1. Introduction

Dairy production is becoming more and more important in Africa as opposed to the past when milk was mainly a product of subsistence. Nowadays, specialised market-oriented production systems have sprouted with the use of improved breeds and more sophisticated technology. Nonetheless, traditional production systems still persist, especially in rural areas where market influence is low. Ndambi *et al.* (2007) showed that milk demand is growing at a higher rate than milk production in Africa, due to increasing population and per capita consumption and that production needs to increase significantly in order to cope with demand. The same authors showed that agricultural policies are very influential in determining the patterns of production and that importance needs to be attached to the farm, which is the basic unit of production. This means that farming systems must be well understood in order to implement developmental policies. Secondly, with recent global trends, competitiveness of milk production is of great importance, where the question on who will produce the cheapest milk in the future needs to be answered. In addition, individual African countries tend to promote local dairy production and discourage imports in order to reduce foreign exchange on dairy products and attain self sufficiency (von Massow, 1989; Ngwoko, 1986). This means that the costs of dairy production must be low enough to eliminate foreign competition and at the same time, returns from dairying need to be satisfactory for the farmers so that they are motivated to stay in business. Very little work has been done in comparing production systems in different African countries. Worse still, appropriate research tools which enable the comparison of African farms are difficult to establish, bearing in mind the complexity of such systems. The International Farm Comparison Network (IFCN) has developed a unique system for comparing milk production systems worldwide, using the TIPI-CAL (Technology Impact, Policy Impact Calculations model) on typical dairy farms. This method calculates costs and returns per 100 Kg of milk produced on each typical farm, setting an unbiased base for regional, national and international comparison. This paper aims at describing and comparing costs of milk production in the major production systems of four different countries in Africa: South African Republic, Morocco, Cameroon and Uganda.

2. Method

2.1 Analytical model

The methodology applied for data collection, economic analysis and results validation was developed by the International Farm Comparison Network (IFCN) and uses the TIPI-CAL

(Technology Impact Policy Impact CALculations model). This model was developed by Hemme (2000) and has since been refined to suit its applicability on a global scale. This model is an analytical tool for better understanding farming systems and is based on the concept of typical farms. Unlike most other economic analytical methods, the IFCN methodology uses a few typical farms to represent production systems. This means that the selection of such farms is a very crucial issue. The typical farm approach has been proven to be scientifically correct, have access to data on all existing costs, create transparency and international comparability in the arena of costs of agricultural production and produce results which are closer to reality than statistical averages (Hemme, 2000; Holzner, 2004).

2.2 Selection of typical farms

From these production regions, the most predominant dairy production system was selected and one most typical farm was chosen per production system. The most typical farm represents an average-sized farm in the region, having a moderate management and moderate performance and producing a relatively large proportion of milk within the selected system. A second typical farm with a larger herd size was chosen from the same production system in order to enable an assessment of potential impacts of scale economies on the most typical farm. Since the most typical farms in Uganda and Cameroon were from extensive production systems and those from South Africa and Morocco from intensive systems, need arose for the selection of farms from intensive systems from Uganda and Cameroon in order to expand the base for comparison. For this reason, this study has also included two intensive farms from each of these countries.

Table 1: Description of farms analysed

Country	**South Africa**		**Morocco**		**Uganda**			**Cameroon**				
Farm	ZA-89	ZA-366	MA-4	MA-12	UG-3	UG-13	UG-1	UG-15	CM-20	CM-35	CM-1	CM-10
Number of cows	89	366	4	12	3	13	1	15	20	35	1	10
Milk yield (1000 kg)	7.80	6.88	2.21	2.21	0.46	0.40	2.53	1.98	0,49	0,49	2.83	1.16
Dairy region	Free state	Kwazulu natal	Doukkala region			Central region				Western Highlands		
Farming system	Int	Int-P	Int	Int	Ext	Ext	Int	S-Int	Ext	Ext	Int	S-Int
Total land for agriculture (ha)	480	222	2	13	22	41	1	8	21	43	5	30

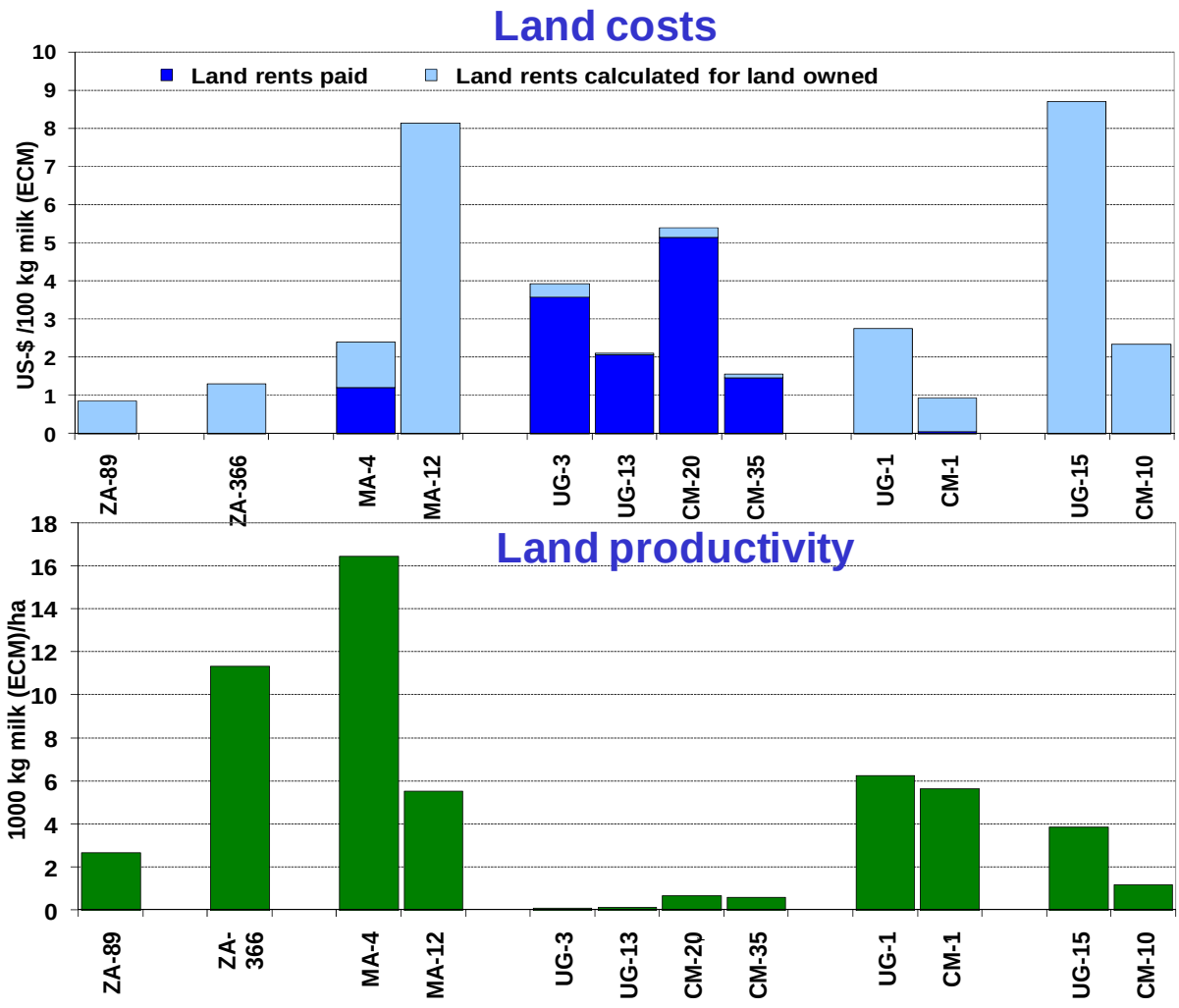
Int = Intensive, Int-P = Intensive pasture based, S-Int = Semi intensive, Ext = Extensive

3. Results and discussions

3.1 Land costs and productivity

The South African farms (ZA-89 and ZA-336), which are the largest in the sample of farms, incur the lowest land costs per 100 Kg of milk produced (Figure 1). Meanwhile, the intensive farms in Morocco (MA-12) and Uganda (UG-15) have the highest land costs per 100 Kg of milk. Farms of the extensive systems in Uganda and Cameroon incur a large proportion or all of their land costs on rented land, whereas all farms of the intensive systems operate exclusively on owned land, except for the smaller farm in Morocco where half of the farmland is rented. The extensive farms have the lowest productive farms as they use large fields or poor quality pasture and produce very little milk.

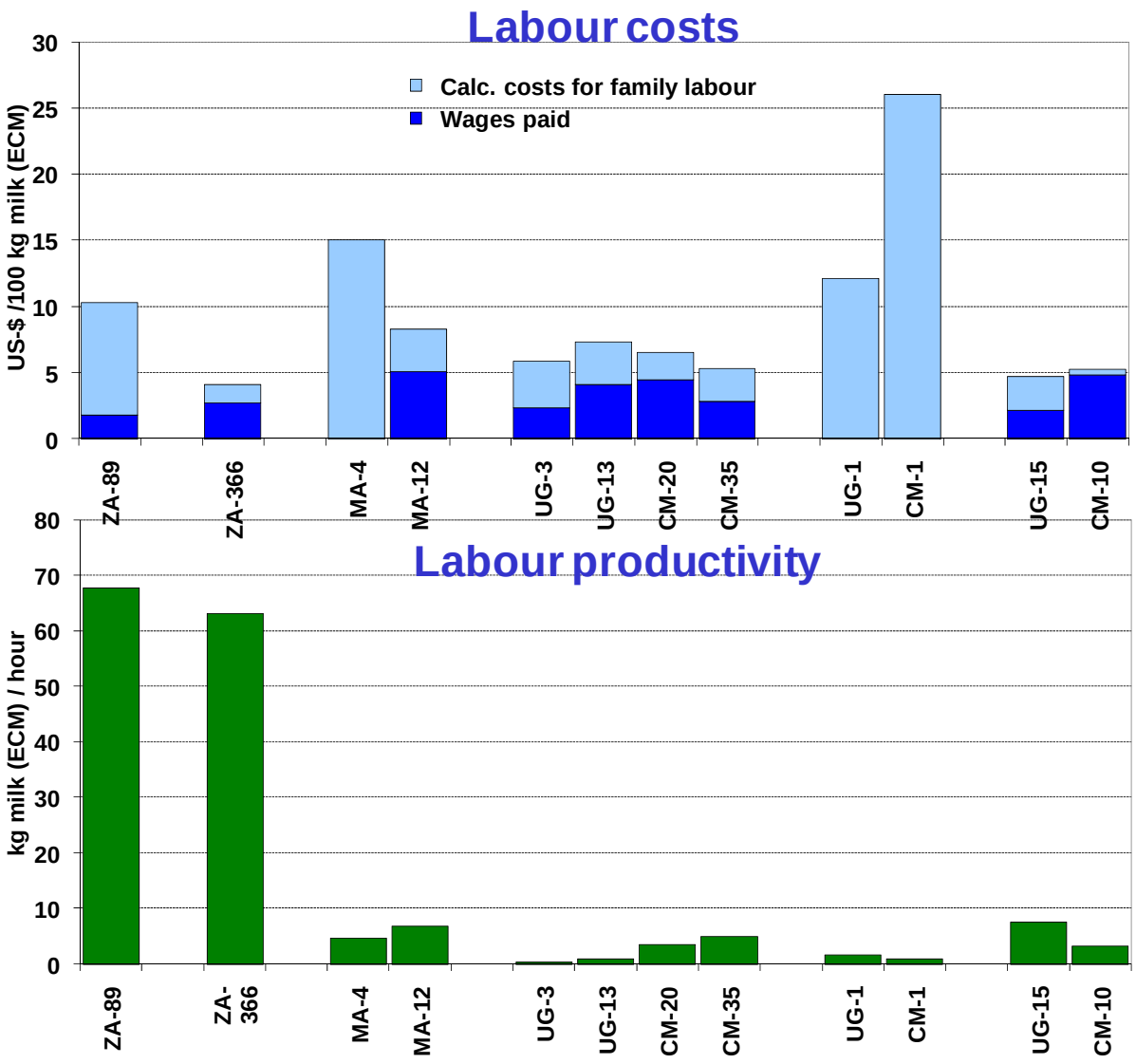
Figure 1: Land costs and productivity of typical farms



3.2 Labour costs and productivity

The farms UG-1 and CM-1 which are intensive one-cow farms have relatively high labour inputs per 100 kg of milk, leading to a very low labour productivity in the farms. These farms invest several hours of family labour on a single cow. Smaller intensive farms only use family labour, while all extensive farms use hired labour since they often need a herdsman. The labour productivity of extensive farms is very low because of the low milk yields. It also increases with farm size, since at this scale they only employ one herdsman and the labour input is similar in terms of hours per day while the number of animals on the farms changes. The South African intensive farms have very high labour productivities due to the much high milk yields as compared to the other countries.

Figure 2: Labour costs and productivity



4. Conclusions

Several milk production systems exist in various African countries, each system specific in its input and outputs. Farm costs and returns depend on the degree of intensification of production as well as on the size of the farm. As farms grow larger in size, family resources (especially land and labour) become insufficient and there is a greater need for their acquisition from external sources. Though extensive systems with local cows produce milk at low costs, milk output per cow is very little, leading to very low net cash returns from the dairy enterprise. Large intensive farms such as those in South Africa produce milk at relatively low costs while receiving high returns for the milk sold. This indicates that intensification of production at a large scale is a better alternative for dairy improvement in Africa. Moreover, the role of smallholder intensive dairy systems in improving the nutritional status and generating daily income to poor farmers should not be overemphasised.

References

Holzner, J., 2004. Eine Analyse der internationalen Wettbewerbsfähigkeit der Milcherzeugung an ausgewählten Standorten in Ostdeutschland, der Tschechischen Republik und Estland. *Landbauforschung Völkenrode - Forschungsanstalt für Landwirtschaft Braunschweig*. 282+pp

Hemme, T., 2000. Ein Konzept zur international vergleichenden Analyse von Politik-und Technikfolgen in der Lanwirtschaft. *Landbauforschung Völkenrode, Sonderheft 215 (2000).*

Ndambi, O.A., Hemme, T. and Latacz-Lohmann, U., 2007. Dairying in Africa - Status and recent developments. *Livestock Research for Rural Development. Volume **19**, Article #111*. Retrieved August 8, 2008, from http://www.cipav.org.co/lrrd/lrrd19/8/ndam19111.htm

Nwoko, S.G., 1986. The development of dairy imports in Nigeria. *International Livestock Centre for Africa / Livestock Project Unit Working Paper* No. 10. ILCA, Addis Ababa.

von Massow, V.H., 1989. Dairy imports into sub-Saharan Africa: Problems, policies and prospects. Research Report 17. International Livestock Centre for Africa, Addis Ababa, Ethiopia.