Gender and Soil Fertility Management in Mbale District, Southeastern Uganda

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Introduction

This paper explores gender-related aspects of agriculture and agricultural change in a densely populated, high potential area in eastern Uganda, particularly in relation to declining productivity in the region. Much recent literature has investigated the impacts of specific agricultural policies and projects on women farmers in sub-Saharan Africa [1]. In many cases, these policies and projects have resulted in unexpectedly negative consequences for women – and often failed in other objectives as well – to a large extent because they did not adequately consider the critical and complex roles that women play in most African agricultural systems. Far less often examined in the literature on gender, have been the chronic but pervasive impacts of persistently low agricultural productivity throughout most of sub-Saharan Africa. This stagnation is one of most striking and widespread features of agriculture in Africa today, and it stands in sharp contrast to the experience of most developing regions in Asia and Latin America. The impacts of this stagnation and decline in agricultural productivity are likely to be particularly severe for African women farmers, whose economic livelihoods are so closely linked to the production and sale of agricultural products and services.

The paper also examines gender differentiation in agricultural activities and resources in the survey region and the interaction of gender with other household and demographic characteristics. Many aspects of gender roles in African agriculture are more complex and variable than is often assumed, including the common assumption that women specialize in food crop production while men concentrate on nonfood cash crops. Moreover, important features of age and household structure overlap with gender in complex ways, and characteristics that are often interpreted as related to gender also involve other demographic and household variables. Finally, gender roles have been undergoing considerable change in response to changes in economic conditions, migration, and disease incidence (particularly HIV), among other factors, all of which have necessitated adaptation of traditional gender roles. As discussed below, in the survey region many activities, resources, and outcomes are

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not differentiated solely by gender, and many of the activities and attributes of women and men farmers cannot easily be distinguished.

After examining some of the context of Ugandan agriculture, and comparing Uganda's experience to those of other regions in Africa and elsewhere, this paper reviews research data from a survey conducted in 1998 to explore the differentiation of agricultural characteristics and activities on the basis of gender and household structure. Recent trends in production and food security are then examined, also differentiated by gender and household structure. The conclusions address the current conditions and prospects of the agricultural systems of the area and the significance of gender and household structure to these.

UGANDAN EXPERIENCE AND CONTEXT

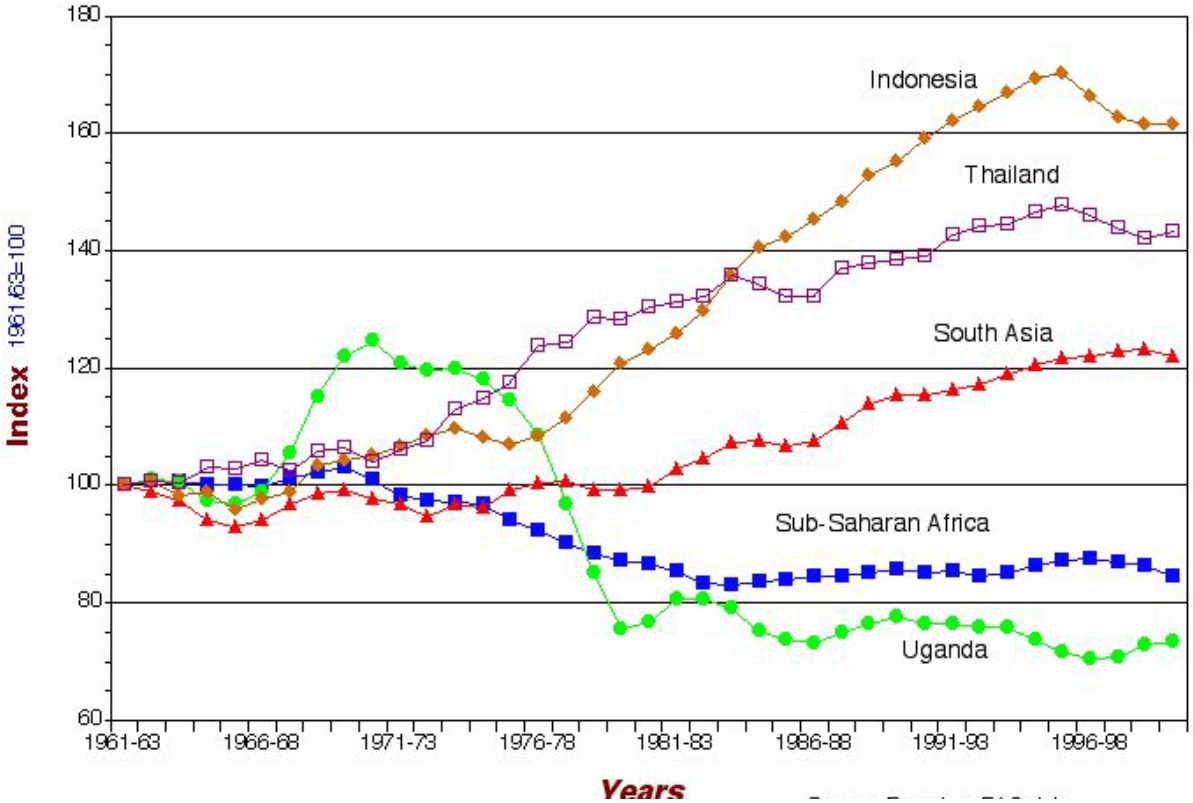
Much of Uganda, including the survey region in this study, is endowed with favorable agricultural conditions. Ample rainfall, divided between two rainy seasons in much of the country, and relatively fertile soils helped make southern Uganda one of the most productive areas of eastern Africa through the pre-colonial and colonial periods [2]. Uganda is estimated to have at least twice as much high potential land as Kenya [3]. The historic development of large agrarian populations, often associated with centralized states such as Buganda and others, testify to the long term productivity of the region. In the 20th century, agricultural output increased dramatically for most of the decade after independence – more rapidly in fact than most other developing regions in Africa or elsewhere (Figure 1). However, since the mid-1970s, Uganda has been plagued by more than two decades of severe political and social turmoil, combined with four decades of rapid population growth since 1960 and over three decades without agricultural input use, particularly for soil fertility improvement. These have all contributed to stagnant or declining productivity in agriculture and persistent rural impoverishment in much of the country.

The UN Food and Agriculture Organization (FAO) estimates that about 80% of Uganda's 1999 population of 22.6 million is agricultural and over 85% is considered rural [4]. These proportions are high even by African standards, and they indicate the continuing dependence on agricultural production in Uganda. Despite this, virtually no aspect of agricultural production in Uganda has been able to keep pace with population growth for the last two to three decades. Per capita agricultural production in Uganda declined steadily through the 1980s and most of the 1990s, and it is currently estimated to be about 75% of the level of per capita production in the early 1960s (Figure 1). Per capita production of food crops and of livestock, two of the components of total agricultural production, have similarly declined to 75% to 80% of their 1960s levels. The most dramatic decline, though, has been in nonfood ("cash") crops, which are currently at about 40% of the per capita level of the early 1960s. These are markedly more severe declines than those estimated for sub-Saharan Africa as a whole, for which per capita agricultural production in 1999-2001 is estimated by the FAO at about 85% of the 1961-63 level.

Figure 1

Per Capita Agricultural Production, '61/'63 - '99/'01

Indices, Selected Countries & Regions *(3-year running averages)*



The Ugandan experience as well as that of sub-Saharan Africa as a whole are in marked contrast to the record of most developing Asian and Latin American countries. Per capita agricultural production in Indonesia, for example, is about 60% greater in 1999-2001 than it was in 1961-63, despite massive population growth there [5]. Less dramatic improvements have occurred in South Asia, where recent per capita production is about 20% higher than in the early 1960s. Nonetheless, this more modest improvement occurred despite a 130% increase in population over 30 years (to over 1.3 billion in 2000) and under conditions of far higher population density than found in sub-Saharan Africa.

A substantial part of the failure of agricultural production to keep pace with population growth in Uganda and in most of Africa is due to the failure to increase agricultural productivity. Maize yields in Uganda, for example, are estimated to be at approximately the same level as they were in the early 1960s – approximately 1.1 to 1.3 tons per ha [6]. In contrast, maize yields in most countries of Central and South America, and South and Southeast Asia, which all started at levels about the same or lower than Uganda's in the 1960s, are now estimated to be two to three times as high. The same is true for Africa as a whole in comparison to other developing regions.

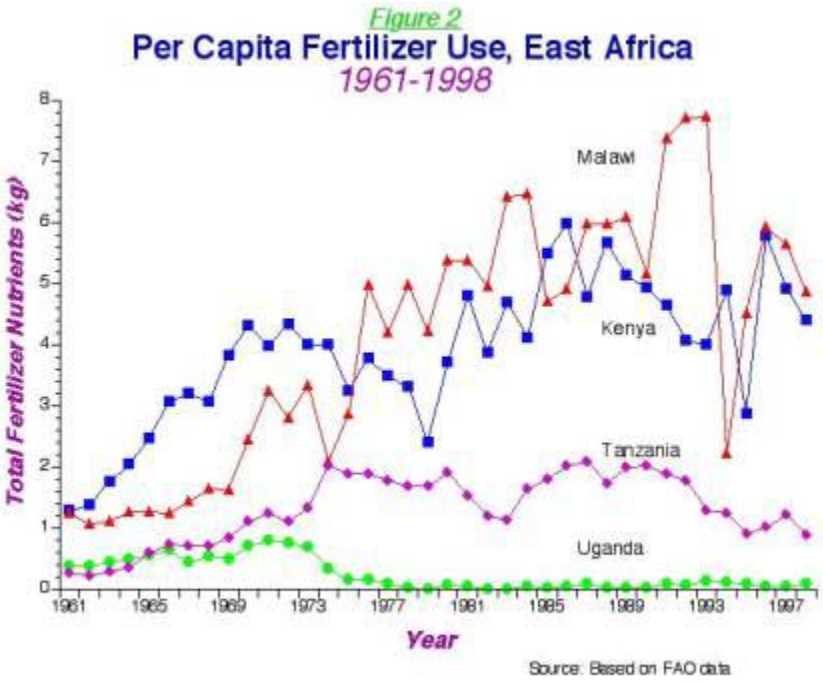
The single most important cause for the persistence of low productivity in African agriculture is probably the extremely low level of fertilizer use there, which contrasts sharply

with all other parts of the developing world. Table 1 shows per capita use of total fertilizer nutrients – nitrogen, phosphorus, and potassium – in 1998 (the latest year for which FAO estimates are available) for sub-Saharan Africa and the other main developing regions of the world.

Table 1: Per Capita Use of Fertilizer Nutrients, 1998
(kilograms nitrogen, phosphorus, & potassium per capita)

World	Sub-Saharan Africa	Latin America	China	South Asia	Southeast Asia
23.3	3.4	22.3	27.8	16.0	17.1
Source: Calculated from FAO data [3]					

Even in view of the low and declining level of fertilizer use in most of Africa, Uganda stands out in comparison to other African countries, particularly in East Africa. Figure 2 shows fertilizer use per capita in Uganda in comparison with several other East African countries from 1961 to 1998. It illustrates the recent declines in fertilizer use in most countries as well as the notable absence of fertilizer use in Uganda for the last quarter century. Few countries in Africa, or in the world, particularly those with agriculturally-based economies, have experienced such an extended absence of fertilizer use over the period. As a result, even substantial reservoirs of soil nutrients such as found in the more fertile areas of Uganda will be severely depleted with increasingly intensive use. As in most developing countries, fertilizer subsidies were common in the early 1960s in Uganda. Following the economic disruptions of Amin's regime and subsequent conflicts, fertilizers were unavailable in Uganda except on the black market. They are now again available, but their trade is entirely privatized, with no government subsidies [7]. These conditions are further discussed below in relation to the responses of the farmers interviewed in the research survey.



RESEARCH SITE AND SAMPLING METHODS

Mbale District was selected for this study as a high potential region which is one of the three most densely populated rural districts in Uganda, the others being Kabale and Kisoro which neighbor each other in the extreme southwest of the country (Figure 3).

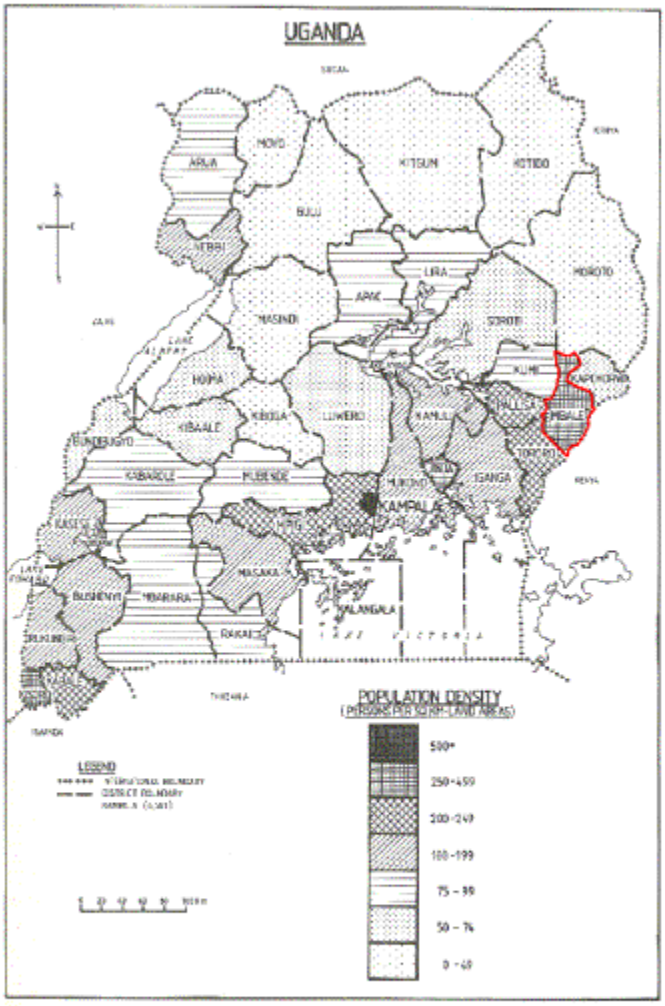


Figure 3: Uganda population density & location of survey area

Source: Uganda, 1994

At the time of the last national census in 1991, Mbale had a population of about 711,000, over 91% of which is rural, and a density of about 284 per sq km [8]. Projected district population in mid-1998 was approximately 905,000, which would imply a density of 361 per sq km and an annual growth rate of about 2.4% [9]. The district also had a sex ratio (the number of men per 100 women) in 1991 of 100.2, unusually high for a rural African region where male outmigration typically leaves many more women than men in rural areas. (By comparison, Kabale and Kisoro had 1991 densities of 246 and 301 per sq km and sex ratios of 90 and 86, respectively [10].) The average rural household size in Mbale in 1991 was 4.6.

Mbale has been relatively prosperous in comparison with other areas in Uganda. It has reasonably favorable agroecological conditions, including volcanic soils in much of the district,

and fairly good rainfall (see below). Because it borders Kenya, it has had access to Kenyan input and output markets, and the western, relatively lower altitude, part of the district is quite well connected to Kampala and other urban centers of central and southern Uganda. Mbale town, the district capital, is about 240 km from Kampala along fairly good paved roads.

Mbale district is also a site of the USAID-supported Investment In Developing Export Agriculture Project (IDEA) to help develop export-oriented agriculture, including major food crops such as maize and beans, as well as a wide range of food and nonfood income crops. Numerous domestic and international NGO projects also work in the district, which includes the western portion of Mount Elgon and the Mount Elgon National Park. Together with its neighbor to the north, Kapchorwa District, which also borders Mount Elgon but has lower population density, Mbale is often seen as among the most agriculturally progressive areas in Uganda [11].

The district is physically divided between lower and higher altitude regions. The former are only relative lowlands, at altitudes of about 1500 meters, with flat or rolling landscapes. The highlands, with agricultural regions at 2000 to 2500 meters and higher, include areas of steep topography and often very fertile volcanic soils. Population density is generally very high in the high altitude areas, and roads can be extremely poor and often impassable in the rainy seasons. Mean annual rainfall ranges from about 1000 to 1700mm, divided into two rainy seasons, with higher altitude areas generally receiving higher amounts [12]. The northern lowland areas are drier than those in the south, and most of the northern region, both lowland and highland, is less well connected to transport networks and urban centers than southern areas. Soils in the lowlands are generally not as fertile as in the higher altitude areas, but population densities are lower, and roads and levels of access to markets and towns are considerably better. The northern lowlands have also in recent years been subject to cattle raiding by heavily armed Karamoja pastoral groups from the dry plains north of Mbale. The predominant ethnic group throughout the district are the Bagisu (or Gisu), who are considered closely related linguistically to the Luhya of the Kakamega region of Kenya.

Four villages were selected for this survey, two each in the lower and higher altitude regions and in the northern and southern portions of the district. The sample was stratified so that ten women and ten men were interviewed in each village, yielding a total sample of 80. Respondents were selected at random from lists of village households compiled by village leaders. Seventy one percent of the respondents are married, but the sample included eleven single women (28% of the women interviewed) and twelve single men (30% of the men).

In order to explore the gender and household aspects of agricultural activities and soil fertility management, the survey data discussed below is categorized into four groups: married men and women and single men and women. In some parts of Africa (particularly West Africa), married men and women have very distinctive responsibilities and activities, including separate crops, agricultural plots, tasks, and income sources [13]. As discussed below, such distinctions are far less marked in this region than elsewhere. Female-headed households figure prominently in much literature on gender. The group labeled single women represents most of the female-headed households in the survey sample. Their special characteristics in this sample are discussed below. Because of the low rate of male outmigration in the district, there were very few of what are sometimes termed "de facto female headed households" – i.e.,

households with a husband living and working elsewhere. Only two of the 29 married women in the sample said their husbands lived elsewhere for much of the year. Single men also emerged as a distinctive group, as discussed below.

The surveys dealt with household conditions and activities as well as gender distinctions in agricultural resources, activities, and incomes, with particular focus on aspects of soil fertility management and productivity. Current conditions and outcomes were compared with those in the past (ten years ago) to get a sense of trends. Some additional anecdotal material is also reported below. (There were few differences in gender-related characteristics among the villages, and as a result the villages are not dealt with separately in this paper.)

HOUSEHOLD SIZE, STRUCTURE, AND LAND OWNERSHIP & USE

Household Demographic Characteristics

Basic demographic characteristics of the respondents and their households, divided by gender and marital status, are shown in Table 2.

Table 2: Average Age, Household Size, & Age Distribution

	Total Sample (N=80)	Women (N=40)	Men (N=40)	Mar'd Women (N=29)	Single Women (N=11)	Mar'd men (N=28)	Single men (N=12)
Average age	41	42	40	34	62	41	39
Household size	6.1	6.4	5.8	7.1	4.5	7.5	1.6
No. adults (>18)	2.6	2.7	2.4	3.0	1.7	2.8	1.5
No. children (<18)	3.5	3.8	3.3	4.1	2.8	4.7	0.1
Adults/ children	0.7	0.7	0.7	0.7	0.6	0.6	18.0
% polygamous (N= 57)	37%			62%		11%	

The average age for the total sample is 41. While women and men differ only slightly in mean ages overall, there are sharp distinctions between the subsample of single women and the other categories. All of the single women are widows. Their average age is 62, and eight of the 11 single women are 60 or older. The single men, in contrast, have an average age of 39.

Married women are the youngest sub-sample, with an average age of 34; none of the married women is 60 or over. The average age of married men is virtually identical with the total sample mean.

An important implication of the age distribution of this sample is that for women, the effects of age cannot be distinguished from the effects of being a single female head of household. Life cycle features clearly play a significant role in characterizing the sample of single women in this case. The category of single women, as a result, should be seen as representing characteristics combining gender- and age-based characteristics. Although there is a substantial age difference between the single women and single men, both groups have far fewer adults in their households than do married households, and thus less available labor. (They also have considerably less land, as shown in Table 4 below.) An important difference between single males and females, however, is that the single women care for an average of almost three children under 18, often grandchildren, while most single men have no children in their households. This further reduces the amount of land per person in the female headed households (see below).

The average resident household size (i.e., the number of people resident in the household) is 6.1 for the sample of 80 respondents, with a total household population of 487. The gender and age and distribution of resident household members reported by the respondents is summarized in Table 3.

Table 3: Gender & Age Distribution of Household Residents

Age	Male	Female	Percentage
Over 60	5	18	5%
18 – 60	98	83	37%
Under 18	143	140	58%
Totals	246	241	100%

The approximate equivalence of male and female residents is consistent with the sex ratio for Mbale reported in the census data, but this is atypical of many rural areas in Africa where male outmigration usually leaves a substantially larger number of women in the main working age groups. The significantly larger number of men than women in the 18-60 age range (although somewhat offset by the preponderance of women over 60) is particularly striking. It suggests either that migration by young men is less frequent and/or migration by women is more frequent than elsewhere, or that there has been considerable return migration, or all of these. The very high proportion of young people, with almost 60% of the population younger than 18, is indicative of the high fertility rates of the country and in this region. The fact that the proportion of young people in the population is higher than it is for the country as a whole, suggests the influence of outmigration, although this does not seem to have been as gender-biased as it usually is.

Traditionally, the Bagisu have involved their children in household chores and agricultural labor at a very early age (as is true in most African cultures). Beginning at the age of six or seven, children are expected to perform chores including gathering water and firewood (mainly done by girls), weeding household plots, and tending livestock (mainly by boys). Household labor capacity changed substantially with the provision of free primary education in 1997. Primary education is mandated by law, and up to four children in each household are permitted free primary education (although additional costs are often collected by school personnel). Children still do some household labor after school, but households with children between the ages of 6 and 12 have lost at least some of the labor traditionally provided by these children.

Landholding Size and Trends

The Bagisu are patrilineal, and land is passed to sons. They are also patrilocal, and women generally move to their husband's family compound at marriage. (A brideprice is expected from the husband or his family, which has traditionally been paid in cattle or other livestock, though other forms of wealth may also now be used.) Survey respondents report that in recent years, land purchases have become common, and the sale of land is used as a source of quick cash. Land rental or borrowing for one or more seasons are also common, as reported below.

Household landholdings are extremely small, both in the lower and higher altitude villages and among all demographic groups, reflecting the high population density of the region. The average farm size across the total sample is 2.2 acres or about 0.9 hectares. (Acres are generally used below because farmers speak in terms of acres rather than hectares in estimating land sizes.) With an average household size of 6.1 persons, this represents a mean per capita landholding of 0.4 acres (0.15 ha) – very little land on which to produce both household food and income. Nineteen of the farmers (24%) have less than one acre, and 15 (19%) have over three acres. Only four farmers in the sample (5%) have more than five acres (about 2 ha) per household, and the largest landholding in the sample is 10 acres (4 ha). Household land is typically divided into several plots, with an average of 3.7 plots per household. Table 4 lists reported average landholdings, numbers of plots, land per capita, and the percentage of farmers who rent or borrow land, disaggregated by gender and marital status.

Overall, women and men respondents reported roughly similar total household landholdings, with women having slightly less than men. (With the exception of widows who retain some of their husband's land, women do not own land on their own in the region.) There are, however, sharp differences in landholdings between married and single households. Single men or women have less than half the land that married households have. However, when the amount of land per person is calculated, single men, with their small households, have the largest amount of land per capita of any subgroup, while married men and women have the same amount per capita – about half as much as single men. Single women have the least land per capita, reflecting the number of dependent children in their households and their low total land holdings. This is one of several aspects of poverty among households headed by single (older) women.

Table 4: Household Land Holding and Usage

	Total Sample (N=80)	Women (N=40)	Men (N=40)	Married women (N=29)	Single women (N=11)	Married men (N=28)	Single men (N=12)
Land (acres)	2.2	2.1	2.3	2.4	1.2	2.9	1.0
Land per capita (acres)	0.42	0.34	0.50	0.38	0.24	0.38	0.80
Avg. no. of plots	3.7	3.3	4.2	3.7	2.3	5.1	2.0
% who rent or borrow land	46%	43%	50%	45%	36%	50%	50%

In addition to gender, age and life cycle characteristics are clearly involved in landholding for this sample. Elderly men and women both tend to have very small landholdings, mainly due to the passing of land to their children and the limited labor resources they have available. Three of the single men in the sample are over 50, and two of these have only a quarter acre. Similarly, two of the 11 single women have only a quarter acre of land, and another five have a half acre. In all of these cases, farmers are likely to rent land from others when they have available funds. Almost half of the sample borrow or rent land to plant in addition to the plots they own. Single women are the least likely to do so, while single or married men are most likely to rent or borrow land.

Although it might be expected that landholdings have been declining for most households, only 29% of the respondents indicated that their farm size has decreased over the past 10 years; 40% said their landholding has remained constant, and 31% said it has increased (Table 5). Male respondents, particularly married men, were much more likely to have increased their landholding over the period than women. This could be a result of additional land purchase or inheritance. Half of the single women and single men reported having less land than in the past, though for differing life cycle reasons. The single women were widowed and in general much of their previous household land would have reverted to their male children (or co-wives' children in the case of polygamous households; about 37% of the sample who responded were from polygamous households). The much younger single men might have less land than in the

past as they moved out of their family compounds and established their own single households. Only one among the single males and females reports having increased cultivated land over the past 10 years.

Table 5: Land Currently Planted vs Land Planted 10 years ago

	Total Sample (N=58)	Women (N=30)	Men (N=28)	Married women (N=20)	Single women (N=10)	Married men (N=20)	Single men (N=8)
Decreased	29%	30%	29%	20%	50%	23%	50%
Increased	31%	20%	42%	30%	0	50%	17%
Same	40%	50%	29%	50%	50%	27%	33%

GENDER AND CROP & LIVESTOCK OWNERSHIP & MANAGEMENT

Gender identification of crops, livestock, and household farming plots is a common feature of African agricultural systems. Certain crops and livestock are often strongly identified as predominantly within a male or female domain, although this can vary considerably among cultures and is likely to change over time. In many African areas, it is common for nonfood income crops such as coffee, cocoa, and cotton to be principally men's crops. Women traditionally have primary responsibility for food crops, but gender identification is usually more complex than this, with the disposition of some food crops, often staple grains or root crops, controlled by men, while other foods, particularly many legumes, controlled mainly by women. Livestock also often are linked to male or female household members, with cattle more often being controlled by men and goats and/or poultry by women. But again, there are many variations, and considerable change is underway [14].

Various aspects of crop and animal management and their gender dimensions were examined in this study, differentiated by the four main gender and household categories: married and single men and women. In general, gender identification is less clearly defined in Mbale than it often is in other African agricultural systems, and age and/or life cycle characteristics are often strongly confounded with gender.

Main crops

The four main food crops in the region are starchy bananas (known as "matoke" in much of Uganda), cassava, maize, and beans (*Phaseolus vulgaris*), each of which is considered one four most important food crops by between 65% and 90% of farmers interviewed (Table 6). Sweet potatoes and cocoyam are also moderately important food crops. Coffee, beans, bananas, and

maize are the most important income crops in most of the region, with various vegetables (tomatoes, cabbage, and onions) also important for some farmers and in some regions.

There are some gender distinctions in crops, but they do not as seem as sharp as in other areas of Africa or, possibly, as they were in the past. The main food crops grown by men and women are approximately similar, as are those considered main men's and women's crops. Bananas are considered the single most important crop by both men and women, married or single. Maize and cassava are somewhat more important to men, and beans, sweet potatoes, and cocoyam are somewhat more important to women. All of these, however, are commonly grown by both genders.

Among income crops, coffee is generally considered a men's crop, and it predominates among married men, but over half of single women also grow it, generally because they are widows who inherited their husbands' coffee plants after his death. Bananas and beans are important income crops for most households, and although beans are considered more a woman's crop, they are also grown by single men for income. Tomatoes, onions, and cabbages are also grown by women as cash crops and are sold in local markets. They are rarely if ever sold to traders for transport to distant markets. Other than those women who have inherited coffee, the produce women sell is generally only for local markets. In terms of gender identification of the main food and income crops, the responses indicate that although there are some differences, the distinctions are relatively subtle, and they may have become more flexible than they were in the past.

There are also some crop distinctions between married and single households of both genders. The main household income crops for married women are beans, coffee, bananas, and maize, in this order, with tomatoes, onions, and cabbages as additional income crops. Among single women, the main income crops are bananas, coffee, and beans. Maize, tomatoes and onions are less commonly grown by single women as income crops. Among married men, coffee stands out as the most important income crop, followed by beans, maize, and bananas. Tomatoes, onions, and cabbage, and in a few cases cotton, are also important income crops. For single men, bananas are approximately as important as coffee as an income crop, followed by beans, maize, and tomatoes.

Many of the responses as well as anecdotal information provided by the respondents, however, indicated that although specific crops sold by men and women may not differ substantially, their marketing patterns often do differ. Women often sell sold their crops only locally, either in front of their homesteads or at the nearest market or trading center. Partly because of their heavy domestic workload, they often tend to travel very little. Indeed, one of the female respondents said that she does not travel anywhere except to her plots and back, while her husband does all of the marketing. Although this is an extreme case, men generally travel much more than women, and they are much more likely to sell produce in more distant markets. In addition, women often report that they have limited control of the money they earn from crop sales or some of their other activities (see also Table 10 below), as the money is said to "go into the husband's pocket.

Table 6: Main Food & Income Crops

(a) Main Food Crops

Percentage of farmers listing crop as one of four main household food crops

	Total Sample (N=80)	Married women (N=29)	Single women (N=11)	Married men (N=28)	Single men (N=12)
Bananas	90%	90%	91%	93%	83%
Beans	78%	86%	73%	79%	58%
Cassava	69%	62%	36%	82%	83%
Maize	66%	62%	46%	82%	58%
Sweet potato	39%	41%	64%	36%	8%
Cocoyam	29%	38%	46%	11%	33%
Millet	8%	10%	9%	7%	0%

(b) Main Income Crops

Percentage of farmers listing crop as one of four main household income crops

	Total Sample (N=80)	Married women (N=29)	Single women (N=11)	Married men (N=28)	Single men (N=12)
Beans	62%	66%	55%	67%	50%
Coffee	60%	55%	55%	70%	58%
Bananas	52%	52%	64%	37%	67%
Maize	35%	41%	9%	44%	25%

Tomatoes	20%	21%	9%	22%	25%
Cabbage	14%	14%	18%	15%	8%
Onions	14%	17%	0%	22%	0%
Cassava	10%	10%	18%	7%	8%
Cotton	8%	10%	0%	11%	8%

Livestock

Livestock, particularly cattle and chickens, are a sign of wealth and a means of storing wealth among the Bagisu. Milk and eggs provide additional protein in peoples' diets, but meat is not a major element in their meals. When a household includes meat in a meal, the meat is most often purchased one or two kilograms at a time. The only time a cow is slaughtered for food is when the family is preparing a large ceremony or feast that will include extended family and community members. Otherwise, cattle are used almost exclusively for brideprice or gifts to young men preparing for their circumcision ceremonies.

While the people in this district are relatively poor, most households own at least some livestock, mainly cattle, goats, and poultry. About 70% of the sample households own cattle, and slightly more have poultry (Table 7). Slightly under half of the households own goats, and fewer than 20% own other livestock, mainly pigs or sheep. In general, single men's households are the least likely to have livestock. Most single females, in contrast, own cattle, poultry, and/or goats, having inherited them from their deceased husbands. While virtually all married households own some type of livestock, the women usually in these households do not own the major livestock themselves. Women own cattle in only about 10% of married households and they own goats in about 20% of these cases. Even poultry, which are often considered women's animals, are owned by women in only about one-third of the married households. (Knutsen [15] reports a roughly similar gender pattern of livestock control in southern Tanzania, but a much greater degree of female ownership and control in parts of northern Tanzania.)

A high proportion of women, both married and single, sell livestock products, notably eggs and milk. Eggs are somewhat more frequently sold by single women, and milk by married women. Married men are less likely to sell either of these, and almost no single men sell eggs.

Almost 80% of farmers in the total sample, and over 90% of male respondents, say they do not have enough feed for their livestock. A small proportion say they buy feed for their animals, but almost none of the women purchase feed. As discussed below, livestock provide manure for many of the farm households, even many of the female headed households, The constraints on feed resources, however, limits the numbers of animals and the amounts of manure available.

Table 7: Livestock Ownership, Sales, & Feed

Percentage of farmers

	Total Sample (N=80)	Married women (N=29)	Single women (N=11)	Married men (N=28)	Single men (N=12)
Ownership (in household)					
Cattle	69%	76%	64%	71%	50%
Goats	46%	55%	55%	46%	17%
Poultry	73%	72%	73%	82%	50%
Ownership (by women)					
Cattle	18%	10%	55%	11%	0%
Goats	24%	24%	36%	18%	0%
Poultry	35%	35%	55%	29%	0%
Sales of livestock products					
Milk	31%	45%	36%	25%	8%
Eggs	38%	41%	55%	29%	33%
Feed supply					
Enough feed?	21%	38%	27%	7%	8%
Buy feed?	15%	7%	9%	25%	17%

FALLOW PERIODS, SOIL MANAGEMENT, & INPUT USE

The survey included questions on whether farmers maintain a fallow period on their fields and the length of fallow, the use of manure and other soil nutrient additions, the use of purchased fertilizer, and purchased hybrid maize seed. Leaving land fallow is one of the most

important traditional means of soil fertility management, but with very high population density and very limited household landholdings, it is difficult for farmers to leave land unused on a regular basis. Farmers also often add animal manure and/or compost from crop and food byproducts to their fields to replenish soil nutrients. These techniques involve the collection, concentration, and recycling of nutrients already present in the local land use system, but they are limited by important material and labor constraints. Manure and compost have low nutrient concentrations relative to manufactured fertilizers, and large volumes and weights need to be carried to planted fields. Their use in many labor-based agricultural systems is limited to fields near the homestead, unless draft animals or other power sources are available to cart the material to outer fields. More extensive use is constrained by limits on the supply of organic material itself as well as the labor needed to transport and spread it over extensive fields.

Fallowing Practices

Even with fertile volcanic soils, fallow periods of several years are necessary to restore fertility after cropping, particularly in the absence of fertilizer use or the limited use of nutrient recycling techniques (see below). However, as might be expected from the small size of landholdings, fallow periods for most farmers in this sample are very short or nonexistent. Almost three quarters of the sample say they do not fallow their fields at all, and only 26% of the surveyed farmers report they maintain some fallow on their fields, with an average fallow period of two years (Table 8). These farmers plant their plots for an average of about three years before leaving them fallow. The length of fallow does not differ significantly between men and women who maintain a fallow period, but far fewer women than men do so: in the total sample, only six women (15%) vs. 15 men (38%) say they practice any fallow. Almost half of married men say they maintain some fallow period, a considerably greater proportion than any other group, including married women. Only one of the single women and two of the single men say they maintain a fallow period.

The general lack of fallow, and its brevity in the cases in which it is practiced together with the low levels of nutrient inputs (below), indicates that soil nutrients are almost inevitably being depleted in agricultural fields. Nutrients are continually removed through sale of agricultural products, erosion, and other social and natural processes. Unless lost nutrients are concurrently replaced, mainly through the use of fertilizers and/or other inputs, it can be expected that soil fertility in the region has declined and is likely to continue to do so. Indications of severe nutrient decline are discussed below.

Soil Inputs

One or more "traditional" techniques or inputs to maintain soil fertility – animal manure, compost, household refuse, and/or mulching – are used by almost all of the respondents, but, even with small land holdings, farmers do not believe that these inputs are available in sufficient quantity to offset fertility decline. Labor constraints also often limit their use, since all of these require high labor inputs. The most labor- and land-constrained households, which include most of the elderly single women, generally make least use of these inputs, since they

generally have the lowest availability of both labor and materials. As a result, they would be expected to have the lowest yields and most severe yield declines.

Commercial fertilizers represent net imports of nutrients into agricultural systems – whereas the other techniques mostly represent a rearrangement and concentration of nutrients already present). Their high nutrient concentrations also largely overcome the labor requirements of traditional inputs, which have low nutrient concentration and thus high mass and volume. However, they usually require cash for purchase, and relatively few farmers in the region have previous experience with them, so few know much about their use or potential impacts on output. At the time of the survey, there were also relatively few shops or vendors selling fertilizers, though they were available in some rural locations.

(1) Manure use: About two thirds of the respondents use at least some animal manure, usually on plots close to the homestead and/or the animal stall. The most common use of manure is on bananas, although respondents say it is also used on coffee and maize. None of the respondents purchases manure; all of the usage is from animals owned or controlled by the household.

Somewhat surprisingly, the highest proportion of manure use is among married women, which may reflect intensive small plot cultivation. As noted above, ownership of cattle and most other livestock is roughly equivalent among married men and women (over 70% of married respondents own cattle). However, only 36% of single women use manure, considerably lower than any other group and lower than the proportion who own cattle or other livestock (Table 6 above). This suggests that labor constraints, even more than livestock availability, limit use of manure among these elderly single women.

Only a small minority, about 20%, of respondents say they have enough manure for their needs. The relatively small number of animals per household, due largely to limited grazing and other feed sources, is probably the main factor constraining the supply of manure.

An additional recent problem has appeared in some areas. Lower altitude villages in the north of the district have been repeatedly attacked by pastoralist Karamojong raiders from the north in the last several years, losing many of their cattle and other livestock. In addition to the insecurity and loss of wealth resulting from these raids, they have removed farmers' source of animal manure. News reports indicate that cattle raids in this area have continued through 2000 and 2001 [16]. Such loss of livestock to raiding is likely to accelerate soil fertility decline unless fertilizers or other soil fertility enhancements become more accessible

(2) Use of compost & household refuse, mulching, & agroforestry: Almost all farmers -- 94% -- report some use of compost or refuse on their fields, though mostly in plots close to the homestead. Bananas are the crop on which compost is most often used. The more labor intensive practice of mulching is reported by only 51% of respondents. Thirty percent of the respondents report some planting of trees specifically to improve soil quality. This has been promoted by some local NGOs, though less than one third of farmers report any tree planting for soil fertility improvement.

Use of all of these practices is roughly equivalent between male and female and single and married respondents. The one exception is that single elderly women report substantially lower use of agroforestry than other groups. This is probably due to the small sizes of their landholdings, which limits land available for tree planting (Table 4 above).

Due to the high degree of land use pressure throughout the region, none of these techniques for recycling or concentrating nutrients has great potential to significantly retard or reverse the general decline in soil nutrient supply and crop yields. To do so, all would require the utilization of considerable amounts of noncropped land -- for livestock forage, generating large amounts of biomass, and/or planting of nitrogen fixing trees. Such land reserves are simply no longer available in most of this area. Moreover, considerable labor would be required to disperse the manure or biomass to the crop fields, and farmers consistently say they have little or no labor available for this purpose. Finally, the sale of agricultural products outside the region implies an irretrievable export of nutrients. Thus, although these techniques may increase the efficiency of utilization of the existing nutrient supply, they can at best retard some of the decline in nutrient supply and cannot represent a long term solution, nor can they reverse the substantial declines in yield and output reported by farmers throughout Mbale, as discussed below.

Table 8: Fallow Periods, Soil Inputs and Hybrid Maize Use

Percentage of farmers

	Total Sample (N=80)	Married women (N=29)	Single women (N=11)	Married men (N=28)	Single men (N=12)
% who fallow	26%	17%	9%	46%	17%
Avg fallow length (years)	2	2	2	2	1

Manure use	66%	83%	36%	64%	58%
Enough manure?	19%	25%	25%	6%	29%
Compost use	94%	100%	91%	86%	100%
Mulch use	51%	48%	46%	57%	50%
"Agroforestry"	30%	35%	9%	32%	33%
Fertilizer use (this or last season)	18%	24%	0%	25%	0%
Never used fertilizer	75%	72%	100%	64%	83%
Hybrid maize use	69%	76%	64%	75%	42%
Kg hybrid seed	5.2	4.4	2.8	6.0	6.8

(3) Fertilizer use: As noted earlier, there has been little or no use of fertilizers in most of Uganda for the past 30 years, in contrast to much of Kenya and, to a lesser degree, Tanzania [17]. A small number of farmers in Mbale have recently begun to use fertilizers to address declines in soil fertility, but it seems that this incipient trend has been arrested or reversed by sharply rising prices.

Fewer than 20% of farmers in the sample reported use of commercial fertilizers within the last two seasons, all of them in married households, with no difference between married men and women. None of the single women or single men were currently using fertilizers. Moreover, seventy five percent of the respondents have never used fertilizers. None of the single women, and only two of the single men had ever used them. Among those who regularly or occasionally use fertilizers, the average amount purchased was 11.5 kg.

Most farmers say they are aware of the benefits of fertilizers, having at least seen some of the demonstration plots that the Ministry of Agriculture and the IDEA Project have scattered through the district, mostly for maize. Some farmers who have not used fertilizers are also reluctant to begin because they have heard that once one starts using fertilizers, one cannot stop

using them. (This belief is common in many areas where there is little or no use of fertilizers. Agricultural officials believe it reflects the inability to maintain higher yields without fertilizer use [personal communications].) However, the main constraint to use of fertilizers cited by farmers is cost. The current average price reported by respondents is about UShs 633 per kg (approximately US $0.60 at the exchange rate at the time of the survey). Although not very high in absolute terms, this price represents about a 65% increase over the cost five years earlier, and a 28% increase from the cost two years earlier. This price is comparable to the usual casual labor wage rate of about UShs 600 per day (about 5-6 hours of labor). The average usage of about 11.5 kg would cost about UShs 7300. In addition to the total expense, the lack of a mechanism to purchase fertilizers or most other inputs on credit is certainly a major constraint on fertilizer use.

With about 25% or less nitrogen content in the compound fertilizers, the average purchased amount of 11.5 kg would represent about 2.9 kg of nitrogen (the most common limiting nutrient). If this were distributed evenly over the approximately one hectare average landholding per household, it would represent an extremely small nitrogen addition to counter the large losses that occur regularly through crop sales and removal, soil erosion, and other sources.

The significance of these very low levels of fertilizer and other soil nutrient use (low even in comparison to other similar areas in East Africa) is suggested by a recent study of soil nutrient balances in three densely populated high potential districts in Kenya (Kisii, Kakamega, and Embu) [18]. The study estimated average net nitrogen losses for these three cases to be 71 kg per ha per year, despite farmers' use of fertilizers and manure and other organic inputs in all of these areas. The largest sources of loss of nitrogen and other nutrients were erosion, leaching, and harvested crops. Inputs averaged 21 kg per ha from fertilizers and 31 kg per ha from manure and other organic sources, both probably considerably higher than comparable input use in Mbale District. Similar processes of nutrient loss prevail in Mbale, and it is likely that net losses of nitrogen and other nutrients are more substantial in Mbale than in any of the Kenyan cases.

(4) Hybrid maize use: Hybrid maize varieties, developed and adapted to local conditions by Ugandan and Kenyan agricultural research stations, can potentially increase yields, particularly in combination with fertilizer use. Some hybrid varieties also mature more rapidly than local varieties, which may reduce drought and/or pest losses. However, new hybrid seed must be purchased each year by farmers, unlike traditional varieties or other open-pollinated improved varieties for which farmers can plant saved seed from the previous season. Hybrid maize use has been widespread in many areas of Kenya, including areas bordering Mbale for a long period, but hybrid maize adoption is more recent and less prevalent in Uganda.

In contrast to use of fertilizers, hybrid maize varieties are now widely grown throughout the Mbale region. Almost 70% of the total sample, and over 80% of those who grow maize, plant some hybrid seed (Table 8). Both men and women, including elderly single women, buy hybrid maize seed, though a smaller proportion of single men than any other group plant hybrid seeds. There are more substantial differences in the amounts of hybrid seeds purchased, however, with women overall purchasing about one-third less seed than men. Elderly single women buy the lowest amounts –- less than half what men generally purchase. Most farmers

say they buy fresh seed each year and most report that hybrid maize gives them higher yields, even though only a small number use fertilizer with the seed. The demonstration plots and other efforts to distribute hybrid maize seed in Mbale by the Ministry of Agriculture and the IDEA Project have clearly had a substantial effect on its adoption.

PRODUCTION LEVELS AND TRENDS

Farmers were asked to estimate their most recent (1997) production levels for their main crops (usually bananas, maize, beans, and coffee) and to estimate output for those crops 10 years ago (or when they began farming if that was more recent). Such estimates, particularly for the past, are difficult to make accurately, of course, but they may at least give an indication of production trends in an area. An additional limitation to the data discussed below is that although total sample sizes for responses are reasonable (over 40, except for coffee), several of the subsamples are too small to be statistically significant. The results may nevertheless suggest current conditions and directions for future research.

Table 9 summarizes responses on current output and comparisons of present and past output levels for the four main crops. Current production is converted to per capita output based on the number of resident household members, with children under 18 calculated as equivalent to 0.75 an adult. The figures for 10-year change represent the mean percent difference between current and past output levels for each group. Overall, the responses suggest that farmers are producing considerably less of their main food crops than are required to meet the basic nutritional needs of their households. In addition, there are strikingly large and prevalent declines in output of the region's main crops.

The per capita output estimates for the three main food crops in Table 9 strongly suggest that farmers are not producing enough basic food for their household nutritional needs – although these figures are, of course, very rough estimates, those for banana production (in bunches) particularly vague. Farmers clearly must purchase additional food to meet their needs, as they in fact report doing almost universally (Table 10, below). (Animal products, particularly eggs and milk, also contribute to household nutrition, though output and availability of these was not investigated.)

Among the gender/household categories, single women report the lowest levels of staple food output per capita, with the lowest per capita production of maize and bananas, though their bean production may help provide some additional protein. The main reason for this is probably the severely limited land available to these households, which are typically composed of an elderly woman and several children. Interestingly, however, single women report a relatively high level of coffee output, about twice that reported by the married men. Sample sizes for all of the coffee production estimates are very low, however, and the confidence level for most of these responses is correspondingly low. Estimated per capita production of food staples by married men and women are roughly similar, although contrary to expectations, married men estimate a higher output of beans than do married women. It is possible that this represents inaccurate information by married men of bean production that is done predominantly by women. It may also indicate a growing importance of beans as an income earning crop for men as well as women, as suggested by the high estimated bean output by single men as well as by the high proportion of respondents of both genders who list beans as

major income crops (Table 7). Overall, there are so few production estimates by single men that these are not statistically meaningful. The estimates suggest, however, that their per capita production of staples, particularly maize, is considerably higher than that of the other three groups. The small household size (in most cases just one person), and relatively high amount of land per capita of single males certainly is a major factor in their ability to produce more than the other groups.

The sharp decline in output reported by most respondents for their main food and income crops is one of the most striking findings of the survey. Over 80% of farmers who made output comparisons reported declines for each of their main crops: bananas, maize, beans, and coffee. The extent of reported declines in output was also dramatic. Farmers reported mean production declines of 44% for bananas, 39% for maize, 48% for beans, and 46% for coffee in comparing current output with output on their farms 10 years ago (Table 9). Since only about 30% of respondents said their farm sizes had declined over the period (see above), the major part of these output declines apparently resulted from lower yields per land area. Anecdotally, farmers also report that individual plants tend to be smaller and produce less edible output than in the past. Even those who are planting hybrid and other improved varieties and those using various forms of organic inputs (manure, compost, etc.) report disappointing harvests. The sharp declines in yields would presumably be due to the conditions discussed in the previous section – short fallow periods, and insufficient or no use of fertilizer or organic recycling and additions. In addition, disease and pest damage were reported to have increased for many crops, especially bananas, beans, and cassava, which contributed to the lower yields. The incidence and severity of several diseases may also be linked to low soil fertility.

There are several notable differences in reported production trends among the gender-household groups, though as noted above, the small size of some of the subsamples limits the statistical significance of the results. Single women in particular stand out as reporting the largest percent declines in production for three of the four crops. The decline of maize and bean production by single women was particularly severe and substantially greater than for any other group. The reported decline in banana production was comparable to the declines reported by married men. Many of the single women in the sample might have lost their husbands and/or given some of their land to sons over the previous ten year period, which helps account for the sharp output declines they report. Since almost all are still caring for children under 18, however, their household needs have not declined to the same degree as their productive capacity. Married men reported notably larger percentage declines in maize, banana, and coffee production than did married women, and roughly comparable declines in bean production. Indeed, married women reported lower declines in all four crops than did single women or married men. Single men stood out as the only group to report production increases, which were especially high for beans and coffee production (though as noted, sample sizes are very small for this group). The sharp contrast between single men and the other groups is probably largely a result of their youth; having recently begun farming on their own, they are likely to be producing more than in the past.

Despite the inherent uncertainties of these production estimates, if the farmers' estimates are even roughly accurate, they indicate that the agricultural system of this region is undergoing a profound production crisis, one whose reversal is not in sight.

Table 9: Per Capita Production (1997) & Ten Year Production Trends ('87-'97), Main Crops

	Total Sample (N=80)	Married women (N=29)	Single women (N=11)	Married men (N=28)	Single men (N=12)
Bananas (bunches)					
Per capita output*	8.2 (N=41)	8.5 (N=18)	6.2 (N=10)	9.2 (N=10)	9.2 (N=3)
10 yr change**	-44%	-32%	-54%	-58%	+80%
Maize (kg)					
Per capita output*	67.5 (N=59)	61.3 (N=20)	28.6 (N=10)	56.8 (N=22)	174.5 (N=7)
10 yr change**	-39%	-25%	-77%	-49%	+82%
Beans (kg)					
Per capita output*	19.5 (N=42)	12.9 (N=16)	18.1 (N=10)	19.2 (N=13)	21.7 (N=3)
10 yr change**	-48%	-42%	-73%	-53%	+338%
Coffee (kg)					
Per capita output*	26.2 (N=24)	33.8 (N=8)	25.5 (N=6)	11.7 (N=9)	100.0 (N=1)
10 yr change**	-46%	-27%	-71%	-67%	+300%

* Mean 1997 per capita household; children under 18 calculated as 0.75 adult household member

** Mean per cent difference between estimated 1987 and 1997 production of crop

FOOD SECURITY & FOOD PURCHASES

The production trends discussed above suggest that most farmers in the region are probably less food secure than in the past, except in cases where other income sources allow them to purchase sufficient food. In order to obtain a rough gauge of food security in the region, respondents were asked about food sufficiency from their own production, recent experiences of hunger, and food purchases and related income sources, the responses for which are summarized in Table 10. Given the reported declines in the region's output reviewed above, it is not surprising that almost all farmers now purchase food in addition to what they produce themselves, and that, for the large majority of respondents, their own production does not last until the next harvest.

Approximately half of the respondents report having experienced a period of serious hunger in their household at least once over the past 10 years. Only the younger single men among the demographic categories report a substantially lower incidence of such cases, which may be related to their ages as well as the small size of their households. A larger proportion of married men than other groups report hunger incidents. Fewer than half of the single women reported such incidents, contrary to what might be expected given the low production levels they report. This may be because they receive additional food from their adult children living nearby, especially in stressful situations.

Fewer than a third of the respondents report that the food they produce is sufficient to last until the next harvest. Single men appear to be best off in this respect as well, while single women are the worst off, with fewer than 20% having enough food to last until the following harvest. Their limited land and labor resources in relation to their household needs are probably the main causes of their widespread shortfalls in production. Only a quarter of the married men and women, who together comprise over 7% of the respondents, report that their food output lasts until harvest.

It is not surprising under these conditions that almost all respondents report that they buy food to supplement their own output. By itself, this can be an indication either of prosperity or low production, but given the current conditions in the area, it is most likely to indicate stress. The relatively low proportion of single women reporting food purchases is probably an indication of cash shortages rather than food security. Over 90% of each of the other groups, including single men, who seemingly have the most favorable ratio of output to needs, buy food. It should be noted that virtually all households also sell agricultural produce to obtain cash for basic needs and children's education, even when they don't produce enough food to last until the next harvest. Similar behavior appears in most of the studies in this collection.

Maize is the most commonly purchased food, with almost 87% of respondents reporting maize purchases, followed by rice (50% of respondents) and cassava (40% of respondents). (Rice is not grown in most of the survey areas, but it is planted in areas to the west of the survey region in Mbale and neighboring districts and is available in many local markets.)

Table 10: Aspects of Food Security

	Total Sample (N=76)	Married women (N=29)	Single women (N=11)	Married men (N=26)	Single men (N=10)
Hunger in last 10 yrs?	51%	52%	46%	63%	20%
Food lasts until harvest?	32%	25%	18%	25%	75%
Buy food?	93%	100%	73%	96%	91%
Sources of funds for food purchase					
Work for wages	36%	45%	46%	27%	20%
Sale of cash crops	50%	45%	27%	54%	80%
Borrow money	7%	0%	36%	0%	10%
Salaried employment	16%	14%	0%	27%	10%
Other business (incl. beer brewing)	11%	0%	9%	27%	0%

Sources of funds: The two main sources of income for food purchases are working for wages, generally on other people's farms, and the sale of crops. These are somewhat gender differentiated, with wage labor significantly more important for women, both married and single, and the sale of cash crops somewhat more important for men. About 45% of both single and married women report wage labor as an important income source, but this overshadows other income sources for single women, while many married women also sell crops for income. Only about 25% of the married men and fewer of the single men report wage labor as an important income source. They seem to rely to a far greater extent on the sale of crops for income. The usual casual labor wage rate in the region was reported to be about UShs 600 per day (though some food is also often included, and work is usually for about four to five hours).

This was roughly equivalent at the time of the survey to about US $0.60, which is low even by East African standards.

The sale of cash crops is important to both men and women, but it plays a particularly important role for men. Over half of married men and 80% of single men report earning income from crop sales. Single women are the least reliant on crop sales, probably because they have the least surplus production. (The sale of livestock, which is not listed in the table, is important for only about 8% of the sample.) Borrowing money is not a large income source overall, but it is especially important for the single women in the survey, a further indication of their relative impoverishment. Salaried employment and other business ventures were reported by a minority of respondents and were concentrated among married men. This is an indication of at least some of the greater diversity of income sources available to men that are generally available to women.

All of the data summarized in this and the previous sections suggest an endemically low level of agricultural productivity and welfare in the region, despite its seemingly favorable agro-ecological potential. Some of the implications of this, particularly with regard to gender, are discussed below.

SUMMARY OF GENDER AND HOUSEHOLD DISTINCTIONS

The survey results suggest that gender does play an important role in the agricultural resources, activities, and outcomes of farmers in Mbale, but many of its effects overlap and are linked with other important demographic characteristics. In particular, households headed by single males or females differ to a significant extent both from each other and from married households. Many of the distinctions are linked to age and dependents. Among married households, both men and women are usually heavily involved in agricultural production, which comprises their single most important economic activity. Although there are gender distinctions in some activities and in control of household resources, there are relatively few major differences among married men and women with respect to the variables examined in this study. The Mbale area itself is somewhat atypical in the high proportion of men who have remained here rather than migrating elsewhere. Both the official census data on sex ratios in Mbale District, and the gender distribution of household members cited by the respondents indicate the presence of an unusually high number of adult working age males in the region, even in these rural villages included in the survey (Table 3).

Married men are somewhat older than married women, but the households of married men and women are similar in size and in numbers of adults and children. Both have equivalent amounts of land on a per capita basis – an extremely low total of about 0.4 acres (0.1 ha) per person.

In contrast single women in the sample are older than any other group, and almost all are widows who care for two or more children. They comprise virtually all female headed households in the sample, as a result of which the effects of age and widowhood are interlinked with the effects of gender for this category. Because of the high number of working age men who have remained in the region, there are almost no households in the sample with absent male household heads who have moved to distant urban areas. The female headed households have the lowest amount of land per household member – about 35% less than married men or

women – and none has more land than they had 10 years ago. In contrast, single males are generally younger unmarried men with no dependents. They have little land and fewer livestock than other households, but because of their small household size, they often have more land and produce higher output than others on a per capita basis.

There are few major distinctions in the types of crops grown by women and men in married or single households. Even coffee, the main nonfood income crop, is grown by similar proportions of households of different kinds, including those headed by single women. Men are more mobile, however, and have a wider range of marketing outlets, and they generally have control of most income generated by the household. Livestock ownership is common among all types of households, including female headed households. In married households, however, men generally have actual ownership of major livestock, particularly cattle and goats. Among the household types, those headed by single males are least likely to have livestock.

Many aspects of soil management and input use related to soil fertility are also roughly similar among men and women in married households, but single female headed households are disadvantaged in a number of respects. Fewer single women than others fallow their fields, or use manure or agroforestry techniques, and none use fertilizers. They do use compost and mulch, and plant hybrid maize at proportions comparable to married households, but they plant less hybrid seed than married households.

Single women also report the lowest per capita output of the two main staples, bananas and maize, as well as the most severe declines in output over the past decade for all four main crops. Male and female respondents in married households also report low output levels and sharp declines in output for each of these crops. Single males, are the only group to report gains in output over the last decade, and they have the highest per capita output of some crops, notably maize.

Finally, most indicators suggest that single women are less food secure than other groups and have fewer income sources for food purchases. Household food production is usually not sufficient to last until the next harvest for married households, but it is even less likely to be sufficient for single female headed households. Single males stand out from the others, however, in that 75% report producing enough food to last themselves until the next harvest. The absence of dependents is probably the key factor in this. In general, women's sources of income for food purchases are tied mainly to doing agricultural work for wages, while men are more likely to earn such income from crop sales. Single women in particular are heavily reliant on wage labor and to some extent on borrowing money for food purchases. Their food security, and that of their dependents, as a result, is especially closely tied to the state of the agricultural economy, in terms both of their own production as well as their employment.

CONCLUSION: ARE WOMEN HARMED BY LOW SOIL FERTILITY?

In comparison with many other areas of sub-Saharan Africa, an unusually high proportion of adult men remain in Mbale and are involved in agricultural activities there. Perhaps in part because of this, many of the traditional gender distinctions found elsewhere, such as gender identification of crops, livestock, and various activities, are less apparent here. Men still have greater control of household resources, however, and a greater range of economic activities than women. Women's economic livelihoods and their income sources are especially closely linked

to agricultural production, both through wage labor, their most common income source, and sale of crops and livestock products. They are particularly vulnerable, as a result, to low and declining agricultural productivity, whether it occurs as an acute short term crisis, or as a more chronic process of decay. Single women with dependents are the most vulnerable group among those surveyed, although they are often assisted in crisis situations if they have adult children living nearby. The whole regional economy is of course dependent on agriculture and is affected by low productivity. But men have a somewhat greater range of economic activities, and so may be slightly less vulnerable. Most women have almost no other alternatives.

Intensive, almost continual land use is essential in much of Mbale, as in other areas of very high population density. Soil fertility is likely under these conditions to become the key limiting factor to increasing production or even to maintaining output at previous levels. Soil nutrients must be replaced to maintain productivity over time; they must be increased to raise productivity. Farmers in this survey indicate that output and yield levels are currently extremely low, and they have in most cases declined substantially over the last decade. Traditional organic techniques of soil fertility management are widely practiced, but they have apparently not been able to arrest the decline of productivity and output. Little surplus is available for sale as a result, and crop sales, which are the most common source of funds for most farmers, can generate relatively little income, either for food purchase or for agricultural or other investment.

Low productivity also guarantees low wages, and these have severe negative impacts on women farmers in general and single elderly women in particular, who rely so heavily on wage income and who remain impoverished as a result. At the low level of wages in Mbale, wage labor is incapable of providing more than a supplement to bare subsistence, and it is difficult or impossible for farmers to purchase inputs of any kind to increase productivity, especially fertilizers, or to devote labor to improving output on their own land.

Crop sales usually have a greater potential than wage labor for capital generation and incentive for reinvestment in order to increase productivity. Crop sales are an important income source for women as well as men, but single elderly women are the least able to take advantage of them. In addition, crop sales imply an inevitable export of the nutrients embodied in the product. Given the small size of agricultural holdings in Mbale, as well as the short or nonexistent fallow periods, the limited sources of local biomass or biomass import, and the common absence of fertilizer use, crop sales also accelerate the decline of soil productivity.

It will not be possible to increase agricultural productivity without substantial increases in soil nutrient supply. The most effective way of accomplishing this is through the import of nutrients in the form of fertilizers, which has been an essential and ubiquitous component of strategies for increasing productivity in all world agricultural regions in the 20th century, especially areas of high population density, as illustrated in Table 1 and Figure 2. Uganda has in this respect dramatically lagged behind even other countries of eastern and southern Africa.

The market cost of fertilizers and its rapid recent increase is the main obstacle to fertilizer use reported by farmers. Even farmers who had begun to experiment with fertilizer use were reducing or giving up on it in the face of rising costs. This is not surprising given that the current cost of a kilogram of compound fertilizer is roughly equivalent to a day's wage earnings. Wages are not likely to increase in the absence of increases in productivity, but

productivity cannot increase in the absence of significant increases in soil nutrient supply. Fertilizers are the only effective way to substantially and rapidly increase soil nutrients and productivity, especially in this and other high density regions. This argues strongly that reliance on market prices will not result in rapid or significant increases in fertilizer use in this kind of region. To accomplish this end and achieve any significant improvement in agricultural welfare in this area, it will probably be necessary to subsidize the cost of fertilizers, or at the very least, the cost of borrowing cash for fertilizer and other input purchase. Otherwise, stagnation in production and welfare are likely to continue, and the impacts on women farmers who rely so heavily on agricultural wage labor and crop sales, will continue to be especially severe.

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Notes

1. Carney, 1992; Francis, 1997; Gladwin, 1992; Meeker and Meekers, 1997; Sorensen, 1996; Schroeder, 1999.
2. The best rainfall and soil conditions in Uganda are mostly found in the southern half of the country, which have historically corresponded with the areas of greatest agricultural output and of highest population densities in colonial and immediate precolonial eras. These included the areas around Lake Victoria, the southwest of the country (currently comprising Kabale and Kisoro Districts), and the area around Mt. Elgon in the east of the country, currently comprising Mbale District (Uganda, 1967; Van Zwanenberg and King, 1975).
3. Van Zwanenberg and King, 1975.
4. FAO, 2001.
5. FAO, 2001.
6. FAO, 2001.
7. Makabay, 1998; Laker-Ojok, 1995.
8. Uganda, Republic of, 1996.

9. Uganda, Republic of, 1996.
10. Uganda, Republic of, 1996.
11. Kirkby, 1998.
12. Uganda, Republic of, 1967.
13. Fisher, et al., 2000; Guyer, 1991; Martin, 1984.
14. Knutsen, 1999.
15. Knutsen, 1999.
16. Odeke, 2001.
17. FAO, 2001.
18. Van den Bosch, et al., 1998.

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