ECONOMICS OF PERI-URBAN ZERO-GRAZING IN UGANDA: THE CASE OF MPIGI DISTRICT

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DECLARATION:

I, Kirembe Gerald, hereby declare that this thesis is my original work and has not been presented for award of a degree in any other University.

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OF PERI-URBAN ZERO-GRAZING IN UGANDA: THE CASE OF MPIGI DISTRICT.

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ABSTRACT

This study was conducted using 73 zero-grazing farm units selected randomly in the environs of Kampala City. It aimed at (1) describing the socio-economic characteristics of zero-grazing farmers in the area; (2) identifying their production constraints; (3) estimating variable cost components of zero-grazing and (4) assessing the economic viability of zero-grazing enterprises in semi-urbanised environments. Cross sectional data collected on structured questionnaire was used. Descriptive statistics, analysis of variance (ANOVA), gross margin calculations and Linear regression were utilised to analyze the data. Descriptive statistics provided the mean estimated values of inputs and outputs used by individual study farms. Gross margins gave a measure of the returns to farmers' fixed capital, management and risk. The ANOVA determined whether the established value differences were statistically significant. Linear regression in a causal relationship identified variable farm level factors that explained the significant differences.

Constraints identified by farmers through score board ranking were as follows: Labour requirements (17.0%), Marketing of milk (15.0%), Cost of inputs: Concentrates (12.6%), livestock diseases (12.0%), poor milk yield (11.7%), Periodic fodder shortage (9.0%), Veterinary extension services (9.0%), poor reproductive performance (7.2%), water shortage (2.7%), credit facilities (1.3%), in security of livestock (1.3%), and manure disposal (0.9%). The provision of concentrate feeds at 35.1 percent of the total variable costs was found to be the biggest farm variable cost component. This was followed by labour at 28.3 percent, forage at 16.8 percent, animal health at 13.4 percent and routine farm services at 6.4 percent.

Dairy enterprise gross margins per year were established to range from Ush. -314,214 to Ush. 5,600,026, with a mean of Ush. 1,493,259 (±752,900). Altogether there were fifty-seven farms (80%) with positive gross margins. ANOVA indicated that gross margins significantly differed depending on farmers' access to off-farm sources of income ($p=0.005$), type of acaricide used on the farm ($p=0.009$), farmers' education standard ($p=0.014$), initial source of capital ($p=0.028$), and distance of the farm from the urban centre ($p=0.034$). Enterprise gross margins were, however, not significantly different ($p>0.05$) for sex of the farm owner, breeding method used by the farm, method of manure disposal, land tenure systems, farmers' experience, herd sizes, family size, farm area(s) under forage, total number of milking cows on the farm, farm mean lactation length, labour input in man-hours, and the farm mean daily milk yields.

Modelling revealed that profit (EGM) for a given farm was dependant upon the volume of milk produced per lactating cow per day ($p<0.001$), milk prices ($p<0.001$), number of lactating cows on the farm ($p=0.001$), market channel used to sell off milk ($p=0.013$), distance of farm from urban centre ($p=0.019$) and whether farmer used home grown forages or not ($p<0.001$).

The study concluded that zero-grazing was a profitable farm enterprise (EGM>0) for farmers dwelling in the study area. a possibility of farmers to in crease their profit margins was also established. It is recommended that farmers in peri-urban areas should take up zero-grazing as an alternative source of household income.

BIOGRAPHICAL SKETCH

The author was born on 28th June 1962 in Masaka District Uganda. He attended Rubaga Boys' primary school from 1970 to 1977. He joined Old Kampala Senior Secondary School in 1998 and obtained a Uganda advanced Certificate of Education in 1984. He joined Makerere University in 1985 and graduated with bachelor of Veterinary Medicine in 1989. From, 1992 he joined civil services under the Ministry of agriculture, animal industry and Fisheries. In November 1995 he was registered in the University of Nairobi for a post-graduate degree course in Veterinary Epidemiology and Economics.

DEDICATION

This thesis is dedicated to; my parents Mr. and Mrs. Musenze, my wife Annet and our children Julius, Josephine and baby Catherine for the moral support and endless encouragement they gave me throughout the period of this study.

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CHAPTER I

1.0 INTRODUCTION

1.1 Background Information

Uganda is a small landlocked country on the eastern part of Africa. It has an area of 236,036 Km^2. One hundred ninety seven thousand Km^2 (>75 %) is dry land area (Ochwo *et al.* 1996). Climatic conditions are mild and over 157,600 Km^2 (>80%) of the dry land area is arable and suitable for farming (World Bank, 1993; Dhalwa, 1995 and MAAIF, 1996). The country has agriculture as its mainstay economically, with over 80 percent of the adult working population engaged in it (Dhalwa, 1995). In the rural setting, agriculture is so important that it employs over 90 percent of the population (MFEP, 1996). Farm units in Uganda, like elsewhere in tropical Africa (Jahnke, 1982), are predominantly of the smallholder mixed type, onto which livestock and crops co-exist (ILRI *et al,* 1996).

Animal management systems in Uganda although vary a lot, similar types of animals are often kept. These include cattle, goats, sheep, pigs, donkeys and poultry. Of all livestock, cattle are the most important in terms of biomass, production and monetary value (MAAIF, 1996). Their population was estimated to be at 5.1 million heads in 1995 (MFEP, 1995). About 3.5 million (>69%) head of cattle in Uganda are located in the southern part of the country, close to or within the Lake Victoria Crescent (LVC) area, south of latitude 1°N. Because of its diffuse dairy activities, this area is normally referred to as the southern milkshed area (SMA) in Uganda (ILRI *et al*, 1996). This area has Mpigi District as its central region. Cattle in Mpigi district, like elsewhere in the SMA are kept for both cultural and socio-economic reasons. They are in most cases integrated with crop farming systems to enable farmers to maintain a certain level of nutrition and income. Earnings from animals, especially sale of fresh milk, constitute the farmer's main income when crops are out of season. Dairy therefore ensures that farmers get a regular continuous income (MAAIF, 1996). The income from animals, together with other non-crop enterprises, is also known to help salvage families from starvation in case of total crop failure (Jahnke, 1982). Unlike pigs and poultry, cattle consume feeds (fodder) not eaten by man, therefore ensuring that there is no competition for food between man and animals (FAO/ILRI, 1995). Animals also augment crop production in crop-livestock mixed smallholder systems by providing manure and draught power (Jahnke, 1982).

Milk in Uganda is the most important source of animal protein for low income earners (MAAIF, 1996). This is particularly in urban areas where beef is expensive and is generally not affordable (Sabiti, 1994). Livestock enterprises in general also give increased economic stability to households as they act as a cash buffer and hedge against hard cash devaluation (FAO/ILRI, 1995). These advantages vis a vis benefits associated with livestock farming, together with the fact that prices of milk in Uganda have been rising, have given farmers confidence to continue investing in dairy enterprises in the form of zero grazing. However, the low financial returns per livestock unit hardly meet the capital invested (MAAIF, 1996). The economic viability of the dairy enterprise in the form of zero-grazing in Uganda are thus doubtful. The need therefore arises to carry out constant periodic reviews on the industry's performance in order to ensure that it thrives economically, and remains sustainable, particularly so in urban environs where traditional farming methods are rapidly disappearing due to urbanization.

1.2 Problem Statement

Milk production in Uganda is still comparatively low, and ranges from 6-15l per cow per day compared to over 20l which is the mean genetic potential of the exotic dairy animals (Sabiti, 1994). The constraints to increased milk production in Uganda have been found to include: shortage of farm inputs such as forage, water, pasture seeds, lack of capital and market opportunities, and the presence of livestock diseases (MAAIF, 1993 and Suzuki, 1994). In addition, the dairy industry in Uganda suffers from information gaps, with no comprehensive data available (MAIF, 1988; MAAIF, 1993 and Nalule, 1996), and even the little information that is available is known to be sparse and highly unreliable (MAAIF, 1996). Dairy animals are also generally poorly managed in Uganda as a result ignorance on the use of locally available dairy resource inputs (Sabiti, 1994). Despite the recognition of these problems, very little dairy related production research has been carried out to seek solutions to the problems (MAAIF, 1993). Moreover, the majority of farmers in Uganda have limited resources to undertake formal research on their own. These factors have led to a situation where farmers adopt new technologies due to group influence without considering consequences. Zero-grazing, as a new technology, has fallen prey to this anomaly. Promotion of this industry has been further disadvantaged by the fact that traditionally, farmers have not practiced zero-grazing (Kalule-Sewali, 1994). The Ugandan farmer therefore lacks knowledge on zero-grazing practices, particularly so on implementation, its effects on the environment, resource requirements and how the available resources can be optimally utilized. Interest also exists for knowing how zero grazing can be integrated with other pre-existing dairy production systems. It is also still doubtful whether this new technology can survive as an independent economic enterprise (MAAIF, 1996). Farmers that invested in it also desire to know whether it really pays economically. This is especially so in the peri- and intra-urban environs of LVC where most zero grazed animals are concentrated, and yet essential dairy inputs such as feeds and labour are costly due to existence of other alternative uses. This study was undertaken to seek solutions from the farmers' economic point of view. The peri-urban areas of Kampala City (located in Mpigi District) were used as study areas for zero-grazing in peri- and intra-urban environs in central Uganda with special reference to the LVC area.

1.3 Research Objectives

1.3.1 Broad Objective

To assess the economic viability of zero-grazing dairy enterprise in the peri-urban farming systems in central Uganda.

1.3.2 Specific Objectives:

(1) To describe socio-demographic characteristics of farmers engaged in zero-grazing and type of livestock management practiced.

(2) To identify production constraints farmers engaged in zero grazing face.

(3) To identify inputs used by zero grazers in semi urban environs and establish their relative contributions towards total enterprise variable costs.

(4) To carry out a financial analysis to establish whether zero-grazing is a profitable enterprise in semi-urbanized parts of Mpigi district.

1.4 Hypothesis

The following hypothesis was tested in this study: that zero-grazing is a profitable enterprise in semi-urbanized areas of the southern milkshed region of the lake Victoria Crescent i.e. enterprise gross margins are positive.

1.5 Organization of the Thesis

This Thesis is divided into six chapters. Chapter I gives the introduction of the study, problem statement, objectives and hypothesis tested. It describes also why the study was considered important to farmers, researchers and policy makers. Chapter II covers a review of literature relevant to this study. In Chapter II, a description of the procedures that were used to accomplish the set objectives is given. An explanation of data needs, and collection and analysis is given, too. Chapter IV presents the results of the descriptive statistics while Chapter V presents results from financial analysis and linear regression. Chapter VI contains conclusions and recommendations drawn from the study.

1.6 Significance of the study

This study contributes information on commercial livestock production in the milkshed of central Uganda with special reference to farmers practicing zero-grazing in urban environs. The study highlights the constraints of zero-grazing as a sub-method of dairy production system. It seeks solution and suggests practical recommendations to farmers to help resolve identified problems. New knowledge concerning implementation of zero-grazing, its resource allocation and use are provided to farmers. Some existing information gaps on dairy, and zero-grazing in particular, within the studied area are bridged. The study also provides a resource of demographic and socio-economic parameters pertaining to farmers who practice zero-grazing in the study area for agricultural extension staff and researchers. This study contrasts with all previous study approaches on zero-grazing in the study environs, since:

(1) the systems of interest are purely livestock orientated with animals intensively managed.

(2) the study area is peri-urban with a high human population pressure on land.

(3) the study concentrates on very small holders with a maximum of four lactating cows.

(4) economic assessment is based purely from the farmers' economic perspective.

CHAPTER II

2.0 LITERATURE REVIEW

This chapter gives a review of available literature considered relevant to this study. First, a theoretical background on the concept of resource use in agricultural production is given. Next, it cites a number of studies, which have attempted to shows that introducing better farming methods as a new technology can improve human welfare in developing countries.

2.1 The Concept of Profitability

Production was defined by Rhodes *et al.* (1968) as a process whereby certain goods and/or services are turned into different forms. The goods and/or services used are called resources or inputs whereas the goods and/or services created are called goods, outputs or products. The purpose of changing goods and/or services into different forms centres on the fact that goods/or services can have their valves enhanced by increasing their utility in a society. The rationale is therefore to use goods/services which have low utility to produce others that are of high utility for consumers. The difference in value between the input and created goods and/or services serve as an incentive for the producer. This is loosely refereed to as profit in production. So universally before producers attempt to produce any product they consider the cost of resources at their disposal and the likely valve of the goods and/or services they are poised to producer. In agricultural the farmers often produce what is most convenient depending on local resource endowment, principal of comparative advantage. Resources, which are readily available, free or of low value are abundantly exploited while scarce, expensive or limited resources are sparsely, used (Ackello-Ogutu and

Wachi, 1990). Under farming conditions, the producer through guessing, observation, uncontrolled farm trials and informal experiments learn and establish what are the right relative amounts of inputs and out that achieve desirable results. In the long run producers in the same area using similar outputs and producing similar outputs therefore establish a plane of production onto which they oscillate (Price, 1991). Moving out require additional use of inputs or an increase in the efficiency of current resource use. This can be in a form of new technology.

2.2 Relevance of Economic Principles to Farmers

According to Makeham and Malcolm (1986), the starting point in understanding why economics is of real life relevance to farmers is that there is not much sense in doing something if the end result is that one ends up being in similar or worse situation than the initial stage. This implies that farmers consciously engage in farming activities, which have social and/or economic benefits. The inference here is that rationality and opportunity benefit maximization forms the key principles in all economic endeavours. These principles are applicable to all people, regardless of where and how they live, for both developed and under developed countries (Barnard and Nix, 1979; Ackello-Ogutu and Wachi, 1990 and Panin, 1993). Decisions made by farmers are based on these principles depending on farmers' objectives and goals.

2.3 Farm Goals

Households constitute the key decision making units in rural settings where subsistence and/or semi-subsistence is the main form of agriculture (Ahmed and Rahman, 1992). Household objectives were identified by Belete *et al.* (1993) as primarily to secure subsistence survival, and at the same time to maximise profit from the sale of the household surplus produce. However, it should also be noted that as one moves away from subsistence through semi-subsistence into commercial farming, profit maximization gains at the expense of pure subsistence survival (Ackello-Ogutu and Wachi, 1990). Farming families therefore have clear objectives in deciding whether, what, how and how much to produce (Reynold, 1996). The farm objective is not simply increased marginal profit.

2.4 Contributions of Economics Towards Livestock Production

According to ILCA (1989), economics contributes to the improvement of policy formulation and decision making for animal health projects and programmes, by explaining factors which influence livestock producers, how they decide what and how much to produce, what prices are acceptable to them, why production is expanded or contracted, and how much they should invest. It is also used to analyze how producers of livestock interact with consumers of livestock products. It can also be used to predict the likely consequences of changes in the livestock sector, hence impacts of changes can be assessed before specific policies are implemented. Economic analysis is also used in livestock project priority ranking. Project prioritization is essential in developing countries where resources are limited, and there is a need to ensure that only those projects that are economically viable are implemented (ILCA, 1989 and Oakley, 1997).

2.5 Factors Affecting Animal Production

There are many factors, which influence animal production. In dairy animals, however these factors are all subject to the interaction of: (1) the animal's genome (thus at the farm level one has got to consider the animal's breed and type) and (2) the environment; this encompasses two broad aspects_ the climate and management (Radostits *et al.*, 1994).

Management factors are most important for individual farmers because they can be easily manipulated at the farm level to achieve desired outcomes. Factors, which determine outcomes, are known as variables, and their cost values are known as variable costs. Farmers as decision makers striving to operate efficiently, must identify farm variable costs that are most relevant in determining the levels of production in their enterprise in order to achieve set farming goals (Oakley, 1997). In livestock enterprises the variables which are important in explaining production are: concentrate feeding; pasture acreage and type of fodder, use of farm by-products and farm operating capital (Murithi, 1990; Sharma and Singh, 1993; WIIAD, 1994 and Oakley 1997,). Operating capital for dairy enterprises includes the monetary value for mainly replenishable farm inputs such as chemicals, mineral licks, drugs, vaccines, acaracides, and routine farm services (Radostits *et al.*, 1994). The latter are largely in the form of treatments and inseminations. The relationship between inputs and milk production in dairy systems is often examined by researchers by identifying factors that affect production critically, functional relationship analysis.

Murithi (1990) using this approach identified inputs on dairy farms that influence milk production to be:

(X_1) Concentrate (kg) fed per animal per year.

(X_2) Labour (man-hours) per animal per year.

(X_3) Area (ha.) under forage per animal per year.

(X_4) Farm by-products (kg) fed per animal per year.

(X_5) Operating capital (kshs.) used per animal per year.

The model obtained took the following form:

$$y = A.X_1 B^1 \cdot X_2^B 2\, X_3^B 3.X_4^B 4\, S\ ^B 5\, E$$

Where B_i is the specific input regression coefficient and E is an statistical error term. Of all the inputs (X_i), concentrates i.e (X_i) had the highest B_i values indicating that change in the levels concentrate feeding would effect milk yield most.

Kilungo (1998) in a study in Kiambu district of Kenya also used the production function approach to identify factors that influence milk production. The results showed that at 90% confidence level that factors include concentrates, hired labour, forage, and farm operational capital. It was also interestingly revealed that concentrate and forage consistently had coefficients of positive quantitative signs, implying that forage could be substituted with concentrates or vice verse to a certain extent in diets of lactating dairy cows. These findings are in parallel to those of Nalule (1994) who reported dairy cows with satisfactory milks yields on a diet devoid of concentrate. In central Uganda, of which this current study is part, household refuse, particularly banana peels are exploited by farmers as forage for animals.

2.6 Tools for Analyzing Farm Profitability

Many analytical tools have been developed over time for use in economic studies. These include: gross margin analysis, partial budget analysis, cost-benefit analysis, decision tree analysis, functional analysis, linear programming, dynamic programming, the Markov chain and complex composite analysis tools like system simulations models. For examining agricultural farm enterprises the analytical tools which are of value and significance according to Makeham and

Malcolm (1986) are gross margin analysis, partial budget analysis, costs-benefit analysis, decision tree analysis, and function analysis. The selection of one tool and not the other(s) or combination of two or more is subject to the scope and duration of the study; whether it be farm level or national analysis, farming systems analysis or the study of specific enterprise or programmes and\or the study is over one year or a number of years (Oakley, 1997). The selection of one tool and not the other(s) or combination of two or more is subject to the scope and duration of the study; whether it be farm level or national analysis, farming systems analysis or the study of specific enterprise or programmes andthe study is over one year or a number of years (Oakley, 1997).

2.6.1 Cost Benefit

This is a procedure of determining the profitability of programmes over a period of time. Future costs and benefits are "discounted" to make amounts occurring at different points in time completely comparable. The results are expressed either as a differences of sums (net values) or as a ratio (benefits:costs ratio). The relationship between costs and benefits can also be expressed as cost-effectiveness when benefits are extremely difficult to quantify as in social programmes. Both cost-benefit and cost-effectiveness have been used a lot in developing countries during the process of project prioritisation (ILCA, 1989). Cost benefit analysis, according to Oakley (1997), is suitable for periods of time between five and ten years.

2.6.1 Partial Budgeting

This is quantification of the economic consequences of a specific change in farm procedures. It involves examining the following four: (1) Additional revenue realised form the change; (2) Reduced costs as a result of the change; (3) Revenue foregone as a consequence of the change and (4) Extra costs incurred due to the implementation of change. Decision is made to adopt the change if the sum of (1) and (2) is greater than the sum of (3) and (4). Partial budgeting on the farm is, as rule, considered if changes are minor. For example when a farmer is culling an animal with an fertility problem (Martin *et al*, 1987).

2.4.3 Decision Tree

This is defined as any framework used as a strategy for handling complex decisions so that they can be reviewed for being readily evaluated by the human mind (Rhodes *et al*, 1968). Choice such as whether to intervene or not are presented visually. Probability concepts are then used between contrasting options. Eventually a tree form is formed which diagrammatically represents the problem solution and possible limitation. This helps the mind to explore all consequences of possible decisions. The final decision is then taken on the criteria of monetary valve and expected utility of the outputs. In livestock the decision trees have been used in the poultry industry to evaluate the economies of poultry disease control programmes, Carpenter (1980), quoted by Martin *et al.*, 1987.

2.4.4 Gross Margin Analysis

Gross Margin Analysis (GMA) is the most practical method for assessing enterprise profitability, and determining the importance of an enterprise in a mixed crop/livestock production system (Martin *et al.*, 1987). It is most frequently used for livestock enterprises (Makeham and Malcolm, 1986). It is particularly recommended for examining farm performance especially if profitability of enterprise(s) is the point of interest (Dedertin (1986) as quoted by Omore (1996). Gross margin is defined as the value of enterprise output less the variable costs attributed to it (Oakley (1997). It is symbolically presented as shown by the formula below:

$$GM = (\sum_{i=1}^{n} Y_i * P_{yi}) - \sum_{i=1}^{n} (Xi * P_{xi})$$

Where: $\Sigma(y_i * p_{yi})$ is the gross income of the enterprise obtained as a sum of the quantities of products produced (y_i) multiplied by their prices (p_{yi}).

The $\Sigma(x_i * p_{xi})$ are the total variable costs obtained by taking quantities (x_i), monetizable farm inputs which are directly related (varies) to the farm outputs and multiplying them by their respective prices (p_{xi}).

Gross Incomes

In livestock enterprises gross incomes, according to Barnard and Nix (1979), are made up of two main farm events. The first involve changes in the farm livestock inventory. This shows how much stock (monetised animal value) the farm has at the end (at hand) less what it had at the start of a specified time period. A one year period is recommended for stall-fed farm animals. The value of animals and animal products consumed by the household without selling for cash are also considered. The second event includes cash sales of farm animals or/ and outputs. This constitutes all monetizable outputs from the farm such as sales of animals, animal products, animal draught power, and animal by-products.

Variable Costs

Makeham and Malcolm (1986) stated that consideration of the variable costs of any livestock farm activities must reflect on the following: (1) Feeds_ these include costs of forage crops, silage, purchased feed, home-grown grains, maintaining improved pastures, payments for grazing, and direct labour costs involved in watering and feeding the animals; (2) Husbandry i.e medicines, cleansing materials for milking sheds and utensils, and veterinary services; (3) Breeding services and costs of replacement stock where they (animals) are not reared on the farm and (4) Marketing (i.e. transport, processing and selling the produce).

2.4.4.1 Advantages of Gross Margin Over Other Tools

Gross margin is a user-friendly economic analytical technique. This is so because it offers simple straightforward results. According to Price (1991) results expressed in complicated scientific terms carry little meaning, if any, for lay farmers. Thus, frequently such results are not understood and end up having no impact on targeted farmers. Ellis and James (1979) and ILCA (1989), working with gross margin observed a number of advantages too. First, gross margin is the most practical and simple method for assessing enterprise profitability, and offers a good comparison of different enterprises. Second, it is also widely used in farm management studies and therefore readily understandable by most people. Martin *et al.* (1987) also emphasizes this advantage of Enterprise gross margin. Third, the method can also be used to estimate the effects of change (sensitivity analysis) within the limits of fixed assets and resources available to the farmer. Fourth, gross margin can also be used to test technologies before scarce resources are committed to production (ILCA, 1989). According to Martin *et al.* (1987), identifying and categorizing costs at farm level for obtaining gross income and variable cost components is considered to be advantageous for the farmer, as it is known to give the farmer an idea of the size of the change in costs that would occur if one or more activities on his/her farm were to contract or expand. Because of its many advantages gross margin analysis was also adapted in this study too.

2.4.4.2 Computation of Gross Margin

Gross income minus variable costs is a straightforward calculation. It simply requires the listing of all the various components of the farm's gross income (output) and variable costs the farm incurs. The problem with this approach however is that it involves the identification of the components on an individual basis (Makeham and Malcolm, 1986), and one is compelled to decide on what type of price to use in computing the results. For the purpose of this study the milk producer farm gate and animal sale prices were used to compute enterprise gross income. Similarly, farm variable costs were established by using the prices of individual items purchased and used by the farm.

2.5 Economic Assessment of Smallholder Farming Systems

A number of research studies have been carried out in developing countries to ascertain whether small-scale farmers benefit economically by taking on new technology. The designs and economic tools used in these studies varied depending on the local conditions where the study was conducted, the economic theory behind the assessment and research hypothesis tested. Findings from some of these studies are reviewed here. Attention is given to those carried in East Africa, where this study took place.

Kalule-Sewali (1994), evaluated the performance of a zero-grazing project in central Uganda. Her objective was to establish whether aid extended to women in kind (in-calf heifers) would improve women livelihoods. Data was collected from 40 purposively selected households with zero-grazed animals and summary statistics worked out.

The result showed that the women managed to raise their household incomes through the sell of milk. They also improved on the welfare of their families by being able to meet sundry expenses in the home. The nutritional status of the families with lactating animals was also found to be superior. Milk intake was over 96 litres per household member per year of the cow owner family as opposed to 22.4*l* the per capita intake of milk in Uganda. The study also established that zero grazing enable farmers to integrate animals and crop as manure could easily be harvested.

The researcher, basing on these results, concluded that zero-grazing as a new dairy system could assert a positive economic impact on smallholder farming, stabilize household income(s) by providing a daily income in form of milk sales, improve food security through increase food production, and control malnutrition.

The sample of farmers used in this study was however gender biased, as all the study farms were owned by women. Farmers also got initial cows free of charge from the project and all the animals were of high milk production potentials (pure exotic animals). For many farmers in Uganda these conditions are a rarity. The study nevertheless showed that zero-grazing was a potentially viable enterprise in Uganda.

In southern Uganda, a study similar to that of Kalule-Sewali (1994) was carried out by Nalule (1996). The objective was to assess whether zero-grazing was profitable where milk prices are comparative low. The researcher during a cross sectional study examined the relationship between inputs and outputs to measure economic performance of households. Results were presented in form of ratios (Benefit/cost) or/and as summed up differences (gross margins). Gross margin was established to be ranging from -712,000 to 5,230,000 /=. The differences in values were established to depend on the levels of milk production, sex of the calf sired and on whether farmer managed to sell off the calf born within the year. A sharp difference in benefit/cost ratio was observed between the farmers that had started with donated cows (B/C = 1.98) and those that had purchased their own animals (B/C = 1.32). This difference in B/C registered was shown by the researcher to be due to differences in milk production between the cows that were donated and those purchased by farmers. The donated animals were largely pure exotic as opposed to the purchased ones, which were cross-breeds. The researcher, basing on B/C ratio obtained and gross margin values concluded that zero-grazing was a profitable venture, even when milk prices were quite low (250/- per litre), and recommended zero grazing as a new practical technology to improving dairy farming in Uganda.

One unique feature of this study was that feeding of concentrate was very limited (5%). Instead of concentrate, farmers relied heavily on cheap readily available farm bi-products. In respect to the current study area, milk prices are high because of demand by the elite population in nearby urban centres. The provision of concentrates is also high due to land resource shortages. Farmers in the study area also had an opportunity to use an intensive extension service system, which is non-existent in the present study area.

In a study to determine the profitability of different farm enterprises, Laker (1999) assessed the economical justification for routine treatment of dairy animals against trypanosomiasis. Fifty farms randomly selected from a sampling frame of 187 dairy farms and stratified by herd size were used. The assessment involved estimation of total cost of disease as a component of farm variable costs. The researcher, using simple herds spreadsheet models, estimated the economic cost on farms due to trypanosomiasis to be negligible. Only Ush. 1,900, 1,300 and 700 annually for small, medium and large herds respectively. Basing on this finding the researcher concluded that trypanosomiasis comparatively was not as major a constraint in the study farms as originally thought. He therefore recommended that the government policy of carrying out routine chemoprophylaxis at specific interval irrespective of the <- fly challenge, and disease risk in different production system as a new technical measure needed re-evaluation.

This study revealed that some farmers might actually maintain or take on new technological innovations, which are not economically justifiable. It highlights the need to periodically conduct research and up date information on farming systems. In respect to the present study zero grazing is a newly introduced technology and operated on recommendations drawn from different geographical areas. It is therefore worth while to examine production systems in new areas to diagnose problems which are peculiar in location. A system of production is best examined using the " systems approach" whereby all the production components and their inter-linkages are considered in totally. Practically this is limited by the scarcity of resources and time available for research (Martin *et al*, 1987). So in most cases researcher examine only one or a few components of a given production system and draw conclusion whether to recommend or not.

Wange (1998) in a study "studies on primary tillage implements and systems used for draught animal cultivation featuring Uganda situation" examined ways for improving farm profitability through new technology and changes in animal management systems. The study was in form of a basic analytical review of literature on the performance of animal drawn implements. An old type of plough drawn by one ox was compared with a broad plough drawable by a team of two oxen, which could be introduced to farmers. Operational costs were estimated and income realizable projected for the two systems. The results showed that farm total revenue could increase by introducing the new plough by 29.7% due to improvement in crop yield. Basing on this the use of a bigger plough drawn by several animals was found to be both technically and economically feasible. The researcher therefore concluded that it was potentially worthwhile to farmers to invest in the new plough. For the future the researcher predicted that changes in animal use would will directly lead to increase in standard of living of the farmers and income in the area.

Curry *et al.*, (1996) conducted a study on dairy in relation to human welfare in Kwale and Kilifi District, Kenya using data from 779 households. The objective was to assess whether human nutritional status and health had improved as a result of new technology in form of dairy intensification. A longitudinal survey was conducted to monitor status of the community at different points between July 1985 and 1987 using anthropometric parameters. Points of articulation between livestock and nutritional systems in households included income, resource allocation, food consumption and human disease risk. The main finding was that the potential nutritional impact of increased livestock production depends on the direct consuming of milk by families with cows. It was also established that milk is nutritionally important for dairying households, as it provides essential amino acids, fat, vitamin A and calcium, which are always deficient in most African diets. An intensive dairy production system was also observed to create employment opportunities, and result in the reduction of the consumer price of milk too. This study clearly reveals that intensification of dairy production can exact impact on people facing land constraints, and that the system has many advantages and benefits which are not easily quantifiable into monetary values. In the present study area, unlike in Kilifi, the population is urbanite. Milk is produced for both income and feeding the families member. A female family member often provides most of labour (MAAIF,1996).

Mullins *et al.*, (1996) examined the intensification of dairy in coastal Kenya from a gender point of view. Cohorts of 16 female and male farmers were formed and socio-economic and production characteristics data collected. The data when analyzed showed that 48% of work in the dairy unit is done by women, while the labour contribution of men in both cohorts was relatively small. It was also shown that dairy intensification had positively increased both women's personal income and household income. There was also consensus that human welfare had generally improved at household level as a result of the intensifying dairy enterprises in the area. Positive changes in social well being associated with changing animal management systems have also been reported Omore *et al.*, (1997).

CHAPTER III

.0 MATERIALS AND METHODS

This chapter describes the general area where data for this research was collected and a escription of the procedures used to analysis it

ŀ.1 Study Area3.1 Study Area

.1.1 Geographical Location

Uganda is administratively divided into 45 units called districts. Mpigi, where this study was arried out, is one of them. The district is located on the northern shores of Lake Victoria sharing orders with four other districts. Luwero in the north, Mukono in the east, Masaka in the west, and ˦ubende in the north west. On the eastern part, Mpigi district also surrounds Kampala, the largest and ɿost densely populated (1.5 Million) city in Uganda. Mpigi District as a catchment area of the city is lso densely populated (MFEP, 1992; Sabiti, 1994). The geographical location of Mpigi District is hown in figure 3-1.

MAP OF UGANDA

Figure 3-1: Map of Uganda Showing Mpigi District

3.1.2 Administration

Politically, Mpigi District is divided into several sub-administrative units: 5 counties and one municipality, 35-sub-counties, 256 parishes and an unspecified number of villages. The sub-county forms the key political administrative unit in the district, and it is headed by a sub-county Local Council Chairman (LCC). All local public servants serving within the sub-county, including agricultural extensionists, are answerable to the LCC.

3.1.3 Zero-grazing Enterprises

In Mpigi District, like in all other parts of Uganda, people are engaged in agriculture, which is a mixture of crops and livestock. Animals are therefore found everywhere and smallholder livestock management systems are a key feature. However, as a rule, intensive systems of livestock production are associated with urban environs. Zero-grazing activities in Mpigi District are therefore concentrated mainly in peri-urban parts of the district (areas adjacent to Kampala City), and within or around towns inside the district (DVSAI, 1996). This study purposively focused on these areas (Figure 3-2).

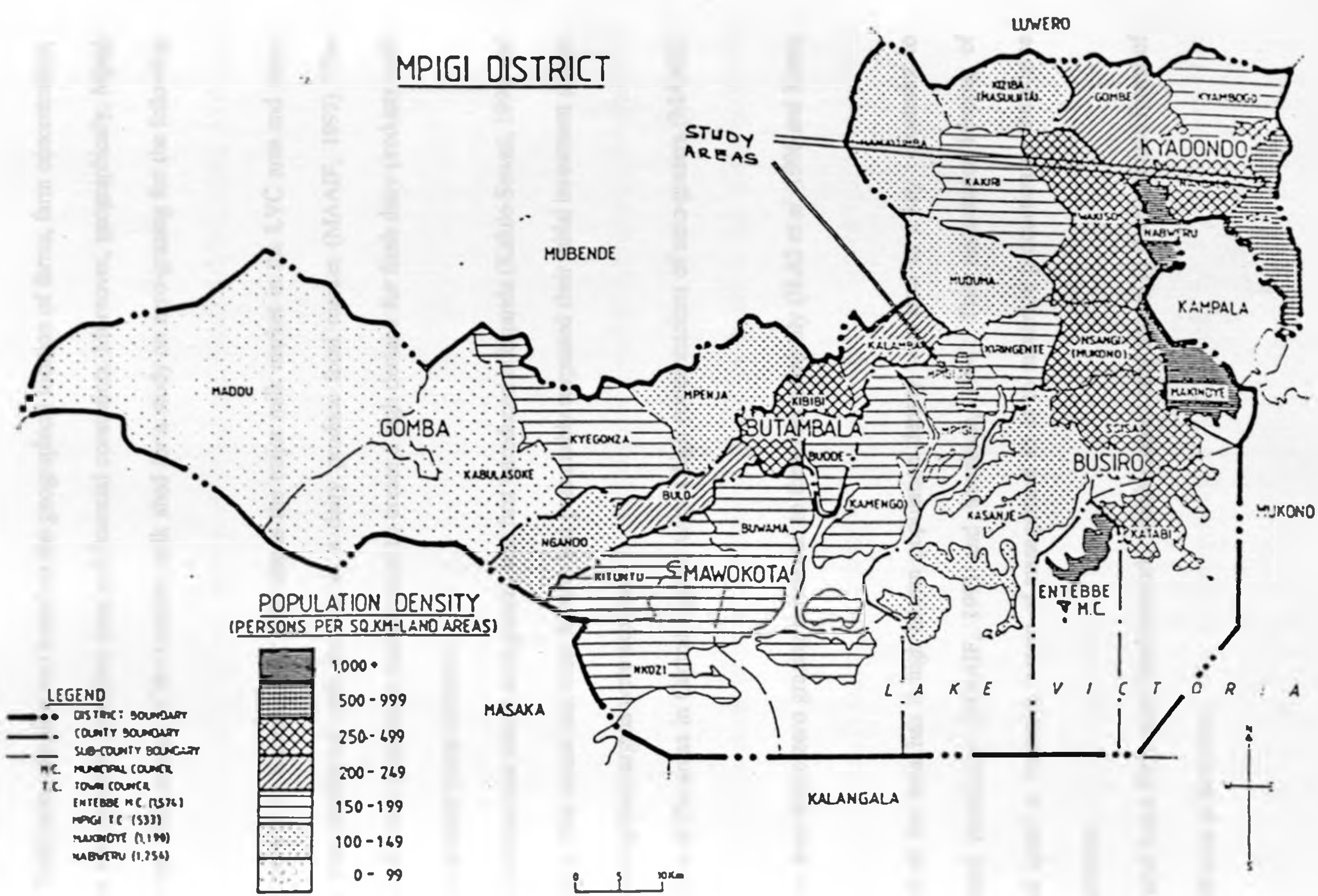


Figure 3-2: Map of Mpigi Showing the Study Areas

3.1.4 Site Selection Criteria.

Study area selection was based on the geographical location of farms, farm concentration, time that was available to collect data and financial constraints. Moreover, geographically, Mpigi District was ideal as part of the southern milk shed for a study on zero-grazing for the following reasons:

1. Its proximity to Kampala City. The city is the major milk market in the LVC area and zero-grazing was established with the city as a dairy produce focal market (MAAIF, 1993). The presence of a vast population was assumed to create a high demand for fresh dairy products with fairly high market prices for them.

2. It is a pioneer area where zero-grazing was first introduced in Uganda (Kalule-Sewali, 1994 and HPI, 1992). This meant that most farmers had presumably surpassed their initial investment phase, and positive gross margins were expected.

3. It is one of the areas in Central Uganda with a high concentrations of zero-grazers (MAAIF, 1996).

4. It is an area where zero grazing is believed to thrive economically (ILRI *et al*, 1996 and Kinte, 1997).

5. Much of the area has a high human population density with land as a key constraint to agricultural production (MAAIF, 1993 and Mwebaze, 1994). This necessitates keeping of livestock under an intensive system of management so as to maximize production on the scarce land resources.

6. The area has a fairly good road network, which enabled easy access to it with simple forms of transport such as bi-cycles.

3.2 Sampling

3.2.1 Selection of Study Sites and Subjects

Selection of the study areas (sub-counties) was guided by an inventory of commercial livestock farming activities in Mpigi District kept at the Veterinary District Headquarters, which showed that the area has a high concentration of zero-grazed animals (DVSAI, 1996). All the sub-counties located within the 5-20 km radius outside Kampala City, Entebbe municipality and Mpigi town, the key urban centres in the study area were considered and designated as peri-urban for the study. Nine sub-counties; Nangabo, Nabweru, Nsangi, Sissa, Makindye, Kira, Katabi, Entebbe and Mutuba 1 Mpigi comprised of the area.

Using a simple random sampling technique, Mutuba 1 Mpigi and Kira sub-counties were selected to constitute the study sites. Geographical location of farms and the socio-demographic characteristics of the study farmers in the two sub-counties were then used to group the study sites into the two zones, zone one (zone I) and zone two (zone II). Farms in zone I were located in parts of Kira sub-county closest to Kampala City (<5 km), in areas with a high human population pressure on land of over 500 persons per km^2. Farms in zone II were located further away from Kampala City (>5km) in either Kira or Mutuba 1 Mpigi sub-counties in areas which had relatively low human population densities of less than 500 persons per km^2. Boundaries of the created zones corresponded with political, administrative boundaries at parish levels.

2.2.2 Sample Size Determination

In research work the sample size (n) required for estimating the means of livestock dependant quantitative variables is given by the following formulae: $n = Z^2 * S^2/L^2$ (Martin *et al.*, (1987).

Where:

n is the appropriately desired sample size.

Z^2 is the square of the reliability coefficient for a fixed level of statistical confidence. This is normally put at 95 percentage ($Z = 1.96$) in most biometric studies (Lachin, 1981).

S^2 is the variance of variable(s) under estimate.

L^2 is the square of the allowable error.

In the dairy enterprise, milk is the most important component of farm produce contributing towards sales, hence income. This is supported by findings by Murithi (1990), MAAIF (1993), Kalule-Sewali (1994), Ntegua (1994), ILRI *et al* (1996) and MAAIF (1996). Since farm incomes are directly proportionate to enterprise gross margin, which is also dependant on milk produced by farm, milk production levels on farms could give a better alternative for sample size determination instead of enterprise gross margin which is known to be very variable especially on small holder dairy farms in Uganda (MAAIF, 1996). Lachin (1981) recommended that it is necessary for researchers to adjust the sample sizes (n) obtained by statistical consideration upward to a factor (N_d) to cater for subjects that drop out of the study as researchers collect data in the field (Lachin, 1981). N_d is given by the formula: $N_d = n/(1-R)2$. Where N_d equals the sample size after adjusting for losses of an estimated (R) proportion of study subjects. A value of 15% ($R=0.15$) is normally used.

The sample size (n) required for the study was calculated:

$$\text{With } Z^2=1.96,\ S^2=7.67,\ L^2=0.75\ .$$

$$n = (1.96)^2 * 7.67/(0.75)^2 = 52.4$$

These results showed that a minimum of 53 farms were required to carrying out this study. Using Lachin's (1981) approach, the required field sample size (N_d) needed to give a minimum sample of study 53 units was computed by assuming an expected dropout of 15% farms (R=0.15). Substituting in the formulae: $N_d=N/(1-R)^2$.

$=> N_d = 53/(1-0.15)^2=73$

A total of 73 farms were thus selected randomly for data collection.*

3.2.3 Reference Population

These are small holder dairy farms in the southern milk-shed areas of the Lake Victoria Crescent (LVC) of central Uganda undertaking zero-grazing practices in urban environs. Small holders dairy farms for zero-grazing were defined as farm units with a total of five or less lactating cows per year, with animals (cattle) kept and fed permanently in stalls. Only animals that were registered by the resident local veterinary sub-county in-charge(s) were considered. In all, a total of 318 farm units were identified to satisfy the study description of zero-grazing in the two sub-counties selected to constitute the study area. These served as the study reference population.

3.2.4 Study Sample Population

The study sample population consisted of 73 farms obtained by simple random sampling from 318 zero-grazing holdings in the reference population. The number of animals, geographical proximity and human population density in a parish area were used as a mean of stratification to

* The variance (S2 = 7.67) and allowable error (L2 = 0.75) equated above were derived from figures of milk production which were obtained in a survey by MAI&F In the study area in 1988 (Uganda MAI&F, 1988).

divide the study area into two (02) zones. For each parish, a proportionate number of animals were included in the sample frame. Individual farms were identified using records kept by resident agricultural/veterinary officials. The physical locations of the farms were then established through the assistance of sub-county local civic leader(s). Table 3-1 shows the distribution of sampled farms. Farms in zone I are indicated by "*" sign.

Table 3-1: Location of Study Farms by Zone

Parish Area	Kirinya*	Bweyo* Kireka*	Namu Kira Kung	Mutuba 1 Mpigi	Total
No. farms	67	68	102	81	318
No. Sampled	15	16	24	18	73
Sample as % total	21.1	22.5	34	22.4	100

Where:

Bweyo = Bweyogerere

Namu = Namugongo

Kung = Kungu

Source: Author's Computation, 1998

3.3 Field Work

3.4 3.3.1 Research Tools.

Tools used in this study included land area measuring equipments: pocket compasses, measuring tapes, nylon cords and poles. Buckets, measuring cylinders and plastic cups were utilised for capacity measuring (volumes). Pocket calculators, paper and pen were used in working out simple sums. Computer software packages: SAS, Dbase and Word Perfect were used for data analysis, writings and printing reports.

3.3.2 Surveys

Initial reconnaissance surveys were undertaken by the investigator between December, 1996 and March 1997 to establish cordial relationships with the local participants. These included farmers, government administrators, civic leaders, agricultural extension officials both government and private, and animal interest groups such as livestock donor agencies. Informal introductory interviews were held with each of the above groups to get an over-view of the farming situation in the study area. Special interest was given to zero-grazing activities especially in peri- and intra-urban environs. Local inputs such as an interpreter, enumerators and foreknowledge on the use of public facilities were sought at this level. Further subsequent visits were paid to these local agents, whenever it was deemed necessary.

3.3.3 Data Collection

Data was collected between June 1997 and 30th October 1997 by two trained enumerators who were supervised by the investigator. Both primary and secondary data were collected. Primary data was collected on pre-tested structured questionnaire (Appendix I), supplemented by secondary data from the farmers' record books. The data collected was broadly of two categories: socio-demographic data of the farmers and farm production data. Socio-demographic data of the farmers provided explanatory variables while farm production data was concerned with expenditure and income for the farmer relating to zero-grazing activities.

3.3.4 Information Generated

Information generated on farm owner was on sex, marital status, experience, access to off-farm jobs and educational level; while information on the farm was on location of the farm, source of initial capital, source of forage, type of acaricide used, breeds of lactating animals kept, market outlets for selling farm produce (milk), breeding methods used, prices of produce, farm size, herd size and farm yard manure disposal method used. Information collected on farm inputs included costs on shed construction, initial stock (animals), and equipment and utensils purchased (capital). Information on farm running costs (variable costs) consisted of farm expenses on labour, feeds, animal health, and routine farm services. Information on farm output was on milk and animal sale.

3.4 Data Analysis

3.4.1 Standardization

All the information generated pertaining to production was standardized to conform to established rational economic measures for presentation as inputs used or outputs produced per unit of resource used. Land area in hectares, labour in man-hours, and capital in Uganda shillings were considered as key farm resource inputs. Prior to computation, an appropriate monetary value was estimated for every identified farm inputs and outputs. These values were assumed to be equivalent to the average market prices of the services or goods in question at the farm level. Actual values were obtained by asking the farmer how much he or she was offering, or was offered to purchase a given good or services. Alternatively, where a farmer had neither actual goods nor services purchased or sales made, the opportunity cost of such a good or service to the farmer himself or herself was considered as its equivalent market value.

3.4.2 Selected Analytical Procedures

The raw data from the study questionnaires, after being coded, were entered into a Dbase file. It was then cleaned to detect any possible discrepancies and manipulated into a pro-written SAS programme for analysis. Three analytical procedures were used in handling the data: descriptive statistics, gross margin analysis and analysis of variance (ANOVA). Descriptive statistics was used to compute figures to establish gross margin values while ANOVA was used to test whether mean gross margin values across the farm sampled were statistically different. Statistical significance was affixed at 95 percent level of confidence (α<0.050). Gross margin was further examined by modelling to identify factors (explanatory) that influenced its magnitude on individual study farms.

3.4.2.1 Statistical Methods

Descriptive statistics involved constructing parameters of central tendency in the raw data in form of frequency distribution tables, mean values, modes, medians and percentages. This was supplemented by calculating measures of dispersion; variance and standard deviations. ANOVA was used to test whether figures obtained from different farms were different statistically.

3.4.2.2 Enterprise Gross Margin

Enterprise gross margin (EGM) analysis was the key economic analytical technique used in this study. Values were calculated for each farm by subtracting variable costs from gross income.

Enterprise Gross Income

This was calculated by summing up the value of milk (yield*price) produced in a period of time equivalent to one year (365 days) and annual animal sales on farms. The milk considered included amounts used to feed animals (mainly calves), household members, as gifts and actual sales. The change in animal inventory was assumed to be negligible because of the time the study considered (one year). A short run term consideration was taken. Animal products and by-products such skins, hides and draught power were excluded too in the estimates as none of the farmers had turned them into direct monetary values. It was also impossible to incorporate into enterprise gross income the monetary value of the manure produced by animals on a farm(s) as quantities and prices could not be meaningfully determined. Furthermore the investigator wanted to establish whether this system of dairy production would still be justifiable without farmers harvesting manure.

Furthermore manure is often used more as a benefit than a marketable farm product by most farmers Wange (1998).

Variable Costs

These were obtained by summing up estimated annual farm costs of inputs, which were routinely replenished. These included costs on veterinary inputs and services, animal feeds, transportation, plus costs incurred to pay for hired labour, both casual and permanent. Enterprise gross margin was then established by deducting variable costs from enterprise gross income. Lastly, EGM was weighed against important resource farm inputs, which are known to influence farm production. These included the land area used to produce fodder in hectares, the labour used in man-days, and animal(s) value, equipments and shed as capital invested by the farmer in Uganda Shillings (/-). Results were expressed as EGM/Hactare of land under fodder crops per lactating cow, EGM/man-day employed per lactating cow, EGM/capital investments per lactating cow respectively. The presentations gave the magnitude of a unit resource productivity for modeling.

3.4.2.3 Modeling

An expanded functional form of the relationship Y=f(x) was used and the model developed took the following format: $Y= B_o+B_ix_{i..n} + E$.

Where: Y was dependant variable (out put),

$x_{i..n}$ are independent variables (inputs: 1,2,3...n),

B_i are coefficients values which cause Y to change by one level unit,

B_o is constant (regression intercept) and

E is an error term which is possible in predicted Y values.

Models were fitted by a forward/stepwise procedure in SAS programme using enterprise gross margin (EGM), enterprise gross margin per mean lactating cow (EGMC), enterprise gross margin per man-day per lactating cow (EGMMLD), and enterprise gross margin per captal per cow (EGMS) as individual dependent variables (Y). The explanatory variables ($x_{1...n}$); location of the farm (zone), breed of the lactating animals kept (Breed), type of acaricide used (Acar), initial source of capital (Funso), farmers' educational levels (Educ), sex of the farm owner (Sex), access to off-farm sources of income (Occupt), breeding method (Mate), method of manure disposal (Manuse), markets for milk (Mkts), land tenure (Tenu), source of forage (Forg), prices of concentrates (Pcos), years of experience (Years), herd size (Hsize), family size (Fsize), farm size for livestock (Fstoc), total number of milking cows (Tdm), farm mean lactation length (Mlength), number of work hours (Dman), and mean milk yield (Mmean) were used in the models as independent variables.

CHAPTER IV

4.0 RESULTS OF DESCRIPTIVE ANALYSIS

This chapter presents the results of descriptive statistics from the data generated by this study together with brief discussions and interpretations.

4.1. Farm Parameters

4.1.1 Land Tenure

Three land tenure systems were recognized. These were mailo-land/freehold, lease-hold and customary. There were 21.1% (15/71) farms under the mailo-land/freehold system, 33.8% (24/71) on lease-hold and 45.1% (32/71) farms on customary system of land tenure. Almost half of the farmers (45.1%) still dwelt on plots of land that did not have land titles (customary ownership). According to Maxwell (1995) the majority of people in central Uganda do operate on pieces of land with unsecured titles because land ownership is still generally a contentious issue. Typically it is characterized by beruacry and high costs. These are curcumustancially limiting for the poor people.According to Maxwell (1995) the majority of people in central Uganda do operate on pieces of land with unsecured titles because land ownership is still generally a contentious issue. Typically it is characterized by beruacry and high costs. These are curcumustancially limiting for the poor people.According to Maxwell (1995) the majority of people in central Uganda do operate on pieces of land with unsecured titles because land ownership is still generally a contentious issue. Typically it is characterized by beruacry and high costs. These are curcumustancially limiting for

the poor people.

4.1.2 Farm Size

The size of the farm (excluding the cattle shed area) ranged from 0, where a farmer had no land at all, to 35 ha, with a mean of 4 ha (±4.9). The farm sizes were generally small, and 52 (74.3%) of the 70 farmers who had recorded farm sizes had less than 4.1 ha; 11 farmers (15.7 %) had between 4.1 and 8 ha. Only 7 farmers (10%) had land area of more than 8 ha. Land area reserved for livestock (fodder) is presented as a percent of the total farm land area in Table 4-1. The table 4-1 shows that 15 (21.1%) of the 71 study farmers had less than 10% of their farmland under livestock, while 34 farmers (47.9%) had 11-30% of their farmland used for livestock. Only 22 farmers (31%) had more than 30% of their farmland reserved for livestock. This showed that the majority of farmers used only small proportions of their farmland for zero- grazing. The mean farm size obtained in this study is similar to findings of Sabiti (1994) of 1.25-12.5 ha for zero-grazing farmers in Kampala City peri-urban area. It is also in close agreement to the farm land size areas of zero-grazers in other parts of Uganda. For example 3.9 ha in Entebbe (Kalule-Sewali, 1994) and 5.4 ha in Ntungamo (Nalule, 1996). This mean farm size is also comparable to that established in Uganda nationally and other East African countries, that is, Uganda 5.2 ha (MAAIF, 1996), Kenya 4.6 ha (Omore, 1997) and Tanzania 6 ha (Ntengua and Steve, 1995).

The small size of total land area under livestock in this study is explained by the fact that crop production tends to be the dominant form of land use on smallholder farms in central and southern Uganda (MAAIF, 1996). The word smallness in this study is however relative. For example, in Java farms for peri-urban dairying households are only regarded to be small if their average sizes are less than 0.52 ha (Widodo *et al.*, 1993).

Table 4-1: Proportion of Land Reserved for Animals' Fodder

% of land used for livestock	No. of farms	Percentage(%)	Cumulative %
<10	15	21.1	21.1
11-20	12	16.9	38.0
21-30	22	31.0	69.0
>30	22	31.0	100
Total	71	100	

Source: Author's Computation, 1998.

4.1.3 Herd Size

A total of 218 animals were found on the 71 selected study farms. These consisted of 77 lactating cows (35.5%), 17 dry cows(7.8%), 41 heifers (18.8%), 31 heifer calves (14.2%), 37 bull calves (17%) and 15 bulls (6.9%). The smallest units had one cow while the largest unit had a total of 10 animals. The mean and median of the herd size was 3 animals (±1.5). Thirty-one farms (43.7%) had either 1 or 2 animals, while 20 farms (28.2%) had 3 animals. Eleven farms (15.5%)

had 4 animals and 9 farmers (12.9%) had five or more animals each. There were only 2 farmers (2.8%) that had single animals on their farms. These results show that the majority of farmers (69 farmers or 97.2%) kept more than one animal on their farms. The mean herd size (3) is similar to the established national herd size for zero-grazing enterprises in Uganda (MAAIF, 1996 and ILRI *et al*, 1996). Kalule-Sewali (1994) in Entebbe and Nalule (1996) in Ntugamo, also obtained the same value for zero-grazing herds they investigated. Widodo *et al*. (1993) found the mean herd size for zero-grazers in Java to be three. Similarly Omore (1997) found the modal herd size in Kenya (Kiambu District) to be three. The fact that very few farmers (2) had only single animals shows some progression and growth since, each farm initially started with one animal. This may however be a reflection of the small farm holders belief in animal numbers as a measure of livestock safety/economic success as suggested by Jahnke (Jahnke, 1982). It should also be noted that a herd of three animals: one cow, one heifer and calf is considered to be a rational animal family for zero-grazers in Mpigi District (personal observation). It is also possible that some farmers have considered the economies of scale of production and are trying to increase the number of production units (cows). Indeed the keeping of only one animal under zero-grazing in Uganda has been found not to be cost-effective for certain farmers (MAAIF, 1996).

4.1.4 Animal Breeds

Both pure and crossed dairy animal breeds were encountered. Friesians and their crosses constituted the bulk of the stock, making up to 193 (86%) of the 218 total study animal population. Other breeds encountered included Jersey (one animal or 3.2%). Twenty-five animals

(11.5%) out of the 218 study population could not be categorized as their progeny was uncertain. Herds were either of purebred animals or of mixed breeds. Nineteen farms (26.8%) of the 71 study farms kept pure breeds (Friesian) while one farm kept a pure Jersey (1.4%). The remaining 51 farms (71.8%) had mixed breeds. These results show that the Friesian breed is the major contributor of genome (>86%) among the zero-grazed animals and that the majority of farms (71.8%) kept mixed breeds of animals. These results also show that very few farmers (28.2%) keep only one animal breed. This implies zero-grazers, like other smallholders, spread farm financial risks by diversifying the form of production even when dealing with seemingly similar enterprises.

The fact that certain animals' genealogy could not be established shows that farmers in the area attach very little (if any) importance to breed. Indiscriminate breeding of animals has also been rampant in Uganda (Mbuza, 1994). The dominance of the friesian breed and their crosses in the Ugandan dairy animals has been noted before, for example, MAIF (1988), MAAIF (1993), Kiconco (1995), Mbuza (1996), Sewali-Kalule (1994), Nalule (1996), ILRI *et al* (1996), MAAIF (1996) and Kinte (1998).

4.1.5 Herd Structure

4.1.5.1 Lactating Cows

The number of lactating cows per farm ranged from zero to four with a mean of 1.34 animals per farm. Three farms (4.2%) had no lactating animals while the majority (61 farms or 85.9%) had one lactating animal each. Seven farms (9.8%), however, had more than two lactating animals. Milk sales constitute the key daily source of farm incomes (ILRI *et al*, 1996). The presence of lactating animals on the majority of farms is therefore expected.

4.1.5.2 Dry Cows

Dry cows were encountered on only 16 farms (23.5%), and 15 of these farms (94%) had single non-lactating animals each. The presence of a very small proportion of farms with dry cows is indicative of either shorter dry periods, extended lactation or synchronicity of lactation patterns for the study cows. Farmers mentioned that they at times had to shorten the dry period in order to maintain daily incomes if they had no alternative source of income to meet routine family sundry expenses.

4.1.5.3 Heifers and Bulls

Heifers were found on 37 farms (52%) and 33 of these farms with heifers (89.2%) had a single heifer each. Bulls were encountered on only 13 farms (18.3%), and they were largely kept in singles for breeding cows on the farm and neighborhood, as communal bulls. Two of the farms with bulls, however, had a pair of bulls each. These results show that only a very limited number of farmers maintained male animals on their farms up to breeding age. The zero grazers in the study area have easy access to artificial insemination services. The few bulls encountered were used as communal bulls and were located on farms on the fringes of the demarcated study area. The number of male animals in this study was very small compared to that of females. This was expected in zero-grazing systems. Since male animals are deliberately removed (culled) at an early age to avoid feeding them on expensive milk.

4.1.5.4 Calves

Bull calves were found on 37 farms (52%) and 35 farmers (95%) had one bull calf each. The remaining 2 farms (5%) had two bull calves each. Heifer calves were present on 27 farms (38%). On these farms the number of calves ranged from 1 to 4 with 24 (88.9%) of the 27 farms with heifer calves having one calf each, and 2 farms (7.4%) having a pair of calves each. The remaining farm (3.7%) had a total of four heifer calves.

It is evident from these herd structures that female animals are dominant in the herds in terms of numbers, with the bulk of the herds being constituted by lactating cows and young heifers. This finding is similar to what was observed in 1996 by Uganda MAAIF workers on a nation-wide livestock systems' study (MAAIF, 1996).

4.2 Socio-economic Characteristics of Farmers

4.2.1 Sex

Of the 71 study farm owners 49 (69.0%) were females while 22 (31%) were males. There were therefore more female farmers than male ones. The dominance in the zero-grazing industry of female farmers has been previously reported in the LVC (Kalule-Sewali, 1994 and Kiconco, 1995). It is attributed to the fact that the industry is home based and fits in very well in the female gender roles as family managers. Also nation-wide, women in Uganda have shown a stronger presence in the zero-grazing system than men (MAAIF, 1996 and Mwebaze, 1994). Women in Uganda are also more likely to opt for landless forms of agricultural production such as zero-grazing as they traditionally do not own land (Bigsten and Kayizzi, 1995; Mwebaze, 1994 and Kalule-Sewali, 1994). It is also likely that men get employed in the urban city nearby leaving women (wives) as farm operators.

4.2.2 Age

Age of the farm owner ranged from 26 to 76 years, with a mean of 45.7 (±12) years. Table 4-2 shows the distribution of the ages of the farm owners at 10 year intervals. It should be noted that the majority (73.9% or 51/71) of farmers were of middle age, between 31 and 50 years. This age group, according to Murithi (1990), is the most productive age group in society, which often engaged in agriculture. The younger members of the society are often involved in career building activities (schooling) while the elderly lack the energy to engage in laborious manual labour. Both men and women past middle age were however observed in this study fully participating in zero-grazing without any obvious physical hindrance.

Table 4-2: Age Distribution Among Zero-grazing Farmers in Mpigi

Age range(years)	No. of farmers	Percent(%)	Cumulative %
<31	2	2.9	2.9
31-40	33	47.8	50.7
41-50	18	26.1	76.8
51-60	12	17.4	94.2
>60	4	5.8	100
Totals	71	100	

Source: Author's Computation, 1998Source: Author's Computation, 1998Source: Author's Computation, 1998

4.2.3 Occupation

Eight (11.3%) of the 71 study farmers had zero-grazing as their sole source of earnings while 34 farmers (47.9%) combined zero-grazing with subsistence farming. The rest of the farmers (29 or 40.8%) had regular off-farm sources of income. The low level (11.8%) of farmers whose livelihood were entirely dependent on zero-grazing shows that very few people are engaged in zero-grazing as a possible sole source of farm income. According to Mbuza (1991) very few people specialise in dairy production in Uganda because returns to livestock as indicated by gross margin calculation are generally low, which offers the farmers very little incentives to engage in it exclusively.

4.2.4 Marital Status

Fifty-five farmers (77.5%) out of the 71 study farmers had spouses while the rest (16 or 22.5%) were single. These results show that the majority of study farmers were married people. However, it should be noted that the number of single family heads was also relatively high. This is probably due to the fact that donor projects for zero-grazing animals in Uganda exercise a positive bias for the disadvantaged resource poor farmers (HPI, 1992). These are often single parent headed families such as widows, orphans and divorcees.

4.2.5 Educational Standards

None of the 71 study farmers was completely illiterate (that is, could neither read nor write). Those who had not attended formal educational institutions had informally acquired at least vernacular reading skills through religious institutions. Sixteen (22.5%) of the 71 sampled farmers had either informal or lower primary education, 22 farmers (31.0%) had full primary education and 33 farmers (46.5%) had above primary level education. Ten (30%) of the 33 farmers who had education levels above primary had acquired college training in various academic disciplines. Table 4-3 shows the farmers' educational level. It is evident that 55 farmers (77.5%) would easily communicate using English, which is Ugandas' official language. This finding is similar to that of Vanegas and Akwang (1992) who established that most dairy farmers in Uganda have basic formal education: 29.7% having attained primary level education, 33.1% with secondary level education, and 32.2% with above secondary level education. It should however be noted that educational standards were too broadly categorized by Vanegas and Akwang.

Table 4-3: Distribution of Educational Levels Among Zero-grazing Dairy Farmers in Mpigi District.

Educational standard	No. of farmers	Percentage(%)	Cumulative%
Informal and/or lower primary	16	22.5	22.5
Upper primary	22	31.0	53.5
Secondary	23	32.4	85.9
College	10	14.1	100.0

Source: Author's Computation, 1998

4.2.6 Family Sizes

Of the 627 people found on the 71 study farms, 185 (29.5%) were adult female and 152 (24%) were adult males (14<age>66 years), 260 (42%) were children below 15 years of age, and 30 (4.8%) were old people, over 65 years of age. The mean family size was 8.8 (±2.9) persons. The smallest families had only 4 members each while the largest family had 17 members. Majority of families (84.5% or 60/71) had 6-11 members. Forty percent of the human population on the study farms was of very young people below 15 years of age. Majority of adults (53.9%) were females. These observations on zero grazing farmers' family are comparable to the national household survey report (MFEP, 1992). Families in the study, however, have more females than males contrary to the MAAIF findings (MAAIF, 1996). This difference is probably due to sample size effect. The sample size used in the MAAIF report was too small; only four (n=4) farms compared to seventy one (n=71) farms in this study.

4.2.7 Source of Funds

Forty-seven (66.2%) of the 71 study farmers had started their zero-grazing enterprises by using assistance from in-calf heifer donor agencies, 18 farmers (25.4%) had pooled personal funds while 2 farmers (7.0%) had acquired loans from livestock interest groups. Only one farmer (1.4%) had started by combining donor aid and pooled personal funds. These results showed that the majority of farmers (74.6%) were only able to start zero-grazing after acquiring some kind of financial assistance. It should also be noted that the majority (87%) of the 53 farmers that were assisted to start were beneficiaries of in-calf heifer donor agencies. Only 13% of the farmers had used means of assistance other than in-calf heifer donor agencies (loans). Small holder farmers in Uganda are generally poor and yet zero-grazing is an enterprise which requires high capital inputs. This explains why very few farmers (25.4%) had managed to start off without assistance.

4.2.8 Experience

The experience of farmers in the practice of zero-grazing ranged from 2 to 11 years, with a mean of 3.67 years (±1.8). All the farmers however were found to have had prior experience with some kind of livestock before they embarked on zero-grazing. Fifteen (21.1%) of the 71 study farmers had kept animals for 24-30 months, 29 farmers (40.8%) for 31-48 months, 15 farmers (21.1%) for 49-60 months, and 12 farmers (16.8%) had animals for a time period exceeding 60 months.

4.2.9 Milk Consumption

The volume of milk consumed per day by the family of the animal owner(s) ranged from 0 to 4*L*, with a mean of 2.42*L* (±0.94). This observed level of milk consumption is equivalent to 126 litres of milk per person per year on the farm(s). It is more than six times the national (24.5*L*-rural and 31.5*L*-urban consumers) level of milk consumption per capita in Uganda (Kabuye, 1994). The value obtained here is however comparable to the FAO (120.5*L*) recommended per capita milk consumption levels (FAO, 1989) and close to the level of milk consumption per capita in central Kenya (120*L*) (Sabiti, 1994). Non consumption of milk by zero-grazing households was also observed in Mpigi District in 1993 (Kalule-Sewali, 1994). Severe financial constraint was the reason advanced by farmers incriminated.

4.3 Farm Production Parameters

4.3.1 Milk Yield

Milk production per farm ranged from 6*L* a day to 42*L* with a mean of 17.4*L* (±9.4). Expressed on a per mean lactating cow per farm, milk production ranged from 6*L* to 28*L* per day with a mean of 13.16*L* (±4.3). Milk production, expressed either on a farm level or as a function of the mean number of lactating animals, had therefore a median value which was less than the mean, implying that most farms with lactating cows were producing below the 13.16*L* daily production average established by the study. Similarly this mean-median profile can be interpreted to mean that few cows attained the mean production level quoted (13.16*L*).

Table 4-4 shows the distribution of mean milk yield per lactating cow on a farm basis. It should be noted from the table that 58 (81.7%) of the 71 study farms had cows with mean lactation yields of less than 16*L* per day. The range of milk production obtained in this study (6-24*L*/day) is generally higher than the 10-15*L* for pure breed friesian, 5-9*L* for crossbred/grades and 1-4*L* for indigenous cattle in Uganda reported between 1990-1993 (Vanegas and Akwang, 1992 and MAAIF, 1993). Despite the differences in range the average production (13.16*L*) from this study is close, within one standard deviation of the means given by other workers on dairy in Uganda. For example: 8-12*L* MAIF (1988), 12.5*L* MAAIF (1993), 10.62*L* Kalule-Sewali (1994), 13*L* Kiconco (1995), 7-15*L*, Bareeba (1995), 9-12*L* ILRI *et al* (1996), and 14*L* MAAIF (1996). It has however been noted in Uganda that among systems of dairy production, zero-grazing animals have the highest milk yields (MAAIF, 1996).

Table 4-4: Milk Production Per Cow Per Day in Mpigi District

milk(*L*)/cow/day	No. Farms	percent(%)	accumm %
<8.5	11	15.5	15.5
8.6-11.0	16	22.5	38
11.1-13.5	17	23.9	62
13.6-16.0	14	19.7	81.7
>16.0	13	18.3	100
Totals	71	100	

Source: Author's Computation, 1998

4.3.2 Lactation Length

The lactation length for milking cows per farm ranged from 300 days to 780 days, with a mean of 372 days (±83). These observations are well above the 305 days recommended lactation length for dairy animals. They are also beyond the 270-300 days stated by Sabiti (1994) and 325 days reported by ILRI *et al.* (1996) for dairy animals in Uganda. The observed lactation length is however comparable to those reported in the Kenya highlands (400-432 days) (Odima, 1994 and Omore, 1997). In these studies, prolonged lactations were attributed to delayed conception which led to large calving intervals. This has also been suggested to occur in the study area in animals kept on poor nutrition (Sabiti, 1994). The lactation length observed here also compares very well with the calving interval (426 days) for dairy animals in Mpigi stated by Heinonen (MAAIF, 1993) when it is truncated by 60 days, the normal dry period given to lactating animals. Kiconco (1994), working in Mpigi, also encountered animals with calving intervals beyond 880 days which meant they had lactated for over 780 days, the upper limit of the observed lactation length in this study. Loss of the foetal calf (abortion) was also observed in the study. This led to farmers experiencing uninterrupted milk over consecutive pregnancies. This also stretched the lactation length. Some farmers reported that they deliberately extended the lactation period by delaying matings or by giving cows a shorter dry period. This was practised by farmers who wanted to maintain stable regular farm incomes from milk sales as long as it was possible. Table 4-5 shows the distribution of mean lactation length per study farm cumulatively. It should be noted that most study farms had their animals lactating for over 305 days, the normal recommended lactation period for dairy cows. Mean calving intervals for these farms would therefore inevitably extend beyond 13 months even if breeding was successful within 90 days post-partum.

Table 4-5: Distribution of Lactation Length Among Zero grazed Animals in 71 Farms in Mpigi District, Uganda

mean lactation length (days)	No.Farms	percent (%)	accum %
<300	8	11.3	11.83
306-325	10	14.1	25.4
326-345	13	18.3	43.7
346-365	12	16.9	60.6
366-400	15	21.1	81.7
>400	13	18.3	100
Totals	71	100	

Source: Author's Computation, 1998

4.3.3 Lactation Yield

The mean milk yields per cow in a lactation period ranged from 2,094*L* to 8,079*L*, with a mean of 4,465*L* (±1,359). The median yield (4,487*L*) was higher than the mean (4,465*L*) but both measures of central tendency were quite close. This showed that majority of lactating cows attained the mean lactation yield of 4,465*L*. The lactation yields observed in this study are comparable to the recommended optimum of 4,500-6,000*L* /lactation for Friesian animals. The yields are however higher than 1,664-3,630*L* range report on zero-grazing in different zones of Uganda (MAAIF, 1996). It should however be noted that these observed yields were attained from cattle in extended lactation phases at relatively low production levels. Longer lactation in low producing cows were also observed by *Omore et al.* (1994) in Kiambu District of Kenya. Poor reproductive management, sub-clinical diseases and limited availability of feed were advanced as possible causes for the observations made in lactation length. The mean lactation length of 372 days established in this study does not compare with that of the Kiambu study of 432 days. It is however apparent that milk yields in the study carried out in Kiambu District were lower (5.8*L*) than those obtained in this study (13.16*L*). A compensatory kind of mechanism whereby cows which are poor yielder extend their lactation periods probably caused the differences obtained between these two studies. It is known that low yielding cows tend to compensate for their deficit by extending the lactation periods (Syrstad, 1993). The high milk yields attained by cows in this study show that it is possible for exotic dairy cattle to achieve their potential for milk production when conducive conditions are provided as suggested by Mwenya (1992). It should, however, be remembered that farmers who prolonged lactation lose a certain amount of milk and a proportion of calf crops in subsequent lactations. The opportunity cost involved in prolonging lactation must therefore be properly assessed by the farmer.

4.3.4 Annual Milk Output

The volume of milk produced per farm per year ranged from 2,094*L* to 15,150*L*, with a mean of 5,918.3*L* (±3,226). The distribution of mean annual milk output by the farms is shown in Table 4-6.

Table 4-6: Distribution of Annual Milk Output for 71 Farms in Mpigi District.

Milk output(*L*)	No. Farms	percent(%)	accum %
<3100	10	14.1	14.1
3100-4099	17	23.9	38
4100-5099	12	16.9	54.9
5100-6099	8	11.1	66.2
6100-7099	6	8.5	74.6
>7099	17	25.4	100
Totals	71	100	

Source: Author's Computation, 1998

From the above, it can be seen that milk output from the farms was roughly evenly distributed, with 39 farms (54.9%) producing below the average, and 31 farms (45.1%) producing above the average. This pattern of milk production is expected since farmers were randomly selected and variations in genotype constitution and environmental conditions, including management, which influence annual milk yields (Mwenya, 1992) were also randomized on the farms.

4.4 Prices of Essential Farm Inputs/outputs

4.4.1 Milk

The price of one litre of fresh milk ranged from 300 to 600 Uganda shillings, with a mean of 446/- (±76). The mean prices offered for milk were highest (503/-) for farmers selling their milk to nearby trading centres and lowest for farmers who sold their milk through vendors (389/-). Farmers selling milk to their neighbours received an intermediate milk price of 477/-. The milk prices registered in this study are similar to those observed in 1997 in Mukono (nearby) by Laker (1999). But higher than those reported in other parts of Uganda. For example Kalule-Sewali (1994) reported 400/- in Entebbe sub-district, Nalule (1996) 250/- for Ntungamo District, and Uganda MAAIF (1996); 295/- for Kabale, 276/- for Mbarara, 364/- for Kabarole and 300/- for Pallisa. Differences in prices in terms of place and locality are expected since prices are influenced by demand and supply forces. High prices are expected to prevail for milk in peri-urban environs as established in this study because of its high demand by the elite population in the city. Farmers would also obtain better prices by selling their milk directly to the consumers because middle men (Vendors) were cut out.

4.4.2 Veal Calves

Prices for veal calves aged 1-14 days ranged from 10,000 to 30,000 /-, with a mean of 25,000 /- (±7,200). The length of time given to the veal calf to mature was determined by farmers on the basis of the colostral period allowed, and availability of market. All the veal calves were bulls. Bulls normally prove to be costly to maintain as there are no milk replacers in Uganda. The farmers therefore decide to save on costs by selling the calves as veal. This is rational as it increases milk available for sale that would otherwise be consumed by calves. This is a direct attempt by farmers to increase their gross earnings through proper animal husbandry management.

4.4.3 Heifers and Culled Cows

Prices of these animals ranged from 400,000 to 700,000/-, depending on the breed, size and age of the animal. Purebred animals (Friesians) generally fetched higher prices than cross or local breed animals. Reasons given for culling animals included poor milk production, diseases and old age. The prices offered to farmers for their heifers (400,000-700,0000/-) in this study is comparatively low because animals were sold at relatively young age of less than 6 months.

4.4.4 Animal Feeds

The cost prices for dairy meal (DM) ranged from 170/- to 360/- per Kg, with a mean (same as the mode) of 248/- (±30). Eleven farms (15.5%) purchased DM at a cost price below 210/-, 58 (81.7%) utilized DM at a cost price beyond 210 but below 260/-. Only 2 farmers (2.8%) used DM costing over 260/-. The farmers attributed the differences in DM costs to difference in source and quality of the product. The cost prices for calf weaner ranged from 165 to 400/- with a mean of 264/- (±65) per Kg.

4.5 Animal Husbandry Practices

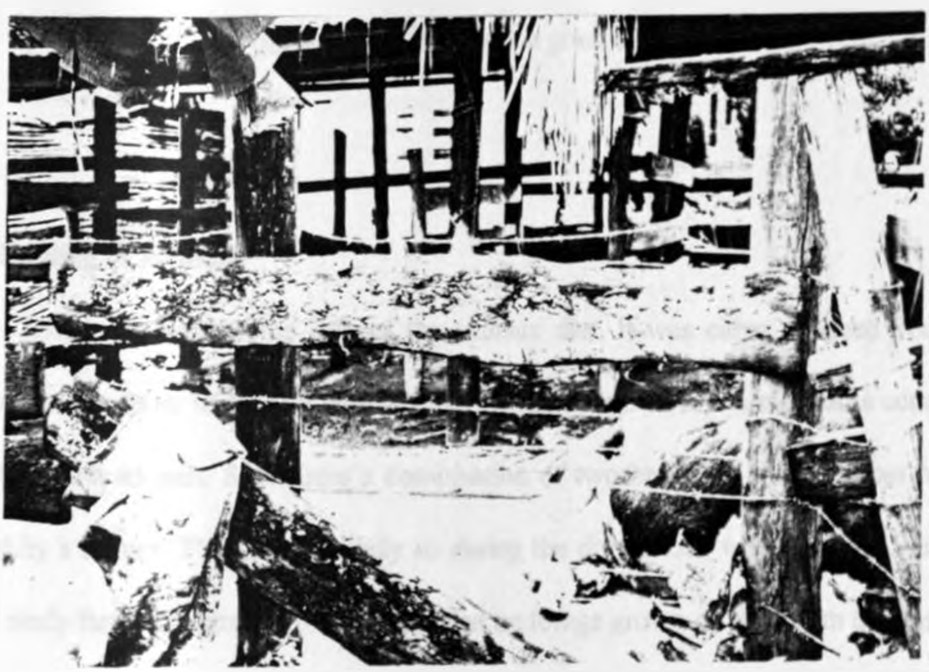
4.5.1 Housing

Animals were housed under permanent confinement in roofed but open sided sheds. The roofing materials used for constructing the sheds were either iron sheets or grass reinforced with polythene. Twenty-four farms (34%) had iron sheets while a majority of farms (66%) had the other types of roofing material. Floors were narrowly slatted and made of either bare compacted murram or concrete. Concrete floors were encountered on 52 farms (73.2%) while compacted murram floors were found on the remaining 19 farms (26.8%). Both calves and adult animals were housed side by side. Unweaned calves were however kept on raised calf crate(s) constructed within the dams' stall. Wooden feeder troughs were also constructed on the sides of the shed while water was provided in drums or sauce pans (Sufuria). Two separate below-ground level catchment areas were provided to trap the animals' urine and dung outside the shed. The majority of stall conformed to the building structures types for zero-grazing recommended by the Ministry of Agriculture, Animal Industry and Fisheries with minor variation. Plate 4-1(a,b,c) shows the types of stalls used.

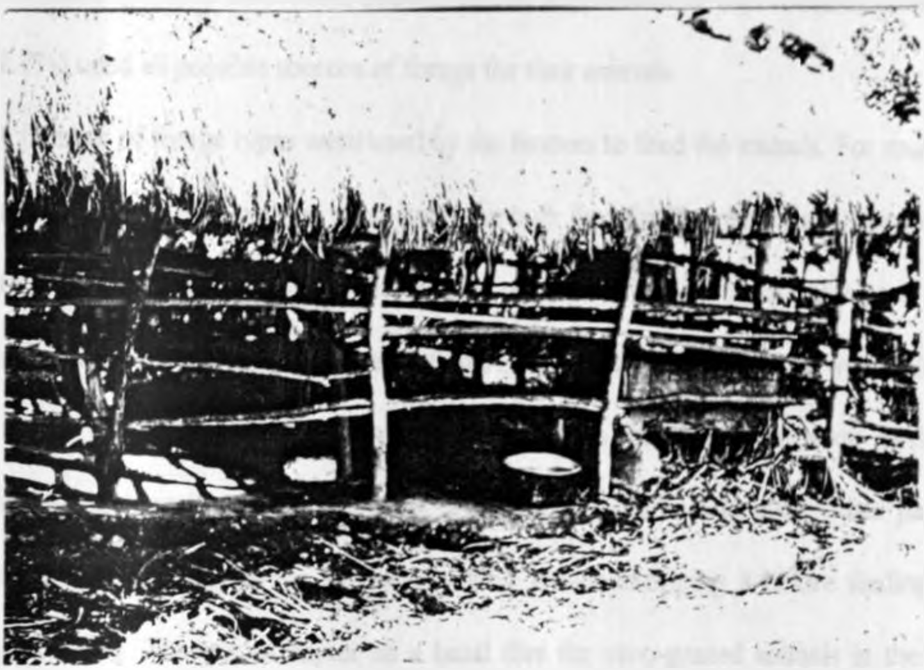
Plate 4-1: Stalls Used to House Animals by Zero-grazers in Mpigi District

(a): Murram filled floor with an iron roof.

Note the flooded floor area indicated by arrow



(b): concrete floor with a papyrus covered iron roof.



(c): concrete floor with a grass thatched roof.

4.5.2 Feeding of Animals

Forage constituted the bulk of the animals' diet. It was either obtained from established pastures on the farm, from road reserve plots or purchased. Every farmer had a consistent source of feed for the animals. Sometimes a combination of two or all the three sources of forage was utilized by a farmer. This was especially so during the dry periods when pastures were scarce. Of the 71 study farms, 21 farms (29.6%) depended on forage grown on their farm units as established leys, 10 farms (14.1%) were dependent on roadside cuttings, 4 farms (5.6%) used purchased forages, 24 farms (33.8%) used home grown pasture supplemented with roadside cuttings, and 9 farms (12.7%) used all possible sources of forage for their animals.

A number of forage types were used by the farmers to feed the animals. For routine animal feeding, all the farmers used nappier grass as a base bulk feed for their animals. Other forages used by farmers for feeding their animals included crop residues such as banana stems/peels and sweet potato vines. Banana peels were used on 43 farms (60.3%) while potato vines were utilized on 19 (26.8%) farms. In addition to these forages, some farmers fed their animals on garden weeds, kitchen left-overs, banana stems, crop tops, tree prunings, herbs and even waste paper. Most farmers semi-processed the forage by either wilting and/or chopping it before feeding it to the animals (Plate 4-2). The use of napier as a basal diet for zero-grazed animals in the tropics is known to be widespread (Abate *et al.* 1992). According to Nsubuga (1992) and Mwebaze (1994) farmers in Uganda prefer to feed their animals on nappier. This is so because nappier is hardy, high yielding and easy to harvest unlike other fodder crops in Uganda. It is also very palatable to cattle (Nsubuga, 1992).

Plate 4-2: Farmer Feeding Animals on Forage

(a) Fodder being processed by chopping and wilting

(b) animals feeding on fodder mixed with farm by-product (Banana stems)

High-energy feed used as concentrates on the farms included commercial/home made dairy meal, weaner calf pencils and brewers mash. Table 4-7 shows the quantity of dairy meal provided per animal. Dairy meal was used on all the 71 farms (100%) and it was fed exclusively to lactating animals with the exception of one farm, which fed dairy meal to all animals. The amount of dairy meal given per lactating animal ranged from 1.25 to 10 Kg per day with a mean of 4.5 Kg (±1.9); 54.9% of the study farmers (more than half) gave their animals 4 kg or less dairy meal per day.

Table 4-7: Quantity of Dairy Meal (DM) Provided to Lactating Cows Per Day Under Zero-grazing Systems in Mpigi District, Jan-Dec, 1997.

Kg DM	Frequency	Percentage(%)	Cumulative %
2.0	17	23.9	23.9
2.5	2	2.8	26.8
3.0	4	5.6	32.4
4.0	16	22.5	54.9
5.0	6	8.5	63.4
6.0	20	28.2	91.5
7.0	2	2.8	94.4
8.0	3	4.2	98.6
10	1	1.4	100
Totals	71	100	

Source: Author's Computation, 1998

Commercial calf weaner pencils (CWP) were used on 39 (55%) farms. The quantity of CWP provided to calves ranged from 5 to 320 kg (mean=71±56.5). The use of concentrate on the farm and the amount of concentrate given to individual animals was arbitrarily decided by the farm owner. The decision was said to be influenced by the availability and affordability of the concentrate, and productivity of animals.

4.5.3 Milking

Lactating animals were milked twice a day, early in the morning (between 6-8 a.m.) and in the afternoon (between 3 and 5 p.m.). Some farmers however reported that they sometimes milked their animals thrice in a day during early lactation when the animals produced a lot of milk. The method of milking used was hand milking by stripping by either the owner, a family member or sometimes a milk vendor. Milk let-down was induced by washing of the udder with lukewarm water and massaging the teats using milking salve. Commercial salve Salvo® was used on all the farms

4.5.4 Breeding

Farmers used both artificial and natural breeding methods. The natural method was used on 8 (11.3%) of the 71 farms where personal or communal bulls were used. Artificial insemination was used on 58 (81.7%) farms. The remaining 5 farms (7.1%) used a combination of both natural and artificial breeding. These results indicated that a majority of the farmers (81.7%) depended on artificial breeding services. This finding is similar to what was observed by Kiconco (1995), MAAIF (1996), and ILRI *et al* (1996) in southern Uganda. It is however contrary to Nalule's (1996) findings which showed that in Ntungamo District all zero-grazers were dependent on the natural breeding method. The differences are likely to be due to the fact that Ntungamo is a typical rural setting which made the delivery of artificial insemination (AI) services impractical, as a result of poor infrastructure. This study area on the other hand has good infrastructure with good communication for delivering AI services. In this study, most farmers used the AI method because the method is economical for zero-grazers (MAAIF, 1996). This is largely because it is relatively cheaper to pay for AI services than meet the cost of maintaining a bull for small herds (ILRI *et al*, 1996).

4.5.5 Vector Control

Both sprays and pour-on acaricide preparations were used by the farmers to control ticks and flies on the farms. Pour-ons included Baytical(R) (Flurethrin) which was used on 36 (50.7%) of the 71 farms and Spoton(R) (Deltamethrin) which was used on 20 farms (28.2%). Decatex(R) (Deltamethrin), as a spray, was used to protect animals on 12 farms (17%). Three farmers (4.1%) used a combination of both sprays and pour-ons. For all the farms, all the animals would either be sprayed or dressed, with the exception of very young calves (<1 month). Results showed that pour-ons were preferred by most farmers (>78.9%). The MAAIF report also showed that a similar number (80%) of zero-grazers used pour-on in Uganda (MAAIF, 1996). Acaricide preparation in the form of pour-on are favoured by farmers in this study, probably because of their ease of application. In addition the use of pour-ons does not entail over-head costs in the form of purchasing a spray pump.

4.5.6 Labour Use

Both family and hired labour were used by the study farmers. Family labour was utilized by 70 farmers (98.6%) and the number of people contributing to family labour per farm ranged from 0 to 6, with a mean of 1.65 (±0.78) persons. Forty one percent Of those farms where family labour was used had only one member of the family who looked after livestock while 38 farmers (53%) had 2 members of the family who looked after livestock. Only 3 farms (6%) used 3 or more individuals to look after livestock. The total number of family members participating in zero-grazing was 108 persons (30%) out of 366 adult people living on farms.

Hired labour was either permanent or casual. The two forms of labour were used either concurrently or interchangeably. Casual labour was utilized by 44 farmers (62%), while permanent labour was utilised by 42 (59%) farmers. There was only one farm (1.41%) which depended exclusively on hired labour. The number of hired individuals per farm was restricted to one on 40 (93%) of the 44 farms using hired labour. The remaining 4 farms (7%) had two hired employees each. The number of hours required to carry out routine zero-grazing activities on farms ranged from 5.7 to 30.7 work hours per day with a mean of 16.5 (±4.9) work hours. When the time required to carry out zero- grazing activities was expressed as a function of mean number of lactating cows on farms, it ranged from 2.4 to 29.7 work hours per cow with a mean 9.4 (± 5) work hours per cow.

These results showed that the number of individuals involved in zero-grazing was small, compared to the total number of available working people dwelling on the units, and that most of the farms utilised family labour. Also, the time required to carry out daily zero-grazing activities, both for the farm and on single animal basis, exceeded the normal man-day (8 work hours). This showed that at least two persons are required (full time) to provide labour on the farm(s) even when the farm has only one animal. The dependence on family labour observed was expected because the farmers were generally poor people who could not afford hired labour. Also, zero-grazing is generally a part time occupation, with members of the family providing labour before they leave to tend to their main occupations.

The extra members of the families can also be considered as a potential reserve human resource maintained on the farm unit for providing extra work hours into zero-grazing in order to meet high labour requirements demanded by the system.

4.5.7 Marketing of Farm Produce

Milk and young bulls were the main sources of farm income. Milk alone contributed over 95.1% of the total farm income, leaving 4.9% as income from sale of animals. Milk was marketed either to neighbours, through vendors or delivered to nearby trading centres. Milk sold directly to the consumers by the farmers was either collected by the consumer or delivered to the consumers' residence by a family member. Some farmers also reported that they sometimes peddled milk in villages around their farms; this was especially so on week-end days. All the milk was sold in its natural fresh state and none of the farmers sold milk to formal milk handling institutions such as milk collecting centres. Morning and evening milk was marketed separately. The farmers would peddle milk over week-end days to utilize the extra labour provided by the school going children and partially so because civil servants who routinely consume milk on week days would be away on week-end holidays. This implies that the farmers had evolved a marketing strategy to suit prevailing local market conditions. The dominance of the informal Ugandan milk market has been long established. For example, according to the Uganda Dairy Master Plan Brief (1993), in 1990 over 70% of the milk produced in Uganda was handled by the informal dairy market sector (MAAIF, 1993). Farmers also mentioned that they were discouraged from using formal milk markets by the low prices offered to them, delayed payments and lack of transparency by the institutions' executives.

4.5.8 Disposal of Milk

Milk produced by the farms was used to feed calves, sold off to fetch income or\and used by the family as food (Figure 4-1). It was found that 22% of the milk produced was used on the farm to rear calves and\or as food for the family while the remaining 78% was marketed to fetch earnings. Some farmers did not market any milk (2/71) and others did not use any of the milk produced on their farms for food (1/71). Reasons advanced for this included low yields, which left producers with no surplus produce for sale. Some farmers also had to sell all the milk produced without leaving any for the family to meet scheduled financial obligations on the dairy unit. Of the volumes of milk sold, 41.2% was bought by people in the farm neighbourhood, 31% handled by vendors and 27.8% consumed in nearby trading centres or towns (Figure 4-2).

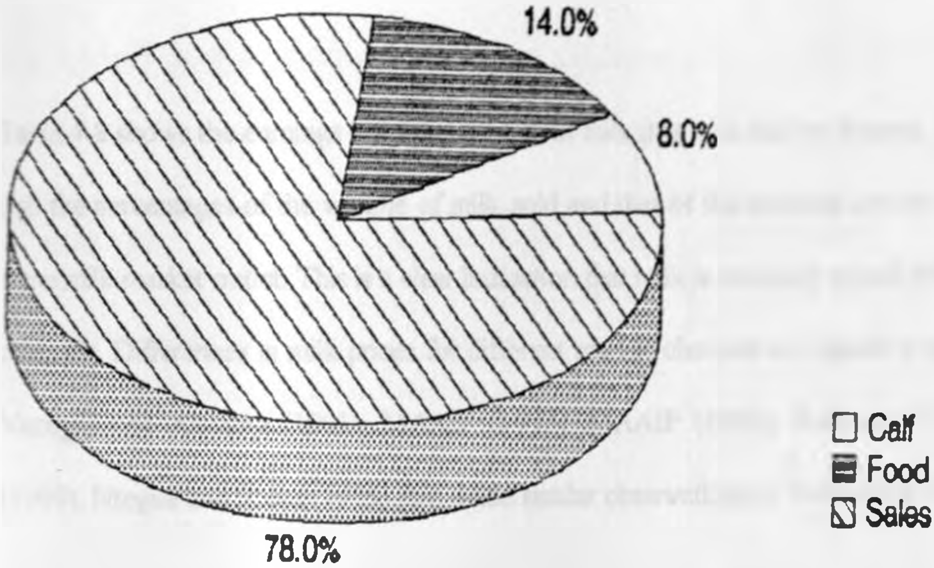


Figure 4-1: Distribution of Milk Among Disposal Methods

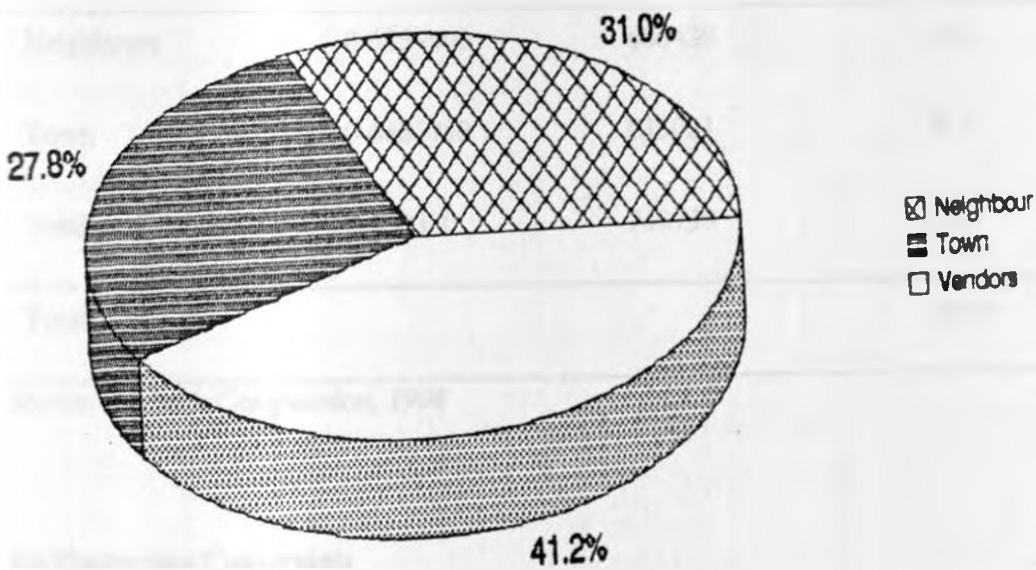


Figure 4-2: Distribution of Milk Among Market Channels

Table 4-8 shows the earnings from the volume of milk that was sold by farmers. It should be noted that the percentages of the volume of milk sold and that of the earnings are not equivalent for the same milk market outlet. This is a clear indication that milk is variously priced for the different milk channels. Differences in milk prices for different market channels in Uganda was also observed by Vanegas and Akwang (1991), MAAIF (1993), MAAIF (1996), ILRI *et al* (1996), and Laker (1999). Ntegua and Steve (1995) also made similar observations in Tanzania in 1994.

Table 4-8: Distribution of Earnings From Milk (/-)

Channel	Range	Mean	Percent(%)
Neighbours	0-6559500	686420	30.1
Town	0-6483750	635021	30.1
Vendors	0-460380	748739	36.8
Totals			100.0

Source: Author's Computation, 1998

4.6 Production Constraints

Table 4-9 shows the scoring for the different problems perceived by farmers in the study area.

Table 4-9: Scoring for Different Production Constraints Perceived by Zero-grazers in Mpigi District, 1997.

Factor\Rank	1st	2rd	3rd	4th	total	Percent
Labour requirements	12	11	11	7	41	17.0
Marketing of milk	12	12	2	0	26	15.7
Livestock diseases	8	10	6	2	26	15.7
Cost of inputs:Concentrates	9	8	5	5	25	12.6
Poor milk yield	9	5	8	2	24	11.7
Vet. extension services	2	4	11	3	20	9.0
Fodder shortage	12	5	1	1	19	9.0
Poor reproductive performance	3	4	8	0	15	7.2
Water supply	1	2	2	1	6	2.7
Credit facilities	0	1	1	1	3	1.3
Insecurity of livestock	0	0	1	2	3	1.3
Manure disposal (0.9%).	0	0	1	1	2	0.9
Totals						100

Source: Author's Computation, 1998

CHAPTER V

5.0 RESULTS OF FINANCIAL ANALYSIS AND LINEAR REGRESSION

This chapter presents financial analysis and linear regressions, short discussions and interpretation of the results.

5.1 Enterprise Gross Income5.1 Enterprise Gross Income5.1 Enterprise Gross Income

This was constituted by considering the value of milk produced (total produce volume) and that of animal sales. Values ranged from 1,056,000/- to 9,024,000/-, with a mean of 1,314,292/- (±645,471) per farm per annum. According to a comparative analysis of dairy cattle management in different parts of Uganda (districts), mean gross incomes for zero-grazing enterprises in Uganda are 1,729,200/- for Kabale, 1,895,200/- for Mbarara, 1,398,240/- for Kabarole, and 742,800/- for Pallisa (MAAIF, 1996). With the exception of Pallisa District, all the equated figures are similar to the mean enterprise gross income obtained in this study.

Enterprise gross income (EGI), when examined using ANOVA was found to be significantly different between farmers with different educational levels (P=0.004), initial sources of capital (P=0.001) and access to off-farm sources of income (p=0.028). Farmers with higher educational levels had higher EGM than those with lower educational levels, possibly because education may make a farmer more receptive to advice (Sseruyange, 1994). Farmers who had started off with some form of assistance also had higher gross incomes compared to those who had started using their own savings, because farmers that started off on their own often could not

The table indicates that labour requirements (17.0%) is the problem biggest experienced by most farmers. This was expected as zero grazing is an enterprise which is labour intensive (Stotz, 1987; Dieckman, 1994; Widodo et, Ntengua and Steve,1995). In addition within the study area manual work such as chopping grass, milking animals, vending milk are associated to gender, where females perceive it as being menial and too laborious. Women also often have a lot of odd jobs in their home. These include: caring for the family, cooking, home sanitation, washing and ironing clothes, and digging. With these set up the presence of animals in the homestead is obviously added work. Farmers in Uganda are also likely to complain as stall feeding cattle is relatively new and they are yet to become accustomed to it. The selling of milk is a common problem because (1) there are organised marketing systems (2) technical knowledge and facilities to preserve milk are lacking and (3) the high tropical temperatures also sours milk rapidly.

Other problems encountered by farmers can be explained by the fact that farmers are generally handicapped by lack of proper knowledge on how to manage animals in a stall. This is probably aggravated by the fact that extension services are inadequate too as reported by nine percent of the farmers. Manure disposal as a problem, although mentioned by only a few farmers, is likely to expand with increasing urbanisation. The significance of this finding is that in future manure disposal may be an important problem for farmers located close to the city. It is also interesting to note that Maxewell (1995) (using RRPA) did not identify manure disposal as one of the problems associated to presence of animal in kampala city (nearby). Here animals were allowed to roam and scavange freely.

afford exotic animals such as those imported by donor dairy projects. They instead purchased relatively cheaper animals locally, which turned out in the end to be poor milk producers. The volume of milk produced was small, thus gross income from its sales was also small. This directly lowered GI. Farmers with off-farm sources of income generally had a higher GI because they would easily afford to purchase inputs such as concentrates which influence animal production positively (Ofwona, 1994). These essential dairy inputs can raise milk production and raise GI directly (Murithi, 1990). Statistically significant differences in GI with respect to the farmer's educational standards observed in this study are contrary to what was reported by Widodo *et al* (1993) in households engaged in dairy in Java. The differences are due to the fact that farmers in Java are more experienced in managing zero-grazed animals, unlike in the study area where the industry is relatively new.Enterprise gross income (EGI), when examined using ANOVA was found to be significantly different between farmers with different educational levels (P=0.004), initial sources of capital (P=0.001) and access to off-farm sources of income (p=0.028). Farmers with higher educational levels had higher EGM than those with lower educational levels, possibly because education may make a farmer more receptive to advice (Sseruyange, 1994). Farmers who had started off with some form of assistance also had higher gross incomes compared to those who had started using their own savings, because farmers that started off on their own often could not afford exotic animals such as those imported by donor dairy projects. They instead purchased relatively cheaper animals locally, which turned out in the end to be poor milk producers. The volume of milk produced was small, thus gross income from its sales was also small. This directly lowered GI. Farmers with off-farm sources of income generally had a higher GI because they

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(1993) in households engaged in dairy in Java. The differences are due to the fact that farmers in Java are more experienced in managing zero-grazed animals, unlike in the study area where the industry is relatively new.

5.2 Variable Costs

Considered were costs on animal health, concentrates, feeds, labour, and routine farm services. Values ranged from 127,945/- to 2,985,278/- per farm per year, with a mean of 1,296,992/- (±723,562). Values for individual components of variable costs are as follows.

5.2.1. Animal Health Costs

Animal health costs ranged from 46,150/- to 864,000/- per farm per year, with a mean of 200,343/- (± 117,509). Variable costs considered included cost of milking salves, cleaning the pens, dry cow therapy, control of flies, control of ticks, vaccinations, deworming, control of theileriosis, plus costs of treating skin conditions, mastitis, tick borne diseases other than theileriosis, digestive disorders, reproductive diseases and any other non-specified diseases reportedly treated against on the study farms.

5.2.2. Cost of Feeds

Forage costs included expenses on purchased forages which comprised of elephant grass, banana peelings, sweet potato vines, legumes, mineral licks and silage feed. These costs ranged from 4,000/- to 1,022,000/- per farm per year with a mean of 250,700/- (±249,070) per farm per year.

5.2.3 Costs of Farm Services

These included costs of breeding, transport and membership to animal interest groups. These costs ranged from 8,000/- to 307,400/- per farm per year, with a mean of 96,100/- (±54,230) per farm per year.

5.2.4 Labour Costs

These were constituted by cost of hired labour which was either permanent or casual. The cost of hired labour ranged from 25,000/- to 895,000/- per farm per year, with a mean of 422,600/- (±212,500). About 59.8% of the labour costs were paid to permanent workers while 40.2% was taken by casual workers. The two forms of farm labour were therefore utilized about equally by farmers. Figure 5-2 shows the summary of farm costs in a form of a pie chart.

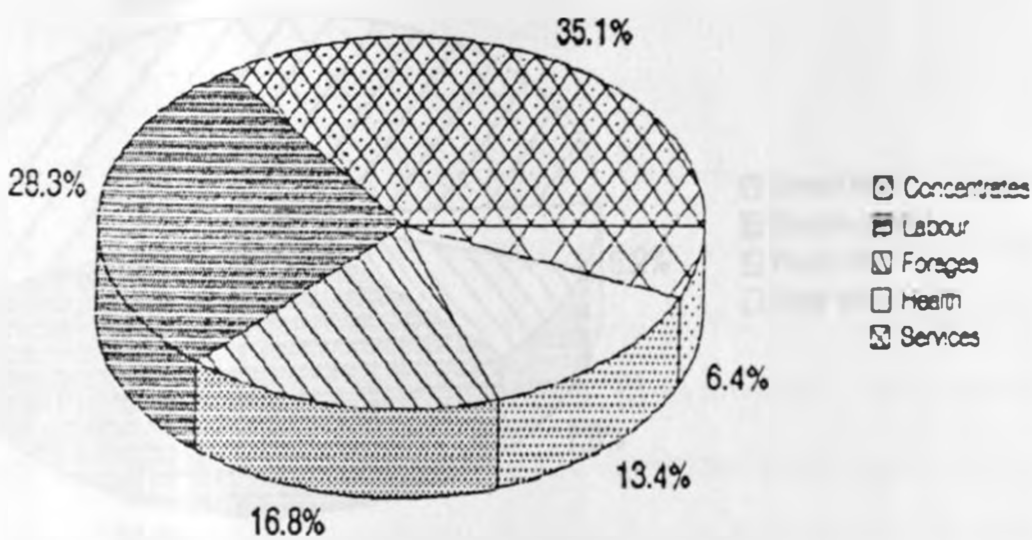

Figure 5-2: Distribution of Farm Variable Costs

The median value (157,600/-) for the costs of animal feeds was however very small compared to the mean. This showed that the majority of farmers were spending less than the mean forage cost (250,700/-) per farm per year. Proportionately, banana peels were responsible for 56%, elephant (napier) grass 31%, potato vines took 7.8% while the remaining feed inputs took 5.2% of the total expenses (Figure 5-1).

Costs of concentrate feeds consisted of expenditure on dairy meal, calf weaner and brewers mash and ranged from 14,790/- to 1,790,000/- per farm per year with a mean of 523,500/- (±312,800) per farm per year. Dairy meal accounted for 89 percent, calf weaner 7 percent, and brewers mash 4 percent of the total annual cost of concentrates used by the study farmers.

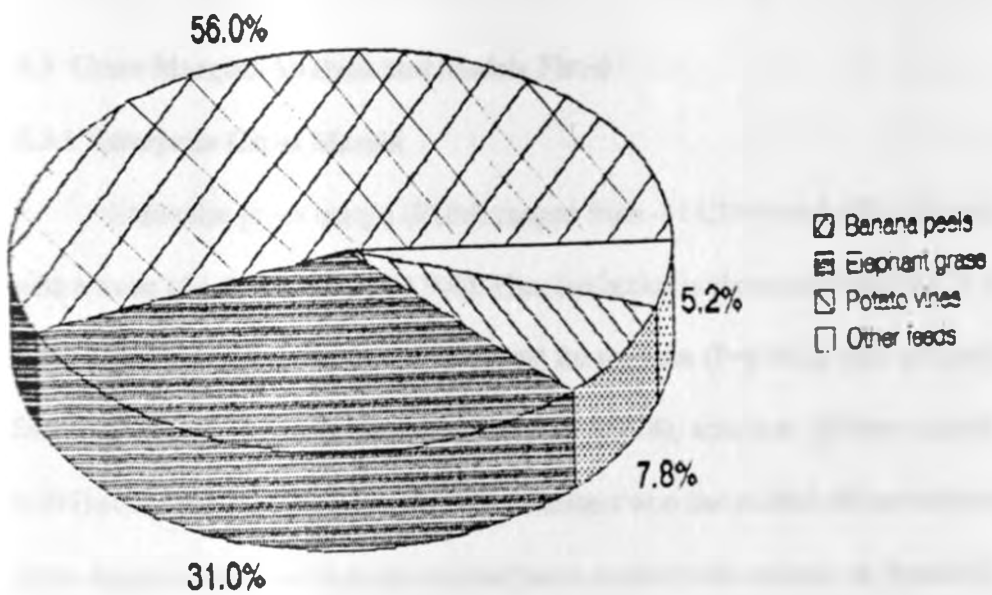

Figure 5-1: Distribution of Forage Variable Costs

Of these variable costs, 523,500/- (35.1%) was due to costs of concentrates, 422,600/- (28.3%) was due to labour costs, 250,700/- (16.8%) was due to cost of forage and supplements, 200,343/- (13.4%) was due animal health, and 96,100/- (6.4%) was due to costs of farm services. A comparatively similar pattern in the importance of farm variable costs in smallholders was reported by Murithi (1990) in Kenya. Using ANOVA the farm variable costs were established to be (only) significantly different by the type of forage source utilized by the farmer (P=0.007). Farmers producing their own forage had lower variable costs than those who used off-farm sources of forage. This was expected since farmers relying on off-farm sources of income had to spend more in order to cover costs for purchasing forage and paying for labour for bringing forage from outside the farm. These practices would inevitably raise their variable costs for running the unit.

5.3 Gross Margins Analysis and Models Fitted

5.3.1 Enterprise Gross Margin

Enterprise gross margin (EGM) ranged from -314,214/- to 5,600,026/- per farm per year, with a mean of 1,493,259/- (±752,900). The distribution is shown in Figure 5-1. It was found to be significantly associated with source of capital for the farm (P=0.001), type of acaricide used by the farmer (P=0.009), farmer's educational level (P=0.014), access to off-farm source of income (p= 0.005) and location of the farm (P=0.034). Farmers who had started off on their own had a smaller gross margin compared to those who had been assisted with animals or financially. Farmers who had off-farm income had a higher EGM than those who were either entirely dependent on the farm or simply practising subsistence farming. These factors are possibly explained by their effects on

GI. Farmers using Baytical(R) had EGM higher than those using Decatex(R) but there was no difference in the mean EGM between farmers using Baytical(R) and Spoton(R). Also there was no observed mean difference in EGM between farmers using Spoton(R) and Decatex(R). Lastly, farmers in zone I had higher mean EGM than those in zone II. This was so because farmers in Zone I generally kept pure bred animals which are higher milk yielders. This indirectly increases their EGM through their direct effect on GI.

It is interesting to note that some values of EGM are negative. Recently Laker (1998) working in Mukono District, Uganda, also observed negative EGM for dairy production systems. Jong and Zwart (1991) associated these negative EGM to the presence of forage costs in calculating farm variable costs as was the case in this study. But it is possible also that some farmers in this study had extended their spatial investing phase by injecting money into zero-grazing with little or no immediate financial returns. It is however interesting to note that despite the presence of some farms with negative EGM values, the overall mean EGM value for this study was positive. EGM values were not significantly associated with breed of lactating animals (P=0.081), source of forage on the farm (p=0.254), method of manure disposal used by the farmer (P=0.366), method used to breed animals (P=0.161), market channel used by the farmer (P=0.085), nor according to land tenure system (P=0.243). Among these factors, breed and source of forage are theoretically known to have direct bearing on EGM in dairy as they are both major components of its functions (GI and variable costs). In this study the effects of these important factors may have been concealed by farmers trying to increase their milk production at unnecessarily higher variable costs. This is suggestive of irrational resource use since the same production level would have been achieved at a lower level of inputs use, and hence, variable costs. According to Aneja (1993) this occurs when the farmer(s) consider output as real farm profits.

When enterprise gross margins (EGM) were examined using linear regression, the final model with all variables left at significant levels of less than 0.050 include the volume of milk produced per lactating cow ($p<0.001$), milk prices ($p< 0.001$), mean number of lactating cows on the farm ($p<0.001$), prices of concentrates ($p=0.091$*), growing forage on the farm ($p<0.001$), channel for marketing milk through vendors ($p=0.013$), and location of the farm ($p=0.019$). The prices for concentrate were left in the model although it had a probability value exceeding the critical ($p=0.050$) because it helped to stabilize the p values for other explanatory variables in the model. Altogether the factors explained over 89% ($r^2=0.891$) of the total variation in EGM on study farms. The prices of concentrates had a negative coefficient showing that EMG would be increased by reducing the prices. The remaining significant explanatory variables in the model had positive coefficients, therefore having/increasing their magnitude on the farm would increase the EMG upwards and positively. Table 5-1 shows details of the model for EGM.

Table 5-1: Enterprise Gross Margin Regression Results

EGM				Linear Model	
Variable	B_i	E	SS	F	SIG F
MMEAN	92450	10814	16187023282260	73.08	0.0001*
MPRICES	3664	8976	3698683396288	16.70	0.0001*
TDM	557785	157960	2761831716481	12.47	0.0008*
PCOS	-3396	1976	654336829042	2.95	0.0906
FORG1	416447	128713	2318661745338	10.47	0.0019*
MRKT3	371031	153824	1288637130110	5.82	0.0188*
Constant	-1857780	677858	1663679880211	7.51	0.0080

R^2 (adjusted) 0.8914755

Analysis of Variance

	DF	Sum of Squares	Mean Square	F	Sign.F
Regression	6	1.2E+15	1.9E+13	86.25	0.0001
Residual	63	1.4E+14	2.2E+12		

* Variables significant at 95% and above level of confidence (a<=0.05)

Source: Author's Computation, 1998

Note:

MMEAN: The volume of milk produced per cow per day
MPRICES: The milk price
TDM: Mean number of lactating animals kept on the farm
PCOS: Price of concentrates
FORG1: Whether farmer is relying on home grown forages
MRKT3: Whether milk is sold through vendors

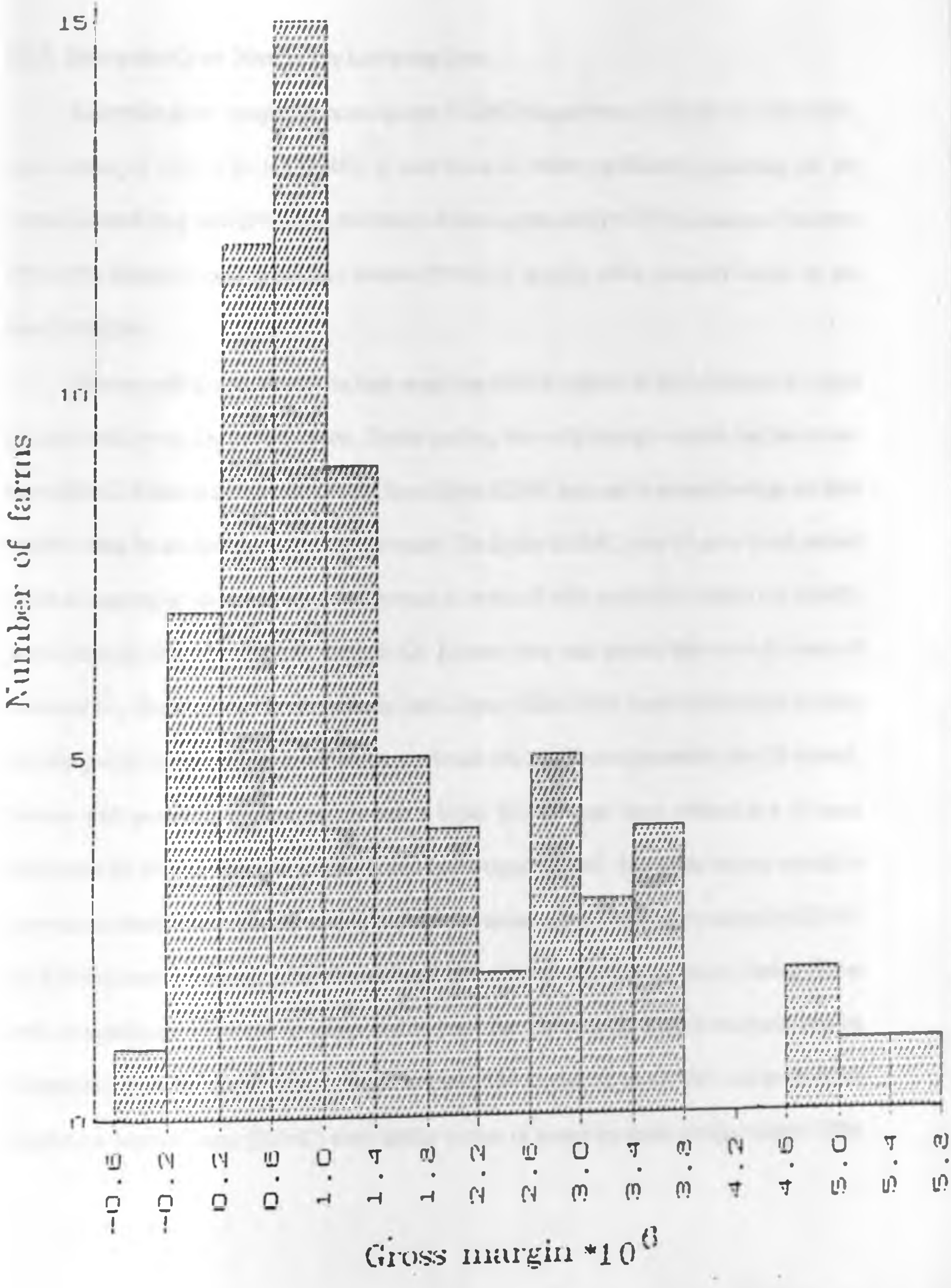

Figure 5-3: Frequency Distribution of Enterprise Gross Margin

5.3.2. Enterprise Gross Margin Per Lactating Cow

Enterprise gross margin per lactating cow (EGMC) ranged from -314,212/- to 3,023,800/-, with a mean of 1,001,83/- (±639,200). It was found to differ significantly, depending on the channel of marketing milk (P=0.004), the breed of lactating animals (P=0.018), location of the farm (P=0.020), farmer's access to off-farm income (P=0.021), and the initial source of capital for the farm (P=0.024).

Farmers selling milk directly to their neighbour had the highest EGMC, followed by those who took milk to nearby trading centres. Farmers selling their milk through vendors had the lowest mean EGMC. Farmers selling milk directly have higher EGMC because they made savings on farm variable costs by excluding vendor service costs. The higher EGMC here for pure breed animal (Friesian) can be explained by breed difference in levels of milk production which are directly proportionately related to EGMC through GI. Farmers who had started their units by way of assistance (i.e. donor cow or by taking loans) had a higher EGMC than those that had started using personal pooled resources due to differences in breed milk production potentials (see GI above). Farmers with access to off-farm income had a higher EGMC than those without due to input effects (see GI above). Farms located in zone I had a higher EGMC than those located outside it again due to breed effects (see GI above). It should be noted that probability (p) values for EGMC and EGM are about the same for similar explanatory variables, with EGM, however, having higher levels of significance. This can be interpreted to imply that the data collected in this study can be extrapolated to farms rather than to single animals. The modelling results for enterprise gross margins per lactating cow (EGMC) were similar to that of enterprise gross margin except TDM had a negative coefficient and prices of concentrates were excluded (Figure 11). It should be noted that the model for EGMC explains only 65% (r^2=0.648) of the observed variation in EGMC. The results from this model compare well to those of Murithi (1990) who found that dairy production in the Kenya highlands was dependent on levels of milk yield, milk prices and the use of concentrate. EGM is dependent on growing forage on the farm probably because farmers make savings on labour required to bring or purchase fodder from outside the farm. In addition, farms using home grown forage are more likely to provide their animals with a consistent uniformly planned diet. This can in turn lead to better milk yield and raise GI which is directly proportionately related to EGM. The influence of market channel is due to the fact that vendors were offering the lowest prices for fresh milk but demanded no extra labour costs for marketing milk. This meant that the negative effects of low milk prices on GI were cancelled out by savings made on labour cost when the farmers sold milk at the farm.

Table 5-2: Enterprise Gross Margin Per Mean Lactating Cow Regression Results

EGMC	Linear Model				
Variable	B_i	E	SS	F	SIG F
MMEAN	74297	9493	10602658226431	61.26	0.0001*
MPRICES	3734	781	3960455339684	22.88	0.0001*
TDM	-661805	139481	3896747229484	22.51	0.0001*
FORG1	414489	113589	2304762061034	13.32	0.0005*
MRKT3	255778	135478	616965532043	3.56	0.0636
Constant	-1244087	352988	215006309269	12.42	0.0008

R^2 (Adjusted) 0.64768281

Analysis of Variance

	DF	Sum of Squares	Mean Square	F	SIG. F
Regression	5	2.1E+14	4.1E+14	23.53	0.0001
Residual	64	1.1E+13	1.7E+11		

* Variables significant at 95% and above level of confidence (a<=0.05)

Source: Author's Computation, 1998

<u>Note:</u>

MMEAN: The volume of milk produced per cow per day
MPRICES: The milk price
TDM: Mean number of lactating animals kept on the farm
FORG1: Whether farmer is relying on home grown forages
MRKT3: Whether milk is sold through vendors

5.3.3. Enterprise Gross Margin Per Man-day

Enterprise gross margins per man day (EGMMD) ranged from -421/- to 4,316/- per man-day, with a mean of 1,408/- (±1,010). It was found to be significantly different between farms with different market channels for farm produce (P=0.010), access to off-farm incomes (P=0.023), initial source of capital (P=0.024), and breed of lactating animals (P=0.036). Farmers selling their milk to neighbours had the largest EGMMD, followed by those who sold their milk through vendors. Farmers selling milk to nearby towns had the highest EGMMD. This trend in EGMMD with respect to the marketing channel is explained by the relative distance between the farm and place where milk was sold, as shown by no significant difference in EGMMD for farmers who sold milk to neighbours and vendors (p=0.81).

Farmers with off-farm sources of income had a higher EGMMD than farmers that did not have such job opportunities as farmers without other engagements would commit more time to zero-grazing from lack of alternatives. Farmers who had started off on their own without acquiring any form of assistance also had lower EGMMD than their counterparts who had started off by being assisted, probably because they were more careful lest they would fail to meet their financial obligations.

Lastly, farmers keeping cross bred animals had a higher mean EGMMD than those with pure bred animals. Exotic animals are more valuable than crosses in the study area. In addition they (animals) are considered to be more delicate, less resistant to adverse conditions, so need more care. The mean EGMMD obtained in this study is equivalent to a monthly wage of 36,608/-

(1,408 /- per day*26 days per month). This is lower than the minimum month wage (42,000/-) given to unskilled workers in Mpigi District. This value of EGMMD is also less than the daily wage (3,000/-) given to manual labourers (able-bodied porters employed at building sites) in the study area.

5.3.4. Enterprise Gross Margin Per Man-day Per Lactating Cow5

Enterprise gross margin per man day per lactating cow (EGMLD) ranged from -422/- to 4,898/, with a mean of 3265/- (±917) per cow per man-day. It was found to differ significantly between farms with different access to off-farm sources of income (p=0.001), the type of acaricide used on the farm (P=0.003), location by zone (p=0.003), market channel for the farm produce (p=0.004), initial sources of capital (P=0.01), educational level of the farm owner (P=0.02), and the breed of lactating animal (P=0.029). Farmers having off-farm sources of income had higher EGMMLD than farmers without such incomes. EGMMLD was highest for farmers using Decatex(R) followed by Spoton(R) and smallest for farmers using Baytical(R). The mean EGMMLD for Spoton(R) and Baytical(R) were not significantly different from each other (p=0.76). Zone II farmers had a higher EGMMLD than zone I farmers. Farmers with lower educational levels had a smaller EGMMLD compared to those with high educational levels. Farmers selling their milk to neighbours had the largest EGMMD, followed by those who sold their milk through vendors. Farmers using off-farm sources of forage also had lower EGMMLD than farmers who were using farm grown forages. EGMMLD was higher for farmers who started off with some form of assistance than their counterparts that had started using only their own financial resources. Farmers keeping cross bred animals also had a higher EGMMLD than those using pure bred exotic animals (Friesians). These results are similar to those of EGMMD except that the type of acaricide used, location of farm together with the educational standards of the farm owner are also included as significant explanatory variables. The use of acaracide as pour-on gave a big EGMMLD. Acaracides are applied less frequently (time and cost saving) when they are supplied as pour-on (ten or more days intervals for pour-ons (Baytical(R) or Spoton(R)) compared to three or four days intervals for sprays (decatex(R)). The high EGMLD for zone II is a kind of confounder because the majority of farms in zone I have pure bred animals which demand extra labour inputs due to their higher milk yields and physiological delicacy. Differences in the EGMLD for educational levels can be explained by the fact that, with increasing education levels, farmers can cope better with new technologies by being able to deal with agricultural technical recommendations that are necessary to achieving technical efficiency (Aldermen, 1987). This can be envisaged as a saving on labour in terms of man-hour functions which is the case in this study. When modelled, variables left in the model at significant levels of less than 0.050 included size of the herd ($p=0.001$), the volume of milk produced per mean lactating cow per farm per day ($p<0.001$), mean number of lactating cows on the farm ($p<0.021$), growing forge on the farm ($p<0.002$), and starting the farm on aid ($p<0.001$), selling milk in the farm neighbourhood or through vendors ($p<0.001$). Total number of lactating animals had a negative coefficient. This showed that EGMMLD was negatively correlated to the mean number of lactating animals on the farm. This is so since more extra labour which is a component of variable costs is required as more animals are added to expand herd size and benefits of increased numbers are out outweighed by the cost of labour (Widodo *et al.*, 1993).

All the remaining explanatory variables had positive relationships with the EGMMLD, their absence or decline would therefore reduce the magnitude of EGMMLD. The model fitted explained over 77% (r^2=0.773) of the variation observed in the EGMMLD. This model was similar to that fitted for EGM except that it took into consideration the importance of herd size. Table 5-3 shows details of the model for EGMMLD (page 82).

Table 5-3: Enterprise Gross Margin Per Man-day Per Lactating Cow Regression Results

EGMMLD				Linear Model	
Variable	B_i	E	SS	F	SIG F
MMEAN	197.44	36.09	68724799	29.93	0.0001*
FUNSO1	2143.31	493.66	43282195	18.85	0.0001*
MRKT3	2637.55	508.73	61719713	26.88	0.0001*
MRKT1	1588.63	451.56	28418701	12.38	0.0008*
HSIZE	679.52	249.84	16985421	7.40	0.0085*
FORG1	1335.55	420.88	2119855	10.07	0.0023*
TDM	-1714.24	722.93	12910463	5.62	0.0208*
Constant	-2095.06	482.41	43305896	18.86	0.0001

R^2 (Adjusted) 0.77326004

Analysis of Variance

	DF	Sum of Squares	Mean Square	F	SIG. F
Regression	7	485488365	69355481	30.21	0.0001
Residual	62	142357822	2296094		

* Variables significant at 95% and above level of confidence (a<=0.05)

Source: Author's Computation, 1998

Note:

MMEAN: The volume of milk produced per cow per day
FUNSO1: Whether farmer started off with any form aid
MRKT1/3: Whether milk sold at the farm gate exclusively
HSIZE: Number of animals farmer is keeping (herd size)
FORG1: Whether farmer is relying on home grown forages
TDM: Mean number of lactating animals kept on the farm

5.3.5 Enterprise Gross Margin Per Capital Per Cow

Gross margin per capital per cow (EGMS) ranged from -0.14/- to 5.09/- per shilling, with a mean of 0.67/-, (±0.77) per shilling. The presence of some negative values for EGM showed that some farmers were receiving returns which were less than their invested capital. Enterprise gross margin per cow per capital was found to be significantly different between farmers according to the breed of the lactating animals kept ($p=0.001$), type of acaricide used on the farm ($p=0.026$), initial source of capital ($p=0.031$), and farmers' educational levels ($p=0.048$). The mean EGMS for farmers keeping cross bred animals was higher than that of farmers keeping pure bred animals. Enterprise gross margin per cow per capital was highest for farmers using Decatex$^{(R)}$ followed by those using Spoton$^{(R)}$ and smallest for the farmers who used Baytical$^{(R)}$. There was a difference in mean EGMS between farmers using Decatex$^{(R)}$ and those using either Baytical$^{(R)}$ and Spoton$^{(R)}$. There was however no difference in mean EGMS between farmers using Baytical$^{(R)}$ and Spoton$^{(R)}$. Farmers who started off without assistance also had a EGM values higher than farmers who had started off using their own resources and farmers with higher educational levels also had higher EGMS than those with lower educational levels. In this study all the statistically significant differences in EGMS with respect to a specific factor are explained by the effects of the factor on GI. When modelled, significant variables selected in the model included the volume of milk produced per mean lactating cows per farm per day ($p<0.001$), use of Decatex$^{(R)}$ ($p=0.001$), mean number of lactating cows on the farm ($p=0.002$), selling milk to neighbours ($p=0.09$*) and keeping pure bred animals ($p<0.001$). Two factors, total mean number of lactating animals and keeping pure bred animals, had negative coefficients. They were therefore negatively correlated to EGMS.

This implied that EGMS would be increased by reducing the mean number of lactating animals on the farm. Similarly EGMS would be reduced by keeping non-pure bred animals. The model fitted explained 44% of the total variations observed in EGMS. This model is also similar to that of EGM with the exception that acaracide is identified as being important in determining EGMS. Table 5-4 shows details of the model fitted for EGMS.

Table 5-4: Enterprise Gross Margin Per Capital Per Cow Regression Results

EGMS			Linear Model		
Variable	B_i	E	SS	F	SIG F
MMEAN	0.06	0.02	6.40	16.70	0.0001*
LBREDS1	-0.73	0.17	7.21	18.81	0.0001*
ACAR3	0.72	0.22	4.32	11.27	0.0013*
TDM	-0.73	0.23	3.94	10.29	0.0021*
Constant	0.88	0.23	5.60	14.60	0.0003

R^2 (Adjusted) 0.40950065

Analysis of Variance

	DF	Sum of Squares	Mean Square	F	SIG.F
Regression	5	17.01	3.40	8.88	0.0001
Residual	64	24.53	0.38		

* Variables significant at 95% and above level of confidence ($\alpha <= 0.05$)

Source: Author's Computation, 1998.

Note: MMEAN: The volume of milk produced per cow per day

LBREDS1: Whether farm is keeping pure bred animals (Friesians)

ACAR3: Whether farmer is using decatex[(R)] to control tick

TDM: Mean number of lactating animals kept on the farm

5.3.6 Enterprise gross margin per Hectare per cow

Enterprise gross margin per hectare per lactating cow (EGMLA) ranged from - 437,432/- to 5,209,324/-, with a mean of 1,140,141/- (±947,439) per hectare. It was observed that the EGMLA figures were grossly very large because of the small farm sizes and farms with no land areas for growing animal fodder were actually left out to avoid getting infinite values. Gross margin per heactare per lactating cow when assessed was found not to be significantly different in all the study explanatory variables ($p>0.050$). Similar results were obtained by Widodo *et al.* (1993) in farming households in Java who concluded that land area - farm income relationships are not feasible for dairy systems where animals are stall-fed on forage obtained from outside the farm (Widodo *et al.*, 1993).

CHAPTER VI

6.0 CONCLUSIONS AND RECOMMENDATIONS

This chapter gives the main conclusions drawn from the results of this research and recommendation that can help researchers, policy makers and farmers to tackle some of the constraint identify by the study.

6.1 Conclusions

6.1.1 Economic Feasibility

Results from this study have shown that, on average, farms have positive enterprise gross margins, meaning farmers are making profits. Zero grazing of cattle is therefore an economically viable venture in peri-urban parts of Mpigi. However, it is evident that there are wide variations in gross margins between farms, i.e some farms have small gross margins while others have very large gross margins. Majority of farms have gross margin close to zero too. The inference here is that most farmers get low returns.

The study shows these returns made by farmers could be increased by: (i) increasing the amount of milk produced per mean lactating cow per day; (ii) an increase in producer milk prices; (iii) a drop in the cost price of concentrate feeds; (iv) growing forage on the farm; (v) selling of milk directly to consumers at the farm; (vi) locating the farm closer to urban centres and (v) maintaining a smaller number of lactating animals on the farm.

The study also indicates that returns to labour or capital decline as the mean number of lactating animals kept on the farm increases. Farmers with one lactating animal proved to perform better than those with two or more. In respect to this it can be concluded that economies of scale are not applicable with this study herd size. Similarly, returns on for zero-grazing by farmers could not be meaningfully interpreted. Farms that had no or very little land reserved for animal fodder production manifested infinitely large gross margin per unit land. Land, as a factor of production, is therefore not a key constraint among zero grazing farmers in peri-urban areas if free fodder can be got from outside and ferried in, using relatively cheap labour.

The study revealed too that returns to the farmers' capital are higher when grade or crossed animals are kept. It was thus concluded that farmers could improve their return to capital by initially starting zero grazing with grade or crossed animals other than going straight for pure exotic dairy animals.

6.1.2 Production Constraints

Labour requirements on farms is the most important constraint limiting production for most zero grazing farmers. The second major constraint farmers faced was lack of markets for their produce (milk). This problem was followed by the problem of livestock diseases, high cost of farm inputs especially dairy concentrates, low milk yields from some of the animals, periodic shortages of fodder on farms, inadequacy of veterinary extension services and presence of animals with poor reproductive performance. There is also water shortages, lack of credit facilities, and insecurity of animals on some farm. In areas which have become urbanised manure disposal is also cropping up as a problem.

Labour and markets for milk being the most limiting factors must be addressed foremost by farmers. Solutions to other problems should then follow according to order of importance with manure disposal being attended to last. However for farms located in fully urbanized areas manure removal must be immediate to minimize pollution.

6.1.3 Variable Cost Components

The costs met by farmers in providing daily concentrate feeds is the largest component of farm variable costs. This is followed by the cost of hired labour on the farm, the cost of fodder, costs incurred to prevent or treat animal diseases and the cost for routine farm services. It can be concluded from these findings that peri-urban farmers in Mpigi district endeavour to feed high energy feeds to their lactating animals (cows) to improve production. Hired labour is also considered important and is utilized by farmers.

6.2 Recommendations

It is apparent from this study that the majority of zero grazing farmers in peri-urban parts of Mpigi make minimal profits, and receive poor returns on their labour and invested capital. Mobilization must therefore be carried out for these farmers so that they are sensitized about their poor production status. This can be achieved by conducting seminars, workshops and shows for farmers during which production can be discussed. Emphasis must also be placed on how the farmers can produce optimally, say by reducing production expenses while raising their gross incomes. Within the scope of this study this can be achieved through improved management, particularly that which aims at increasing milk yield by individual animals on daily basis. Areas, which can be exploited, include:

(1) Nutrition: each animal on the farm must be provided with sufficient fodder with concentrate added for lactating animals according to their production potential and physiological demands. Water must be provided ad libitum

(2) Breeding: every farmer must identify and cull cows on the farm that are poor milkers. Superior sires and dams must be selected or sought to serve as replacement stock.

(3) Record keeping: this must be instituted by farmers so that farm production and animal reproductive events are closely recorded and monitored.

(4) Animal housing: Housing must be examined and as most farmers have their animals in iron roofed shade which constantly heat up the animal(s) during day time. Research must be undertaken to established whether such roof types are not acting detrimentally on animal's productivity.

(5) Labour utilisation: since labour contributes a big component of farm expenses, there is need to re-organise labour. Hired labour must be restricted in favour of family labour. Farmers should be encouraged to met all labour requirements using family labour. Practically, this can be achieved on the farm by committing more working hours to an enterprise and using family labour where and/or whenever it is available. For example, before and after school, children can harvest, ferry and chop fodder, fetch water, milk animals and deliver milk to its consumer. Farmers must also be encouraged to produce their own fodder since most of the hired labour is used to collect fodder. Farmers with no access to nearby free road-side forages or any farm by products, nor land

for planting forage must acquire land to produce their own fodder. This can be either by saving or taking loans.

(6) Capital utilisation: in order to obtain maximum benefits from their capital farmers starting zero-grazing must initially consider the rearing of cross breeds or grade cattle instead of pure bred animals. Farmers already having the local breed types of cattle must start up-grading their animals. An effective artificial insemination (AI) system should also be established to deliver timely services to farmers effectively. In areas far from the AI centres elite breeding bulls must be availed to the farmers to reduce the current practice of using untested sires.

(7) Produce selling: milk is a highly perishable farm product, which must be sold at once else it goes sour and becomes wasted. To limit possible losses the farmers with market uncertainty must be organized into groups and provision make for them to acquire milk coolers. Additional farmers should also be encouraged to turn milk into finished dairy products to add value to the product so that the farmer's earnings increase. Farmers must also be equipped with knowledge of salvaging spoiled milk and making it into sellable products such as Ghee.

Since this study revealed that, economies of scales are not being taken advantage of, farmers must be encouraged to reduce their herds by culling out animals which are inferior in production. For urbanised areas where manure has become a nuisance, biogas technology must be introduced so that biogas is produced to supplement household fuel supplies.

Within the extremes of these recommendations and study limitation it should be remembered that zero-grazing has numerous advantages which are not easily quantifiable into monetary terms. These included the biological values of manure say: on crops, as domestic fuel, construction material and chemotherapeutic agents. Smallholder farmers also generally lack technical guidance, which limits their chances of engaging in non-traditional agricultural production systems. For this category of farmers zero grazing would serve as the best alternative even if profits are minimal. The same would apply for farmers in highly urbanized areas without enough land resources of their own. Zero grazing would also be recommended in peri-urban areas of Mpigi district where free road-side fodder is abundant. For house wives whose main work is to tend to household chores zero grazing would also be a good part time occupation which is gender sensitive.

BIBLIOGRAPHY

Abate, A; Dzowela, B. H and Kategile, J. A . (1992) Intensive Animal Feeding Practices for Optimum Feed Utilisation. In Proceedings of a Workshop on Future of Livestock Industries in East and Southern Africa, Kadoma Ranch Hotel, Zimbabwe, 20-23 July 1992. ILCA Publication, Addis Ababa, Ethiopia

Ackello-Ogutu, C and Wachi, J. J. (1990): Basic Concepts of Microeconomics with Special Reference to Kenya. Nairobi University Press. Kenya. Pp3-24.

Ahmed, S. and Rahman, S. (1992): Resource Allocation by Subsistence Farmers in Asia: Some Findings. Asia-Pacific Journal of Rural Development 2(2): 36-76.

Alderman, H. (1987): Cooperative Dairy Development in Karnaka, India; Assessment Alderman. Harold. Washington, DC, USA.

Aneja, R. P. (1993): Comparative Study of Dairy Development in Indonesia, Philippines and Thailand: The Replicability of the Indian Dairy Development Mode. New Delhi, Mann, E.J and Brookes, B.(Eds.). Pp71-96.

Bareeba, F. B. (1995): Peri-Urban Dairying in Uganda. In: Livestock Production and Development in Tropics. Livestock Production and Human Welfare. Eds Zessin Karl-Hans: Proceedings of the 8th International Conference of Institutions of Tropical Veterinary Medicine Held in Berlin, September 25-29, 1995. Vol. 1, Pp243.

Barnard, C. S. and Nix, J.S. (1979): Farm Planning and Control. 2nd Edition. Cambridge University Press, Cambridge, Uk.

Belete, A; Dillon, J.L. and anderson, F.M. (1993): Efficiency of small Scale Farmers in Ethiopia: a Case Study in the Baso and Warana Sub-District. Agricultural Economics 8(3): 199-209.

Bigsten, A. and Kayizzi-Mugerwa, S. (1995): Rural Sector Response to Economic Crisis in Uganda. Journal of International Development 7(2): 181-209.

Curry, J. J., Huss-Ashmore, R. A., Perry, B. D. and Mukhebi, A. W. (1996): A Framework for The Analysis of Gender, Intra-Household Dynamics and Livestock Disease Control, with Examples from Uasin Gishu District, Kenya. Journal of Human Ecology 24. Pp161-189.

Dhalwa, J. (1995): Animal Health and Production Constraints in Traditional Farming Systems in Mbarara District, Uganda. Msc. Dissertation, Department of Agriculture, University of Reading, Uk.

Dieckman, N. (1994): The Integration of Social and Gender Issues in Smallholder Dairy Production. World Animal Review 1994. Food Science and Agriculture Organization, Rome, Italy. Pp2.

DVSAI (1996): Departmental Report to the District Resistance Council. Department of Veterinary Services and Animal Industry, Mpigi District. District Veterinary office Mpigi. Mpigi, Uganda.

Ellis, P.R. and James, A . D. (1979): Economics in Farm Practice. Veterinary Record, 106: 523-6.

FAO (1989): International Report on Constraints on Food Production in Low income Food Deficient Countries of Africa. Food and Agriculture Organisation. Rome, Italy.

FAO/ILRI (1995): Livestock Development Strategies for Low Income Countries. Executive Summary on Proceedings of The Joint FAO?ILRI Round Table on Developing Strategies for Low Income Countries. Ilri 27th Feb 1995. Ilri, Nairobi, Kenya.

HPI (1992): Namirembe Church of Uganda Annual Report: Livestock activities. Heifer Project International. Church of Uganda, Kampala.

IICA (1989): Veterinary Epidemiology and Economics in Africa. A Manual for Use in the Design and appraisal of Livestock Health Policy. ILCA Manual No. 3. 2nd Ed. Addis Ababa, Ethiopia.

ILRI/NARO/MUK/MAAIF (1996): a Rapid appraisal of the Dairy Sub-Sector in Uganda. A Report Submitted to Overseas Development Agency. IILRI, Nairobi, Kenya.

Jahnke, H.E. (1982): Livestock Production Systems and Livestock Development in the Tropics. Kieler Wissenchaftverlay Vauk.

Kabuye, T. (1994): Livestock Marketing under Trade Liberalization. Uganda Veterinary Journal 2(1): 8.

Kalule-Sewali, A. (1994): Evaluation of the Heifer Project for Women Farmers in Mpigi District. Msc. Thesis, Department of Food and Nutrition, University of Nairobi.

Kiconco, D. (1995): A Study of Reproductive Performance of the Peri-Urban Zero-Grazed Dairy Cattle Kept By Women in Uganda. Msc. Dissertation. Department of Tropical Animal Health, University of Edinburgh, Edinburgh, Uk.

Kilungo, J. K. (1998): An Economic Analysis of Smallholder Dairy Production in Kiambu District, Kenya. Phd. Thesis, Department of Agricultural Economics, University of Nairobi.

Kilungo, J. K., Mcdermott, J. J., Oluoch, W. K. and Omore, a. O. (1994): Socio-Economics of Smallholder Dairy Production in Kiambu District Kenya. In: Proceedings of the 7th ISVEE Symposium 15th-19th, August 1994. Nairobi, Kenya. The Kenya Veterinarian (Special Issue) 18(2): 247-249.

Kinte, F. (1998): A Rationale for the Uganda Field Study. In international Centre for Development Oriented Research in Agriculture (Icra) Workshop on Peri-Urban Small

Dairy Systems in Central Uganda Held on 22RD april 1998 at Namulonge Research institute, Uganda.

Lachin, J.M. (1981): Introduction to Sample Size Determination and Power Analysis for Clinical Trials. Controlled Clinical Trials, 2: 93-113.

Laker C. D (1999): Assessment of the Economic Impact of Bovine Trypanosomiasis and Its Control in Dairy Cattle in Mukono County, Uganda. PhD. Thesis, Makerere University.

Lwasa, S. L. (1994): Estimating The Cost Function of Uganda's Dairy industry: The Case of Dairy Production in Mbarara and Bushenyi Districts. Msc. Thesis, Department of Agricultural Economics, Makerere University.

MAAIF (1993): Master Plan for the Dairy Sector Vols; I and Iv. Ministry of agriculture, animal industry and Fisheries, Government Printers, Entebbe.

MAAIF (1996): Comparative analysis of Dairy Cattle Management Systems in different areas of Uganda: Study Report, Livestock Service Project. Ministry of Agriculture, Animal Industry and Fisheries, Government Printers, Entebbe.

MAIF (1988): Comparative Analysis of Milk Production by Imported and Local Cows. Ministry of Agriculture, Animal Industry and Fisheries, Kampala. Pp17.

MFEP (1992): Background information to the budget 1992/3. Ministry of Finance and Economic Planning. Government of Printers, Entebbe. P3-6.

MFEP (1995): National Household Budget Survey Vol.II Ministry of Finance and Economic Planning, Statistics Department. Government Printer Entebbe, Uganda.

Makeham, J.P. and Malcolm, L.R. (1986): The Economics of Tropical Farm Management. Cambridge University Press, Cambridge, Uk.

Martin, S.W., Meek, a.H and Willenberg, P. (1987): Animal Health Economics in Veterinary Epidemiology Principles and Methods. Iowa State University Press, Iowa, Usa. Pp219-241.

Maxwell, D. G. (1995): Labour, Land and Farming: a Household analysis of Urban agriculture in Uganda. PhD. Dissertation. The University of Wisconsin-Madison, USA.

Mbuza, F.B. (1991): A Systems Analysis of Milk Production Systems in Uganda and Prospects for Technological Change. PhD. Thesis, University of Melbourne, Melbourne, Australia.

Mbuza, F.B. (1994): The Need for Conservation and Sustainable Utilization of indigenous animal Genetic Resources in Uganda. Uganda Veterinary Journal 2(1): 17.

Mfep (1992): Background information to the Budget 1992/3. Ministry of Finance and Economic Planning. Government Printers, Entebbe. P3-6.

Mfep (1995): National Household Budget Survey Vol. Ministry of Finance and Economic Planning, Statistics Department Government Printers, Entebbe.

Mullins G., Wahome L., Tsangari P. and Maarse L. (1996): Impacts of intensive Dairy Production on Smallholder Farm Women in Coastal Kenya. Human Ecology 24(2) Pp231-253.

Murithi, F.M. (1990): Efficiency of Resource Use in Smallholder Milk Producers: The Case of Meru Central Dairy Farmers. Msc. Thesis Department of Agricultural Economics, University of Nairobi.

Mwebaze, S. (1994): The Effect of Zero-Grazing on the Environment. Uganda Veterinary Journal 2(1):25-26.

Mwenya, W.N. (1992): Impact of the introduction of Exotic Cattle in East and Central Africa. In Proceedings of a Workshop on Future of Livestock industries in East and Southern

Africa, Kadoma Ranch Hotel, Zimbabwe, 20-23 July 1992. ILCA Publication, Addis Ababa, Ethiopia. Pp3-7.

Nalule, S. (1996): Economics of Zero-Grazing Dairy Farming in Bwongyera Sub-County, Kajara County, Ntungamo District, Uganda. Special Project Research Report Submitted To Faculty of Veterinary Medicine, Makerere University.

Nsubuga, H.S. (1992): Pastures in the Feeding of Dairy Cattle in Uganda, with Particular Reference to Zero Grazing. Nomadic-Peoples, 31: 85-90.

Ntengua, M. and Steve, W. (1995): Efficiency in Smallholder Dairying in the Kilimajaro Region, Tanzania. Study Report on Subsistence Farming. Department of Agricultural Economics. University of Dar-Es-Salaam.

Oakley, J. (1997): Economics in Livestock Development. Veterinary Epidemiology and Economics Research Unit. University of Reading, Reading.

Ochwo, D.J; Okia, I.J; Sande, S.K. and Situma, W.J. (1996): A New Primary Social Studies for Uganda Bk 6. Rurash Educational Publishers, Kampala, Uganda.

Odima, P.A. (1994): Reproductive Performance of Dairy Cows and Heifers in Kiambu District, Kenya. Msc. Thesis, Department of Public Health, Pharm. and Tox., University of Nairobi.

Ofwona, E. (1994): An Economic Analysis of Coconut Production in Kwale District, Kenya. Msc. Thesis, Department of Agricultural Economics, University of Nairobi.

Omore, A.O. (1997): Epidemiology and Economics of Mastitis in the Smallholder Dairy Sector of Kiambu District, Kenya. Ph.D. Thesis, Department of Public Health, Pharmacology and Toxicology, University of Nairobi.

Omore, A. O. (1997): Epidemiological and Economics of Mastitis in the Smallholder Dairy Sector of Kiambu Distric, Kenya. Phd. Thesis, Department of Public Health, Pharmacology and Toxicology, University of Nairobi.

Omore, A.O., Mcdermott, J.J. and Carles, a.B. (1994): Comparison of Productivity of Cattle Grazing Systems in Small-Holder Dairy Farms in Kiambu District, Kenya. in Proceedings of the 7th ISVEE Symposium 15th-19th, August, 1994. Nairobi, Kenya. The Kenya Veterinarian (Special Issue) 18(2): 121-123.

Omore, A.O., Mcdermott, J.J., Kilungo, J., Gitau, T. and Staal, S. (1997): A Comparison of The Relative Returns to Different Enterprises on Mixed Smallholder Crop-Dairy Systems in Central Kenya. In: Proceedings of the 8th international Symposium for Veterinary Epidemiology and Economics (ISVEE), Paris France, 7-11 July 1997.

Panin, A. (1993): Resource Allocative Efficiency of Smallholder Farmers in Botswana. Agricultural Economics 3(3): 7-13.

Price, E.C. (1991): Estimating Prices of Agricultural inputs and Products for Analysis of agricultural Experiments in: Basic Procedure for Agro-Economic Research. International Rice Research institute, Manila, Philippines. Pp48-63.

Radostits, O.M., Leslie, K.E. and Fetrow, J. (1994): Herd Health; Food animal Production and Veterinary Medicine. 2nd Edition, W.B. Saunders Company, Philadelphia, Usa.

Reynold, S. (1996): Farmers on the Livestock Field of Play. The Courier No. 158 July-August 1996. Cta Wageningen, Netherlands.

Rhodes, V., Dok, J. P., Salid West, J. G. (1968): Economics of agricultural Production, Markets , and Policy. Dorsey Ltd, Nobleton Ontario. P19 - 87.

Sabiti, E.N. (1994): Integrating forage Legumes in to Maize/Elephant Grass Systems for Optimizing Peri-Urban Small Holder Dairy Farming. Paper Presented in a forum on

Agricultural Resource Use and Animal Husbandry at Faculty of Veterinary Medicine, Makerere University, 1st Dec 1994.

Sharma, V.P. and Singh, R.V. (1993): Resource Productivity and Allocation Efficiency in Milk Production in Himachal Pradesh. In China Journal of Agricultural Economics 48(2): 201-215.

Sseruyange, P. K. (1994): A Socio-Economic analysis of the Aggro-Forestry Systems in the Lake Crescent Region. M.Sc. Thesis Submitted to the Department of Agricultural Economics, Makerere University.

Stotz, D. (1987): Production Techniques and Economies of Smallholder Livestock Production in Kenya. Farm Management Handbook of Kenya, Vol. (4). Moal&Md, Nairobi, Kenya.

Suzuki (1994): Jica Field Reports from Central Uganda. Paper Presented in a Seminar on the Master Plan Study on the integrated agricultural and Rural Development Project in Central Uganda. Japan International Cooperation Agency (Jica). Entebbe, Uganda. P9-38.

Syrstad, O. (1993): Milk Yield and Lactation Length in Tropical Cattle. Journal of Animal Health Production and Products, Quarterly Publication 1993/1-2. Food and Agriculture Organisation, Rome, Italy. P68-72.

Vanegas, S.M. and Akwang, A. (1992): An Economic Analysis of Milk Production Costs and Pricing in Uganda. Staff Paper, Department of Agricultural Economics, Makerere University, Uganda.

Wange, J. (1998): Studies on Primary Tillage Implements and Sysetms Used for Draught animal Cultivation Featuring Uganda Situation. Msc. Thesis, Silsoe College, Granfield University.

Widodo, M. W; De Joug, H. and Udo, H. M. (1993): Small Scale Dairying in three Farming Systems in East Java, Vol. I. Economic Analysis of Dairy Report, Department of Tropical Animal Production, Wageningen agricultural University. Wageningen, Netherlands.

WIIAD (1994): Population Pressure Will Lead to Mixed Crop-Livestock Farming. Assessment Report of Animal Agriculture in Sub-Saharan Africa. Winrock International Institute for Agricultural Development, Arkansas U.S.A. Pp3-9.

World Bank (1993): Uganda-Agriculture, a World Bank Country Study. The World Bank. Washington D.C.

APPENDIX:1 QUESTIONNAIRE

ECONOMICS OF PERI-URBAN ZERO-GRAZING IN UGANDA: THE CASE OF MPIGI DISTRICT

1. Study area

County (LC4)	
Sub-county (LC3)	
Parish (LC2)	
Village (LC1)	
Date	
Interviewer	

2. Respondent

(Use tick)

Names	Sex	Age (Yrs)	Relationship with the farm owner				
			Wife	Son	Daughter	Employee	other

For other, explain (briefly)

3. Information on farm owner

(Use tick)

Names	Sex	Age	Marital status				Occupation				Education				
			1	2	3	4	1	2	3	4	1	2	3	4	5

Codes for 3.0;

(i) Marital status; 1: Married, 2: Single, 3: Widow, 4: Widower
(ii) Occupation; 1: Zero-grazer only, 2: Subsistence, 3: Farm employed
(iii) Education; 1: None, 2: Primary, 3: Secondary, 4: College, 5:
Explain......................................

4.0 Household information

Age group (Years)	Below 15		15-65		Above 65		Total	
Sex	F	M	F	M	F	M	F	M
Number								

Codes; F:Female, M: Male

5.0 Information on livestock

5.1 What kind of livestock do you have?

Species	Cattle	Goats	Sheep	Pigs	Rabbits	Poultry	other specify
Numbers							

5.2 How were the animals obtained?

(Use tick)

	Species	Personal Funds	Obtained on loan	Project donation	other specify
1	Cattle				
2	Goats				
3	Sheep				
4	Pig				
5	Rabbits				
6	Poultry				
7	Others				

5.3 For how long have you been keeping cattle (Number of months);

5.4 For cattle, what is the herd structure?

Type	Herd size	Cows		Heifer	Bulls	Calves	
		Lactating	Dry			F	M
Number							

5.5 What are the breeds of animals (cattle) kept?

(give numbers)		Friesian	Jersey	Crosses	Local	Unknown
cows	Lactating					
	Dry					
	Bulls					
	Heifers					
Calves	Female					
	Male					
	Totals					

6.0 Land utilization

6.1 Farm size and tenure

	Ha	Tenure 1, 2, 3	Comments
Land owned			
Land rented			
Land Hired out			
Total Land used			

Codes for Tenure; 1: Free-hold/mailo, 2: leasehold, 3:Customary

6.2 How is the land used

	Use	Ha	Comment
1	Producing Animal Fodder		
2	Crop farming		
3	Horticulture		
4	Woods/Forestry		
5	Fallowing		

***Comment whether crop is in pure stands or intercropped?

7.0 Labour aspects

7.1 Who takes care of the cattle which are zero-grazed?

(give numbers)

Labour source/farm	Women	Men	Children	Total
Family members				
Hired workers				
Totals				

7.2 For hired worker/labour indicate how payment is done.

(Use tick)

Labour form	Cash	Milk	Food	Accommodatio	other specify
Casual					
Permanent					
Cost for month*					

* Applicable for permanent labour only

Extra information:

7.3 How much was spent (cash/material) to pay for labour in 1996?

Form of labour	as Cash	as milk	as accommodation	as food	other specify	Total
Casual						
Permanent						
Totals						

7.4 Who normally provide the following services?

	Activity	Sources 1, 2	No. of individuals	Time spent (hrs)
1	Supervision			
2	Milking			
3	Collecting forage			
4	Fetching water (for animals)			
5	Cleaning shed			
6	Applying acaricide			
7	Watering/feeding animals			
8	Marketing milk			
9	Others			
10	Totals			

Codes for 7.4 (source); 1: Family members, 2: Hired workers

7.5 Expense on specific labour related inputs, 1996

	Activity/Service	Category of worker (use tick)			Amount
		Family	Casual	Permanent	
1	Supplying fodder				
2	Weeding fodder				
3	Transport				
4	Milking animals				
5	Supplying water (Animals)				
6	Marketing milk				
7	Repairing cattle shed				
8	Others specify				

8.0 Animal husbandry aspects, 1996

8.1 Drugs and chemicals (costs)

	Item	Use (Yes or No)	Amount spent	Comments
1	Milking salve			
2	Dry cow therapy			
3	Dewormers			
4	Detergents/soap			
5	Acaricide			
6	Fly repellant			
7				
8	Others			

8.2 Type of acaracide used

Acaracide	Bayticl	spoton	decatex	supona	Greases	Others	none
Numbers							

8.3 Treatments (costs)

	Disorder	Use (Yes or No)	Amount expense	Comments
1	Vaccinations			
2	Mastitis			
3	Gastro-intestinal disorder			
4	Reproductive disorder			
5	Skin/hoof disorder			
6	East Coast fever			
7	Other tick borne diseases			
8	Others unidentifiable			
	Total costs			

9.0 Animal nutrition

9.1 What types of feeds are utilized on the farm?

	Feed	Source 1, 2, 3	All	Animal fed lactating	Heifer	Calves
1	Napier					
2	Banana peels					
3	Potato vine					
4	Silage					
5	Tree Prunings					
6	Garden weeds					
7	Mineral licks					
8	Legumes					
9	Dairy meal					
10	Weaners					
11	Brewers mash					
12	Others specify					

Codes for 9.1 (Source); 1: Farm, 2: purchased, 3: collected free

9.2 Expenses on feeds, 1996

9.2.1 Forages

	Feed	Expenses incurred	Comments
1	Napier/legumes		
2	Banana peels		
3	Potato vines		
4	Silage		
5	Others		
	Total		

9.2.2. Concentrates

	Feed	Expense incurred	Comments
1	Dairy meal		
2	Calf weaner		
3	Brewers mash		
	Total		

9.2.3 Supplements

	Supplements	Expense incurred	Comments
1	Minerals		
2	Salts		
3	Others		
	Total		

10.0 Products from animals

10.1 Uses

(use codes given below)

	Output	Use 1, 2, 3	Comments
1	Manure		
2	Milk		
3	Animals		
4	Skins and hides		
5	Draughter power		
6	Others		

Codes for 10.1 (use); 1: Home, 2: Sold, 3: Given away free

10.2 Production levels (apply to animals with completed lactation)

(use farm record book)

Animal	Breeds 1, 2	Daily milk Production	Lactation Length (L)	Lactation Yield (L)	Parity
1					
2					
3					
4					

Codes for 10.2 (Breeds); 1: Friesian, 2: Others

10.3 Milk used to feed calves

Calf	Sex M or F	As colostrum (Litres)	Saleable milk (litres)	Duration of feeding allowed
1				
2				
3				

Code for 10.3 sex; M:Male, F:Female

10.4 Milk used by the family

Amount consumed per day	Duration	Comments

10.5 Milk outlets (markets)

(use Tick)

Market	Neighbours	Vendors	Nearby town	comments
All surplus				
Shares*				
Milk price				

* Shares; Average quantity of milk channel through the market (percentage)

11.0 Farm services, 1996

	Services	Expense incurred	Comments
1	Breeding		
2	Transport		
3	Memberships		
4	Others		
	Total		

11.1 Farm animals, equipments and utensils used to operate farm

	Item	Numbers	Cost incurred	Year	condition 1,2,3,4
1	Animal(s)				
2	Animal shed construction				
3	Bike(s)\Vehicles				
4	Wheelbarrow(s)				
5	Drum(s)/Tank(s)				
6	Water trough(s)				
7	Feed trough(s)				
8	Hoes, panga, slasher(s)				
9	Water container(s)				
10	Spray pump(s)				
11					
12					
13					
	Total				

Codes for 11 (condition); 1:good, 2:worn out, 3:replaced, 4:lost

12 General questions/comments

12.1 Constrain

	Problem encountered by farmer	Ranking
1	Shortage of forage	
2	Cost of inputs	
3	Animal diseases	
4	Marketing of milk	
5	Manure disposal	
6	Low milk production	
7	Poor extension services	
8	Reproductive failure	
9	Shortage of water	
10	Shortage of inputs	
11	Death of animals	
12	Poor credit facilities	
13	Others	
	Total	

12.2 Recommendations

	Recommendation/outlook	No or yes
1	Expand by adding more animals	
2	To discontinue with enterprise	
3	Change system of production	
4	Change the breed of animal used	
5		
6		
7		
	Total	

APPENDIX:2 SUMMARY OF INFORMATION COLLECTED\GENERATED BY THE STUDY

(i) Codes

1. Sex	Sex of the farmer (1: Female, 0: Male)
2. Occupt	Type of farmer's livelihood (0: Zero-grazing 1: Subsistence, 2: Regular off-farm work)
3. Farmsize	Number of people in the family of farm owner
4. Child	Number of family members with ages below 15 years
5. AdultF	Female family members with ages between 15-65 years
6. AdultM	Male family members with ages between 15-65 years
7. Aged	Number of family members with ages below 65 years
8. Funso	Source of fund used to start zero-grazing (1: palled personal savings, 2: Loan, 3: Project 4: Combinations)
9. Comm	Year when farm was established (zero-grazing unit)
10. Hsize	Number of animals on farm (cattle only)
11. Dry	Number of non-lactating cows on the farm
12. Heif	Number of young female animals on farm (6 months-first calving)
13. Bull	Number of male animals above 6 months on the farm
14. Hcalf	Number of female calves (< 6 month) on the farm
15. Mcalf	Number of male calves (< 6 month) on the farm
16. Tenu	Type of tenure system on units which the farmer operates (1: Mailo/free hold, 2: Lease 3:, Customary)
17. Farsize	Farm size (Ha)
18. Farsto	Farm area used for producing fodder for zero-grazed animals (Ha)
19. Lfarm	Number of family members actively engaging in zero-grazing
20. Lemplo	Number of hired worker on the farm
21. Costcas	Amount of money paid to casual workers by the farmers in 1996 (Uganda Shillings (Ush.))
22. Costper	Amount of money (Ush.) paid to permanent worker in 1996
23. TFo	Time (hours) spent by workers in 1996 to provide fodder to animals (cutting, collecting and carrying)
24. Tma	Time (hours) spent on marketing milking

25. Tmi	Time (hours) spent on milking animal(s)
26. TSH	Time (hours) spent cleaning cattle shed(s)
27. TSU	Time (hours) spent by farm owner on supervision and helping on zero grazing unit
28. Twas	Time (hours) spent doing other farm activities
29. Twat2	Time spent (hours) on collecting water
30. Cosalvo	Cost of milking salve
31. Cosdct	Cost of dry cow therapy tubes
32. Cosworm	Cost of dewormers
33. Costik	Cost of acaracide
34. Costly	Cost of fly repellents
35. Cosvac	Cost for vaccination
36. Mast	Expenses to treat mastitis
37. Scour	Expenses on gastro intestinal disorder/diseases
38. Ugod	Expenses on reproductive disorders/diseases
39. ECF	Expenses for treating East Coast Fever
40. Tbd	Expenses for treating tickborne disease beside East Coast Fever
41. ODD	Expenses on disease condition that were not clearly identifiable
42. Acar	Type of acaracide used by the farm (1: Baytical 2: Spoton 3: Decatex 4: combinations)
43. Farso	Source of forage (1: Home grown 2: Purchased)
44. Cosfor	Cost of forage (purchased)
45. Silo	Cost of making/buying silage
46. Esfed	Cost of buying brewers mash, maize stores
47. Cosbp	Cost of buying banana peels
48. Cospv	Cost of buying potato vines
49. Coscy	Cost of concentrates in 365 day
50. Wcost	Cost of calf weaner
51. Cosmisa	Cost of minerals licks/salts
52. Manuse	Use of manure on the farm (1: Crop fertilizer, 2: Thrown away, 3: Sold 4: others)
53. Mmean	Volume of milk produce by farm per day
54. Lyld	Volume of milk produced by cow(s) per lactation
55. Llength	Accumulated lactation length for cows on the farm

56. Mhome	Volume of milk consumed by family per day
57. Mate	Method of breeding used by the farm (1: Bull, 2: Artificial Insemination, 3: 1 & 2)
58. Costran	Cost expenses for the farm in form of transport
59. Cosmem	Cost expenses for the farm in form of membership fee to animal interest groups/subscription
60. Capcow	Amount of money for purchasing initial farm stock
61. Capunit	Amount of money for shed construction
62. Year	Number of years animal(s), item(s), shed(s), equipment(s) since they were purchased
63. Bike	Cost of bicycles, wheelbarrow, vehicle
64. Drum	Cost of water drum(s), tank(s)
65. Drinka	Cost of water trough
66. Feda	Cost of feed trough
67. Oimp	Cost of panga, hoes, slasher etc
68. Jeca	Cost of water containers/carriers
69. Pump	Cost of spray pump(s)
70. Mprice	Milk prices
71. Mllength	Mean lactation length on farm
72. Incsa	Income from sale of animals
73. Tdm	Number of lactating animals on the farm
74. GI	Farm gross income
75. Newvcto	Farm variable costs (total)
76. Fgmnew	Farm gross margin
77. Newfgmc	Farm gross margin per cow on farm
78. Mo	Value of milk produced by farm in 1996.
79. Asee	Farm identity (code)
80. Age	Age of the farm owner
81 Dmanhrs	Hours works utilised by farm in 1996
82. Dmanhrs	Hours works/cow utilised by farm in 1996
83. VETS	Poor extension services
84. Market	Lack of markets for farm produce
85. Labour	Labour shortages86. Repre Poor reproctive performance

86. Repre	Poor reproctive performance
87. Thefty	Livestock thefty
88. Milk	Low milk yield
89. Forge	Shortages of fodder
90. Manure	Manure disposal
91. Inputs	farm inputs
92. Credit	Lack of credit facilities
93. Disease	Livestock disease
94. Water	Water shortages
95. M	Factor(s) not mentioned

(11) Data obtained/genarated

CASE	SEX	ASEE	AGE	OCCUPT	FAMSIZE	CHILD	ADULTF
1	1	5	50	1	8	[illegible]	[illegible]
2	1	8	36	2	9	4	3
3	1	36	36	0	10	3	3
4	1	44	38	1	9	[illegible]	[illegible]
5	1	59	38	1	11	4	[illegible]
6	1	69	34	1	6	4	[illegible]
7	1	56	31	1	8	5	[illegible]
8	1	55	50	1	17	9	[illegible]
9	1	34	34	1	12	6	[illegible]
10	1	35	36	2	7	2	3
11	1	57	45	1	10	4	[illegible]
12	1	37	39	1	8	3	[illegible]
13	1	58	63	1	8	0	[illegible]
14	1	38	36	2	7	3	[illegible]
15	1	31	33	2	9	6	[illegible]
16	1	19	36	1	11	1	[illegible]
17	1	27	53	2	12	3	[illegible]
18	0	11	46	2	10	2	3
19	0	13	58	2	8	2	[illegible]
20	1	9	48	0	8	3	[illegible]
21	1	15	76	0	8	3	1
22	1	[illegible]	40	0	6	2	[illegible]
23	1	5	32	1	7	4	[illegible]
24	1	16	37	0	7	[illegible]	3
25	1	7	76	0	4	[illegible]	0
26	1	4	38	1	5	3	[illegible]
27	1	41	52	1	7	4	[illegible]
28	1	12	41	1	6	1	[illegible]
29	1	10	36	1	7	[illegible]	[illegible]
30	1	3	35	1	9	5	[illegible]
31	0	28	42	2	15	8	[illegible]
32	0	27	40	2	10	5	3
33	1	18	62	1	10	5	4
34	1	40	47	1	8	2	[illegible]
35	1	54	48	1	11	5	3
36	0	29	73	0	4	[illegible]	[illegible]
37	0	26	58	2	11	4	3
38	0	32	40	2	8	4	[illegible]
39	1	25	45	1	10	4	3
40	1	53	34	1	7	5	[illegible]
41	1	43	56	2	12	4	2
42	1	62	41	2	6	3	[illegible]
43	0	46	67	0	6	2	[illegible]
44	0	[illegible]	41	1	9	4	[illegible]
45	0	24	70	1	13	9	[illegible]
46	0	45	63	1	16	9	4
47	0	60	42	1	7	4	[illegible]
48	0	67	51	2	8	4	3
49	0	61	26	2	6	4	[illegible]
50	0	39	40	2	6	4	[illegible]
51	1	68	60	1	5	2	[illegible]
52	1	47	33	1	10	4	4
53	1	33	38	2	7	0	[illegible]
54	0	65	47	2	16	6	3
55	0	50	61	2	14	4	5
56	0	71	65	3	13	5	4
57	1	51	57	1	9	6	[illegible]
58	1	23	48	1	10	1	8
59	1	64	53	1	9	3	4
60	0	48	57	2	12	4	[illegible]
61	1	42	32	2	10	8	1
62	1	30	35	2	11	6	3
63	0	70	36	2	5	4	[illegible]
64	0	20	48	2	4	2	[illegible]
65	0	63	48	2	7	5	[illegible]
66	1	49	41	1	8	4	[illegible]
67	1	21	45	1	11	2	3
68	1	22	30	1	7	3	6
69	1	66	52	2	9	1	2
70	1	52	32	2	7	4	[illegible]
71	1	14	37	2	8	[illegible]	[illegible]

CASE	ADULTM	AGED	FUNSO	COMM	HSIZE	DRY	HEIF
1	4	1	4	92	4	0	0
2	2	0	3	92	2	0	1
3	4	0	3	93	3	0	0
4	3	0	3	94	2	0	0
5	4	0	3	93	2	0	0
6	1	0	3	93	3	0	1
7	1	0	3	93	1	0	0
8	3	0	3	93	4	1	1
9	4	0	1	86	3	1	0
10	1	1	3	95	2	0	1
11	4	0	3	94	2	0	0
12	2	0	3	94	2	0	0
13	5	0	3	87	4	1	0
14	1	0	3	94	1	0	0
15	1	0	3	93	4	0	0
16	3	0	3	94	4	0	1
17	4	3	1	94	5	1	1
18	5	0	1	94	2	0	0
19	4	0	2	95	2	0	0
20	3	0	2	95	2	1	1
21	3	1	3	93	2	0	0
22	2	0	1	95	2	0	1
23	1	0	3	94	2	0	0
24	2	0	2	95	3	0	1
25	1	1	3	94	3	0	1
26	1	0	3	95	2	0	0

CASE	ADULTM	AGED	FUNSO	COMM	HSIZE	DRY	HEIF
27	1	0	3	94	3	0	0
28	3	1	3	94	2	0	0
29	2	1	3	94	2	0	0
30	1	1	3	94	2	0	0
31	1	2	1	90	7	0	1
32	2	0	1	94	5	1	0
33	0	1	3	93	2	0	0
34	4	0	3	95	2	0	0
35	3	0	2	95	2	0	0
36	0	1	3	94	2	0	0
37	4	0	1	95	3	1	1
38	2	0	1	94	4	0	0
39	3	0	3	93	2	0	0
40	1	0	3	95	3	0	1
41	2	1	1	93	3	0	0
42	1	0	3	92	4	1	2
43	1	2	3	94	3	0	1
44	2	0	3	94	3	0	1
45	2	2	3	95	3	0	1
46	3	0	1	95	2	0	0
47	1	0	1	90	4	0	1
48	1	0	1	92	10	1	2
49	1	0	1	95	2	0	0
50	1	0	3	95	2	0	1
51	1	0	3	88	2	0	1
52	2	0	3	94	3	0	1
53	3	0	3	94	3	0	1
54	4	1	1	91	5	1	2
55	4	1	1	93	4	0	1
56	3	1	1	91	4	1	1
57	1	1	3	95	2	0	1
58	3	1	3	94	4	1	1
59	2	0	3	93	5	1	1
60	1	0	3	94	3	0	1
61	1	0	3	94	3	0	1
62	2	0	3	94	2	0	0
63	1	0	3	91	5	0	0
64	1	0	3	93	2	0	0
65	1	0	3	94	5	0	1
66	2	0	3	94	3	1	1
67	2	4	3	94	3	0	1
68	2	0	3	93	3	0	0
69	2	0	2	94	2	0	1
70	1	0	1	94	7	1	2
71	2	2	1	93	3	0	1

CASE	BULLS	HCALP	MCALF	TENU	FARSIZE	FARSTO	JECA
1	0	1	528	1	5	3.75	8000
2	0	0	176	1	15	2.50	9000
3	1	1	270	2	2.5	0.50	10800
4	0	0	90	2	3.1	1.25	3500
5	0	0	420	2	2.5	1.25	5400
6	0	1	540	2	2.5	2.50	4000
7	0	0	182	2	5	1.25	3000
8	1	0	900	2	6.25	3.75	9000
9	0	0	1500	2	22.5	3.75	4000
10	0	0	540	2	3.	1.25	6000
11	0	1	240	3	3.7	1.25	4000
12	0	0	367.50	3	4.4	1.25	6000
13	0	1	429	3	7.5	2.50	10500
14	0	0	84	3	7.5	1.25	12000
15	0	1	850.20	3	3.7	1.25	4000
16	1	1	175	1	10	2.50	8800
17	0	0	383.60	1	2.5	0	6000
18	0	0	180	2	2.5	0	4000
19	0	0	119	2	1.25	0.6	2200
20	0	0	147	2	0.3	0	8000
21	0	0	240	2	8.7	1.25	6600
22	0	0	480	2	0.3	0	6600
23	0	1	480	2	4.5	3.75	6000
24	0	0	180	3	0	0	4000
25	0	0	900	3	9.5	2.50	6000
26	0	0	480	3	7.25	0.6	4000
27	1	1	138	3	6.25	1.9	3600
28	0	0	300	3	1.25	0	10000
29	0	0	360	3	5	1.25	6000
30	0	0	360	3	3.25	1.8	11000
31	0	2	718	1	20	5	7000
32	2	0	581	1	25	2.50	4500
33	0	0	480	1	6.25	3.75	6000
34	0	0	900	1	1.25	1.25	8000
35	0	0	240	1	6.25	1.8	4000
36	1	0	189	2	25	5	3000
37	0	0	673	2	7.5	3.75	8000
38	2	0	280	2	7.5	2.50	8000
39	0	1	392	2	12.5	5	10000
40	0	0	480	2	11.25	2.50	6000
41	1	0	360	2	5	0	8000
42	0	0	1080	2	7.5	2.50	4000
43	0	1	360	3	15	7.50	6000
44	0	0	147	3	10	2.50	6600
45	0	0	900	3	10	1.5	10000
46	1	0	120	3	10	0.6	4000
47	0	0	240	3	5	2.5	18200
48	0	4	560	3	10	2.5	12000
49	1	0	540	3	1.25	0.75	4000
50	0	0	675	3	11.25	3.75	7000
51	0	0	360	3	1.875	0	7000

CASE	BULLS	HCALP	MCALF	TENU	FARSIZE	FARSTO	JECA
52	0	0	480	3	4.375	3.75	6000
53	0	0	660	3	7.5	2.50	6000
54	0	1	420	1	20	7.50	6000
55	1	1	210	1	37.5	2.50	7200
56	0	0	520	1	M	M	10000
57	0	0	270	1	7.5	2.50	10800
58	1	1	960	1	87.5	5	10800
59	0	1	360	1	30	5	10000
60	0	1	390	2	12.5	1.8	8000
61	0	1	720	2	7.5	2.50	4000
62	0	0	420	2	15	2.50	6000
63	0	1	961	3	6.25	5	5000
64	0	1	1260	3	13.75	3.75	6000
65	0	2	202	3	35	3.75	7200
66	0	0	300	3	5.6	1.75	4000
67	0	1	840	3	5	2.50	12000
68	1	1	245	3	11.25	2.50	6000
69	0	0	420	3	8.75	2.50	6000
70	0	1	720	3	6.25	3.75	8000
71	0	1	1050	3	6.25	3.75	4000

CASE	LFAM	LEMPLO	COSTCAS	COSTPER	TFO	TMA	TMI
1	1	1	175000	480000	1095	243.33	365
2	2	0	146000	0	487	121	487
3	2	0	48000	0	2190	1095	365
4	1	0	0	0	1460	730	365
5	1	1	0	288000	5110	730	243.33
6	2	0	30000	0	1095	243.33	365
7	1	1	0	217000	2920	365	182.50
8	2	1	0	360000	4380	243.33	487.10
9	1	1	140000	180000	547.5	730	547.50
10	2	0	18000	0	4380	365	243.33
11	2	1	146000	28800	1460	1460	730
12	2	0	216000	0	1460	547.50	304.17
13	2	1	0	343000	1825	730	730
14	1	1	0	114000	2920	730	730
15	1	1	36000	324000	730	122	365
16	2	1	15000	420000	2920	182.50	243.33
17	2	0	0	0	1460	973.33	547.50
18	1	1	219000	151250	720	60	121
19	2	1	0	312000	183	92	92
20	2	0	109500	0	3650	122	243
21	2	0	25000	0	1460	122	365
22	1	1	30000	180000	730	63.30	158.30
23	1	1	200000	228000	496	274	365
24	1	0	54750	0	2920	240	122
25	2	0	32000	0	1080	280	540
26	2	0	48000	0	365	365	365
27	2	0	0	0	730	122.15	121.10
28	2	0	140000	0	1825	548	1460
29	2	0	189000	0	1095	365	243.33

CASE	LFAM	LEMPLO	COSTCAS	COSTPER	TFO	TMA	TMI
30	1	1	239500	180000	548	12.40	365
31	6	0	0	0	2190	365	730
32	2	0	0	0	1460	730	365
33	1	1	60000	277000	1095	91.25	487.10
34	1	1	0	240000	1825	365	122.10
35	2	0	91250	0	2190	365	182.50
36	1	1	0	273875	3650	122.10	182.50
37	1	1	1200	300000	1460	1460	182.50
38	2	0	0	0	365	730	182.50
39	2	2	0	502400	3285	182.50	243.33
40	1	1	75000	291875	2920	182	304.17
41	3	0	35000	0	1825	365	182.50
42	1	2	0	480000	2190	365	547.50
43	1	1	72000	292000	4380	274.15	182.50
44	2	0	21000	0	2920	121	365
45	2	0	0	0	1460	243.33	608.33
46	2	0	20000	0	2190	547.50	304.17
47	2	0	180000	0	2555	182.50	730
48	3	0	90000	0	1460	243	730
49	1	1	0	240000	1460	182.50	365
50	2	0	0	0	730	182.50	182.50
51	2	1	156000	253000	1460	730	243.33
52	2	1	0	120000	2555	182.50	243.33
53	0	1	0	312000	4380	1095	304.17
54	1	1	120000	286125	2190	182.50	487.10
55	1	1	107000	456000	2190	730	547.50
56	2	1	0	330000	1825	547.50	304.17
57	2	1	0	120000	1095	487	730
58	1	1	20000	350000	730	365	365
59	2	1	36000	324000	1460	730	365
60	2	0	21000	0	1825	365	304.17
61	2	0	30000	0	1460	1460	122.10
62	1	1	20000	337500	547.5	365	304.17
63	1	1	0	432000	4380	365	243.33
64	1	1	18000	312000	1460	365	243.33
65	2	1	45000	265250	3285	1460	547.50
66	2	0	36000	0	5110	547.50	243.33
67	1	1	0	252000	365	1460	365
68	1	1	39107	208000	4380	1460	243.33
69	1	1	0	240000	1825	365	243.33
70	2	1	87000	243000	2190	304	304.17
71	2	1	0	480000	1460	183	365

CASE	VETS	LABOUR	THEFTY	FORGE	INPUTS	DISEASE
1	M	4	M	1	M	M
2	M	M	M	M	3	1
3	M	4	M	M	M	3
4	M	3	M	M	1	M
5	M	M	M	M	M	M
6	M	M	M	M	2	1
7	M	1	M	M	3	M
8	M	M	M	M	M	1
9	M	1	M	M	M	[illegible]
10	M	M	M	M	1	2
11	M	M	M	1	M	M
12	M	3	M	M	1	M
13	M	2	M	1	M	M
14	M	3	M	M	M	M
15	M	M	M	M	3	2
16	M	M	M	1	2	M
17	M	M	M	2	M	M
18	M	2	M	M	M	M
19	1	M	M	M	2	M
20	M	M	M	M	1	[illegible]
21	M	3	M	1	M	M
22	M	3	M	M	M	1
23	M	M	3	M	4	[illegible]
24	2	M	M	4	M	M
25	2	3	M	M	4	M
26	3	M	M	M	1	M
27	3	4	M	1	M	M
28	M	2	M	M	M	M
29	M	M	M	M	3	M
30	M	M	M	M	M	[illegible]
31	4	2	M	M	M	[illegible]
32	3	M	M	M	4	M
33	M	1	M	M	M	M
34	M	1	M	M	M	3
35	M	1	M	M	M	M
36	M	M	M	1	M	M
37	M	M	M	M	2	[illegible]
38	M	4	M	2	M	[illegible]
39	M	M	M	M	M	M
40	4	2	M	1	M	M
41	3	2	M	M	M	1
42	3	2	M	M	M	4
43	M	2	M	1	M	M
44	M	M	M	M	1	M
45	M	M	M	M	M	[illegible]
46	2	M	M	M	M	M
47	M	1	M	3	M	M
48	M	M	M	M	M	3
49	M	4	M	2	M	3
50	M	3	M	M	M	[illegible]
51	M	3	M	1	M	M
52	M	3	M	1	M	M
53	M	M	M	1	M	M
54	3	4	M	M	2	M
55	M	1	M	2	M	M
56	3	M	M	M	M	M
57	M	M	M	M	4	3
58	M	2	M	1	4	M
59	M	3	M	M	1	[illegible]
60	M	3	M	2	M	M
61	4	M	M	M	1	M
62	3	4	M	M	1	[illegible]
63	3	M	M	M	2	M
64	M	2	M	M	3	M
65	M	2	M	M	M	3
66	M	M	4	M	M	M
67	3	M	M	M	1	M
68	2	3	M	M	M	4
69	3	M	M	M	2	M
70	M	M	1	M	M	[illegible]
71	1	M	M	M	2	M

CASE	MARKET	REPR	MILK	WATER	MANURE	CREDIT
1	M	3	2	M	M	M
2	2	M	M	M	M	M
3	1	M	2	M	M	M
4	2	M	M	M	M	M
5	M	M	2	M	M	M
6	M	3	M	M	M	M
7	M	M	M	2	M	M
8	M	M	M	2	M	M
9	M	3	M	M	4	M
10	3	M	M	M	M	M
11	M	M	2	M	M	M
12	2	M	M	M	M	M
13	M	M	M	M	M	3
14	2	M	1	M	M	M
15	M	M	M	M	M	1
16	M	M	M	M	3	M
17	M	3	1	M	M	M
18	1	M	M	M	M	M
19	3	M	M	M	M	M
20	M	M	3	M	M	M
21	2	M	M	M	M	M
22	2	M	M	M	M	M
23	M	M	3	1	M	2
24	1	M	M	M	M	M
25	1	M	M	M	M	M
26	2	M	M	M	M	M
27	2	M	M	M	M	M
28	1	M	M	M	M	M
29	2	M	1	M	M	M
30	1	M	3	M	M	M
31	M	3	M	M	M	M
32	1	M	2	M	M	M
33	2	M	M	M	M	M
34	2	M	M	M	M	M
35	2	M	M	M	M	M
36	2	3	M	M	M	M
37	M	M	3	M	M	M
38	M	M	3	M	M	M
39	2	M	M	M	M	M
40	M	M	M	3	M	M
41	M	M	M	M	M	M
42	M	1	M	M	M	M
43	M	M	M	3	M	M
44	M	2	M	M	M	M
45	1	M	M	M	M	M
46	M	M	1	M	M	M
47	M	2	M	M	M	M
48	2	M	1	M	M	M
49	M	M	1	M	M	M
50	M	1	M	M	M	M
51	2	M	M	M	M	M
52	2	M	M	M	M	M
53	2	M	M	M	M	M
54	M	M	1	M	M	M
55	M	3	M	M	M	M
56	M	2	1	M	M	M
57	M	2	1	M	M	M
58	M	3	M	M	M	M
59	M	M	4	M	M	M
60	1	M	4	M	M	M
61	2	M	3	M	M	M
62	M	M	M	M	M	M
63	1	M	M	M	M	M
64	M	1	M	M	M	M
65	1	M	M	M	M	M
66	2	M	1	M	M	M
67	2	M	M	M	M	M
68	1	M	M	M	M	M
69	M	M	1	M	M	M
70	M	M	3	M	M	M
71	M	3	M	4	M	M

CASE	TSH	TSU	TWAS	TWAT2	COSALVO	COSDCT	COSWORM
1	365	1095	288	912.50	7500	0	18000
2	243	1460	54	1460	7000	0	14000
3	730	1460	48	365	7000	8000	21000
4	730	1460	36	730	10500	9000	9500
5	730	2190	12	912.50	6500	0	3500
6	365	1460	18	730	7000	14000	10500
7	365	1460	24	730	7000	0	8000
CASE	TSH	TSU	TWAS	TWAT2	COSALVO	COSDCT	COSWORM
8	1460	1825	42	1095	15000	8000	21000
9	1095	1825	24	1095	7000	0	7000
10	730	1460	60	730	7000	0	20000
11	730	1642.5	24	1460	6000	0	12000
12	109.50	1460	36	547.50	8000	0	6000
13	730	1460	42	730	6000	0	21000
14	730	1460	48	730	0	0	12000
15	365	1460	48	1460	10500	0	36000
16	273.75	1460	216	182.50	3500	0	9000
17	730	1460	24	730	17000	16000	21000
18	365	720	134	212	7000	0	7000
19	365	720	12	365	0	0	14000
20	365	2920	24	24	10500	22500	14000
21	913	1095	19.600	548	11400	18000	14000
22	365	1825	67	24.600	7000	0	0
23	276	1095	36	557	14000	0	13000
24	244	730	24	24	10500	0	21000
25	540	1460	48	365	13500	0	14000
26	365	1425	52	740	17500	8000	17800
27	365	1460	72	1095	7000	0	7000
28	365	365	104	730	10500	0	3500
29	730	1825	108	912.50	7000	0	7000
30	548	1425	84	24	10500	0	14000
31	730	1460	24	547.50	6000	0	11000
32	547.50	1095	12	730	9000	16000	10500
33	365	1460	60	365	14000	8000	16000
34	365	1460	24	365	9600	0	11400
35	730	1460	48	365	9600	0	10500
36	730	1095	72	547.50	8000	0	8000
37	182.50	1460	36	365	13200	20000	10500
38	365	1460	12	365	3500	0	8400
39	182.50	1460	96	1095	7500	8000	16000
40	365	1095	36	547.50	3500	0	24000
41	730	730	60	164.25	11200	12000	15000
42	365	1460	12	1095	7500	160000	8000
43	1095	1095	12	365	6000	0	18000
44	547.50	1460	54	547.50	8000	0	10500
45	1095	1095	48	547.50	3500	0	18000
46	547.50	1460	24	730	0	0	3500
47	365	1825	24	730	0	0	3500
48	547.50	1460	30	547.50	8000	0	9600
49	1095	1460	12	365	7500	0	6000
50	182.50	1460	12	730	4000	0	14000
51	730	1095	12	1095	7000	0	12000
52	547.50	912.50	48	1460	7000	12000	21000
53	273.75	2190	36	1460	6500	0	20100
54	365	1095	48	365	7000	0	24000
55	547.50	1095	96	730	7800	0	30000
56	365	1095	24	1277.5	14000	0	14000
57	547.50	1460	48	1095	3500	0	7000
58	365	1460	36	1460	3500	0	14000
CASE	TSH	TSU	TWAS	TWAT2	COSALVO	COSDCT	COSWORM
59	547.50	1095	48	730	8000	8000	13500
60	730	1095	144	1095	7000	8000	17000
61	273.75	1460	24	2920	8400	0	12000
62	365	1095	144	730	3800	0	6000
63	1095	1095	36	1460	14000	0	12000
64	219	1460	84	547.50	7000	0	16000
65	547.50	1460	24	547.50	7000	0	32000
66	365	1095	24	912.50	3500	0	4000
67	365	1460	24	182.50	10500	8000	16000
68	547.50	1460	72	730	3500	0	52000
69	730	730	36	1825	3500	0	8000
70	1460	1460	12	730	12000	16000	29000
71	548	1460	72	1460	10500	0	72000

CASE	COSTIK	COSFLY	COSVAC	MAST	SCOUR	UGOD	ECF
1	104286	2500	4000	50000	0	90000	30000
2	71696	0	2000	0	0	0	0
3	127750	0	3000	18000	0	0	0
4	82125	0	2000	14000	8500	35000	0
5	61320	0	1000	0	0	0	0
6	91250	5000	2000	15000	0	0	0
7	46800	4000	1000	0	0	18000	0
8	156429	3500	5000	22000	0	0	120000
9	88695	2800	2000	40000	0	13500	0
10	99840	4000	2000	0	0	0	0
11	49920	4000	1000	0	0	2000	30000
12	54080	2000	1000	0	0	15000	0
13	40671	5000	3000	22000	0	0	0
14	125140	6000	1000	0	0	0	0
15	100375	7500	3000	18000	0	0	0
16	97500	2500	3000	60000	0	0	0
17	104286	0	8000	12000	0	30000	0
18	52143	0	2000	0	0	0	0
19	35200	5000	1000	0	51600	0	0
20	82125	12000	2000	36000	0	6000	0
21	78300	0	2000	8500	0	0	0
22	53760	2500	2000	0	0	0	0
23	112500	0	1000	25000	0	8000	0
24	82125	0	2000	0	9000	12000	0
25	74752	5000	2000	0	3000	18000	0
26	57500	0	1000	0	0	15000	0
27	67600	3000	2000	5000	5500	0	0
28	36500	0	2000	0	0	8000	50000
29	73000	12000	1000	0	0	0	0
30	34135	0	1000	160000	0	35000	0
31	93600	0	3000	8000	0	0	0
32	37440	0	3000	12000	0	0	68000
33	93600	0	1000	0	0	15000	0
34	780000	0	1000	6000	0	0	0
35	49536	3500	2000	0	0	5000	42000
36	71696	0	3000	0	0	0	70000
CASE	COSTIK	COSFLY	COSVAC	MAST	SCOUR	UGOD	ECF
37	123500	12500	7500	0	0	0	160000
38	46800	2500	4000	0	0	0	0
39	84732	12500	2000	0	0	0	0
40	146000	0	2000	0	0	0	0
41	67160	2500	4000	26000	0	8000	0
42	183960	0	8000	0	0	0	0
43	34415	0	2000	0	0	0	60000
44	40000	24000	1000	0	0	0	0
45	117000	0	1000	0	0	0	7000
46	40150	0	0	0	0	0	0
47	40150	0	2000	0	0	0	70000
48	135572	0	5000	0	0	0	0
49	67600	0	2000	0	0	0	60000
50	62400	2800	2000	34000	0	0	0
51	52143	0	2000	0	0	0	0
52	52143	0	2000	15000	0	0	0
53	102618	0	3000	5200	6000	0	80000
54	180675	0	5000	0	8000	0	0
55	78840	0	6000	0	0	0	0
56	149910	0	6000	16000	0	0	0
57	39107	0	2000	0	0	0	0
58	58500	2500	3000	4000	0	0	30000
59	190092	0	7000	18000	0	30000	0
60	105590	0	9000	8000	0	10000	0
61	78840	0	6000	0	0	52000	0
62	118625	7500	2000	0	0	0	0
63	149760	0	5000	0	0	15000	7500
64	65179	12500	2000	0	0	0	90000
65	163520	0	6000	0	12000	5000	25000
66	65700	0	8000	0	0	5000	0
67	105000	2700	2000	12000	0	5000	0
68	53040	0	4000	0	2500	0	15000
69	78215	0	4000	0	0	5000	25000
70	226821	7500	7000	34000	6000	12000	46000
71	113880	5500	12000	0	0	0	0

CASE	TBD	ODD	ACAR	FORSO	COSFOR	SILO	ESFED
1	0	50000	1	1	150000	0	13000
2	110000	0	1	5	4000	13400	0
3	0	0	1	5	270000	10000	390000
4	0	0	2	4	180000	0	22000
5	0	12000	2	4	0	10000	15000
6	0	20000	1	4	0	0	132000
7	0	0	1	1	0	0	156000
8	0	40000	1	4	0	10000	260000
9	7000	3500	1	5	120000	0	26000
10	20000	5000	1	6	48000	0	208000
11	0	0	m	4	0	5000	12000
12	0	0	1	5	30000	0	3000
13	0	5000	1	5	72000	20000	173400
14	0	5500	1	4	0	5000	0
CASE	TBD	ODD	ACAR	FORSO	COSFOR	SILO	ESFED
15	0	0	2	5	60000	0	100000
16	120000	10500	1	5	60000	0	25000
17	50000	48000	1	5	0	0	650000
18	0	6000	1	6	0	0	0
19	0	10000	2	6	234643	0	10000
20	0	7500	1	6	547500	0	0
21	0	4000	1	4	0	0	0
22	0	15000	2	2	0	0	35000
23	0	6000	1	6	270000	10000	80000
24	80000	0	2	5	91200	0	18000
25	0	0	1	4	76500	0	0
26	0	8000	3	5	80000	13000	72000
27	0	6000	2	1	0	0	0
28	50000	0	3	4	0	0	2000
29	0	37000	1	4	260000	0	90000
30	14000	0	3	5	156000	0	0
31	0	48500	3	4	0	0	0
32	0	0	3	1	0	0	0
33	50000	29000	4	1	0	0	0
34	20000	21000	1	5	100000	0	15000
35	0	9000	3	1	0	0	0
36	0	0	1	5	69000	0	0
37	0	10500	1	5	52000	0	0
38	5000	15000	3	0	0	0	0
39	25000	38000	5	5	30000	0	0
40	0	80000	1	1	0	0	0
41	15000	0	2	7	360000	0	45000
42	0	12000	2	1	0	0	0
43	15000	0	2	5	90000	0	0
44	7000	0	1	1	0	0	0
45	0	0	1	1	0	0	0
46	0	2500	1	1	0	0	0
47	0	0	3	5	60000	0	0
48	0	200000	3	5	109500	0	0
49	0	0	2	3	364000	0	0
50	0	6000	1	7	0	0	0
51	8000	46000	3	4	325000	0	325000
52	0	12000	1	1	0	0	0
53	0	0	1	5	522500	0	0
54	17000	14000	2	1	0	0	600000
55	12000	5000	2	1	0	0	0
56	12000	0	1	1	0	0	0
57	20000	10000	2	1	0	0	0
58	0	33000	1	1	0	0	0
59	21000	0	2	1	0	0	0
60	30000	30000	2	5	12000	0	0
61	0	8000	1	1	0	0	0
62	90000	34000	2	5	180000	0	0
63	0	8500	3	4	0	0	0
64	0	24500	1	5	80000	0	150000
65	7000	16000	2	1	0	0	0
CASE	TBD	ODD	ACAR	FORSO	COSFOR	SILO	ESFED
66	18000	20000	1	4	0	0	0
67	0	21000	1	5	150000	0	0
68	17000	0	3	1	0	0	0
69	4000	0	1	1	0	0	0
70	30000	7500	2	4	208000	0	25000
71	0	12000	2	5	30000	0	0

CASE	MMEAN	LYLD	LLENGTH	MHOME	MATE	COSTRAN	FEDA
1	15.500	5673	742	4	2	156429	9000
2	12.600	4939.2	396	2	2	15643	12000
3	10.500	3307.5	315	1	2	156430	7500
4	9.5000	3277.5	345	2	2	15643	6000
5	12	4680	390	2	2	46930	6000
6	16.500	5230.5	317	2	2	19560	5000
7	13	4251	327	2	2	31286	7100
8	31.600	10696.5	677	4	2	78215	5500
9	31.200	10888.8	698	3	2	66740	7000
10	11	3300	300	2.5	2	31286	8500
11	9	2970	330	3	2	62572	10000
12	17.500	8925	510	2	2	0	5000
13	27	10186	758	2	2	10429	8500
14	6	2094	349	0.5	2	62570	9000
15	32.400	10374	642	4	2	46500	7000
16	12.500	5228	420	2	2	20857	16000
17	27.400	8606	629	2.5	2	0	8000
18	9	4680	520	2	2	15643	12000
19	8.5000	2805	330	2	2	31286	8000
20	10.500	4011	382	1	2	39107	8000
21	17.100	5472	320	4	2	32850	7500
22	7	2975	425	2	2	30857	8000
23	8.9000	5073	570	2.5	2	45000	9000
24	9	2781	309	0	2	15643	8000
25	12	3600	300	1.5	2	56315	10000
26	9.7000	3201	330	2.5	2	15000	30000
27	9.8000	4420	451	2	2	31286	6000
28	10.900	3979	365	2	2	87600	10000
29	11	4926	450	2	2	39107	4000
30	6.5000	4290	660	4	2	27200	6000
31	37.500	4812.5	1155	4	3	41714	16000
32	33.600	11951	1074	2.5	1	31285.7	8000
33	19.500	7741.5	395	3	2	36500	8000
34	22	6908	314	3	2	62570	10000
35	16	4800	300	3	2	13036	7000
36	13.500	4896	360	1.5	1	46929	8000
37	36.200	11877	659	2.5	2	37543	24000
38	20	6600	330	3.5	1	0	8500
39	28	8792	314	3	1	18250	7000
40	11.500	3795	330	3.5	2	37545	10000
41	16	4914	307	4	2	15643	5000
42	36.200	11870	658	3	2	156429	10000
43	8	2400	300	2	1	62571	8000

CASE	MMEAN	LYLD	LLENGTH	MHOME	MATE	COSTRAN	FEDA
44	10.500	4996	480	2	2	39107	6000
45	8	2920	365	2	1	4000	10000
46	7	2520	360	3	3	2000	8500
47	23.200	8300	719	1	2	0	4000
48	32	38400	1200	2	2	52143	9000
49	15	4500	300	2	2	20858	8000
50	21	65100	301	2	2	62570	6000
51	15	5550	370	1	2	31286	65000
52	12.500	4887.5	391	3	1	62570	15000
53	23	6900	300	2.5	3	52143	2000
54	32.200	10567	659	4	3	46929	12000
55	15.200	6156	405	4	3	15643	18000
56	24.600	9016	733	3	2	62572	4500
57	10.500	4053	386	2	2	26072	7000
58	16.500	12870	780	3.5	2	52142	70000
59	27.400	9795.5	715	2	2	31286	9500
60	14.500	50315	347	3	2	26075	6000
61	11.500	6107	531	2	2	20857	10000
62	12	3936	328	3	2	31286	7000
63	42	14784	1056	2	2	31286	10000
64	8.5000	2805	330	2	2	5000	4200
65	14.500	5031.5	347	1.5	1	0	3500
66	8.5000	3323.5	391	1	2	8343	8000
67	18.500	6012.5	325	2	2	109500	10000
68	17.500	6370	364	2	2	4000	6000
69	9.8000	4037.5	412	1	2	5215	6200
70	41.500	17110	1180	4	2	203357	17000
71	18	5508	306	3	2	81343	9000

CASE	COSBP	COSPV	COSCON	COSCY	WCOST	COSMISA	MANUSE
1	30000	0	1043900	1043900	20000	60000	1
2	0	0	167900	167900	17500	30000	1
3	192000	18000	635720	540004	20020	65000	3
4	20800	0	531857	502714	16100	32400	1
5	112000	0	628340	626340	6400	30000	1
6	338920	0	234643	203785	10000	30000	1
7	0	0	533550	480690	10200	21000	1
8	5000	5000	569400	528060	24000	60000	1
9	0	0	751440	717544	24500	30000	2
10	0	0	349360	287145	8000	67600	3
11	0	0	338300	303600	14000	13000	1
12	0	0	500570	500570	0	22813	3
13	12834	0	365000	365000	14000	30000	1
14	7800	12000	333710	319081	0	0	2
15	20800	12000	566300	498473	17920	27000	2
16	547500	0	834286	834286	0	67200	2
17	390000	0	701300	603840	0	33600	3
18	26000	0	182500	182500	29700	46929	3
19	156429	0	356900	349800	0	32400	3
20	182500	0	483625	483625	0	45000	2
21	146000	0	525600	460800	0	32400	3

CASE	COSBP	COSPV	COSCON	COSCY	WCOST	COSMISA	MANUSE
22	547500	136875	292000	292000	17500	60000	2
23	0	0	547500	547500	21600	16800	1
24	31200	0	147460	124836	0	31200	3
25	182500	0	628340	514800	80000	33600	1
26	0	0	545200	492830	5000	16800	3
27	20800	0	469287	469287	1500	70200	1
28	122450	68438	372300	372300	3000	33600	3
29	156429	0	266085	266085	18900	33600	1
30	0	0	255800	255800	4800	15000	1
31	0	0	1001142	1001142	0	64800	1
32	104296	30000	667428	654628	0	30000	1
33	62400	0	664300	664300	0	10800	1
34	63875	52000	563143	484457	0	30000	1
35	0	0	419750	345000	0	20278	1
36	0	36500	594429	586286	6000	60000	1
37	264000	264000	667428	602513	0	36000	1
38	0	0	167900	151800	0	31200	1
39	0	0	554000	502400	0	84000	1
40	0	0	595680	538560	0	31200	1
41	365000	0	453900	386820	0	28800	1
42	520000	0	1955600	1789760	0	72000	1
43	164000	0	511571	411428	0	16800	1
44	0	136875	339450	339450	11500	30000	1
45	0	0	38000	38000	0	4000	1
46	0	0	15000	14794	0	15000	1
47	52000	45625	357700	352310	0	20278	1
48	0	91250	443475	364500	0	60000	1
49	520000	41600	759200	624000	0	33600	1
50	0	0	531857	438599	0	65000	1
51	0	0	338720	338720	12750	30000	1
52	105000	0	503700	503700	0	33600	1
53	121670	52000	933570	771427	0	130000	2
54	260000	0	569400	514020	21560	56400	1
55	90000	0	569400	569400	0	67600	1
56	0	0	470850	470850	0	30000	1
57	0	0	224840	224840	21000	43454	1
58	0	0	521429	521429	8000	23400	1
59	130000	0	397120	388960	15000	30000	1
60	438000	0	463626	459776	21000	30000	1
61	0	0	313900	313900	0	130000	1
62	52148	0	306600	275520	14980	30000	1
63	26000	26000	1191360	1148928	24000	72000	1
64	0	0	13500	12205	30100	43452	1
65	0	0	241812.5	229887	17150	68900	1
66	62400	0	189800	189800	3500	15000	1
67	182500	0	628340	557700	49000	120000	1
68	45000	57000	33000	32909	23000	15600	1
69	0	0	182500	182500	0	15000	1
70	208000	208000	1138300	1138800	30100	62400	1
71	821250	104000	407340	341496	13000	67200	1

CASE	COSMEM	CAPCOW	CAPUNIT	YEARS	BIKE	DRUM	DRIKA
1	20000	1000000	300000	5	0	30000	12000
2	20000	1200000	300000	5	0	15000	15000
3	20000	1300000	240000	4	50000	7500	6000
4	30000	1100000	500000	3	0	14000	15000
5	25000	2000000	300000	4	0	12500	9200
6	20000	100000	100000	4	0	15000	8500
7	25000	950000	200000	4	0	0	8500
8	25000	2100000	320000	4	38000	12000	9000
9	20000	300000	400000	11	0	0	15000
10	20000	1200000	500000	2	60000	15000	9000
11	25000	1200000	230000	3	50000	0	15000
12	25000	1600000	250000	3	0	14000	10500
13	25000	800000	180000	10	80000	13500	12000
14	30000	900000	390000	3	0	15000	14000
15	25000	1350000	450000	4	60000	15000	8500
16	70000	1000000	210000	3	0	7000	10000
17	0	850000	240000	3	65000	15000	9600
18	8000	675000	400000	3	0	0	9000
19	50000	1200000	250000	2	70000	0	7500
20	70000	1200000	250000	2	65000	0	6000
21	58000	1300000	250000	4	65000	12000	6500
22	0	1020000	200000	2	50000	0	7500
23	20000	1150000	350000	3	58000	15000	15000
24	1000	1570000	480000	2	0	0	7000
25	2000	1200000	300000	3	60000	10000	9000
26	18000	1250000	420000	2	65000	0	15000
27	20000	1200000	300000	3	70000	15000	15000
28	86000	1100000	250000	3	0	12500	8000
29	70000	1550000	300000	3	45000	30000	65000
30	75000	1355000	500000	3	0	15000	15000
31	0	300000	145000	7	80000	30000	24000
32	0	1500000	120000	3	65000	0	12000
33	24000	1250000	390000	4	0	15000	10000
34	25000	1600000	300000	2	0	15000	10000
35	20000	1000000	450000	2	0	20000	16000
36	20000	1700000	250000	3	54000	10500	12000
37	0	800000	265000	2	50000	16000	30000
38	0	700000	100000	3	70000	6000	7000
39	30000	1400000	300000	4	45000	30000	12000
40	20000	1600000	350000	2	0	14000	10000
41	0	1300000	320000	4	60000	24000	12000
42	25000	1500000	600000	5	0	16000	15000
43	15000	1500000	171000	3	45000	20000	9500
44	75000	1800000	420000	3	75000	15000	7500
45	10000	1500000	350000	2	65000	15000	12000
46	0	400000	100000	2	60000	0	15000
47	0	250000	140000	7	50000	0	11000
48	0	650000	300000	5	60000	15000	17500
49	0	1000000	295000	2	65000	15000	11000
50	15000	1500000	250000	2	55000	15000	10000
51	15000	500000	160000	9	0	15000	12500

CASE	COSMEM	CAPCOW	CAPUNIT	YEARS	BIKE	DRUM	DRIKA
52	20000	1000000	400000	3	45000	0	10000
53	15000	1000000	120000	3	70000	7500	20000
54	0	600000	240000	6	50000	15000	12000
55	0	700000	180000	4	45000	15000	4000
56	0	760000	120000	6	65000	12000	8000
57	50000	900000	240000	2	50000	0	20000
58	20000	1500000	200000	3	75000	17000	10000
59	30000	1050000	170000	4	0	15000	15000
60	0	1200000	470000	3	0	0	15000
61	25000	1200000	310000	3	60000	90000	10000
62	0	900000	260000	3	60000	15000	85000
63	0	400000	80000	6	65000	20000	15000
64	10000	1100000	155000	4	45000	15500	9000
65	0	1200000	350000	3	40000	15000	7500
66	0	900000	175000	3	0	0	7500
67	30000	1200000	250000	3	55000	17000	8000
68	30000	550000	180000	4	60000	15000	10000
69	0	1190000	360000	3	0	15000	15000
70	0	2400000	600000	3	50000	15000	20000
71	0	520000	250000	4	60000	30000	10000

CASE	MLLENGTH	TDM	DMANHRS	DMANHRSC	INCSA	MO	GI
1	371	2	575.79	287.89	330000	2545875	2875875
2	396	1	565.29	282.88	50000	1839600	1889600
3	315	1	812.13	406 6	600000	1323000	1923000
4	345	1	749.62	749.62	40000	1311000	1351000
5	390	1	1355.1	1355.1	70000	2190000	2260000
6	317	1	568.94	284.24	0	2510640	2510640
7	327	1	801.63	801.63	20000	1700400	1720400
8	338.50	2	1283	320.74	0	4278640	4278640
9	349	2	801.63	400.59	70000	4355520	4425520
10	300	1	1053	526.51	30000	1320000	1350000
11	330	1	972.73	972.73	20000	1485000	1505000
12	510	1	603.62	603.62	0	3513125	3513125
13	379	2	963.60	481.80	100000	3942000	4042000
14	349	1	949	949	19000	1047000	1066000
15	321	2	636.93	318.46	340000	4160160	4500160
16	420	1	699.89	233.14	400000	1825000	2225000
17	314.50	2	786.12	261.89	650000	5170380	5820380
18	520	1	309.79	309.79	0	1642500	1642500
19	330	1	259.15	259.15	80000	1122000	1202000
20	382	1	958.58	479.52	0	1533000	1533000
21	320	1	601.79	601.79	30000	2188800	2218800
22	425	1	422 3	210.79	400000	1277500	1677500
23	570	1	417.93	417.93	500000	1299400	1799400
24	309	1	606.36	302.95	0	1668600	1668600
25	300	1	606.81	303.41	50000	1440000	1490000
26	330	1	486.82	486.82	30000	1600500	1630500
27	451	1	563.93	281.96	0	1430800	1430800
28	365	1	705.36	705.36	50000	2387100	2437100
29	450	1	690.31	690.31	30000	1806750	1836750

CASE	MLLENGTH	TDM	DMANHRS	DMANHRSC	INCSA	MO	GI
30	660	1	415.19	415.19	0	1304875	1304875
31	385	3	938.51	234.51	600000	5475000	6075000
32	358	3	708.56	141.89	0	4811520	4811520
33	395	1	551.15	551.15	10000	2847000	2857000
34	314	1	611.38	611.38	600000	2417800	3017800
35	300	1	713.12	713.12	0	1920000	1920000
36	360	1	830.38	415.19	0	1701000	1701000
37	329.50	2	734.56	245 1	0	4771160	4771160
38	330	1	617.31	205.77	0	3300000	3300000
39	314	1	1000.6	1000.6	0	3516800	3516800
40	330	1	749.62	375 4	600000	1328250	1928250
41	307	1	689.39	344.93	400000	2210400	2610400
42	329	2	822.62	205.77	20000	5954900	5974900
43	300	1	986.41	493.21	0	960000	960000
44	480	1	772.43	385.99	0	1341375	1341375
45	365	1	728.18	364 9	0	1022000	1022000
46	360	1	771 6	385.53	0	756000	756000
47	359.50	2	824.44	274.66	0	4170200	4170200
48	300	4	657.91	109.50	60000	5760000	5820000
49	300	1	674.34	337.17	600000	1800000	2400000
50	301	1	495.94	247.74	0	2212350	2212350
51	370	1	761.94	380.97	20000	2190000	2210000
52	391	1	789.31	394.66	0	1596875	1596875
53	300	1	1399.8	699.89	0	2587500	2587500
54	329.50	2	652.44	162.88	250000	4774455	5024455
55	405	1	776 8	258.69	0	3328800	3328800
56	366.50	2	725.44	241.81	150000	4489500	4639500
57	386	1	773.80	386.90	0	1533000	1533000
58	780	1	616.85	205.77	0	2409000	2409000
59	357.50	2	667.49	222.65	100000	4897750	4997750
60	347	1	724.98	362.72	600000	2515750	3115750
61	531	1	1010.6	505 7	0	1679000	1679000
62	328	1	474 4	474 4	290000	2361600	2651600
63	352	3	1114.6	371.39	210000	7392000	7602000
64	330	1	577.61	577.61	50000	1402500	1452500
65	347	1	1006.9	503.24	120000	2515750	2635750
66	391	1	1067.6	533.81	0	1861500	1861500
67	325	1	550.69	275.12	280000	2405000	2685000
68	364	1	1138.3	568.94	30000	2548000	2578000
69	412	1	753.73	376.86	0	1430800	1430800
70	394	3	845.43	169.27	700000	7573750	8273750
71	306	1	739.13	369.56	0	3029400	3029400

APPENDIX 3: Summary of mean values for parameters used in establishing gross margin

Value in Uganda Shillings

Input or output	Zone 1 (n = 30)	Zone 2 (n = 41)	Over all average
A: Feeds			
1. Concentrates	511,200	540,400	523,500
2. Forages\supplements	246,500	253,700	250,700
B: Hired labour			
1. Casual	75,230	33,670	51,230
2. Permanent	126,900	200,400	169,500
C: Farm services			
1. Breeding	38,720	33,080	41,100
2. Transport	42,930	40,190	41,350
3. Memberships	30,100	12,780	20,100
D: Health related			
1. Acaracides	78,060	110,800	96,980
2. Salves	8,630	7,186	7,796
3. Fly repellants	2,943	2,402	2,631.0
4. Detergents/soap	6,185	6,525	6,381.3
5. Dry cow therapy	3,450	6,732	5,345.1
6. Mastitis (D)	16,850	4,834	9,911.3
7. Reproductive disorders (D)	101,800	4,073	6,654
8. Gastro-intestinal disorders (D)	2,587	842	1,578.9
9. Tick-borne diseases (D)	15,030	10,320	12,310
10. Hoof and skin (D)	1,819	2,283	2,086
11. Non-specified disorder (D)	9,967	18,850	15,100
12. Dewormers	13,190	16,200	14,930
13. Vaccinations	2,167	3,866	3,147.9
14. East coast fever	7,667	20,870	15,290
E: Gross income			
1. Milk value (Ush.)	2,304,300	2,995,000	2,648,000
2. Sale of livestock (Ush.)		138,800	403,900
F: Capital items			
1. Animals	1,157,000	1,074,000	1,109,000
2. Shed construction	312,000	265,500	285,200
3. Spray pumps	7,533	8,854	8,296
4. Bike/vehicle/wheel barrow	31,700	43,760	38,660
5. Feeder troughs	8,786.7	11,730	10,490
6. Drinker troughs	12,380	14,320	13,500
7. Drums/tank	10,330	15,500	13,320
8. Water carriers	6,400	7,178	6,849
9. Milking buckets	4,860	9,327	7,439.4
10. Other implements (pangas, hoes, slashers)	19,770	19,090	19,370
G: Work hours (daily analysis)			

1. Milking	1.1	0.96	1
2. Collecting forage	4.8	5.9	5.4
3. Marketing milking	1.2	1.4	1.3
4. Cleaning sheds	1.5	1.5	1.6
5. Supervision/feeding/watering	3.9	3.5	3.7
6. Collecting water	1.9	2.3	2.1
7. Other work activities	2.1	2.4	2.2
H: Production factors			
1. Farm area reserved for animals fodder (Ha)	1.5	6.1	3.52
2. No. animal per farm (herdsize)	2.5	3.5	3.1
3. No. of lactating animal per farm	1.2	1.4	1.3
Parameter			
1. Gross Margin			
2. Gross Margin/lactating cow			
3.Gross Margin/capital			
4.Gross Margin/hactare of land			