultural policy have occurred in these countries which have also veered some farming systems in the region toward tuber crops. Most notably, many countries in eastern and southern Africa had formerly implemented state-led maize promotion policies featuring pan-territorial producer prices, major investments in marketing board buying stations in smallholder farming areas, and subsidies on fertilizer distributed on credit to small farmers along with hybrid maize seed. These maize marketing policies in Kenya, Malawi, Zambia, and Zimbabwe (among others) were either eliminated or scaled back significantly starting in the early 1990s as part of economy-wide structural adjustment programmes. These policy changes clearly reduced the financial profitability of growing maize in the more remote areas where maize production was formerly buoyed by pan-territorial pricing, and has shifted cropping incentives toward other food crops, especially those relatively unresponsive to fertilizer application, such as cassava.

Many areas where cassava production has increased in recent years appear to be those where the profitability of maize production has declined in recent years rather than areas of especially high HIV prevalence. Taking the case of Zambia, for example, it is noted that the provinces with the lowest rate of HIV prevalence – Northern (13.5%), Northwestern (11.6%), and Luapula (16.2%) have registered the greatest increase in the share of cropped area devoted to cassava and sweet potato. These provinces have faced major declines in the maize/fertilizer price ratios over the past 15 years as a result of changes in agricultural policy. By contrast, several provinces with relatively high HIV prevalence – Central (18.7%), Copperbelt (26.2%), Lusaka (27.2%) -- have recorded relatively little increase in the share of cropped area devoted to these roots and tubers.⁷

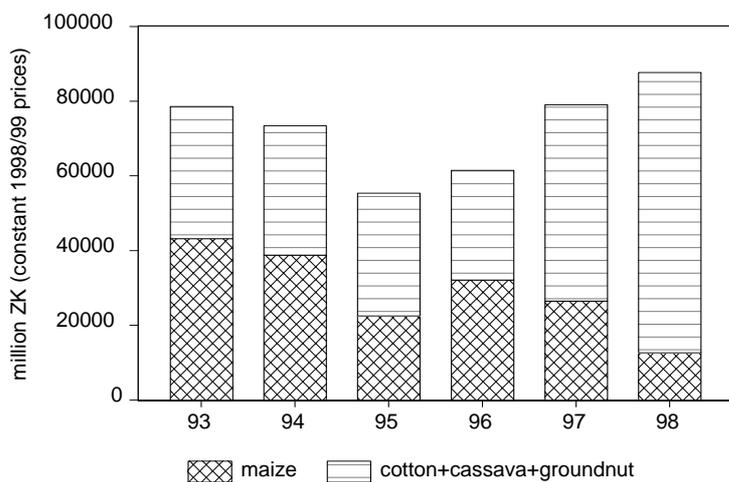
⁷ HIV prevalence data are from the 1998 sentinel surveillance survey in 1998 (Ministry of Health 1999) and include both urban and rural areas. Data on area cultivated is from Govereh, Nijhoff, and Jayne (forthcoming).

Figure 2. Changes in Percentage Area Distribution among Maize and Competing Major Crops, Malawi 1982-2000



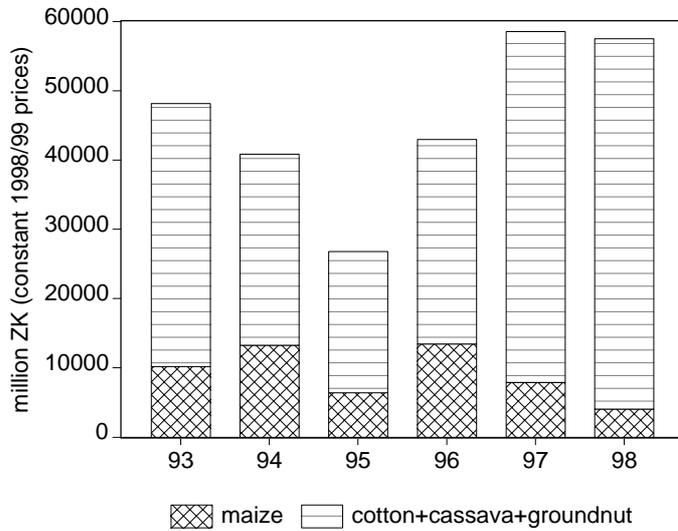
Source: Malawi Official Crop Estimates, 1982-2000

Figure 3a. Production Value of Maize and Major Substitute Crops, 1992/93- 1997/98, Northern Province, Zambia



Source: Post-Harvest survey data, Central Statistical Office, Lusaka

Figure 3b. Production Value of Maize and Major Substitute Crops, 1992/93- 1997/98, Luapula Province, Zambia



Source: Post-Harvest survey data, Central Statistical Office, Lusaka

Using data from Kagera District in Tanzania, Beegle (2003) found that households experiencing a death did not shift cultivation towards subsistence food farming. She concludes that afflicted households were able to maintain their supply of labor by drawing back other family members, or that the agricultural system in this area of the Lake Victoria Basin is not highly vulnerable to labor shocks.

By contrast, Yamano and Jayne (2004) found distinct shifts in cropping patterns among rural Kenyan households suffering either a head-of-household or spouse death, but only for households in the lower half of the income distribution. Households suffering a male head-of-household death incurred a 0.86 acre decline in area cultivated to sugarcane, tea and horticultural crops, compared to their non-afflicted neighbours. These households slightly increased their area to cereal crops (+0.25 acres), but this increase did not approach statistical significance at any typical level. By contrast, households suffering the prime-age death of a female spouse or head-of-household incurred a 1.2 acre decline in cereal crop cultivation compared to non-afflicted neighbour households, and a slight but imprecisely measured increase in traditional cash crop cultivation. There were no apparent shifts in tuber cultivation in the case of death of any household member. Donovan et al. (2003), by contrast, found no distinct gender-based differences in the composition of crops grown after the death of an adult in the household, but did find an increase in sweet potato cultivation. They speculate that sweet potato may have become more attractive for households suffering a labour shock because of its more flexible planting and harvesting schedule compared to most other crops.

In summary, the evidence is mixed as to how AIDS is affecting agricultural systems and cropping patterns. There are good reasons to believe that capital constraints will become more binding over time as the number of deaths from the disease rise in the hardest-hit

countries, which may force many afflicted households to adopt less capital-intensive technologies and crops.

2.4.3. Effects on Land Distribution

Figure 1, which shows how the population pyramid of hard-hit countries will change over the long term, holds critically important implications for land allocation. As shown earlier, by 2025, the number of male and female adults in the age ranges between 40-64 years will be less than half of what it would have been in the absence of AIDS. As afflicted households lose productive members of their families, including those possessing the rights to their households' land, conflicts over the inheritance of land may escalate over the coming decades (Barnett and Blaikie 1992).

Poor and disadvantaged households in particular may have difficulty maintain their rights to land after incurring a death is in potential jeopardy. Widows and orphans are particularly vulnerable to losing access and/or ownership rights to land after the death of the husband/father. The cumulative effects of loss of land rights may turn out to be an increase in the concentration of landholdings within the small farm sector, with control of land shifting from poor households to relatively wealthy ones. This is a likely outcome if relatively wealthy households are better able to maintain their control over land after incurring a prime-age death in the family, and also if they are able to gain control over land assets shed by poorer households that cannot continue to productively use their land after incurring a death. Land disputes and possible land concentration over time are consistent with broader economy-wide predictions that AIDS is likely to exacerbate income inequality in many countries (Lehutso-Phooko and Naidoo 2002).

While an important coping strategy for afflicted households may be to rent out land that cannot be productively utilized after incurring a death, Barnett (1994) found that widows especially were reluctant to do this for fear of losing rights to their land. As will be discussed later, a major challenge for agricultural and land policy is to provide greater clarity over rules governing land rights, including protecting the rights of owners who wish to rent land. Developing land rental markets is envisioned to assist afflicted households earn revenue from renting land that would otherwise go unutilized.

These problems of land tenure overlap with the problem of gender disparities. Much research has documented that widows and their dependents in patrilineal societies are in a more tenuous position with regard to maintaining control over land (Mazhangara 2003; Barnett and Blaikie 1992).⁸ When combined with evidence that female-headed households tend to be poorer in general than their male-headed household neighbours, governments and donors face a serious challenge to devise means to protect poor households (and particularly poor female-headed households) rights to land within future poverty alleviation and rural development strategies.

⁸ By contrast, in most matrilineal societies in the region, land belongs to the woman's family, which may provide more security to her in the event of a husband's death, although there is much debate on this issue (Personal communication, D. E sese, 2003. Former Lecturer, Moi University, Kenya, November 15, 2003).

2.5. Anticipated Impact of AIDS on Shifts in Agricultural Technologies

Households' response to AIDS, and their vulnerability to its consequences, depend on the level and mix of household resources (e.g., landholding size, labour, capacity to substitute for lost labour, cash to purchase inputs, including labour, and crop husbandry and management ability). Households are sometimes able to vary the proportion of inputs used to produce a given amount of crop output, and they can also vary their crop mix to adjust to shifts in availability of their resources. For example, a household with sufficient resources can substitute hired labour for family labour to maintain desired cropping patterns.

Land-to-labour ratios vary greatly within most countries of eastern and southern Africa. For example, nationwide surveys in five countries in the region show that after ranking households by landholding size per capita, there are huge variations in land-to-person ratios within the small-scale farm sector in each country (Table 2). The 25 percent of smallholder households with the smallest farms typically controlled less than 0.1 hectares of land per person. These households are virtually landless although this same group earns over 50% of its income from agriculture, except in the case of Kenya where the agricultural income share of the bottom land quartile was exactly 50% (Jayne et al. 2003b). At least for this strata of smallholder households, land is likely to be a primary constraint on income growth, and it is not clear that the loss of a household member would change this much. At the other end of the spectrum, the 25 percent of smallholder households with the largest land-to-labour ratios controlled at least seven times more land per capita, generally in the range of 0.5 to 1.0 hectares per capita. It is almost certain that the limiting input into agricultural production will differ between these two groups, given the huge differences in relative land-to-labour ratios within these countries.

Table 2. Smallholder Land Distribution in Selected African Countries

Country	(a) sample households	(b) Mean landholding size ¹ (ha)	(c) Mean landholding size/person ratios ranked by quartile ¹ (hectares per person)					(d) Gini coefficient		
			Mean	lowest	2 nd	3rd	highest	Landholding size	Land per capita	Land per adult member
			Ha							
Kenya, 1997	1,416	2.65	0.41	0.08	0.17	0.31	1.10	0.55	0.56	0.54
Ethiopia 1995	2,658	1.17	0.24	0.03	0.12	0.22	0.58	0.55	0.55	0.55
Rwanda 1984	2018	1.20	0.28	0.07	0.15	0.26	0.62	--	--	--
Rwanda 1990	1,181	0.94	0.17	0.05	0.10	0.16	0.39	0.43	0.43	0.41
Rwanda 2000	1,584	0.71	0.16	0.02	0.06	0.13	0.43	0.52	0.54	0.54
Malawi 1998	5,657	0.99	0.22	0.08	0.15	0.25	0.60	--	--	--
Zambia, 2000	6,618	2.76	0.56	0.12	0.26	0.48	1.36	0.44	0.50	0.51
Mozambique 2000	3,851	2.10	0.48	0.10	0.23	0.40	1.16	0.45	0.51	0.48

Note: Numbers for Ethiopia, Rwanda, Mozambique, and Zambia, including Gini coefficients, are weighted. Numbers for Kenya are sample statistics.

¹ Landholding size figures include rented land.

Source: Jayne et al. 2003b

Following standard economic production theory, various inputs can be used to produce a given level of crop output. Take the most basic case in which there are two categories of inputs: labour (L), and a combination of other inputs (C), for example land and capital assets. The curved solid line in Figure 4 represents a given amount of crop output (isoquant). Figure 4 shows that the proportions of labour and other inputs can be varied to reach the same amount of output. For example, the particular production technology represented here shows that L1 units of labour, combined with C1 units of other inputs can produce the same amount of crop output as L2 units of labour and C2 units of other inputs. This is an illustration of “factor substitutability,” i.e., that different factors of production, such as land, labour, and capital, can be substituted for one another, at least to some extent, to produce a given level of crop production.

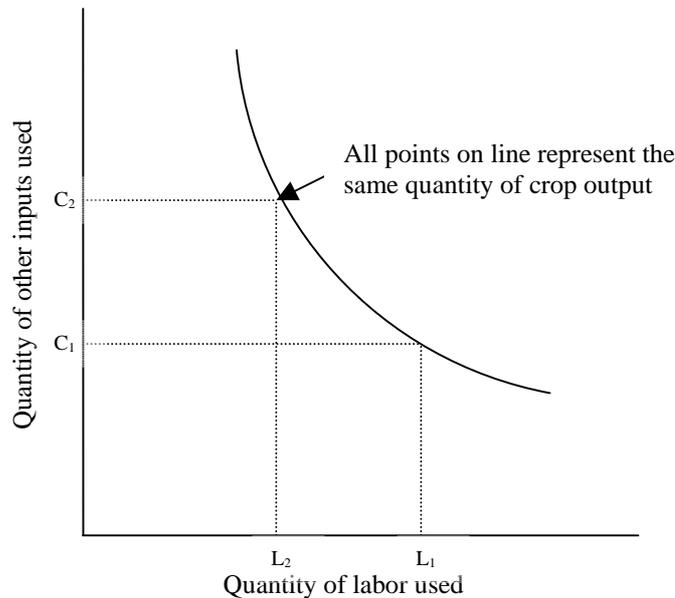
The relevance of this brief digression into economic production theory is to make the point that farmers, even highly resource-constrained small farmers, do not produce agricultural products in fixed input proportions over time. To the extent that factors are substitutable, households incurring a shock to their own labour supply (for example due to an AIDS-related death), can and will often vary the proportions of land, labour, and cash, or adjust their cropping patterns, based on the particular mix of resources that they possess after the death. Examples of this include substituting hired labour for family labour (e.g., sharecropping arrangements), renting animal traction services for land preparation instead of preparing the land with family labour, substituting fertilizer application for labour, or reducing the amount of land cultivated to maintain a similar intensity of labour input on the smaller amount of land under cultivation.

Donovan et al. (2003) empirically examine this issue based on household survey data in Rwanda. Researchers in this study asked households recently incurring an adult death about the strategies they used to adjust their use of farm inputs and cropping patterns. In this relatively densely populated country, Donovan et al. found that households suffering a male adult death often responded by relying on neighbours and social networks to augment their own labour in crop production. Households suffering the death of an adult female tended to draw back household members residing off the farm and attract new members, as well as reduce their weeding labour and area cultivated. Similar results were found in an exploration of household strategies in response to adult death in Mozambique, which generally has much lower population densities than in Rwanda (Donovan et al. 2003). Additional household responses noted in both the Mozambique and Rwanda studies are spending from savings and selling off assets to hire labour and inputs, and for households suffering a long female illness, taking children out of school to help with agricultural activities or sending them to relatives.

The observation that households employ strategies involving factor substitution to cope with the loss of family members does not mean that they can maintain their former levels of agricultural output, income, or other measures of welfare. AIDS-afflicted households simultaneously incur losses in capital assets as well as labour and knowledge, making it particularly difficult for them to shift to more capital-intensive technologies in response to labour shocks. Referring to the example in Figure 4 again, a household that suffers a decline in family labour from L1 to L2 may not possess the required amount of other inputs to maintain former production levels (i.e., C2). This implies that factor substitutability may be limited, especially for relatively poor households and communities lacking the cash and capital assets to substitute for labour (e.g., Gillespie 1989). The aggregate consequence of this over many households in the community is a change in the overall farming system.

Some analysts have conjectured that a reduction in the supply of rural labour could lead to shifts to less labour-intensive cropping systems, a de-intensification of agriculture, and even a return to shifting cultivation.

Figure 4. Concept of Factor Substitutability in Crop Production



Our point, however, is that the loss of family labour due to a death in the household does not mean that labour necessarily becomes the limiting input in agricultural production, and hence it does not necessarily follow that the appropriate policy response for agricultural research and extension systems is to focus inordinately on labour-saving agricultural technology. Labour-saving technology may indeed be appropriate for many households (those who already face high land/labour ratios and lack other resources which could be substituted for labour, such as cash for hiring labour). The main implication for crop research and extension systems is that a broad range of agricultural production technologies – appropriate for the wide range of land/labour/capital ratios found among small-scale farm households – are needed to respond to the AIDS.

2.5.1. Factors Rendering Agricultural Systems Vulnerable to the Effects of HIV/AIDS

Donor organizations and analysts have increasingly identified the need for a better understanding of the socioeconomic factors influencing households' and communities' vulnerability to the ravages of AIDS (Haddad and Gillespie 2001; Loevinsohn and Gillespie 2003). Some communities suffering high rates of prime-age adult mortality are observed to be able to maintain or even increase basic indicators of welfare such as incomes, agricultural production, and consumption, while other communities suffering similar adult mortality rates

are not. This section discusses some of the factors envisioned to affect agricultural systems' vulnerability to the effects of AIDS. We focus on (a) poverty, and the role of pro-poor agricultural policy in reducing poverty; (b) the availability of surplus labour to fill gaps left by people having died of AIDS-related diseases; (c) cropping patterns and agricultural systems that are flexible in terms of factor substitutability; and (d) the extent to which local social rules and their implementation allow survivors of AIDS-afflicted households to retain household land and productive assets to maintain their livelihoods.

(a) The Role of Agricultural and Rural Development Policy in Reducing Poverty: AIDS and poverty appear to interact in a vicious cycle: AIDS exacerbates poverty, and deepening poverty makes households and communities more vulnerable to the spread and effects of the disease (Barnett et al. 1995). As discussed above, the limited empirical literature on the topic also shows that the effects of adult mortality are most severe among relatively poor households. Therefore, one of the most powerful tools at the disposal of agricultural policy makers is to put in place policies and programmes that can effectively generate broad-based income growth and poverty reduction (Cuddington 1993a, 1993b).

Much can be gleaned from examining the mix and implementation of policies in countries where poverty has declined in recent years. Poverty levels appear to have fallen remarkably in several countries in the region, notably Uganda (where initial estimates indicate that rural head-count poverty rates have decline from roughly 50 percent in 1991 to under 30 percent in 1999),⁹ and to a lesser extent, Mozambique. It is important that agricultural policy makers in the region learn from what is working and what is not working to reduce poverty and increase rural incomes, so that policies shown to be effective can be replicated and adapted elsewhere. Because the benefits of supportive agricultural policy and programmes do not occur immediately but rather accumulate over time, there is some urgency in putting into place effective pro-poor agricultural development policies now so that they can effectively bolster rural communities' resilience when the long-wave impacts of AIDS become most severe.

(b) The availability of surplus labour to fill gaps left by people having died of AIDS-related diseases: As found by some recent empirical studies, the effects of AIDS on agricultural systems in some areas of eastern Africa were mitigated by households' ability to draw additional labour (Beegle 2003; Ainsworth, Ghosh, and Semali 1995; Donovan et al. 2003). The ability to draw on additional labour depends on the availability of underemployed labour in the informal sector, and rural population densities. Densely populated areas are likely to employ labour intensively in their agricultural systems, and this enable such communities to cope better with high adult mortality rates, although it bears repeating that even in densely populated areas there are large variations in individual households' land/labour ratios as suggested in Table 1.

(c) Cropping patterns and agricultural systems that are flexible in terms of factor substitutability: Agricultural systems differ in their ability to flexibly adjust the inputs of land, labour, capital, and knowledge in response to changes in relatively input scarcity and costs. For examples, in sparsely populated communities where the availability of unutilized labour at peak periods is constrained (e.g., first weeding), the AIDS epidemic may make it exceedingly difficult to maintain existing cropping patterns and/or cultivated land. This

⁹ Personal communication, P. Kristjanson, based on forthcoming analysis of Uganda income and expenditure data, August 20, 2003.

implies that the kinds of factor-substitutability discussed earlier in the context of Figure 4 will be constrained in relatively poor sparsely populated areas rural communities where both labour and capital assets are limiting factors of production. Special attention to such communities that are hard-hit by AIDS will be warranted in rural poverty alleviation programmes.

(d) Local social rules and their implementation allow survivors of AIDS-afflicted households to retain household land and productive assets to maintain their livelihoods: Sociologists and anthropologists have an important role to play in determining how different social institutions and their implementation affect the ability of surviving spouses and their dependents to retain their productive assets to maintain their livelihoods. Villarreal's (2002) discussion of AIDS among the Luo people in Western Kenya indicates how social norms affect the vulnerability of women after losing their spouse, and how their disadvantaged economic position even increases their susceptibility to contracting the disease. Mazhangara (2003) describes how matrilineal and patrilineal inheritance rights affect the distribution of property, land, and children after the death of the husband or wife. The spread of the disease and peoples' ex post vulnerability to its effects appear to be related to gender inequality (Matangadura 2001). External attempts to impose changes in local social norms and rules may be met with opposition from those in control. Yet more open discussion and analysis of the effects of existing inheritance rules and gender rights on poverty, social problems, and the spread of AIDS may help to bring about endogenous changes that help maintain the cohesion of rural communities. This would be a particularly relevant topic for participatory poverty reduction strategy processes.

2.6. Summary

In summary, the micro-level empirical record on the effects of HIV/AIDS on agriculture is still quite limited, but is growing rapidly. The time periods over which impacts are measured are mostly short-run, which probably understate the full impact on households and communities over time. Even given this short-run time dimension, the weight of the empirical evidence to date does indicate that AIDS is having a measurably adverse impact on household agricultural production, although these impacts are often mitigated by attracting new household members (or bringing back members residing away from home) to compensate for the lost labour and knowledge of the deceased. Effects appear to be highly sensitive to the age, sex, and position of the deceased – being the greatest in cases where the head-of-household or spouse dies – and the initial level of wealth of the household.

While much of the discussion to date has anticipated that AIDS would have a major effect on labour availability and costs in agriculture, it is possible that capital constraints and knowledge may be a more severe impediment on maintaining agricultural output and productivity. Based on the discussion and review of empirical evidence in this section, Table 3 presents a broad, long-term prognosis of possible shifts in the availability and cost of the major factors of agricultural production.

Table 3. Conjectured Impacts of AIDS on Use and Cost of Factors of Production in Agriculture

	Effect of AIDS on availability and cost of resources used in agriculture							
	Capital assets used in agriculture		Labour in agriculture		Land		Knowledge/skills used in agriculture	
	supply	cost	supply	cost	supply	cost	supply	cost
Hardest-hit countries (HIV prevalence > 20%)	↓↓ R	↑↑	↓	↑	R	--	↓↓	↑
Countries with HIV prevalence between 5-20%	↓ R	↑	↓?	--	R	--	↓	↑

Key: ↑ = increase; ↑↑ = major increase; ↓ = decline; ↓↓ = major decline; R = redistribution from afflicted households to others; ? = depends on policy and availability of underutilized labour in the informal sector; -- = no anticipated major impact.

The policy implications of these possible changes to the agricultural sector are discussed in Section 3.

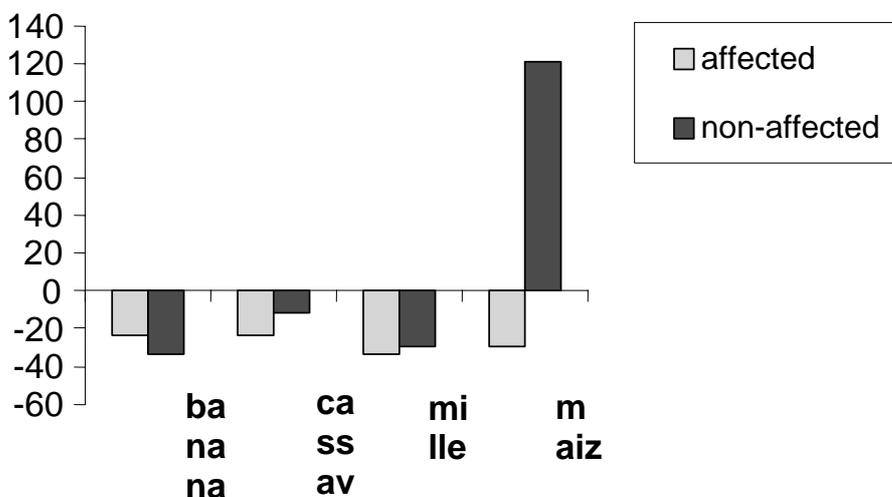
3. POTENTIAL IMPLICATIONS OF HIV/AIDS FOR AGRICULTURAL POLICY

The most effective strategic response to the ravages of AIDS in eastern and southern Africa must include policies to promote economic growth and poverty alleviation. Central to both of these are policies to promote agricultural growth. The historical priorities on developing productive new seed technology, extension systems to help farmers adopt improved techniques and instituting commodity and input marketing arrangements to stimulate smallholder productivity remain critically important.

AIDS does have implications for appropriate agricultural technology. Because afflicted households have widely varying land, labour, and capital assets (both prior to incurring a death, as well as afterward), the appropriate policy responses in terms of developing and disseminating useful agricultural technology are not uniform. The most successful strategies for incorporating the HIV/AIDS concerns into agricultural policy and programmes are likely to be multi-pronged approaches that recognize the varied resource constraints affecting AIDS-afflicted households. However, it is likely that government priorities to promote re-investment and re-capitalization of smallholder agriculture, especially for the poor, will have important payoffs. Extreme conditions often require solutions that might be considered inappropriate or uneconomic if the effects of HIV/AIDS are not accounted for.

To illustrate the potential linkages between agricultural policy and HIV/AIDS, we provide two examples from a recent FAO study. In Uganda, as a result of a government policy to increase maize production in order to increase cash and export crop production, non-AIDS-affected families were able to substantially increase the land cultivated with maize by reducing the amount of land dedicated to banana, cassava and millet and. By contrast, AIDS-affected families were found to reduce the amount of land cultivated in all of the cited crops (Figure 5).

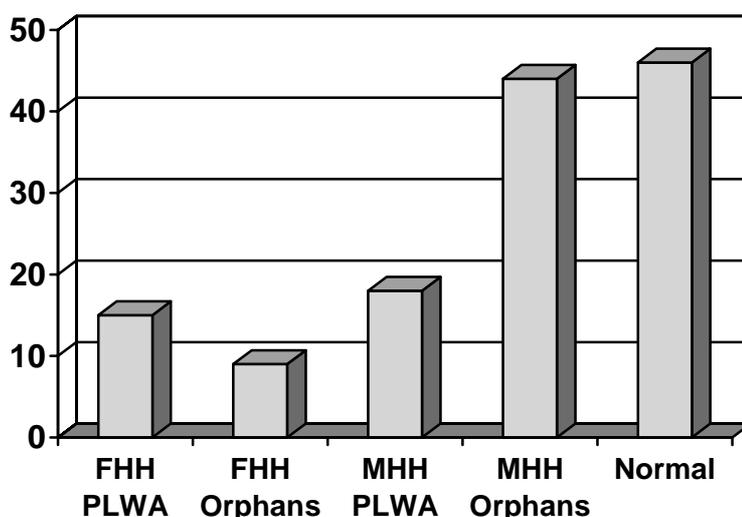
Figure 5. Percentage Change in Land Cultivated, Selected Cash and Food Crops, Selected Sites in Uganda, 1996-2002



Source: FAO 2003

In Zambia, a government policy sought to increase small holder agricultural production through the promotion of cooperatives as a means to distribute subsidized agricultural inputs. While roughly one in two households that were not directly affected by AIDS were members in such cooperatives, only one in ten households headed by women with a person living with AIDS, or fostering orphans were able to obtain subsidized inputs through the cooperatives. Affected male headed households fared better, especially those fostering orphans. Although the reasons for this are complex and involve more dimensions than whether households suffered from AIDS or not, the study hypothesized that these were intact households who took in orphans with some of their land or other property.

Figure 6. Zambia: Household Membership in Cooperatives



FHH/PLWA: female-headed households with a person living with AIDS

FHH/Orphans: female-headed households with orphans

MHH/PLWA: male-headed households with a person living with AIDS

MHH/Orphans: male-headed households with orphans

Source: FAO 2003

This section lays out some elements of a framework for Ministries concerned with agriculture, rural development, and poverty alleviation to determine whether and how their mix of policies and programmes need to respond in order to meet national objectives in light of AIDS.

3.1. Elements of a Framework for Assessing the Potential of Agricultural/Rural Development Policies and Programmes to Contribute to AIDS-related Goals

The policy categories to be analysed in the rudimentary framework presented below will vary from country to country depending on the economic structure as well as the mix of policies and programmes contained in relevant Ministries' activities.

The first step in the process is to assess how HIV/AIDS is affecting the structure of the rural socio-economy. This will vary from country to country, based on prevalence rates, the types of agricultural systems found in the country, and the operation of local rules and institutions. The objective is to obtain a clear prognosis of how fundamental aspects of the rural economy will be altered in the coming decades in light of AIDS. Such an exercise would need to be multidisciplinary, bringing to bear the various expertise of physical scientists such as epidemiologists and agronomists, and social scientists such as demographers, economists, sociologists and anthropologists.

Moreover, effects are almost certain to be compounded over time. As can be understood from examination of Figure 1, AIDS will have a delayed and long-wave impact because, according to demographic projections, the full effects of the disease on population and labour will not manifest until the next several decades. Therefore, the framework would be oriented to forecast impacts of these demographic changes on the agricultural/rural sectors in both the near-term (next 5-10 years) as well as the long-term (10-25 years).

The exercise would also need to account for the different types of broad production systems found in each country.

The following is an illustrative list of issues to be included for analysis in Step 1: how will AIDS affect the following structural features of the rural/agricultural system, given the existing set of national policies and programmes:

- Supply and opportunity cost of household inputs and factors of agricultural production:
 - family labour
 - land
 - productive capital assets such as oxen and draft power equipment
 - knowledge (crop husbandry, management expertise, marketing skills, ability to liaise with outgrower companies, farmer organizations, etc., to acquire needed inputs and take advantage of income-earning opportunities)
- Supply and cost of purchased inputs for agricultural production
 - hired labour
 - land
 - productive capital assets such as oxen and draft power equipment
 - knowledge
- Distribution of assets
 - land, e. g, after the death of a household member
 - include an analysis of who loses assets, by gender
 - productive equipment
 - knowledge
- Private investment in agricultural marketing services (input supply, commodity traders, processors, etc.), as well as marketing costs such as transportation, processing, and storage.
- Effective domestic demand for commodities produced (e.g., will declining rates of population growth or increased poverty reduce the demand for farmers' marketed output and depress prices? Or will this be counteracted by a decline in agricultural production due to AIDS that would reduce the supply of agricultural output and raise local prices to import parity levels?)

- Effects on purchasing power and distribution of purchasing power within the broader economy
- Effects on the ability of government ministries to implement existing policies and programmes due to attrition and loss of human capital within the ranks of the public sector.

Once Step 1 is complete, which factors in the implications of AIDS for the agricultural and rural sector, the next stage is to identify the main policy thrusts and specific policies and programmes of the Ministry of Agriculture and other ministries responsible for rural development and poverty alleviation.

Step 2 is basically an inventory of the existing set of government policies and programmes responsible for agriculture and rural development.

Step 3 is to analyze the effectiveness of existing agricultural policies to meet national policy objectives in light of AIDS. For example, how should the policies and programmes of the Ministry of Agriculture be modified to best achieve national policy objectives after considering the likely effects of the disease as determined in Step 1? This will again vary from country to country according to the severity of the disease, the types of agricultural systems, social norms, etc.

Because the agricultural system is embedded in the broader national and regional economic systems, Step 3 should not stop at forecasting the implications of HIV/AIDS on agriculture but also consider the broader economy-wide effects that are likely to occur and feedback into the agricultural system. For example, macro-models have projected that AIDS is affecting national GDP growth, which will affect demand and price levels for some agricultural commodities, especially those relying mostly on local demand as opposed to export demand. Many effects of AIDS on the agricultural sector are likely to operate through the overall economy, and would be neglected in an analysis that focused simply on direct pathways within the agricultural sector.

Table 4 provides a matrix for considering the effects of a country's existing policy set. The policies listed in the table are illustrative examples only. In practice, the actual composition of policies and programmes is country-specific, and would include all major strategies and programmes of a country's agricultural and rural development portfolio.

Table 4. Elements of a Framework for Factoring in the Effects of HIV/AIDS in the Review of Agricultural Programmes and Policies

Policy Category	Specific Policy	Effect of HIV/AIDS on:			
		Agricultural and rural development objectives		Broader economic and social objectives	
		Near-term	Long-term	Near-term	Long-term
Agricultural Research / Farming System Research	Promote labour- saving maize production technologies				
	Promote improved sweet potato cultivars				
	Conservation farming practices				
	etc.				
Land Tenure Policies	etc.				
Livestock Programmes and Policies					
Farmer Organization/ Cooperative Development					
etc.					

To review, the steps in the review and adjustment process are:

(1) assemble multidisciplinary teams to project and forecast the effects of HIV/AIDS in the near-term and long-term on the agricultural and rural sector. This will require some attention to broader economy-wide impacts and their feedback loops back to the agricultural sector.

(2) identify the major policy strategies/programmes of the Ministry of Agriculture and related government agencies (for example, rural poverty reduction programmes that may fall under different ministries' portfolios). This involves filling out the first two columns in Table 4.

(3) taking into account the analysis from Step 1, conduct ex ante analysis of the effects of agricultural policies and programmes (identified in Step 2) on national rural development objectives, and consider how these policies and programmes should potentially be modified – in light of the effects of the disease – to better achieve government's rural development objectives.

As a concrete example, let us take the case of livestock development programmes in the Ministries of Agriculture. In many countries of the region, public sector funding for veterinary services, extension, and breeding have declined, with a corresponding contraction of services available to small-scale farmers (Umali, Feder, and deHaan 1994; Omamo et al.

2002). Yet Omamo et al. argue that it is the demand-side of a veterinary extension system that matters the most—i.e. the demand for new information, which itself derives from demands for veterinary goods and services. As indicated earlier, AIDS is likely to increase the attractiveness of labour-saving agricultural technologies such as animal traction for land preparation and other tasks. As shown previously in Table 1, there will slower or zero population growth of males and females in the 20-59 year age range in the hardest-hit countries of the region by 2025 due to AIDS. Maintaining rural incomes from agriculture and maintain productive use of land currently under production (not the mention the challenge of increasing the intensity of land cultivation over time) will require strategies to facilitate land preparation by rural households afflicted by AIDS.

One possible intervention strategy concerns efforts to make labor-saving land preparation and weeding technologies more available to rural households and communities. Animal draft power (e.g., ox-driven plows and harrows) is a commonly utilized land preparation technology in most of eastern and southern Africa, particularly Ethiopia, Kenya, Zambia, and Zimbabwe. However, household surveys in the region generally find that ownership of oxen and tillage equipment is concentrated disproportionately among relatively wealthy households in the top half of the income distribution (e.g., Jayne et al. 2003b). Though oxen and draft rental markets have developed in many parts of the region, their performance is highly constrained, and there are many reasons why relatively poor households are unable to make use of such rental markets even when they are available (Govereh and Jayne 2003).¹⁰

An obvious challenge for agricultural policy is how to overcome the labor constraints on current and future agricultural production through making labor-saving land preparation technologies more accessible to relatively small and poor farm households. Conservation farming techniques that shift land preparation labor to the dry season may be particularly attractive for promotion in many areas. Conservation farming options are discussed further below. In other areas, strategies to rapidly increase the stock and health of animal assets within the small-scale farm sector as well as the stock of animal draft equipment such as plows and harrows may be important. Enhancing farmers' incentives and ability to acquire draft animals and equipment will help alleviate the crucial labor burden of land preparation that is increasingly limiting AIDS-afflicted households' ability to maintain full use of their land and their desired cultivation practices. Moreover, relatively asset-poor households that still cannot afford to buy such assets themselves will nevertheless be in a better position to utilize such services through the increased availability of oxen and equipment through draft rental markets. In short, there may be increasing payoffs to increasing public goods investments in livestock veterinary and extension services and, where feasible, stimulating new investment in private veterinary services. There are some examples, as in Mali, where a very successful system of private veterinary drug retailers has developed.

In some countries in the region, the stock of cattle assets in the small-scale farm sector has declined due to cattle disease, the demise of state veterinary services providing dipping facilities and medicines, and the slaughtering of cattle when a person dies. The AIDS epidemic has probably led to a concentration in the ownership of cattle assets, as afflicted households sell off assets to those with the resources to accumulate them.

¹⁰ For example, oxen owners typically reserve the perceived optimal time for animal traction functions for their own plots, leaving renters with the option to rent weakened oxen at sub-optimal times.

A broad-based programme to restock cattle assets for small-scale farmers could be pursued through the promotion of veterinary services, disease eradication programmes, and aggressive promotion of improved cattle breeding stock. While such programmes are expensive and were often curtailed or eliminated in recent years because of budgetary pressures, the costs and benefits of coupling innovative state extension efforts with private-sector led veterinary and cattle stocking programmes should be assessed in light of the anticipated zero or slow growth of the agricultural labour force in the region.¹¹

Capital-intensive technologies such as tractors have been found to be expensive and uneconomic in most parts of Africa in the past because of the availability of relatively cheap agricultural labour, which made other land preparation technologies such as hand-hoe cultivation more appropriate, and because of the problems of tractor maintenance and markets for imported spare parts. Notwithstanding the validity of such conclusions in the past, in many parts of Western Kenya, many small-scale farm households cultivating 1-10 hectares currently utilize tractor rental services for land preparation, particularly for maize production (Nyoro, Kirimi, and Jayne 2004). The widespread use of tractors in Western Kenya has been facilitated by the existence of a medium-scale and large-scale farm sector in close geographic proximity to smallholders in these areas, giving rise to a reasonably well-functioning rental market for land preparation using tractor technology. In most other parts of the region, however, tractor rental markets have been impeded by the absence of capitalized large farms, companies, or cooperatives possessing the managerial know-how or incentives to supply tractor land-preparation technologies to smallholder farmers in the area. It may be possible, however, for governments to provide such firms with the incentives to invest in tractor equipment for rent, or to stimulate the entry of new firms providing such services for smallholder farmers. Current efforts to develop viable farmer organizations may also provide opportunities for group procurement of land-preparation equipment, although this will introduce new challenges for developing the institutions and internal management to equitably spread the use of group assets across the intended beneficiaries. Public investment in analysis of feasible design of tractor mechanization for small-scale farmers and import options might have useful payoffs. Of course, such an approach would not be warranted in all (or perhaps even most) smallholder areas, and detailed cost-benefit analyses would need to be the guiding principle to determine where such programmes might be warranted. However, the projected reduction in the growth of agricultural labour over time in the hardest-hit countries in eastern and southern Africa is likely to substantially change the calculus of costs and benefits associated with capital-intensive agricultural production technologies.

This section concludes with an illustrative set of policies related to agriculture and rural development that may also need to be re-evaluated in the context of AIDS.

3.2. Potential Sectoral Recommendations for Consideration in Light of AIDS

This section provides illustrative examples of policies related to agriculture and rural development that may mitigate the impact of AIDS or reduce its transmission. Further evaluation and refinement of these proposals would be needed in each specific country context. These examples are separated into four categories: policies and programmes

¹¹ Innovative private-sector led approaches, in which private veterinary and reproduction firms are provided special incentives to operate in particular areas under performance contracts can also be considered.

affecting (1) factor use and input market; (2) agricultural research and extension systems; (3) commodity markets; and (4) gender-differentiated resource allocation.

3.2.1. *Policies and Programmes Affecting Factor Use and Input Markets*

- *Land Tenure/Security Policies:* Research findings have underscored the need to reduce insecurity of land tenure for women (and their dependents) who lose their husband (father). The limited available evidence indicates that widows and their dependents are most vulnerable after incurring an adult death (the husband in this case). Policies designed to improve women's rights (e.g., land tenure security for widows), which would reduce the spread of AIDS associated with women resorting to risky behaviours due to unequal gender relations.
- *Development of Land Rental Markets:* Relatedly, government efforts to ensure that landowners will not lose their land if they rent it out to others will help in the development of viable land rental markets. Evidence suggests that land rental markets are constrained in many cases by landowners' fears that they will lose their land if they allow others to use it repeatedly. Because AIDS-afflicted households often suffer from a shortage of family labour, their welfare could be enhanced if well-functioning land rental markets that allowed them to earn income from allowing others to make productive use of the land.
- *Strategies to Promote Labour-saving Modes of Land Preparation and Weeding:* The importance of preserving and promoting capital-intensive factors such as livestock and draft equipment has been discussed at length in the previous section. An obvious challenge for agricultural policy is how to overcome the labor constraints on current and future agricultural production through making labor-saving land preparation technologies more accessible to relatively small and poor farm households. An important priority for analysis is to assess the costs and benefits of innovative new veterinary, cattle stocking, and livestock extension programmes.
- *Migration:* Labour migration is an important means by which an economy grows, by allowing people to respond to opportunities outside their community. Agricultural policy itself frequently induces migration by creating such opportunities, establishing concomitantly the conditions in which the HIV virus is transmitted. The idea is not necessarily to impede migration, but to develop programmes and policies (education and health) to encourage families rather than individual workers to relocate. This could be encouraged by providing incentives for companies to provide family housing for workers on commercial farms, plantations, and other large employers of labour connected with agriculture. Such a policy could also apply to mines and other non-agricultural firms as well. Another possibility is to develop specific prevention and education programmes for all migrant workers as well as company-based medical services including anti-retroviral treatment for people living with HIV and AIDS.

A major impediment to the effectiveness of such a policy concerns land tenure structure. Despite the fact that an adult may find lucrative employment away from home, existing usufruct tenure rules provide incentives for some family members to remain at the rural homestead to retain rights over their land, even if it is only

marginally utilized. More secure tenure rights for owners would again allow families to temporarily relocate, with assurances that they would be able to return to their land at a later time.

- *Invest in improving access to water and fuel* (e.g., borehole sinking, agroforestry projects) to reduce time spent on these labour-intensive tasks (Gillespie 1989). These may have a high benefit-cost ratio in terms of health effects and simultaneously increase the amount of labour that could be freed up for productive income-earning activities. Benefits will be especially high for women, who do most of the water and fuel fetching.

3.2.2. *Policies and Programmes Affecting Agricultural Research and Extension Systems*

- *Labour Saving Technologies as One of a Variety of Technology Responses:* Given the wide variations in land-to-labour ratios found throughout eastern and southern Africa, labour saving technologies may not be appropriate for all afflicted households or in all hard-hit communities. Payoffs to research in improved seed technology (generally considered to be land-saving) have historically been very high (Oehmke and Crawford 1996) and it is unlikely that seed research will be any less valuable given the existence of AIDS.

Despite the likelihood of more severe capital constraints over time, low-external input technologies are unlikely to contribute much to AIDS mitigation. It is possible that low-input technologies are appropriate in a limited number of household-situations. For the most part, however, low-external input technologies without soil fertility enhancement mean substantially lower yields and production, and lower returns to land and labour. Promoting such a response in the aggregate would most likely contribute to poverty and misery rather than alleviate it (Haggblade, Tembo, and Donovan 2003).

It is in this vein that caution is warranted about promoting new crops simply because they are labour-saving or possess important nutritive qualities. While these are important criteria, the promotion of new crops also needs to be assessed in terms of its effect on returns to land and labour, and broader agricultural and rural development objectives. For example, if the promotion of the crop would shift cropping patterns and displace other crops that yield higher production per unit of land and labour input, then there may be adverse effects on agricultural productivity, crop income, and food security. The trade-offs between superior nutritive value of certain crops vs. lower overall value of output produced need to be assessed in greater detail to determine whether production of certain crops ought to be promoted. Since resources are scarce, proposals to promote the use of food crops with desirable nutritive qualities will likely come at the expense of production of other crops, with uncertain effects on overall crop income or the quantity of food produced. There has been little cost-benefit analysis to date indicating whether such proposals represent the most effective use of resources to save lives and build up resilience to the effects of the disease.

- *Conservation Agriculture Approaches That Provide Productivity Improvements and Economize on Labour Input:* This proposal also relates to the previous set of

proposals affecting agricultural input use. By using labour in the dry season for land preparation, conservation agriculture methods may assist in ameliorating the severe labour constraint at land preparation periods. When the first rains come and planting needs to quickly follow, those farmers practicing conservation agriculture would have been able to spread the work out over time and achieved it. Challenges in practicing conservation agriculture arise, however, due to the high weeding needs in the early years, as well as the total time spent in land preparation for those early years (Haggblade, Tembo, and Donovan 2003).

- *Programmes to Educate and Change Behaviours of Agricultural Extension Workers:* Agricultural extension systems have been adversely affected by the AIDS epidemic as many workers have died. Agricultural extension workers possess attributes known to be correlated with HIV contraction: mobility, education, and relative affluence. There is a need to focus on attitude and sex behaviour change among agricultural extension workers and utilize them as forces for positive behaviour change in the community. As stated by the Uganda's Ministry of Agriculture, Animal Industry and Fisheries:

Extension workers interact regularly with the crop farmers, livestock farmers and the fishing folk. However, despite this regular interaction ...extension workers are not involved in HIV/AIDS work, as it does not fall within their mandate. Also the extension workers at present lack the knowledge and skills of addressing HIV/AIDS issues since it had long been perceived as a health matter. In a way, HIV/AIDS seemed to have been perceived in the agricultural sector as a health issue, but not a development issue. The proposed mainstreaming of HIV/AIDS messages into agricultural extension is recognition by the agricultural sector that the epidemic is not only a health issue, but a development issue as well (Government of Uganda 2003, p. 3).

- *Programmes to Increase the Number of Trained Agricultural Extension Workers:* As men and women die of AIDS, much of their accumulated knowledge and skill is lost to the succeeding generation. Problems of intergenerational knowledge transfer, if not redressed, will reduce the productivity of labour in agriculture, as well as the contribution of people to society, and the contribution of society to individuals (Bell, Devarajan, and Gersbach 2003). This highlights the importance of education and skill development, which goes far beyond the Ministry of Agriculture. However, an important role for the Ministry of Agriculture is to rehabilitate the agricultural extension system. This means more than reviving the number of extension agents and contacts with farmers, but also improving the mode of transmitting information to farmers. The detailed design of extension system rehabilitation is beyond the scope of this paper. Our main point here is to highlight the important role of more effective agricultural extension systems in overcoming AIDS-related problems of intergenerational transfer of agricultural husbandry and marketing knowledge.
- *Programmes to Make Agricultural Extension Systems Viable and Effective in AIDS-affected Contexts:* The contents of extension services also need to change in order to be responsive to the AIDS epidemic. Not only will more extension workers be needed, but knowledge and skills they transmit need to be in line with the changes in

the societies and their access to labour, agricultural inputs and services. Extension services need to cater to the knowledge needs of women, the elderly and the very young. Extension contents need to incorporate conservation agriculture and other labour saving technologies and practices that address the specific labour shortages arising as a consequence of the epidemic, especially among the most vulnerable groups and among those rendered vulnerable due to the epidemic. They need to promote crops that are more suitable to the families affected by AIDS.

3.2.3. *Policies and Programmes Affecting Commodity Marketing Systems*

- *Improved Input and Commodity Marketing Systems:* While this issue is important irrespective of its relation to HIV/AIDS, we include it here to highlight the fact that one of the most important ways to reduce the impacts of AIDS is to strengthen the rural economy. Agricultural markets for inputs and commodities are central to this process (Johnston and Mellor 1961; Mellor 1976).

Intensification of smallholder agriculture requires greater access to inputs such as fertilizer and improved seed as well as reliable access commodity traders at prices greater than production costs. Instituting well functioning input and output systems has been difficult in much of the region. While some controversy remains over the appropriate direction for future marketing policy, there is little doubt that greater public goods investments in road, rail, and port development, as well as communications infrastructure, are crucial. High domestic transportation costs have clearly impeded fertilizer use in the region, as they account for roughly half of the total price borne by farmers, and contribute to the fact that fertilizer prices are among the highest in the world (Jayne et al. 2003a).

The development of competitive commodity markets for export crops has also been impeded by high marketing costs. Efforts to improve the competitiveness and productivity of smallholder agriculture are likely to be among the most important ways to help afflicted households and communities cope with the ravages of AIDS.

3.2.4. *Policies and Programmes Affecting Gender-differentiated Allocation of Resources*

- *Redress Gender Biases in Agricultural Programmes:* Access to credit and inputs through out grower schemes – recipients are usually men, not women. It is primarily men who receive the specialized crop husbandry and marketing knowledge to grow these crops under out grower and cooperative arrangements.

Marked gender inequalities in the access and ownership of productive resources make the whole society more vulnerable in the wake of an external shock such as AIDS. In large parts of Africa, while men traditionally control and own many resources, women gain access and use rights through marriage. When marriage links are broken through the death of the spouse and women are denied access or use of the resources or lose them through property grabbing, they are frequently left only with their body to gain access to food, money or rights. The AIDS epidemic has evidenced the inherent danger in acute gender inequalities in access to resources. Therefore, programmes

that seek to ensure gender equality in participation and access will have a protective effect for the society. In addition, they will have an empowerment effect on women, further protecting them against HIV. All agricultural policies and programmes should be revised in order to take gender issues adequately into account. They should ensure equal access to valuable resources such as land, knowledge, skills, credit, extension, and equal participation in all activities.

- *Education Campaigns Aimed at Reducing Widow Inheritance:* Studies in Kenya and Uganda indicate that the widespread traditional practice of widows being “inherited” by one of the deceased husbands’ brothers is no longer mandatory (Government of Uganda 2003; Rugalema 1999). It is now well recognized that this custom has exacerbated the spread of AIDS. Unfortunately, initiatives to stop these practices may leave widows in a weak economic position, which has been observed in some cases to contribute to other types of risky sexual behaviour. Alternative approaches to caring for widows and their dependents are necessary to reduce the spread of the disease.

4. CONCLUSIONS

HIV/AIDS is not simply a problem for Ministries of Health to address. Mitigating the spread and the consequences of HIV/AIDS requires a coordinated approach involving agencies responsible for agriculture, health, trade and commerce, and finance. Based on projections of future demographic change in the hardest-hit countries of eastern and southern Africa, the full impacts of HIV/AIDS on the agricultural sector are only just starting to manifest, and will intensify over the next several decades. It is critical that agricultural policy makers anticipate the changes that HIV/AIDS will bring to the agricultural and rural sector, and proactively respond through the development of policies and programmes that factor in these projected impacts of the disease. Because many policies and programmes take years to implement and provide tangible results with a time lag after implementation, there is indeed urgency to put in place an appropriate set of public investments and programmes that can cushion the blow by the time the long-wave impacts of AIDS are in full force, rather than respond reactively after crises caused by structural changes in the economy have already manifested.

One of the most important ways in which agricultural policy can contribute to reducing the spread and consequences of AIDS is to contribute effectively to poverty reduction. Risky sexual behaviours are at least partially related to limited opportunities to earn a livelihood through other means.

As stated by Topouzis and du Guerny (1999), it is understandable that a sectoral ministry might be reluctant to engage itself in an area in which it possesses no real competence and could be perceived as treading on the authority of the Ministry of Health. But there is a need to systematically address the contribution that Ministries of Agriculture could make toward the goals of (1) preventing the spread of HIV; (2) supporting people living with HIV and AIDS; (3) reducing the vulnerability of individuals and communities to HIV/AIDS; and (4) alleviating the socio-economic and human impact of the epidemic.

This clearly does not mean that all agricultural policies should be modified in ways that contribute to these four goals. Some government actions can potentially make a huge contribution to reducing the spread and impacts of AIDS without seriously compromising other important development objectives, while other government policy changes might have a modest contribution to reducing the spread of AIDS but at a huge opportunity cost in terms of foregone agricultural productivity and income growth, which could exacerbate poverty and misery rather than alleviate it. Examples of policies in the latter category might be labour policies that attempt to impede migration. While peoples' migration off the farm to seek better employment opportunities in urban areas, mines, and commercial farms may increase the spread of AIDS -- especially in the absence of other policies devoted to education and behaviour change -- policies designed to limit migration would almost certainly exacerbate poverty and land pressures in densely populated rural areas. While migration is part of the problem, there may be ways to modify the conditions of migration to encourage relocation of families rather than individuals.

This paper has laid out some elements of a framework for systematically reviewing existing policies and programmes of the Ministry of Agriculture, with a view to identifying those policies and programmes with the greatest potential to mitigate the spread and consequences of the disease, while having the least adverse effect on the achievement of other important

national policy objectives. It is proposed that these assessments be cast in a cost-benefit framework, taking into consideration the general equilibrium effects that may occur outside the agricultural sector. This will indeed be a daunting task because of limitations on data and models to empirically incorporate such intricate cross-sectoral effects.

Lastly, what can we learn from countries where major progress has already been made in reducing the spread of HIV (e.g., Uganda)? If the ingredients of success can be replicated more broadly, then doing so in a proactive way may be one of the most effective ways by which governments and donors can not only support their agricultural and rural development objectives, but also save millions of lives that can contribute to society more broadly.

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