

Smallholder dairy production in Northern Malawi: production practices and constraints

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Abstract Milk production in Malawi is still unsatisfactory despite efforts by different stakeholders to boost the dairy sector. To investigate the roots of the problem, a survey on the current production practices and constraints on smallholder dairy farming was conducted in the Northern Region of the country. A total of 210 farmers were interviewed. The results revealed that farmers had small herd sizes in the region with an average of 2.2 ± 0.6 cattle per farmer. Average herd size was larger in male-managed farms than in female-managed farms (2.6 ± 2.8 vs. 1.8 ± 1.3), farmers with more than 5 years of dairy farming experience had larger herds than those with less experience (2.6 ± 2.8 vs. 1.9 ± 1.2) and farmers who grazed their animals tended to have larger herds than those that stall-fed their animals (4.4 ± 5.1 vs. 1.9 ± 1.3). Average milk production was 8.2 ± 6.5 l per cow per day. Higher average daily milk production was observed in farmers with above primary school education (10.3 ± 8.3 vs. 7.7 ± 5.6), those with

dairy farming as main activity (9.3 ± 6.6 vs. 6.5 ± 6.1) and farmers with more than 2 years of experience in dairy farming (9.3 ± 6.3 vs. 6.1 ± 6.4). Unreliable supply of improved animal genetics, poor animal health, feed shortage and poor prices for milk were considered to be the most important constraints to smallholder dairy farming in descending order.

Keywords Constraints · Dairy farming · Malawi · Production practices

Introduction

About 20% of the world's population are small-scale livestock farmers. They farm most of the agricultural land in the tropics including Malawi where agriculture remains a dominant activity. It contributes to about 39% of the country's gross domestic product (GDP) and employs about 85% of the labour force. The livestock sector alone contributes more than 11% of total GDP and 36% of total agricultural domestic products. Cattle production increased by 32.4% from 1998 to 2008 with a highest cattle population in the Northern Region compared to other regions of the country (Department of Animal Health and Livestock Development (DAHLD) 2005; FAOSTAT 2010).

The average milk consumption in Malawi is estimated to be 4 to 6 kg per capita and year. This is far below the estimated 15 kg per capita for Africa (DAHLD 2005; Chagunda et al. 2010). Additionally, the increasing population and rapid urbanisation around the country's major cities have led to an increase in the demand for milk and dairy products. To satisfy this demand, the productivity of dairy cattle has to improve. In this light, the Malawian Government has put in place strategies such as facilitating farmer's access to improve dairy breeds. Alleviating constraints that limit the

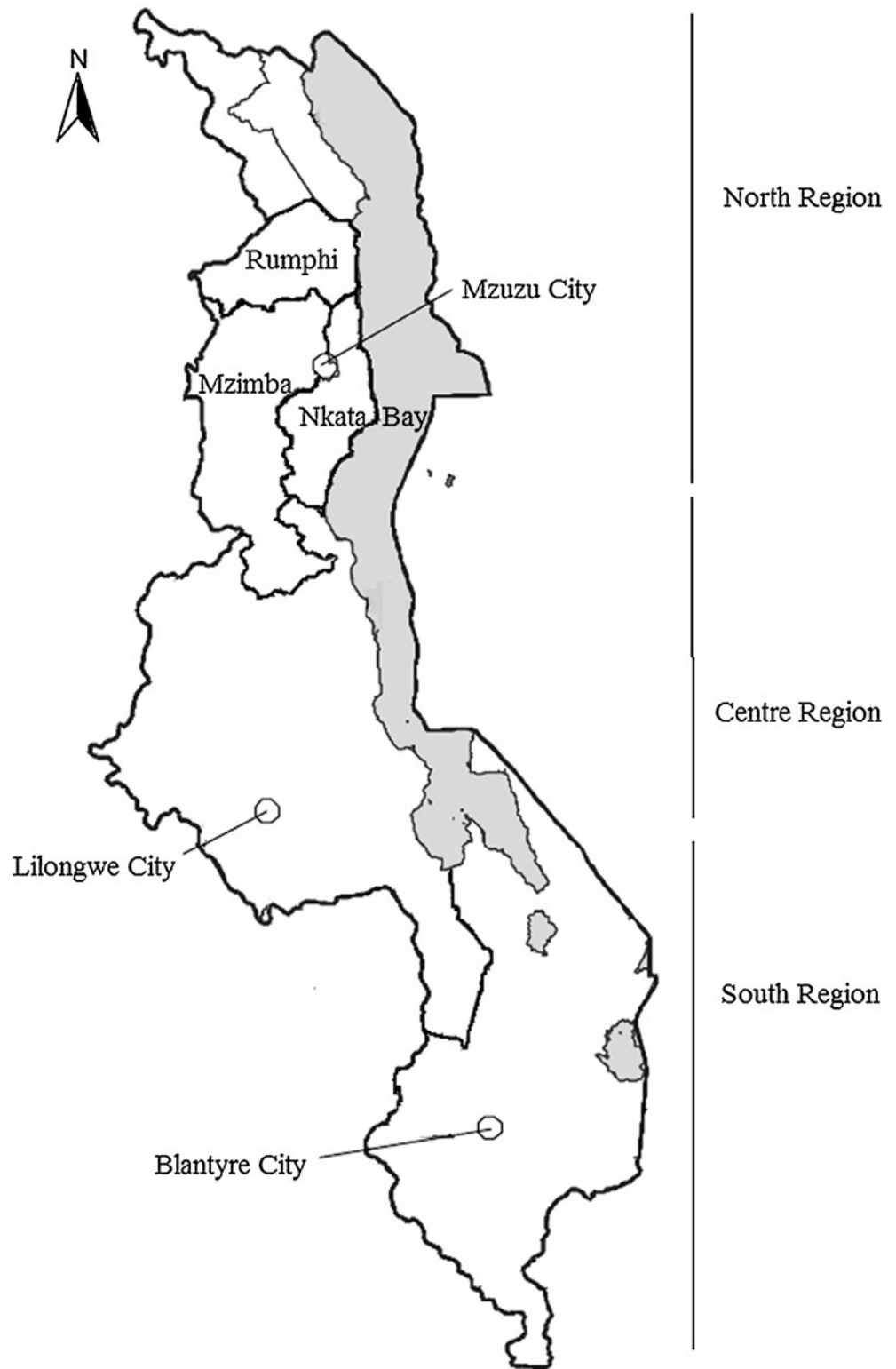
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Fig. 1 Map of Malawi indicating the three regions included in the study (Rumphi, Mzimba and Nkata-Bay). Grey regions represent lakes



productivity of these animals could further boost milk production.

Milk production is dominated by smallholder dairy farming located around the three major cities of the country: Blantyre (Southern Region), Lilongwe (Central Region) and

Mzuzu (Northern Region). Farmers are organised into milk bulking groups (MBGs) around these cities. Those located within a radius of 8 to 10 km transport their milk to a central cooling unit from where milk is collected by processors. Currently, about 80 of these MBGs are present in Malawi.

Table 1 Smallholder dairy farm characteristic (mean±standard deviation) by district

Characteristic	Mzimba (<i>n</i> =124)	Rumphi (<i>n</i> =4)	Nkata-Bay (<i>n</i> =82)	Total (<i>n</i> =210)
Herd size	2.1±1.6a	10.0±10.3b	1.9±1.1a	2.2±0.6
Daily milk yield per cow	7.8±6.2	8.3±2.9	8.9±7.1	8.2±6.5
Price per litre of whole milk in MK ^a	64±18	68±25	55±17	60±2
Duration in dairy farming (years)	4.6±4.4a	5.8±7.8ab	6.3±5.1b	5.3±1.0

Means within a row with different letters are significantly different ($p < 0.05$)

^a The exchange rate of US Dollar to Malawi Kwacha (MK) at the time of this study was 1 USD=150 MK

Many constraints have been reported to limit smallholder dairy farming in the tropics. In a series of reports, unavailable technology, lack of training and finance, low milk price, feed shortage, poor farm management, low productive and reproductive performance and high disease prevalence have been reported as main constraints to smallholder dairy farming in Eastern and Southern African countries (Nkya et al. 2007; Mekonnen et al. 2010; McDermott et al. 2010). Previous studies in Malawi identified poor recording schemes, poor artificial insemination (AI) services and production environment as constraints to smallholder dairy development (Chagunda et al. 1998; Chagunda et al. 2004; Chagunda et al. 2006). Although these reports provide a wealth of information, a study on the current dairy production practices and constraints could provide a better understanding of the constraints faced in the development of the dairy industry in Malawi. The present study investigates the current production practices and identifies constraints and major factors associated with the development of smallholder dairy farming in the Northern Region of Malawi.

Materials and methods

A survey based on a face-to-face interview was carried out in the Northern Region of Malawi. Details of the survey methodology are presented in Kasulo et al. (2010). In summary, the study was conducted in April 2009 in three (Mzimba, Nkhata-Bay and Rumphi) of the five districts in the region (Fig. 1). These districts were those in which smallholder dairy was predominantly practised (Mzuzu Agricultural Development Division (MZADD) 2009). The area has a subtropical climate and is situated 1,200 m above sea level. The average annual temperature was 20°C and mean annual rainfall 1,750 mm. The rainy season lasts from November to April and a dry season from March to October.

Information on the number of dairy farmers and districts in which dairy farming is practised was collected from official reports of the DAHL, MZADD of the Ministry of Agriculture and Food Security. Two hundred and ten farmers

were randomly selected from the three selected districts and included in the survey. These farmers made up 30% of all those actively participating in the activities of MBGs, dairy farming clubs, local institutions and individual farmers in each district.

A structured questionnaire was used. This questionnaire included information on personal details, number and breed of animals kept, average milk production and sales, feeding method and constraints faced. The questionnaires were administered by a team comprising an animal nutritionist, two dairy production officers, assistant veterinary officers and a natural resource specialist. The questions were in English, but later translated into the local Chitumbuka language by the enumerators. All members of the team had a sound knowledge of the local language and were briefed on how to interview farmers on the basis of the questionnaire.

Data analysis

Data obtained were analysed using Microsoft Excel 2007 (Microsoft Corp) and Statistical Package for Social Sciences (SPSS release 12, 2004) computer programs. Descriptive statistics such as means and percentages were generated. Student's unpaired *t* test and one-way analysis of variance followed by Student–Newman–Keuls multiple comparisons test were used to assess the difference between the means of the farmer characteristics and factors studied. *p* values <0.05 were considered significant.

Table 2 Distribution of dairy cattle breeds by district

Cattle breeds	Number of cattle (%)			
	Mzimba	Rumphi	Nkata-Bay	Total
Malawi Zebu	2 (1)	0 (0)	5 (3)	7 (2)
Exotic ^a	198 (76)	38 (95)	111 (73)	347 (76)
Crosses	61 (23)	2 (5)	37 (24)	100 (22)
Total	261 (57)	40 (9)	153 (34)	454 (100)

^a Exotic cattle breeds reared are mainly Holstein-Friesian, Jerseys and Ayrshire

Table 3 Ranking of Smallholder dairy farmers by herd size and by district

Herd size	Percentage of farmers	Mzimba	Rumphi	Nkata-Bay	Number
1	43	56	0	35	91
2	35	40	1	32	73
3	10	11	0	10	21
4	5	7	0	3	10
5	2	3	1	1	5
6	1	2	0	0	2
7	2	4	0	1	5
8	0	0	1	0	1
9	0	1	0	0	1
25	0	0	1	0	1
Total	100	124	4	82	210

Results

Dairy production practices

All 210 farmers had permanent houses for their animals. Ninety percent of the farmers stall-fed and 8% grazed, while 2% stall-fed and grazed their animals, respectively. A majority (54%) of dairy farms were managed by women. Dairy farming was the main activity of 61% of the farmers interviewed, while 20% had no pasture land and depended on fodder from communal land.

Characteristics of smallholder dairy farms are presented in Table 1. Ninety-eight percent of the respondents were located in both Mzimba (59%) and Nkata-Bay (39%) districts. The mean daily milk yield as well as price per litre of milk was not significantly different in all three districts. Herd sizes were significantly larger ($p < 0.001$) in Rumphi compared to Mzimba and Nkata-Bay districts. The mean duration of operational dairy farms in Nkata-Bay was longer ($p < 0.05$) than those in Mzimba district.

Approximately three out of every four (76%) dairy animals owned by farmers were exotic breeds. Exotic cattle breeds reared are mainly Holstein-Friesian, Jerseys and Ayrshire. A majority (57%) of these dairy cattle were owned by farmers in Mzimba district. Dairy herd sizes were variable. Seventy-eight percent of the farmers had one or two animals each, while 7% had more than 5 animals (Tables 2 and 3).

Table 4 Ranking of farmers by average milk produced per cow per day and by district

Average milk production day/cow (l)	Percentage of farmers	Mzimba	Rumphi	Nkata-Bay	Number
<5	33	38	0	32	70
5–10	37	52	3	22	77
11–15	19	26	1	13	40
>15	11	8	0	15	23
Total	100	124	4	82	210

The daily milk yield per cow varied from 0 to 35 l. A majority of the farmers (67%) produced more than 5 l/cow/day (Table 4).

The effect of farm characteristics on herd size and milk yield is illustrated in Table 5. Herd sizes were larger in male-managed herds ($p < 0.05$), farms that have been operational for more than 5 years ($p < 0.01$) and those practising free grazing ($p < 0.01$) either partially or on full time. Average milk production was higher in farmers with at least secondary ($p < 0.05$), farmers whose main activity was dairy farming ($p < 0.01$) and those with more than 3 years of dairy farming experience ($p < 0.01$). Farmers with larger herd sizes produced more milk per cow on daily basis (Fig. 2).

Constraints to smallholder dairy production

Major farmer-identified constraints were divided into six groups (Table 6). The most important constraints in descending order were inefficient breeding programme, high disease prevalence, feed shortage, poor market for milk, poor farm management and poor management of farmer associations.

Discussion

A majority of small holder farmers included in this study came from Mzimba and Nkata-Bay districts. In these

Table 5 Effect of smallholder farmers' characteristics on average herd size and milk yield

Factor and category	Number of farmers	Herd size		Milk yield/cow/day (l)	
		Average	<i>p</i> value	Average	<i>p</i> value
Gender of farm manager					
Male	97	2.6±2.8a	0.01	8.6±6.8	0.42
Female	113	1.8±1.3b		7.9±6.3	
Education					
Primary School	156	2.2±2.3	0.40	7.7±5.6a	0.02
Secondary or High school	44	2.0±1.5		9.9±8.7bc	
Above high school	10	3.0±2.1		11.9±7.7c	
Main activity					
Dairy farming only	128	2.3±2.5	0.23	9.3±6.6a	0.00
Dairy farming and other activities	82	1.9±1.3		6.5±6.1b	
Farming experience (years)					
<3	71	1.7±1.4a	0.01	6.1±6.4a	0.00
3–5	75	1.8±0.1a		9.0±6.3b	
>5	64	2.9±2.8b		9.7±6.4b	
Management systems					
Full-time zero grazing	189	1.9±1.3a	0.00	8.1±6.6	0.34
Partial grazing	5	3.8±2.4bc		12.4±5.4	
Full-time grazing	16	4.6±7.1c		7.94±5.6	

Means in the same column with different letters within the same factor are significantly different ($p < 0.05$)

districts, typical peri-urban smallholder dairy farming is practised. Mzuzu, which is the main city of the Northern Region of Malawi, is situated partly in these two districts. This geographical location provides a ready market for milk and milk products. Moreover, the first MBG in the Northern Region was created in Nkata-Bay district with subsequent expansion to Mzimba and Rumphu districts. This justifies the longer duration of dairy farming reported in Nkata-Bay.

The average herd size observed in the current study was lower compared to findings of previous studies on smallholder dairy farming within Malawi and in other East African countries. Chagunda et al. (2006) reported

an average herd size of 3.5 cattle per farmer in the centre region of Malawi, while Kivaria et al. (2007) and Nkya et al. (2007) reported a mean herd size of 24 ± 10 cattle in urban/peri-urban based smallholder dairy herds in Dar es Salaam region and a range of 5–25 cattle per farmer in Tanga township of neighbouring Tanzania respectively. Also, smallholder farms in Debre-Zeit area and Dejen district, Ethiopia had an average herd size of four and six cattle, respectively (Mekonnen et al. 2006; Mekonnen et al. 2010). The small herd sizes observed in the present study could be a contributing factor to low milk production in the region.

Results of this study reveal higher average daily milk production compared to 5.5 ± 3.8 l recorded in 86 randomly selected smallholder farmers in the centre region (Chagunda et al. 2006). This value, though lower than 10 l reported in Debre-Zeit area, Ethiopia (Mekonnen et al. 2006), is comparable if not higher than the 8.4 ± 3.4 l reported in Tanzania (Kivaria et al. 2007) and 5.2 l reported in Bahir Dar Zuria and Mecha woredas, Ethiopia (Tassew and Seifu 2009), respectively. The relatively low daily milk yield in Malawi reiterates the need to address constraints faced by smallholder dairy farmers in order to boost milk production.

Farmers in the Northern Region predominantly use exotic cattle breeds instead of cross-bred animals as earlier reported in the centre region (Chagunda et al.

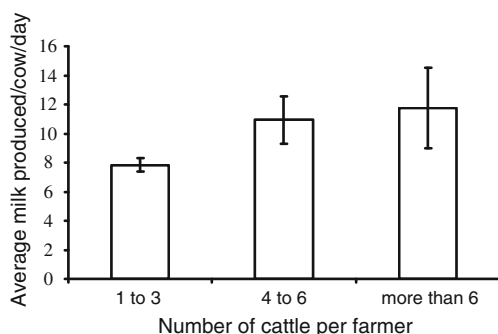


Fig. 2 Average milk production in different herd size groups. Error bars represent standard errors

Table 6 Smallholder dairy farmers' ranking of milk production constrains and possible causes by district

Constraints	Possible causes	Mzimba (<i>n</i> = 124)	Rumphi (<i>n</i> = 4)	Nkata-Bay (<i>n</i> = 82)	Total (<i>n</i> = 210)
1 Unreliable supply of improved animal genetics	unreliable AI service no bulls to complement AI services absence of a liquid nitrogen machine limited number of high grade parent stock low conception rate to AI inadequate training on breeding	58 (47%)	4 (100%)	34 (41%)	96 (46%)
2 Poor animal health	high cost of veterinary medications (drugs) inadequate veterinary and extension services irregular prophylactic programmes high disease prevalence inadequate knowledge on disease management	51 (41%)	0 (0%)	44 (54%)	95 (45%)
3 Feed shortage	limited knowledge on the use of locally available feedstuffs lack of pasture seed less land for pasture improvement poor pastures especially during the dry season	56 (45%)	4 (100%)	31(38%)	91 (43%)
4 Low prices for milk	no reliable price for milk Low demand for milk lack of knowledge and skills in value addition long distance to deliver milk at MBG and market	36 (26%)	0 (0%)	28 (33%)	59 (28%)
5 Poor farm management	inappropriate cattle sheds and equipments scarce material for cattle shed construction inappropriate training on dairy husbandry different information from extension workers	28 (23%)	3 (75%)	20 (12%)	41 (20%)
6 Poor farmer group management	high levies charged by farmers organisation farmers have less influence on the market prices for milk poor information network insufficient funds for group activities	4 (3%)	0 (0%)	7 (9%)	11 (5%)

Figures in parenthesis indicate the percentage of dairy farmers of each district

2006). Most of the dairy cattle in the Northern region were imported and given to farmers on a loan basis by the Malawian government and non-governmental organisations. Moreover, farmer in the region used imported semen through the national AI programme to breed their animals.

Although the involvement of women in dairy farming out weighed that of men, herd sizes of men-managed dairy farms were larger. Smallholder dairy husbandry entails human and material resources such as labour and land for stable construction and pasture improvement. Men are generally regarded as heads of families and have

easier access to these resources. Farmers with access to communal land had larger herd sizes. This further confirms the fact that dairy herd size is closely associated with access to farm resources. Similarly, average milk yield was associated with farmer's education, main activity and experience in dairy farming. The average dairy farming experience of 5 years with about 70% of farmers involved in dairy farming for only up to 5 years suggests an increase in the average milk production in the region with time.

The constraints recorded in the present study are comparable to those identified in smallholder market

oriented dairy systems in peri-urban areas of Tanga, Tanzania (Nkya et al. 2007) and in other East African countries (McDermott et al. 2010). Inefficient AI and bull services continue to be a call for concern. Chagunda et al. (1998) observed that AI services in Malawi were inefficient and did not provide sustainable solutions to farmers a decade prior to this study. Based on the results of the present study, it is evident that the current situation of AI services is similar or worse when compared to the findings 10 years earlier. Moreover, inefficient AI and bull services could have had a spill-over effect resulting in relatively low milk production and small herd sizes reported in this study.

Poor animal health was the second important constraint cited. Mastitis, East Coast Fever, peri-natal calf mortality and retained placenta were among the most common animal health concerns. High cost of veterinary inputs, irregular prophylactic programmes, inadequate knowledge of disease management, and irregular veterinary and extension services account for the high disease incidence in some areas. The inadequate number of veterinary personnel in both the private and public sector could justify the poor health conditions of cattle observed. To alleviate this problem, some stakeholders in the livestock sector embark on short-term majors such as seeking for personnel from without the country. Training more veterinary and animal production personnel would be of valuable importance for the sustainability of the livestock industry in Malawi.

Feed shortage especially during the dry season was another limitation. Most farmers interviewed had less than a hectare of improved pasture land and depended mainly on harvesting fodder from communal pasture land. Capacity building of farmers on the use of locally available feedstuffs, pasture improvement, fodder conservation and use of farm by-products could be of importance in alleviating this constraint.

Low price for milk was ranked fourth constraint in contrast to its ranking on the first position by farmers in Tanzania (Nkya et al. 2007). Limited access to the market and low demand for milk at local level were the assumed reasons for poor milk prices. At the time of this study, the Northern Region had only one milk processor giving farmers little or no choice on where to market their milk. Moreover, most farmers could not afford to move long distances to Mzuzu to sell milk to the urban dwellers on daily basis. Involving dairy processors from the other regions and introduction of value addition to milk could fetch a better market for milk and milk products in the Northern Region.

Results of the present study show that smallholder dairy farming in the Northern Region of Malawi has a huge potential for development. Inefficient breeding

programmes, high disease prevalence, feed shortage and poor market for milk are limiting factors to the development to dairy husbandry. Milk production is dependent on farmer's education, activity and experience in dairy farming. In light of the present husbandry practises and limited land-resource in the urban and peri-urban areas of the region, the establishment of large commercial dairy farms is unlikely. Considering more farmers who could devote most of their time to dairy farming and having above primary education in dairy improvement programmes could be a catalyst to smallholder dairy farming in the region. Detailed studies on constraints identified in this study could help to enhance smallholder dairy farming in Malawi.

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