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DISPOSAL AND REPLACEMENT POLICIES IN KENYA'S SMALLHOLDER DAIRY HERDS

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SUMMARY

Knowledge of disposal and replacement policies is essential in the planning of replacement and breeding programmes in dairy herds. The objective of the present study was to characterise disposal and replacement patterns in smallholder herds using farmer's stated primary reasons for disposal. Data related to exits and entries in dairy herds were available from 987 farms randomly sampled in a cross-sectional survey conducted in the central highlands of Kenya between June 1996 and April 1999. The herds had an average disposal rate of 22% and the entries were 19% replacements into the milking herd. The most frequent reasons for disposal of heifers and cows were diseases (36-38%) and cash needs (27-33%). Cow had an average productive life of 3.7 parities. In the zones with better access to milk market compared to those with poor access, poor performance was less ($p<0.01$) tolerated. It was concluded that smallholders rear their own heifer replacements. The number available is insufficient for the replacement of cows leaving the herd. Deficits are reduced through purchases made largely from other smallholder farms (90%) and less frequently from large-scale farms (10%). Diseases remain a major health problem with negative impact on generation of replacements. Household livelihood needs have great influence on the disposal and replacement patterns in smallholder dairying. Therefore, reproductive management and breeding policies in smallholder dairying cannot be isolated from the interactions between the biological constraints and the socio-economic conditions prevalent to the system.

Keywords: Smallholder dairying, disposal reasons, replacement rate

INTRODUCTION

In Kenya, the majority of smallholder dairy herds are concentrated in the highlands where intensification of agricultural production is necessary due to human population pressure on land (Reynolds *et al.*, 1996). A major constraint as smallholders shift to intensive dairying systems is inadequate feed quantity and quality resulting in sub-optimal reproductive performance. It is reported that realised growth rates are less than 0.25 kg day^{-1} in calves and heifer replacements (Gitau *et al.*, 1994; Omore, 1997). Mortalities are in the range of 10 to 28% among calves, heifers and cows. Ages at first calving are delayed to 3 years and calving intervals are as long as 2 years (Odima *et al.*, 1994; De Jong, 1996; Omore, *et al.*, 1996).

These reproductive indices suggest that the herds may not generate their own replacements and that there are no opportunities for selection to bring about genetic change. Insufficient number of replacement heifers means that the herds cannot maintain their numbers unless there are alternative sources of replacement stock to support smallholder herds. Such alternative sources of replacement stock are limited in Kenya. In the history of dairy development in Kenya (Connely, 1998), privately and publicly owned large-scale dairy farms played the role of producing replacement stock to the smallholder dairy sector. The majority of these farms collapsed or were subdivided.

The objective of this study was to characterise disposal and replacement patterns in smallholder herds using farmer's stated primary reasons for disposal. Such knowledge is essential in the planning of replacement and breeding strategies in dairy herds.

MATERIALS AND METHODS

Data related to exits and entries into dairy herds were available from 987 farms randomly sampled in a cross-sectional survey conducted in the Kenya highlands between June 1996 and April 1999. This region vary in market opportunities for milk depending on the level of local demand, condition and density of roads, availability of milk marketing institutions, distance from and access to Nairobi urban market. Based on these conditions, regions were categorised into high (HMA), medium (MMA) and

low (LMMA) market access. Three production systems were identified including free grazing (FRGZ), mixed grazing (SMGZ) and zero grazing (ZEGZ). Dairy genotypes kept in these systems include crossbreds (50% or less *Bos taurus*), and high-grade dairy (more than 50% *Bos taurus*). The *Bos Taurus* breeds include Friesian, Ayrshire, Guernsey and Jersey.

Data collection was related to events in the past 12 months preceding the survey. Farmers were asked to designate primary reason for animals that died and were sold. Animals were grouped into classes comprising heifer calves (pre-weaned females), heifers (post weaning to first calving) and cows (after first calving). Data on parities at disposal were obtained separately in semi-structured interviews with individual farmers to supplement information unavailable in the cross-sectional survey. Fifty farmers from the three representative market access regions in same sample were interviewed.

Data processing

Disposal was defined as any exit from the herd and included animals that died and were sold. Replacement was any entry into the milking herd. Total population of female animals in the cross-sectional survey comprised 2156 cows and 1042 heifers and 601 heifer calves. Reasons for death were classified into nine broad categories and included death and sales due to diseases, slaughter for meat, death due to poisoning (acaricide, snake bite, and bloat), death due to injury (accidents), and unknown reasons. Reasons for selling were old age, poor performance, needs for cash, and unknown reasons. Poor performance included low milk yield, low growth and infertility.

Statistical procedures

Frequency distribution and cross tabulations were used to describe the occurrence of disposal reasons and parity at disposal by stage of lactation. Analysis of variance was used to evaluate the effect of market access, grazing systems and milk price as a covariate, on age at disposal for poor performance. Parity at disposal was evaluated as a function of market access, source of breeding stock and type of disposal (death and sales). Analyses were performed in SAS System for Windows (SAS Institute, Cary, NC, USA) with GLM and FREQ procedures.

RESULTS

Table 1 shows that the proportion of cows that left the herd varied with the management system practiced. In the intensive systems (SMGZ and ZEGZ) unlike in the extensive (FRGZ), heifers that would reach the milking herd are insufficient for replacement of the cows disposed of. In the aggregate herd, the deficit was reduced by purchase of 4.7% (102) cows, of which 90% originated from other smallholder farms and 10% from large-scale dairy farms.

The most frequent reasons for disposal (Table 2) for cows and heifers were diseases (≥36%) and cash needs (≥27%). Less than 10% of the cows or heifers were disposed of for poor performance.

Table 1. Disposal and replacement components per N cows in the herd by management systems for smallholder dairy herds in the central Kenya highlands

	Grazing systems			Aggregate
	FRGZ	SMGZ	ZEGZ	
Disposal components				
Died	0.110	0.150	0.121	0.123
Sold	0.082	0.120	0.131	0.101
Total disposal	0.192	0.270	0.252	0.224
Replacement components				
Calving rate	0.680	0.500	0.490	0.560
Heifers surviving after:				
Pre-weaning mortality	0.286	0.210	0.213	0.238
Pre-weaning sales	0.283	0.204	0.209	0.233
Post-weaning mortality	0.263	0.177	0.192	0.122
Post-weaning sales	0.247	0.159	0.161	0.187
Heifers reaching milking herd	0.247	0.159	0.161	0.187

Table 3 shows the ages at disposal referring only to cows that were sold. The average age at disposal was 6.9 y and this varied significantly ($p<0.01$) with reason for disposal. The oldest cows were those sold for old age (over 12 y) and the youngest were those sold for unspecified reasons. Cows sold for poor

performance were older (over 7 y) than those sold for cash needs (less than 6 y) and for disease (5.5 y), but were not significantly ($p>0.05$) different.

Table 2. Frequency (%) of disposal reasons for cows and heifers

Reason for disposal	Cows	Heifers
Disease	36.3	37.7
Slaughter	1.7	0.6
Poisoning	2.6	1.9
Injury	6.7	8.8
Deaths unspecified	5.8	3.8
Old age	6.5	0.0
Poor performance	9.9	5.0
Cash needs	27.2	32.7
Sales unspecified	3.4	9.4
Total [a] number disposed	434	167

[a] Reasons for disposal were not collected in one of the nine districts for 49 cows, 34 heifers

Table 3. Effect of disposal reason on age (y) at disposal

	N	Mean	Standard error
Overall	135	6.9	0.30
Old age	18	12.3^{a}	0.74
Poor performance	34	7.2^{b}	0.52
Cash needs	61	5.9^{bc}	0.29
Disease	11	5.5^{bc}	0.67
Unspecified	11	4.6^{c}	0.49
R square: 47.3			

Means with different superscripts are significantly different at $p < 0.01$;

Age of cows sold for poor performance (Table 4) was significantly different ($p<0.01$) between zones but not between grazing systems. Cows sold for poor performance were younger ($p<0.01$) in the high market zones (HMA) compared to low (LMA) and medium (MMA) zones.

Table 5 presents parities at disposal for the data collected during semi-structured interviews with farmers. Cows left the herd at an average parity of 3.7. This was not different ($p>0.05$) between zones. However, cows bought from large-scale farms left the herd at later ($P<0.01$) parity number than cows born within the herd or bought from other smallholder farms. Cows sold had 0.9 more parities than those that died.

Table 6 shows that more cows left the herd in second and third parity. Cows that left the herd were more frequently ($p<0.01$) lactating or pregnant than in dry state. Cows leaving the herd from sixth parity were more likely to be in a dry state.

The fifty farmers in the semi-structured interviews kept a total of 149 cows of which 68% were born within the herd, 25% were purchased from other smallholder farms and 7% were purchased from large-scale farms.

Table 4. Effect of market access, grazing system and milk price on age (y) at disposal for poor performance

	N	Mean	Standard error	Regression coefficient	Standard error
Overall	34	7.2	0.52		
Zone					
LMA	12	7.4^{a}	0.85		
MMA	14	6.8^{ab}	0.73		
HMA	8	5.5^{b}	0.50		
Grazing system					
Free grazing	-	-	-		
Semi -grazing	14	7.4^{a}	0.73		
Zero-grazing	20	6.9^{a}	0.50		
Milk price, ksh l^{-1}				0.75*	0.34
R square: 31.9					

Means with different superscripts are significantly different at $p < 0.01$:

* Significance of regression coefficient $p < 0.05$

Table 5. Effect of market access, source of breeding stock and type of disposal on cow parity at disposal

	n	Mean	Standard error
Overall	144	3.7	0.3
Zone			
LMA	60	3.6[a]	0.3
MMA	31	4.5[a]	0.5
HMA	53	3.3[a]	0.2
Source of cow			
Born within the herd	85	3.5[a]	0.3
Bought from other smallholder farms	51	3.6[a]	0.3
Bought from large scale farms	8	6.3[b]	1.2
Exit type			
Sold	95	4.0[a]	0.2
Died	49	3.1[b]	0.3
R square: 28.1			

Means with different superscripts are significantly different at $p < 0.01$

Table 6. Frequency (%) of cow disposals by parity and lactation stage

Lactation stage	Parity number						Total
	1	2	3	4	5	≥6	
Dry	21.1	18.8	13.8	26.1	18.8	44.0	23.6
Lactating	26.3	43.2	31.0	43.5	62.5	24.0	37.5
Pregnant	31.6	12.9	34.5	13.0	6.3	24.0	20.8
Pregnant/lactating	21.1	25.0	20.7	17.4	12.5	8.0	18.1
Total							
Percentage	13.2	22.2	20.1	16.0	11.1	17.4	
Number	19	32	29	23	16	25	144

DISCUSSION

In this study, deaths and sales contributed almost equally to the total disposals (12.1 vs 10.3% for cows and 8.8 vs 10.5% for heifers). Deaths were due to diseases indicating that animal health is still a major limitation to dairy production in the smallholder systems. The most important diseases to dairy cattle in the central Kenya highlands are East Coast fever and anaplasmosis (Gitau *et al.*, 1999).

Cash needs was the second most frequent reason for disposal after diseases. These sales do not constitute culling related to insufficient performance; sales are made for the livelihoods of the household. Dairy cattle are capital reserves readily convert into cash whenever there is pressing cash needs that demand larger amounts of money than is available from the daily or monthly sale of milk. Such huge cash needs includes school fees and hospital bills.

Disposal for poor performance were less frequent (9.9% cows, 5% heifers) and were made when a cow was in advanced age (7.2 y). This is an indication of long herd-life of cows in the herd, which implies that there are limited opportunities to implement selection for improved performance. It is expected given the high mortality rates in calves and cows in addition to small herd size (1 to 3 cows) kept. However, cows sold for poor performance in the HMA compared to MMA and LMA zones were younger ($p<0.01$) in age (5.5 y) indicating that poor performance was less tolerated with better access to market for milk. In the HMA zones, farmers use more external feeds and there is high membership to cooperative societies offering inputs on credit (Staal *et al.*, 1998) which may be factors for early disposal for poor performance.

Long productive life for cows is beneficial for smallholders to reduce frequent needs for a replacement. The average parity of 3.7 at disposal supports the view that farmers tend to keep cows for long in the herd. It is possible that the age of 6.9 y at disposal is an under-estimation of the cow herd-life in smallholder systems when compared to the productive life of 3.7 parities. Parity at disposal was computed for both dead and sold cows whereas disposal age was available only for cows that were sold. Parity at disposal was lower ($p<0.01$) in cows born within the herd (3.5) or bought from smallholder farms (3.6) compared to those bought from large-scale farms (6.3). It is possible that these cows were purchased as culls already in advanced parity, with an aim of obtaining superior offspring from them before their disposal.

The evidence in this study shows that smallholder dairy producers rear their own heifer replacements. However, available replacements reaching the milking herd were insufficient for the replacement of cows that left the herd. To meet replacement requirements of the herd, purchases were made, largely from other smallholder farms (90%) and less frequently from large-scale farms (10%).

These replacement practices are related to the fact that there are no readily available cheaper sources of replacement stock in the country following the drastic decline in the number of large-scale dairy farms. As such, the available breeding stock is mostly from smallholder farms. The supply of replacement stock is thus very limited making rearing own replacements the next option. This situation leads to competition for the limited feed resources, as feed is inadequate on majority of the farms (Reynolds *et al.*, 1996). Given the high mortality rate among calves and the frequent selling of cows for the livelihood needs, replacement of a dairy cow with dairy heifer must be a complex management decision by the farmer.

CONCLUSIONS

Smallholder dairy producers rear their own heifer replacements and the number available is insufficient for the replacement of cows leaving the herd. Diseases remain a major health problem with negative impact on generation of sufficient number of replacements. Household livelihood needs have great influence on the disposal and replacement patterns in smallholder dairying. Poor performance is less tolerated with better access to the milk market. Therefore, reproductive management and breeding policies in smallholder dairying cannot be isolated from the interactions between the biological constraints and the socio-economic conditions prevalent to the system.

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