

pre-tested and revised by teams of research and extension staff from ILRI, KARI and MOARD in several district locations before training of enumerators and supervisors commenced. During training, the enumerators and supervisors went through each question with the Nairobi team and revised it and then they pre-tested the questionnaire, discussed it again after which the final version was printed for use in the surveys.

The 42 page questionnaire was divided into sections covering: household composition and labour availability; land size and allocation; farm activities and facilities (including crop husbandry); livestock inventory; dairying history and production practises; dairy marketing; livestock management and health services; co-operative membership; and, household income levels and sources.

The questionnaire was pre-tested in several districts before training sessions with enumerators and supervisors were undertaken where each question was again reviewed and adjusted as necessary.

3.3 Sample size selection and interviewing

The number of households to be surveyed in each sub-location was taken as a proportion of the number of households in the sub-location (Table A1.2) obtained from 1989 census figures (CBS, 1994).

In order to capture as much local variation as possible, the sample in each zone was spread across 56 sub-locations selected randomly. The number of observations in each sub-location was adjusted to reflect the proportion of the number of households, resulting in sample sizes of 15 to 60 in each sub-location. The total sample size obtained for the whole area was 1,563 households (or 2.1 percent of the households in the sample sub-locations), but the total number of households surveyed was 1,576 due to complications arising in the survey process, e.g., some transects had to be elongated when they did not yield enough households, some households could not be interviewed on the same day and had to be revisited later, and so extra households were selected just in case the appointments failed, etc (Table A1.2).

Survey maps for each of the 56 sub-locations were created from ILRI's GIS databases, using ArcInfo software. The survey enumerators, who had previously been trained in the use of the questionnaire, visited their assigned sub-location, and with the help of sub-location Chiefs, marked on the sub-location map the main landmarks. A landmark was defined as any permanent feature like a trading centre, a school, a church, or a factory. Two pairs of landmarks were then selected at random for each sub-location, and line transects were drawn joining each pair. Sampling was thereafter done following as closely as possible the marked transects. Every fifth household on the left and on the right was interviewed alternately, regardless of whether they were agricultural or kept dairy animals. In this way, a random sample of all sub-location households was obtained. The questionnaire was filled out by respondents from representative samples of households drawn from populations representative of the areas surveyed.

The interviews were conducted with preferably the household head or, in their absence, the most senior member available or the household member or manager responsible for the farm. The interviews were carried out between 2nd March and 15th July 2000 by enumerators familiar with the sub-locations, who were selected from among the front-line extension staff of the MOARD. Their superiors from the district together with some KARI researchers supervised them. During the first week of the survey, the

supervisors checked each completed questionnaire within one day of the interview. Any errors were discussed with the enumerator so as to improve the accuracy of subsequent interviews. In some instances the enumerator returned to the household to correct major errors or omissions. Staff from the MOARD, KARI and ILRI who designed, supervised, enumerated and analysed the survey are listed in Annex 3.

The data from the questionnaires were entered into Microsoft Access database management software and checked for data entry errors. Descriptive statistical analyses were carried out using Microsoft Excel and Stata software.

After the initial descriptive statistics were developed, feedback sessions were held with farmers and the research teams in each sub-location. Later, feedback sessions were held with the research teams to propose the way ahead. Inputs from the feedbacks are included in their specific areas in the report.

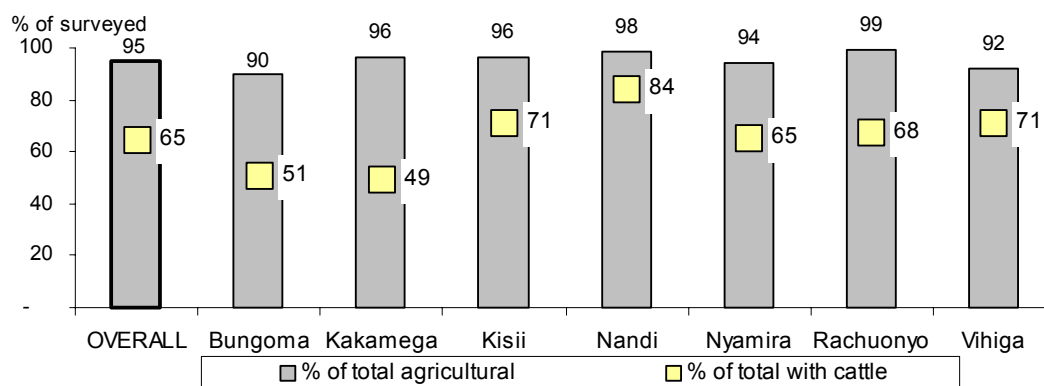
The results of the survey presented in this report are tabular descriptive analyses. The data were later used in principal component and cluster analyses to identify homogenous groups of dairy producers. These clusters represent recommendation domains, which form the focal points for developing policy and technical interventions, by targeting them at identified groups of resource-poor farmers with particular characteristics.

4 DESCRIPTIVE ANALYSIS

4.1 Number of households surveyed and household categories

Of all the households surveyed 95% were agricultural, using part of their land for either crop and/or livestock production (Figure 4.1). This ranged from 90% in Bungoma to 99% in Rachuonyo. Among the agricultural households, 68% kept cattle of various breeds and types. Kakamega had the least number of households with cattle (51%), while Nandi had the most (85%), followed by Vihiga (77%) and Kisii (74%). A household was defined as the smallest decision making unit consisting of people who ate and lived together. It included unmarried members such as students who live elsewhere but depend on the household for income and food, unmarried members working away but regularly bringing in income to support the family and employees living and eating together with the household. Permanent labourers who stayed on the farm but lived independently (made his/her own meals) were treated as outsiders.

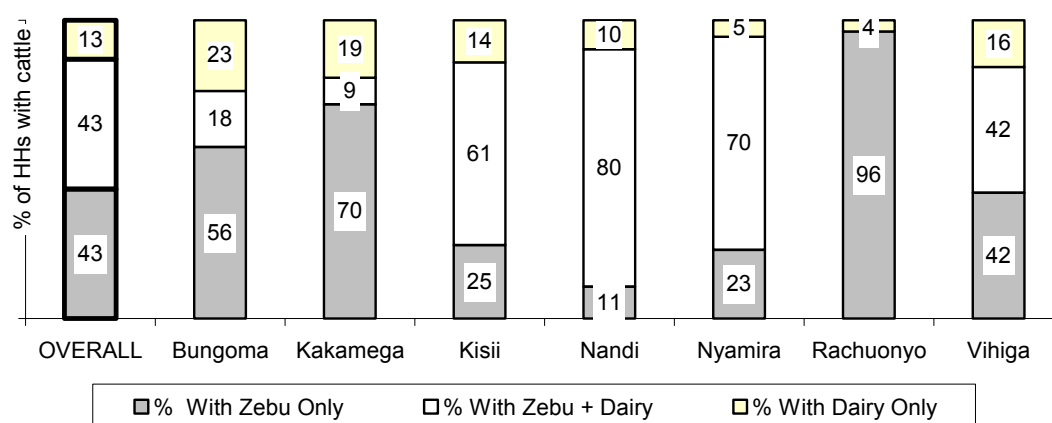
Figure 4.1 Households surveyed, proportion agricultural, and those with cattle



The cattle kept have been split into two main categories: the local zebu and the dairy type or grade cattle (cross breeds or pure grade). Overall, only 13% of the households with cattle solely kept the dairy grades (Figure 4.2). Forty three percent kept zebu alone and another 43% kept a combination of zebu and the dairy grades.

Rachuonyo had the highest percentage of households with only zebus (96%). Bungoma had the highest percentage of households keeping only the dairy types (38%). Nandi had the highest number of households with dairy cattle either the dairy grade alone or in combination with zebu (90%); followed by Nyamira (76%) and Kisii (75%). The district with the lowest number of households with dairy cattle either the dairy grade alone or in combination with zebu was Kakamega with 28%. In Rachuonyo and Bungoma the survey transects left out pockets of areas with dairy cattle as shown in the section on cattle kept.

Figure 4.2 Proportion of households with cattle keeping different classes of cattle



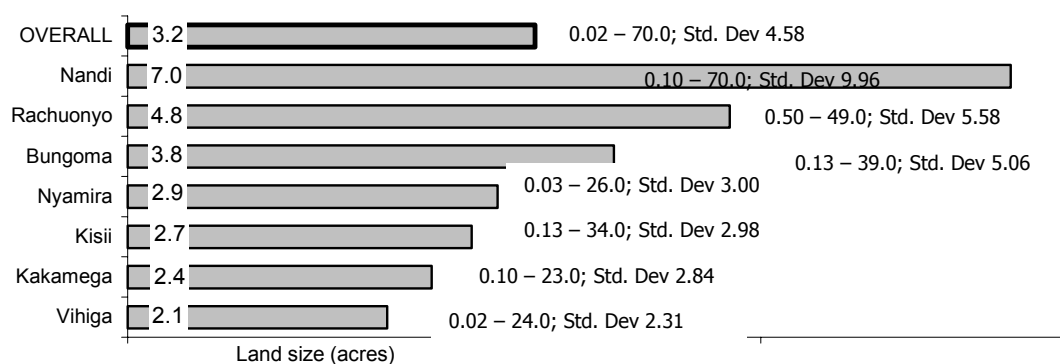
4.2 Household land size, land tenure and land use

4.2.1 Land size

Among the agricultural households, land size per household varied greatly, from a 0.02-acre plot in Vihiga to a 70-acre farm in Nandi (Figure 4.3). The mean acreage for all households surveyed was 3.6 acres (median 2.5 acres). Households in Nandi had the largest farm sizes, with a mean of 8 acres (median 5), followed by Rachuonyo with 5.4 acres (median 4). Vihiga with 2.2 acres (median 1.6) and Kakamega with 2.9 acres (median 2) had the smallest land sizes per household. Depending on where the transects ran through, Kakamega was not well represented as it has higher agricultural land than indicated.

The Non-agricultural households (mainly residential plots in urban and peri-urban centres) comprised 5% of all households surveyed and they had an average land size of 2.5 acres. The mean acreage per household among those with or without cattle, with dairy cattle only, with Zebu only or a combination of the two was about the same at 3.5 to 3.6 acres.

Figure 4.3 Agricultural land sizes in acres



4.2.2 Land tenure

The following land tenure systems were identified:

Traditional: land owned or used by virtue of inheritance from ancestral land and, in this case, any such land where the household head had not acquired a title deed for it yet.

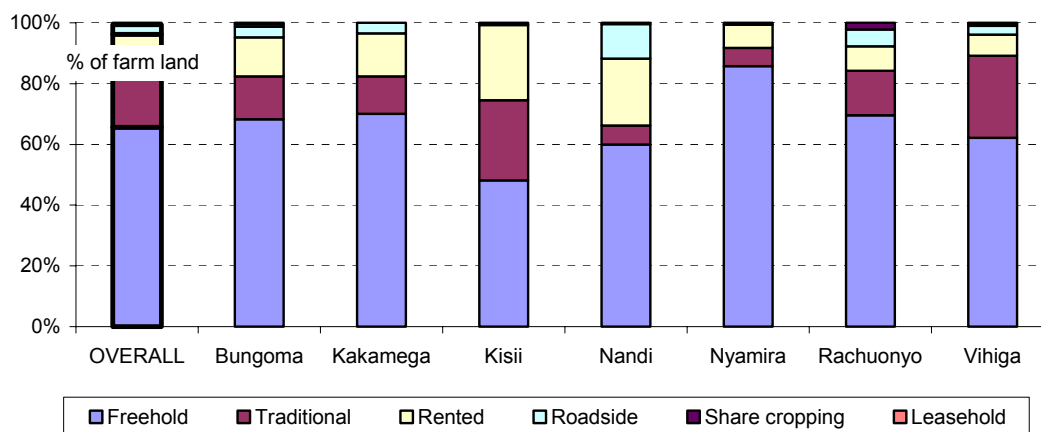
Freehold: land owned (traditional or purchased) for which the owner has a title deed.

Leasehold: land owned but the owner has leased (or rented) to another and was not using at the time of the survey.

Rented land: land rented or leased by the subject household from another for use.

The largest proportion of the land is freehold (65% of all households), followed by traditional land tenure (17%) and rented (14%) (Figure 4.4). Nyamira had most households with freehold (85%) while Kisii had the lowest at 48%. Traditional land tenure was prevalent in Kisii and Vihiga with 26% of the households in either of the districts and lowest in Nandi and Nyamira with 6%.

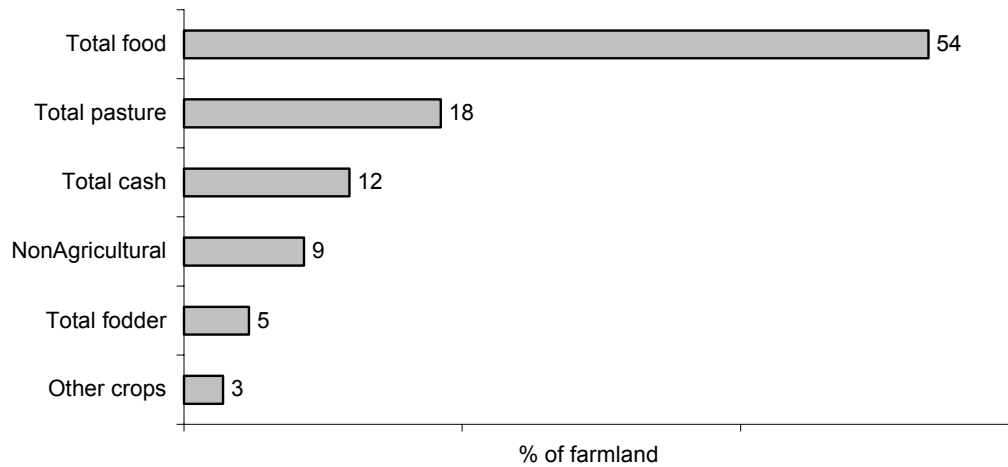
Figure 4.4 Proportions of land under various land tenure systems



4.2.3 Land use

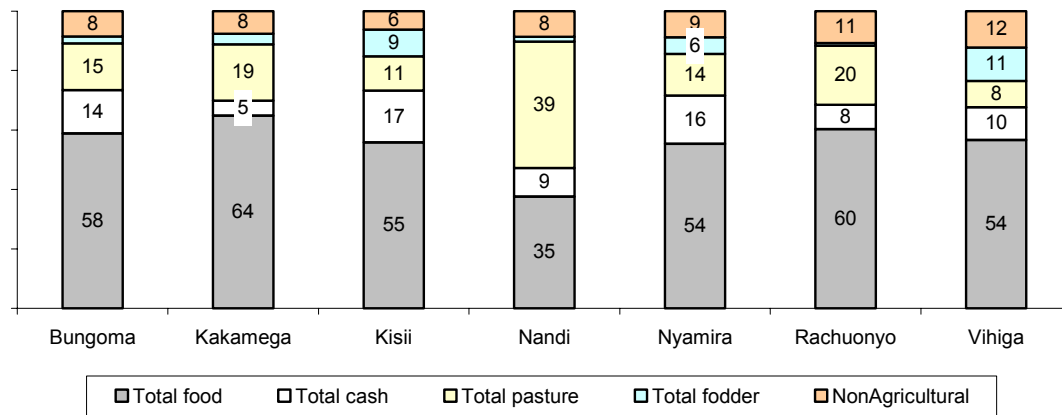
Land allocation to various enterprises is shown in Figure 4.5. Slightly more than half of the land is used in growing food crops. Fallow and natural pasture occupied 20% while planted fodders, including Napier grass was found on only 6%. This allocation pattern was not the same throughout the area (Figure 4.6). Nandi had 40% under pasture, 35% under food crops, and only 8% under cash crops. Rachuonyo had 60% under food crops and 20% under grazing. Kisii had the greatest proportion of land under cash crops (17%) and, along with Vihiga and Nyamira, the largest proportion under planted forages (8 - 10%).

Figure 4.5 Allocation of land to different enterprises



Nine percent of the land under cash crops in Bungoma was allocated to sugar cane while tea had been allocated most of the land in Nyamira (8%), Kisii (7%) and Vihiga (5%) (Figure 4.6 and Table 4.1). In Nandi, sugar sugarcane, tea and trees were the only cash crops mentioned and they shared equal land allocations each, about 3%. Pulses (mostly field beans), was the most prevalent cash crop in Rachuonyo (6%).

Figure 4.6 Allocation of land to enterprises by districts



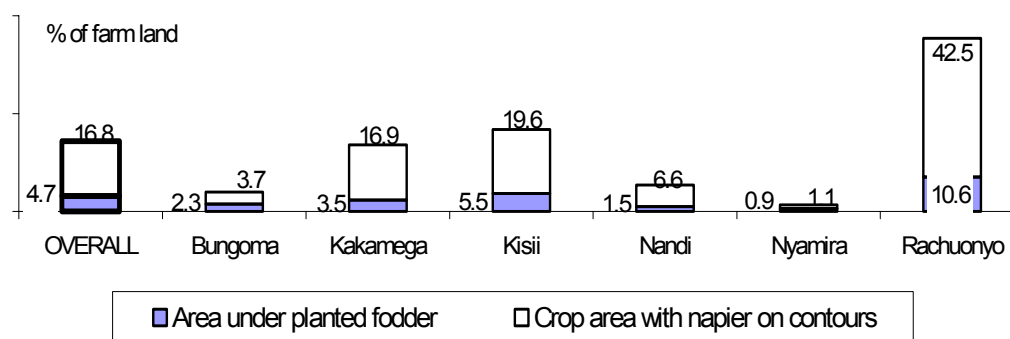
The most common food crops in the whole area were maize at 23% overall, ranging from 19% in Nandi to 28% in Kakamega. Beans took 14% overall ranging from 9% in Rachuonyo to 25% in Kakamega. Rachuonyo had the largest fraction of land under sorghum/millet (17%). The definition of foods and cash crops should be read cautiously since many food crops are a major source of income when they are sold. This becomes quite clear when one considers income sources from farming.

Table 4.1 Spread cash and food crops by percentages of farmland occupied

	Overall	Bungoma	Kakameg a	Kisii	Nandi	Nyamir a	Rachuony o	Vihiga	
Farm area (acres)									
	5,848	588	716	739	926	1,490	763	627	
Food crops	1 st	Maize (23)	Maize (26)	Maize (28)	Maize (27)	Maize (19)	Maize (22)	Maize (21)	Maize (24)
	2 nd	Pulses (14)	Pulses (24)	Pulses (26)	Pulses (12)	Pulses (10)	S/millet (11)	S/millet (17)	Pulses (18)
	3 rd	S/millet (6)	Banana (3)	Banana (3)	S/millet (6)	Pulses (2)	Pulses (10)	Tubers (11)	Banana (3)
Cash crops	1 st	Tea (4)	S/cane (9)	S/cane (3)	Coffee (7)	Tea (3)	Tea (8)	Pulses (6)	Tea (5)
	2 nd	Pulses (2)	Coffee (3)	Tea (0.5)	Tea (2)	Trees (3)	Pulses (3)	Cotton (0.8)	Pulses (2)
	3 rd	S/cane (2)	Trees (1)	Pulses (0.4)	Pyrethrum (2)	S/cane (2)	Coffee (2)	Trees (0.8)	Trees (0.2)

Total planted fodder, which included Napier planted as a one-patch stand, occupied 5% (Figure 4.7) of total farmland and was mostly grown in Vihiga, Nyamira and Kisii. However, Napier was also grown along the contours of other crop plots in 20% of total farmland surveyed, with the highest establishment of this kind observed in Vihiga (42%) and Kisii (31%). Other planted forages (forage legumes) were negligible (0.5%) and were only mentioned in Kakamega. Nandi had the highest proportion of land under pasture (39%), followed by Kakamega (23%) and Rachuonyo (20%), while Vihiga and Nyamira had the lowest at 9% and 8% respectively.

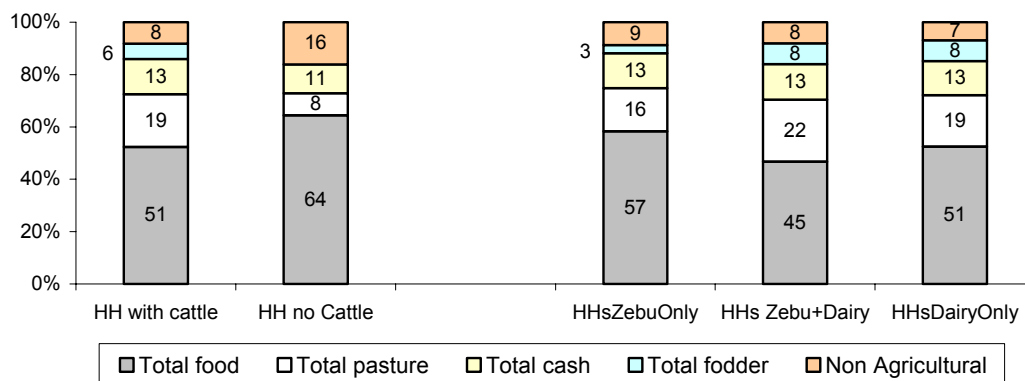
Figure 4.7 Area under planted forages and Napier planted along contours



There was little difference in land allocated to cash crops by the different household categories (Figure 4.8). Land allocated to food crops varied, where households with Zebu only had 57% of their land under food crops, 51% in households with improved dairy cattle only and 45% in households with a combination of Zebu and improved dairy cattle. Households keeping improved dairy cattle only had more

land under maize (24%) than those with a combination of Zebu and improved dairy cattle (at 21%). In addition households with improved dairy cattle had more land under planted forages (8%) than those with Zebu only (3%). They also had more grazing grounds (19% – 22%) than those with Zebu only (16%).

Figure 4.8 Land enterprise allocation by household category



4.2.4 Changes in crop patterns

About 300 households reported a change in the crops they grew 10 years ago that they did not grow at the time of the survey and those they did not grow 10 years ago, but grow them now (Figure 4.9 and Figure 4.10). Among the most dramatic changes were the numbers of households that have taken up Napier, fruit/tree crops, tea and bananas. The number of households that had Napier at the time of the survey but did not have it ten years ago was 243, (16% of agricultural households). This indicates the increase in importance of livestock in the farming systems.

4.2.5 Use of manure and fertiliser

Except for Rachuonyo, 79% of agricultural households in all districts purchased fertiliser for use in their farms; in Rachuonyo only 14% of the agricultural households said they did (Figure 4.11). Seventy five percent of agricultural households indicated they used manure, the highest numbers being in Vihiga (92%), Kisii (82%) and Nandi (80%), and the least, again, being in Rachuonyo (47%). In areas with more grazing, then manure may not be readily collected.

Figure 4.9 Crops grown now and not ten years

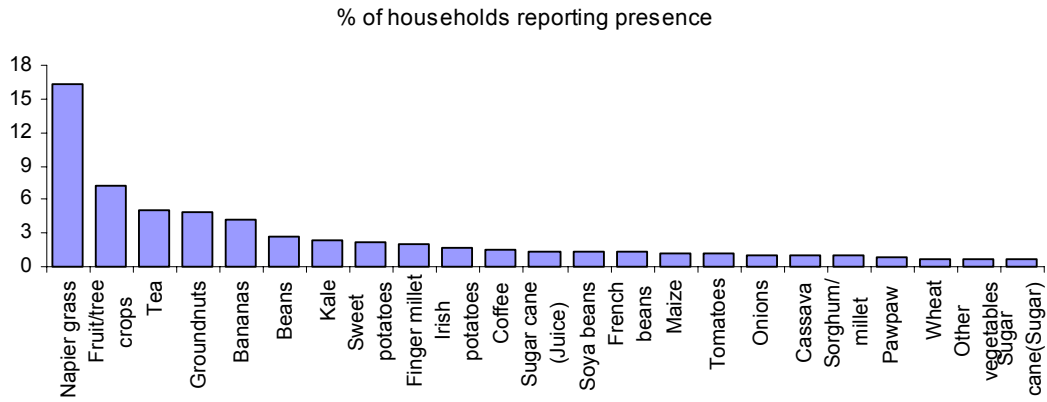


Figure 4.10 Crops grown ten years and not now

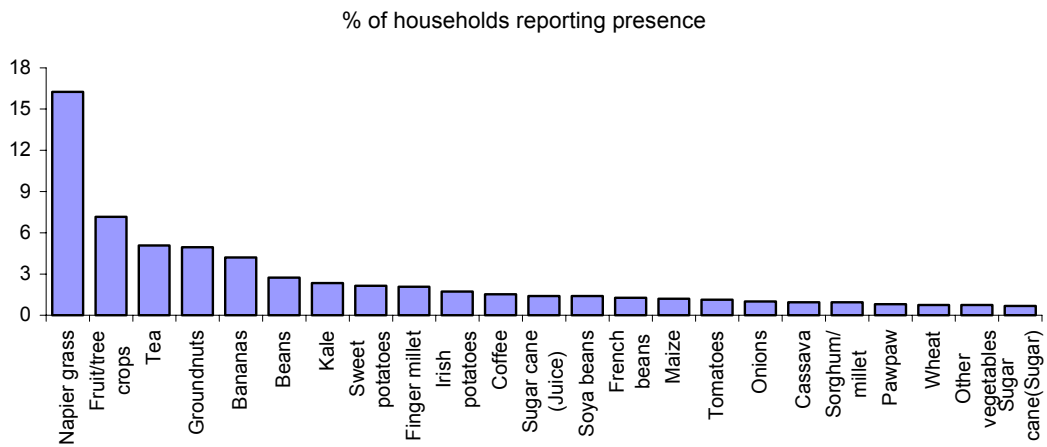
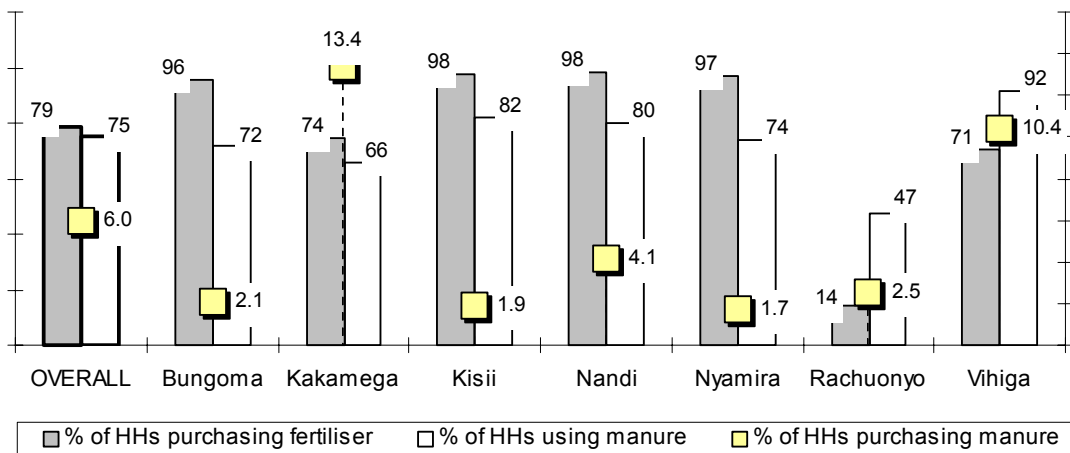


Figure 4.11 Proportion of households using and buying manure and fertiliser



Few households (6%) purchased the manure, with households in Kakamega showing largest numbers of purchase (14%), followed by Vihiga (10%). The manure was applied to maize, beans and bananas in the whole area; as well as to Napier especially in Nyamira and Kisii, sorghum in Rachuonyo and vegetables in Kisii, Nandi and Nyamira. Fertiliser was mainly applied to maize and beans in all the districts, but also to tea in Nyamira and Kisii, sugar cane in Bungoma and sorghum in Rachuonyo.

4.3 Household composition and gender differentiation

4.3.1 Household sizes

The mean household size was 5.8 members per household, ranging from 5.4 in Kakamega to 6.8 in Nandi. Most members fell in the 23 to 65 years age bracket. The dependent population (less than 22 years old) was 64% with a range from 60% in Rachuonyo to 68% in Bungoma (Table 4.2).

Table 4.2 Household size and composition

Age (years)	Overall	Bungoma	Kakamega	Kisii	Nandi	Nyamira	Rachuonyo	Vihiga
0-7	1.2	1.7	1.1	1.2	1.5	1.2	0.9	1.2
8-14	1.3	1.4	1.3	1.5	1.4	1.3	1.2	1.3
15-22	1.2	1.3	1.1	1.2	1.4	1.1	1.2	1.1
23-65	1.9	1.9	1.7	2.0	2.2	1.8	2.1	1.9
>65	0.2	0.2	0.3	0.1	0.3	0.1	0.1	0.2
Total	5.8	6.6	5.4	6.0	6.8	5.5	5.5	5.7

Table 4.3 Household size and composition by household category

Age (years)	Non				Zebu Only	Zebu+Dairy	Dairy Only
	Agricultural	agricultural	With cattle	No cattle			
0-7	1.2	1.2	1.2	1.3	1.2	1.2	1.1
8-14	1.4	0.7	1.5	1.1	1.5	1.5	1.6
15-22	1.2	0.5	1.4	0.8	1.3	1.4	1.6
23-65	1.9	1.6	2.0	1.6	1.9	2.1	2.1
>65	0.2	0.0	0.2	0.1	0.3	0.2	0.3
Total	5.9	4.0	6.4	5.0	6.2	6.5	6.6

Agricultural households had on average more household members than non-agricultural (5.9 versus 4.0), and of the agricultural households those with cattle had more members than those without (6.4 versus 5.0) (Table 4.3). There were no differences in household size among households, related to types of cattle kept; all ranges were found to have between 6.2 and 6.6 members.

4.3.2 Details of household heads

Eighty three percent of the households were headed by males and 17% by females. Kisii had the highest proportion of female-headed households (29%) and Kakamega and Nyamira had the lowest (15%) (Table 4.44). The overall mean age of male household heads was 50 years and 52 years for female heads. The

youngest male household heads (46 years) were found in Kisii and the oldest (53 years) in Vihiga. The youngest female household were in Kisii (43 years) and the oldest in Nandi (59 years).

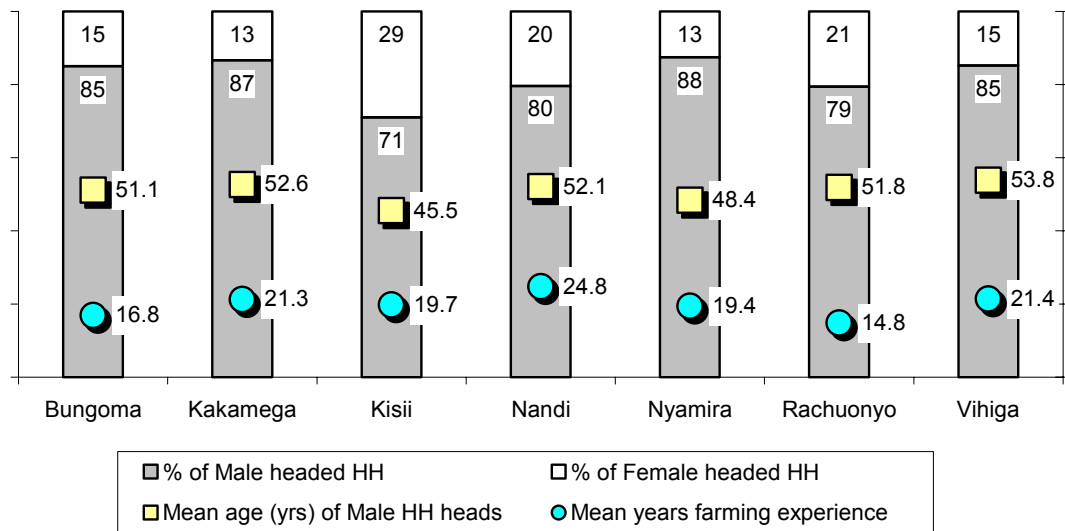
Table 4.4 Gender of household head, farm ownership and education level

Overall (n=1,575)	Male	Female
Sex (%)	82.48	17.52
Age (years)	48.96	51.04
Farm owner (%)	86.4	13.6
Years of farming experience	18.6	26.4
Education (%):		
No formal education	9.0	34.7
Primary	51.0	50.4
Secondary	29.1	12.4
Post secondary	2.9	0.4
University and technical trained	7.1	1.8
Adult education	0.5	0.4
Other	0.5	0.0

Overall, only 9% of male household heads did not have any formal education compared to 35% of the females. The primary level education was attained by 50% of male household heads and the same percentage for females. Only 7% of the male and 2% of the female household heads had University or technical training. Nandi had household heads with the longest farming experience (22 years for males and 36 for females) and Rachuonyo with the least (13 years for males and 20 for females). Bungoma district had the highest number of household heads with secondary and post-secondary education (49%) while Nandi had the least (30%). Kisii had the highest number of female household heads with this level of education (17%) and Nandi the least (4%).

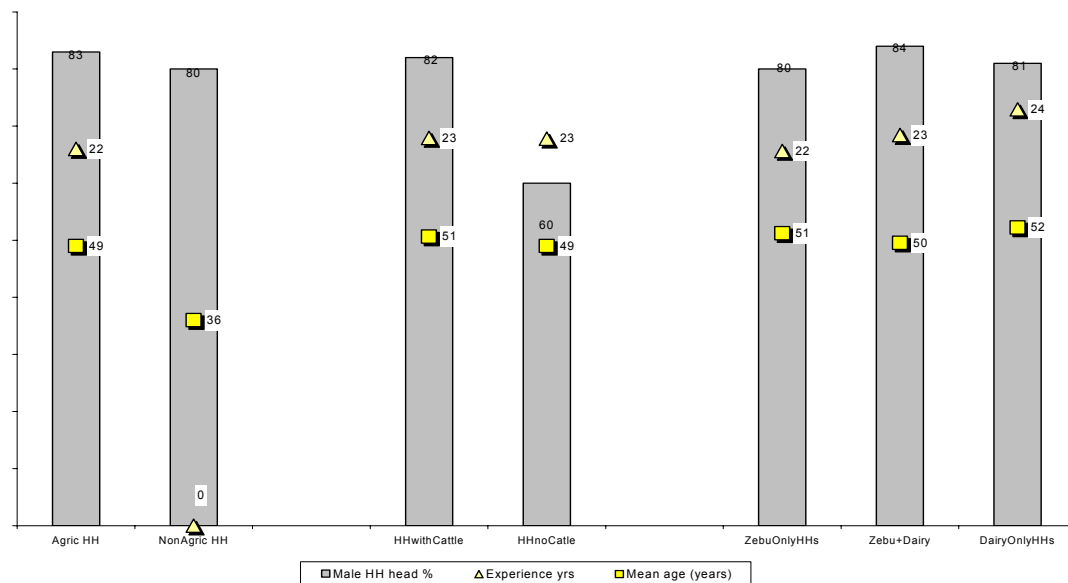
The male to female ratio of household heads remained more or less the same (80% male and 20% female) in the: agricultural households, non-agricultural households, households with Zebu only, households with dairy grade, and households with a combination of Zebu and dairy grade cattle (Figure 4.12). However, in households that had no cattle, females headed 40% of the households.

Figure 4.12 Details of households heads



The mean age of the household head for agricultural households was 49 years while the non-agricultural households was 36 years (Figure 4.13). Non-agricultural households were homesteads in urban and peri-urban areas occupied by business premises like kiosks and dukas, or those homesteads with household heads working off farm. Sixty two percent of non-agric households heads had secondary and post secondary education.

Figure 4.13 Details of household heads by household category



The percentage of households with secondary and post secondary education increased as one moved from households with no cattle, to 26% of those with Zebu only, to 34% of those with only the pure grade and 38% of those with Zebu and improved cattle (Table 4.5).

Table 4.5 Education of household heads by household category

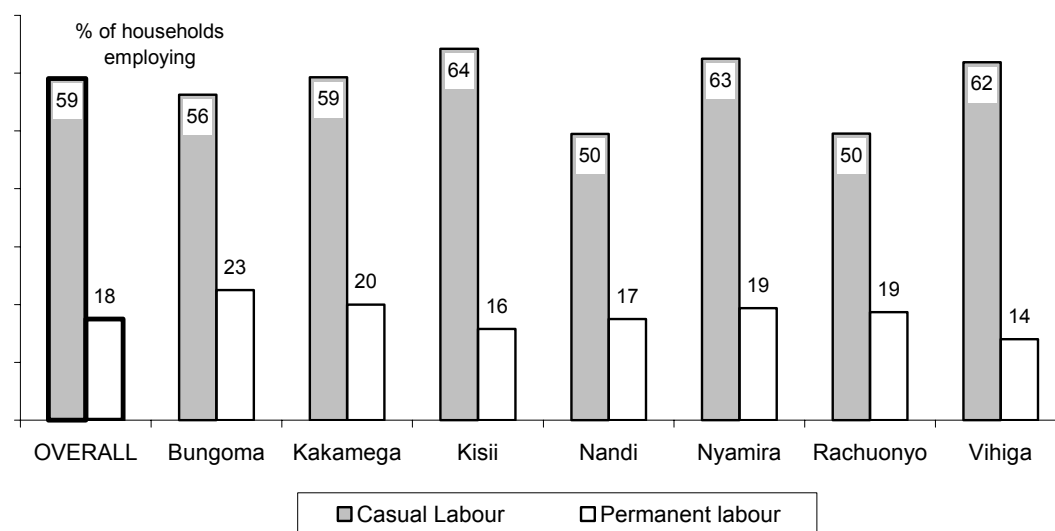
	Agricultural household	Non Agricultural household	With cattle	No Cattle	Zebu only	Zebu+Dairy	Dairy only
No formal education	14.0	3.7	14.4	66.7	18.0	12.1	11.9
Primary	51.7	33.3	52.6	33.3	55.0	49.7	53.7
Secondary	25.3	42.0	23.1		18.9	26.5	24.6
Post secondary	2.3	3.7	2.7		2.7	3.0	1.5
University & technical	5.6	16.0	6.2		4.3	7.8	6.7
Adult education	0.5		0.6		0.5	0.5	1.5
Other	0.4				0.5	0.5	

4.4 Labour use and labour division

4.4.1 Labour activity employment

Fifty nine percent of the households employed casual labour (Figure 4.14). Only 18% of the households used long-term labour, and these were mainly involved in activities related to livestock, such as grazing animals (cited as first activity). Bungoma had the highest percentage of households with long-term labour (23%) while Vihiga had the least (14%). Kisii and Nyamira had a high percentage of households using casual labourers (64% and 63%, respectively). Nandi and Rachuonyo recorded 50% each.

Figure 4.14 Proportions of households employing long-term and casual labour



Casual labour is mainly employed in crop related activities (cited as first activity). Thirty percent of the households reported that casual labour is used for preparing fields for food crops, or for planting and weeding. Thirty percent of the households cited planting and weeding as both a first and second activity.

Twenty percent of households who employed long-term labour used it for all cattle related activities only as first activity, and while another 20% used them in all crops related activities as second activity.

4.4.2 Livestock management activities and responsibility allocation

Of all the households surveyed, 35% had adult females (other than the household head) taking a bigger role in feeding cattle than all other household members (Table 4.6). This involved grazing and/or cutting and carrying feed. In 30% of the households, this activity was the responsibility of the household head regardless of gender. Forty eight percent of the households surveyed had adult females (other than the household head) responsible for fetching water or watering the animals, while 17% of the households had specifically the household head with this responsibility.

Milking was the responsibility of adult females (other than household head) in 56% of the households surveyed. The adult females in 60% of the households did marketing of milk. Adult females cleaned the milk shed in 56% of the household surveyed and the household heads did it in 18% of the households. The household heads in 46% households did spraying or dipping. The household head also obtained AI and veterinary services in 60% of the households. Children, casual and long-term labourers actually played secondary roles when whoever is responsible (especially the household head) decides what is to be done.

Table 4.6 Household members responsible or involved in livestock activities

Activity	Cut & carry		Fetch water					
	Graze	feed	Feeding	& watering	Milking	Sell milk	Clean shed	Spray/dip
Household head	33.3	30.6	31.3	16.9	21.4	19.6	18.1	46.4
Adult males	5.6	6.2	5.0	4.7	5.9	3.8	2.9	9.4
Adult females	33.4	34.7	35.8	48.3	55.7	59.6	55.9	16.7
Any household member	4.4	4.7	4.9	5.1	2.3	2.8	3.9	3.3
Children	5.7	5.2	4.6	7.3	4.0	3.7	4.8	7.4
Long-term labour	8.7	10.1	9.3	9.6	5.9	4.7	7.3	6.5
Casual labour	0.6	1.0	0.9	1.3	0.6	0.5	0.8	2.3

4.5 Household incomes

Over 70% of all the households interviewed got an income of less than KSh 5,000 per month (Figure 4.15). Nyamira alone had (76%), while Nandi had 57% (Figure 4.16) in this category. In Nandi 24% of the households got between KSh 5,000 and KSh 10,000, while 20% got over KSh 10,000. This means that households in Nandi earned the highest income per month as compared to other districts.

Figure 4.15 Proportions of households by monthly income categories

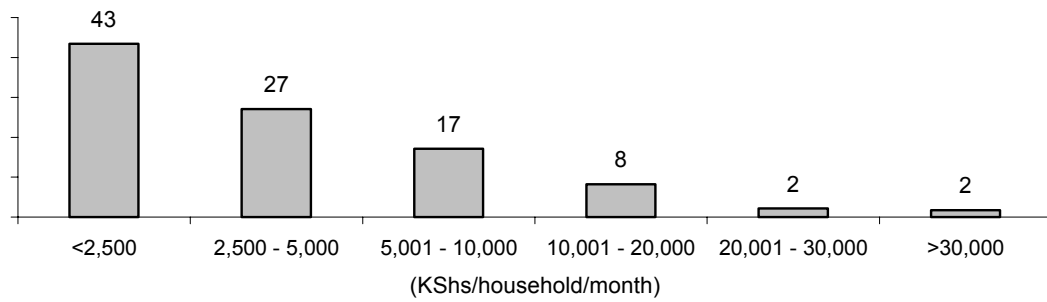
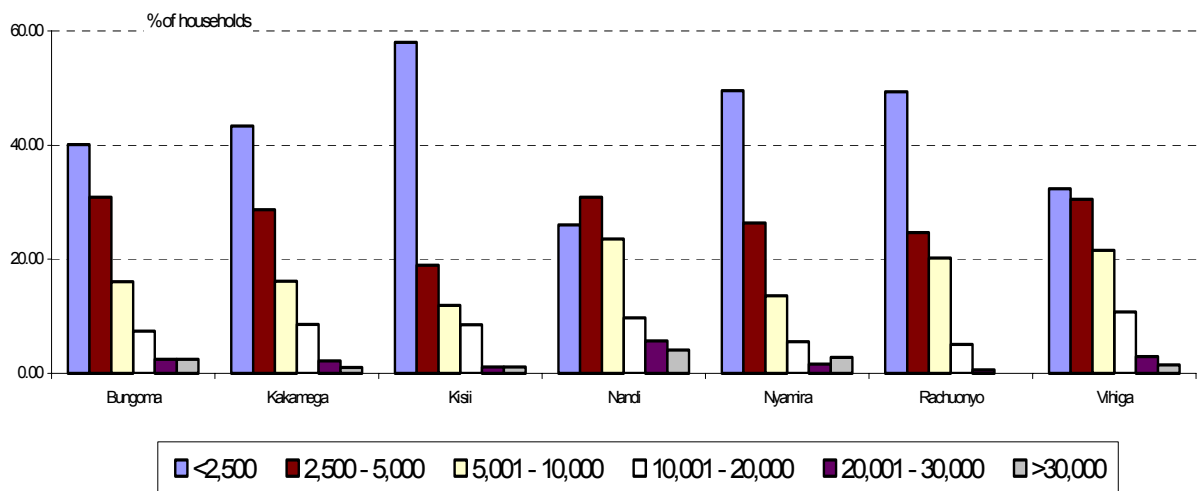


Figure 4.16 Proportions of households by monthly income (KSh) categories



The income levels for non-agricultural households were lower than expected. Possible reasons could have been that there was a general reluctance to indicate true incomes and this may have reduced the final sample size and given an un-representative summary. The households may have deliberately refused to indicate off-farm incomes.

All non-agricultural households earned less than KSh 5,000 per month (Figure 4.17). Although 90% of agricultural households earned less than KSh 5,000 per month, their incomes were higher than for non-agricultural households.

Ninety percent of the households with cattle earned at most KSh 5,000 while compared to the households without. This means that households with cattle earned more than those without. As one moves from households with Zebu to those with pure dairy grades only, income per month increases.