INVESTIGATION OF THE MAIN CAUSES OF REDUCTION IN MILK YIELDS BY ZERO GRAZED SMALL HOLDER DAIRY CATTLE IN NDUMBUINI, KIAMBU COUNTY.

A project report submitted in partial fulfillment of the requirements for the award of degree of Bachelor of Veterinary Medicine, University of Nairobi.

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DECLARATION

This project is my original work and has not been presented for a degree in any other University.

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This project report has been submitted for examination with my approval as the University Supervisor.

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ACRONYMS

CMTCalifornia Milk Test.

GDP Gross Domestic Product

GoK Government of Kenya

1.0 ABSTRACT

Small holder dairy farmers may experience unexpected drop in milk yield during the lactation period of their cows. Such cases may be due to subclinical mastitis or any other factors. Since subclinical mastitis does not show visible clinical signs, farmers may fail to notice the occurrence of the condition. Therefore, the prevalence of the condition may not be well documented in the various dairy farms in Kenya and in particular the small holder farms. This study was undertaken to investigate this problem in Ndumbuini, Kiambucounty.

Ten lactating dairy cows from five households in Ndumbuini area were selected for the study. This was done through the use of a semi-structured questionnaire and interviews of the farmers. Daily milk yield for each cow was monitored regularly by checking the records kept by the farmers. Any sudden drops in the yield were noted, and their causes identified. This was done through examination of the animal, housing, stage of oestral cycle, condition of the udder and quality of the milk being produced. Further tests included CMT, which helped identify the presence of mastitis. In cases where no other clinical signs were observed and the CMT results were positive, subclinical mastitis was suspected to be the cause.Subsequently, remedial measures were advised to the farmers to try and rectify the conditions causing the drop in milk yield.

A total of twenty two significant cases of drop in milk yield were noted from the five households. Cows that were deemed to be having sub-clinical mastitis were eight in number. Three similar cases that, however, had negative (trace) results after carrying out CMT were deemed to be due to management factors e.g poor nutrition or poor housing.Other cases of

sudden drop in milk yield had obvious clinical signs and therefore the cause of the drop could be easily picked out e.g clinical mastitis, pneumonia and diarrhoea. TwoFresian cows from a single household were producing very low milk. This was because their lactation period had gone beyond one and a half years.

Subclinical mastitis was found to be a major cause of sudden drop in milk yield. Flactuations in milk yield were also caused by the fluctuations in the amount of feed given to the cows during the lactation period. It was also noted that cows milked for a very long period of time ended up producing very little amount of milk. Monitoring of daily milk yields by the farmers through record keeping was found to be of great importance. This is because any deviations can be easily noted and dealt with promptly before they cause further financial losses.

2.0 INTRODUCTION AND PROBLEM STATEMENT

Dairy industry is the largest agricultural sub-sector in Kenya contributing 14% of agricultural GDP and 3.5% of the total National GDP (GoK, 2008). Most of the dairy farmers are small-holder farmers, typically with 1-4 cattle on approximately 1-2 ha of land. Most dairy production occurs in fertile highland areas supporting large human populations close to major urban centers where demand for milk is high. Lactating cows are generally milked twice a day by hand. For most of them, milk production is low,averaging only 5-8 kg/day (Omore*et al*. ,1996). Since most of the farmers are market-oriented, there is need for them to monitor and ensure maximum and steady milk yield from their cows. Occasionally, most dairy farmers may experience sudden or unexpected drop in milk yield during the lactation period. This is usually due to various factors affecting the cows directly or indirectly. This drop may go unnoticed especially during the early lactation period (Tanner *et al*. ,1998). This eventually ends up affecting the farmers negatively financially .Drop in milk yield is also one of the symptoms of mastitis, especially subclinical mastitis that does not show clinical signs. Daily per head milk losses increase as the somatic cell count increases (Gillespie*et al.*,1998).

3.0LITERATURE REVIEW

3.1 Milk yield in dairy cows

Milk yield in dairy cows varies along the lactation period .The yield generally increases from parturition to about 35 days post-partum and then falls regularly at a rate of about 25% per week to the end of lactation (Macdonalds*et al.*,1995).

3.2 Factors affecting milk yield

Along the lactation period, there may be a fall in daily milk yield due to various factors. Some of the factors include metabolic and infectious diseases, nutrition, stage of lactation, incomplete milking, pregnancy, climatic factors, animal welfare factors and other management factors.

Nutrition has the most influence on the amount of milk any cow produces (Omore*et al.*,1996; Staal*et al.*,1998). Proper feeding and good care allows the cow to produce closer to her potential ability. Nutrient needs in dairy cows vary with the amount of milk produced. If the cow is not fed well, milk production goes down (Gillespie*et al.*,1998). Nutrition should be adequate in quantity and quality e.g adequate dry matter intake, right amount of concentrate supplementation and provision of clean water *ad-libitum*.

Diseases that occur during periparturentperiod like milk fever, retained placenta, metritis, ketosis and displaced abomasums also affect milk yield in dairy cows. Metabolic disease affect dry matter intake and eventually the milk yield (Wallace *et al*. ,1998).

Milk yield also varies along the lactation period due to hormonal changes. As the lactation period proceeds, the milk yield also decreases. In individual cases, yield frequently reaches a peak earlier in lactation and the fall thereafter is much sharper (Macdonalds*et al*.,1995). It is therefore important to take note of the stage of lactation and the amount of milk the cow is producing at each stage. For example, a cow in an early lactation stage is expected to produce a lot of milk.

Animals on heat do experience sudden drop in milk yield. Studies have shown that milk yield decreases during estrus periods. (Loepez*et al*. ,2002 ;2005, Cowman *et al*.,1979). This drop in milk yield has even been used to detect oestrus (Cowan *et al*.,1979).

Other factors that affect milk yield include those that cause a lot of stress to the cow. For example, any pain results in stress, and eventually affects milk yield e.g lameness, colic. Such factors cause low dry matter intake due topoor feeding. (Wallace *et al*. ,1998).

\Mastitis is the inflammation of the mammary gland, regardless of the cause. Although it occurs sporadically, it assumes major economic importance in dairy cattle. Its economic loss is occasioned less by fatalities, although fatal cases do occur, than from the reduction in milk production in the affected quarters. Most estimates show that on average an affected quarter suffers a 30% reduction in productivity and an affected cow is estimated to lose 15% of its production (Radostits*et al*. ,2000).

Sudden decrease in milk yield is therefore one of the symptoms of mastitis. Daily per head losses increase as the somatic cell count in milk increases. (Gillespie *et al*. ,1998)

Since sub-clinical mastitis does not show visible changes in milk or the affected udder, most farmers are unable to detect the disease. This may therefore eventually develop into clinical mastitis. With the inability to detect drop in milk yield, the farmers will just notice a sudden drop in milk yield without being able to notice the cause .Sub-clinical mastitis is usually detected by the reduction in milk yield, altered milk composition and presence of inflammatory components and bacteria in milk**.** This is done through routine tests such as CMT or routine culturing of milk from all quarters Bradford P. Smith , 2002.Decreased milk production accounts for 75% of the production losses due to subclinical mastitis Colleau*et al.* ,1995. Subclinical mastitis may be economically more important than actual clinical mastitis due to the widespread losses. According to De Graves and Fetrow (1993), total milk loss in quarters affected with subclinical mastitis is approximately 10-26% .

4.0 Objectives.

4.1 General Objectives.

To help the local farmers reduce economic losses due to drop in milk yield and to sensitize them on the various causes of drop in milk yield, especially sub-clinical mastitis, which are mostly not detected by many dairy farmers.

4.2 Specific Objectives.

- To determine the most common causes of drop in milk yield in zero-grazed dairy cows.
- To determine how often cases of drop in milk yield are reported.
- To determine the extent of milk yield drop in kg/day (Average).
- To establish whether the farmers put any effort to counter cases of milk-drop syndrome.

5.0 Hypothesis

Most cows that develop drop in milk yield without any visible clinical sign suffer from sub-clinical mastitis.

6.0 Justification.

Dairy farming in Kenya is important in the livelihood of many farm households in rural Kenya in terms of generating income and employment. There is also the presence of a growing human population who include milk as part of their diet. Therefore, it is of great importance that the farmers ensure maximum milk production from their cows. However, many farmers find their

cows are experiencing a sudden drop in milk yield at various extents. Most of them are also not able to identify or explain the causes of the drop. They may also misdiagnose the cause.

This study was therefore important because it can help identify the various causes of drop in milk yield. With such knowledge, remedies and preventive measures can be taken by farmers and ensure that their cows are always producing maximum amount of milk and therefore better returns for their labour.

7.0 Materials and method.

7.1 Study Area

The study was conducted in dairy farms in Ndumbuini area near the CAVS campus in Upper Kabete. Ndumbuini is in Kiambu county, Central province Kenya, lying between latitude 1^0 16' South and longitude 36^0 43' East. It lies at an altitude of 1844m above sea level. The area is characterized by a warm and temperate climate with minimum and maximum temperature ranging from 12.8^0C to 24.6^0C (Chinci Atlas)**.** The area receives an annual rainfall of 1000mm per annum.

7.2Study Farms and Population.

A total of ten lactating dairy cows were selected for the study and monitoring from five different farms in Ndumbuini. They consisted of sixFresians and four Ayrshires. Each of them was also at a different lactation period. The cows were then monitored for three months at the farms. All the cows were milked by hand everyday in the morning and afternoon.

The cows were housed in sheds made of wooden poles and concrete floor. The lighting, ventilation and hygiene at the farms were good. There was also proper drainage, except in farm 2 where there was slurry. They were all zero grazed, except in farm 3 where the cow was at times tethered outside the farm to graze.

The cows were mostly fed grass (Napier and Kikuyu grass) collected from around the farm. In addition, household kitchen remnants and remnants from harvested crops e.g banana stalks were also fed to the Cows. Cows at farm 4 were also fed silage during dry periods. Feeding at all the farms was done in the morning and afternoon. All the farmers also gave the cows dairy meal at an average of 2kg per cow per day. In addition to dairy meal, bran was also given to the cows in farm 4. All the cows were provided with salt licks and clean water *ad-libitum*.

7.3 Methodology and data collection.

Data collection methods used in this study was through use of a semi-structured questionnaire and interviewsof the small holder dairy owners and observationsof the dairy cattle management. These methods were suitable because they could be used on both literate and illiterate farmers.

The farmers were then asked to keep a daily record of the milk yields. The records werecollected at the end of each week and then analysed. The farms were also visited twice a week for observation and monitoring of the condition of the cows. The daily milk yield for each cow was monitored for a period of 3 months. The trend in milk yield levels for each cow was observed and any sudden drops noted. The affected cows were then examined, taking note of the health

status, nutrition, housing, stage of oestral cycle and the condition of the udder and milk produced.The significant findings that were most likely the cause of the drop in milk yield were noted. After noting the cause, an attempt to rectify it was done and the levels of milk produced after the correction were then checked to see if the milk yield returned to normal levels. If a cause of drop in milk yield was not found after the examination, a CMT test was done to establish whether there was subclinical or clinical mastitis. Clinical mastitis was diagnosed when a positive CMT result was found accompanied with clinical signs like swollen, painful udder, fever, clotted milk and anorexia.

To obtain the extent of drop in milk yield in each case, the average milk yield for the previousseven days when the yield was normal was first obtained and then the difference between the lowest yield recorded during the period of drop in milk yield and the average for the seven days obtained. The percentage drop for every case of drop in milk yield was then calculated.

7.4 California mastitis test (CMT)

The California mastitis test was carried out as described by Hoganet*et al.*(1999)and Quinn *et al*. (2004). A squirt of milk, about 2 ml from each quarter was milked directly into each cup of the CMT paddle.An equal amount of the commercial CMT reagent was added to each cup. A gentle circular motion of the paddle in ahorizontal plane was made for 15 Seconds to mix the milk with the reagent. Based on the thickness and color of the formed gel, the test results were scored as 0(negative/trace), +1 (weak positive), +2 (distinct positive), and +3(strong positive).

A positive result accompanied by visible clinical signs like swollen and painful udder, fever, anorexia and depression indicated clinical mastitis while positive results without any visible clinical signs indicated subclinical mastitis.

8.0RESULTS

8.1 Questionnaire and observations results

The flooring in all the units was concrete. They were all well drained except in farm 2, where there was slurry accumulation. The ventilation, lighting and roofing was also poor in the farm. All the farms had clean water provided to the cows*ad-libitum.* The farmers practiced zero grazing, except in farm 3 where the cow was at times tethered outside the farm to graze. The average amount of milk produced by the cows ranged between 2 and 20 liters per cow per day. The farmers were aware that with proper management, the cows had potential to produce more. They also had previously reported cases of drop in milk and in some of the cases, they could not find or identify the causes of the drop. Mastitis had also been reported in all the farms except farm 3. The mastitis cases were noticed by the farmers using the clinical signs and diagnosis by the veterinarian.The farmers also did not do any mastitis test before milking the cows. There were also no proper mastitis control measures in any of the farms. The farmers only washed the teats with warm water and used a single towel to dry all of them. The cows were mostly fed grass (Napier and Kikuyu grass) collected from around the farm. In addition, household kitchen remnants and remnants from harvested crops e.g banana stalks were also fed to the cows. Cows

at farm 4 were also fed silage during dry periods. All the farmers also gave the cows dairy meals at an average of 2kg per cow per day. In addition to dairy meal, bran was also given to the cows in farm 4. All the cows were provided with salt licks *ad-libitum*.

8.2 Cases of drop in milk yield in the five farms and the identified causes

A total of 22 significant cases of drop in milk yield were noted in the 5 farms. Cows that experienced a sudden drop in milk yield and did not show any clinical signs of disease but had a positive (+1 and above) result after carrying out CMT, were deemed to be cases of sub-clinical mastitis. Other cases of sudden drop in milk had obvious clinical signs and therefore the cause of the drop could be easily picked out. Clinical mastitis was diagnosed using CMT and it was also accompanied by clinical signs like swollen and painful udder, anorexia, fever and depression. Pneumonia had signs of respiratory distress, fever, presence of respiratory sounds on auscultation and anorexia. Diarrhoea had signs of fluidy feces, anorexia and fever in one of the cows. TwoFresian cows from a single farm were producing very low milk. This was because their lactation periods had gone beyond one and a half years. One of the cows was culled and the other one dried after four weeks.

At some instances, the cows experienced a sudden drop in milk yield, but however,had negative (trace) CMT results. On examination of the cows, there was no other accompanying clinical sign that would indicate a disease. Such cases were deemed to be due to management factors that eventually affected the normal physiology of the cows to cause a significant drop in the amount of milk the cow was producing. Examples of such factors includedinadequate feed or water supply and poor housing.

The summary of the number of drop in milk yields in the five farms and the identified causes are shown in Table 1 and Figure 1.

Table 1: Summary of the number of cows affected, cases reported and farms affected.

Causes of drop in yield	No. of cows affected $^{x}/_{10}$	Total no. of the cases reported $^{x}/_{22}$	Farms affected by the case. $^{x}/_{5}$
Subclinal Mastitis	6	8	4
Clinical Mastitis	2	2	2
Diarrhoea	1	1	1
Pneumonia (Respiratory distress)	2	2	2
Foot rot	1	1	1
Prolonged lactation period	2	2	1
Management factors	3	6	3

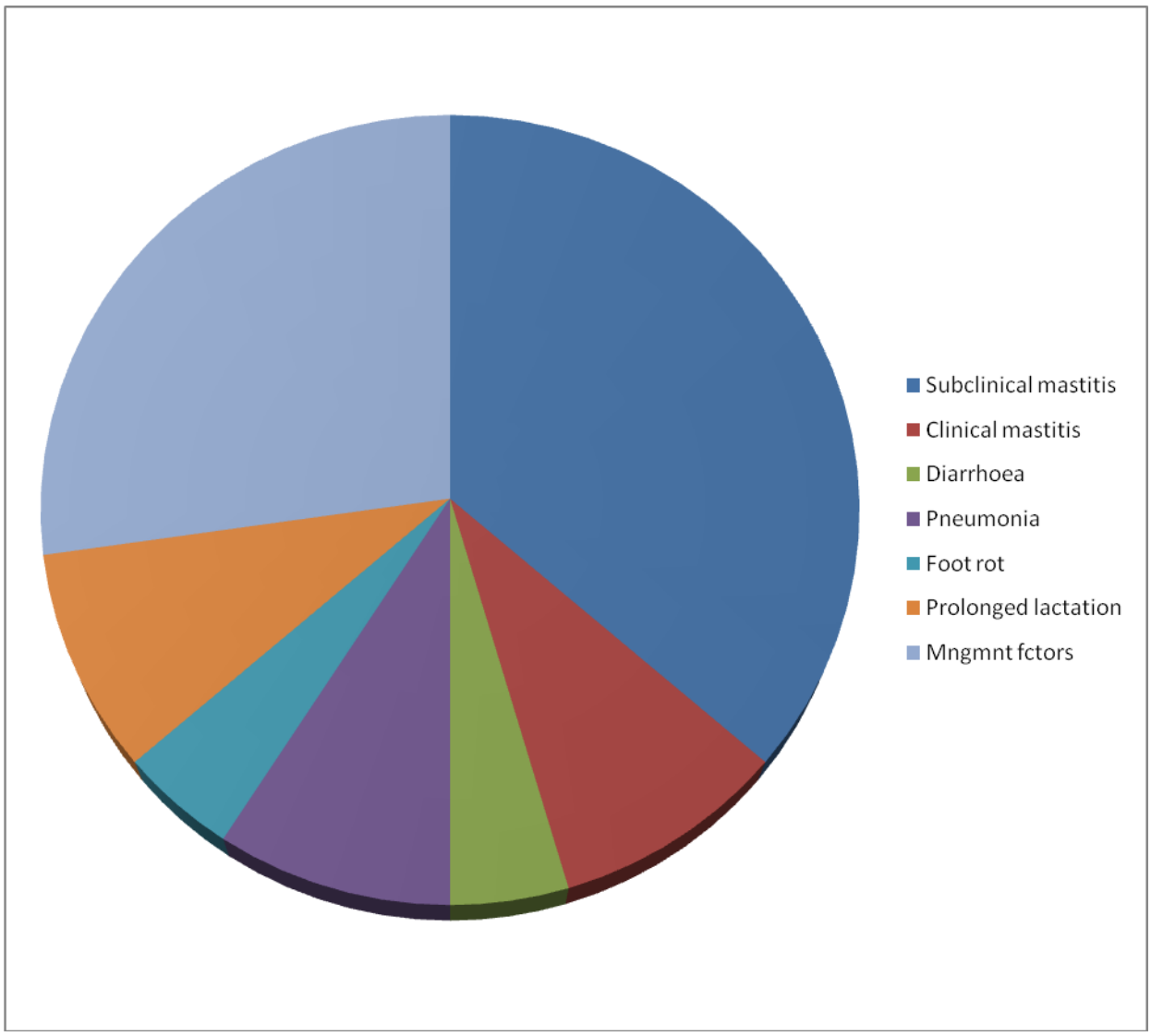

Fig. 1: A summary of major causes of drop in milk yield

The major cause of drop in milk yield in the five farms was subclinical mastitis at 36.4% (8/22), while diarrhoea and foot rot were the least at 4.5% (1/22). (Table 1 and Fig. 1)

Table 2:Extent of drop in milk yield.

FARM	COW I.D	CAUSE OF MILK DROP	EXTENT OF MILK DROP (Percantage drop)
Farm 1	Ayrshire 1	1.Management factors (Heat)	2 Ltrs (11.8%)
		2.Subclinical Mastitis	3 Ltrs (18%)
		3.Management factors	2 Ltrs (13%)
		4.Management factors	2 Ltrs (13%)
	Fresian 1	1.Foot rot	5 Ltrs (26%)
Farm 2	Ayrshire 2	1.Subclinical Mastitis	4 Ltrs (20%)
		2.Pneumonia	5 Ltrs (26%)
		3.Subclinical Mastitis	5 Ltrs (20%)
	Ayrshire 3	1.Clinical Mastitis	> 10 Ltrs (75%)
		2.Management factors	4Ltrs (26%)
		3.Subclinical Mastitis	5Ltrs (29%)
Farm 3	Fresian 2	1.Subclinical Mastitis	4 Ltrs (36.4%)
		2.Management factors	4 Ltrs (36.4%)
		3.Diarrhoea	4 Ltrs (30%)
Farm 4	Itarihia	1.Pneumonia	4 Ltrs (44%)
		2.Management factors	3 Ltrs (36.4%)
	Ina hia	1.Subclinical Mastitis	5 Ltrs (35.7%)
		2.Subclinical Mastitis	4 Ltrs (30.8%)
	Side machine	1.Subclinical Mastitis	5Ltrs (35.7%)
		2.Clinical Mastitis	4 Ltrs (30.8%)
Farm 5	Fresian 3	1.Prolonged lactation	>10Ltrs (>75%)

	Fresian 4	1.Prolonged lactation	>10Ltrs (>75%)

9.0DISCUSSION.

From the above results, it can be noted that subclinical mastitis was the most common cause of drop in milk yield at 36.4% . This was also the same case as it was reported in other studies in different parts of Kenya (Ngatia, 1988; Omore*et al.*, 1996). At 9%, prevalence of clinical mastitis, it is almost similar to 13.3% prevalence reported by Omore*et al.*,1996 for cows from Kiambu.Mastitis was prevalent in all the study farms with a mean of 45.5%. Clinical mastitis was only experienced in two farms over the period of the study. It was noted that in the two farms where clinical mastitis occurred, there was minimal observation of hygiene. The drainage systems in the cow sheds were poor and therefore the floor was very wet with slurry.

Other infectious diseases also caused drop in daily milk yield. They included pneumonia, diarrhoea and foot rot.Such factors usually cause a lot of stress to the cows. For example, any pain due to the diseases resulted in stress, and eventually affected milk yield e.g lameness due to foot rot. Such factors cause low dry matter intake due to poor feeding (Wallace *et al*. ,1998). Due to the low feed intake, there is low production of milk.

Poor management factors also cause a low milk production. For example, a poor housing structure affects the comfort of the animal and this eventually causes stress. Excessive stress causes a low feed intake and therefore reduced milk production. The housing structure at farm 2

had a poor drainage system and there was therefore a lot of slurry present at the farm. This contributed to development of clinical mastitis and diarrhoea. After improving drainage and observing hygiene, the incidences of clinical mastitis reduced. The farmer was alsoadvised to introduce a mastitis control program in order to minimize the incidences of mastitis. With the improved hygiene, there was no more clinical mastitis reported. It also helped increased the healing of the mastitis during treatment.

Under management factors, nutrition was also a major contributing factor to the fluctuations and sudden drops in daily milk yield. Nutrition has the most influence on the amount of milk any cow produces (Omore*et al.*,1996; Staal*et al*. ,1998). This was demonstrated in the farms especially after the amount of feed provided to the cows was varying along the study period with consequent varying in milk yield. With increased provision of feed, the milk yield also increased. This was in agreement with J. Gillespie, 1998, that nutrient needs in dairy cows vary with the amount of milk produced. If the cow is not fed enough, milk production goes down.

Prolonged milking beyond the required period of about 305 days also causes a low milk yield. In farm 5, two fresian cows had been milked for more than one year. The farmer complained that the cows were not showing heat and therefore could not be served. As the lactation period kept on being extended, the milk yield gradually decreased. When the study began, the milk yield was at below 2 liters in both cows. The farmer was advised to synchronize the cows and then serve the cows. He opted to cull one of the cows that was a frequent repeat breeder and serve the other cow after synchronization.

Animals on heat also experience a sudden drop in milk yield. Studies have shown that milk yield during estrus periods are decreasing (Loepez*et al*. ,2002 ;2005, Cowman and Larson, 1979).

However, during my research period, there was only one instance where the cow was found to be on heat when there was a sudden drop in milk yield. Cows on heat tend to consume lesser amount of feed and consequently their milk yield drop.Feed consumption in the cows I was studying may not have changed during my study period and therefore I could not pick out an

instance of drop in milk yield during heat.Another possibility could have been that the drops in milk yield may have coincided with other condition that I was able to single out.

The extent of the drop in milk yield depended on very many factors. Therefore, no significant extent of drop in milk yield could be attributed to a particular disease or any other cause of the drop since it was diversified. However, it was noted that all infectious diseases caused a drop of at least more than 20%. The cows that had been under prolonged milking period had the largest extent of drop in milk yield.

For the period of the study, it was noted that every cow experienced an average of at least two cases of sudden drop in milk yield.This indicated that such cases are bound to be experienced in every dairy cow, but at different frequencies.

10.0 CONCLUSION AND RECOMMENDATION.

From the study, I can conclude that:-

- Sudden drop in milk yield along the lactation period is an important factor among small holder farmers. This is because it affects their monthly returns after selling the collected milk.Subclinical mastitis is the commonest cause of the sudden drop in milk yield among the small holder dairy farmers. Farmers fail to notice the condition because of the absence of clinical signs.
- Feeding is also an important factor that affects the daily milk yield. For maximum and consistent daily milk yields, the farmer must always monitor the feed that he/she provides to the cows to ensure that a regular and consistent amount of feed is provided. Enough water and minerals should also be provided *ad libitum*.
- Any factor that affects the feeding ability of the cow is also an important factor affecting the daily milk yield. This is because they indirectly affect the daily milk yield and can cause a sudden drop depending on their onset. Examples include infectious diseases like pneumonia, diarrhoea, metabolic diseases like ketosis, poor housing structures and pain originating from wounds. They should therefore be dealt with as soon as they are noticed so as to return the daily milk yield back to normal.

- Dairy farmers should also ensure their cows are not milked for a very long period of time (normal period is 305 days). A prolonged lactation period results in gradual drop in milk yield. A dry period of about 60 days should be provided to allow for regeneration of the cow's mammary glands in preparation of the next lactation period.
- It is also important for the small holder dairy farmers to always monitor the daily milk yields of their cows. This can be achieved through taking records of the milk yields after every milking period for each cow. This will then enable them to quickly notice any deviation from normal milk yields. Therefore, there will be an early diagnosis and the cause will quickly be dealt with to ensure the milk yield returns backto normal as soon as possible.

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12.0 Appendices

Appendix 1

OBSERVATION REPORT: TO EVALUATE THE STATE AND THE MANAGEMENT ACTIVITIES OF THE LACTATING DAIRY COWS.

Biodata

Name of owner……..location……

breed……age…….

Number of cattle in the herd……

1.0 OBSERVATIONS

1. Scoring of body condition (1-5)…….

2. State of cleanliness of the animal

3. Physical injuries (old and new) or any abnormality on animal

4. House design and its effect on welfare:

a) Floor type and quality…….

b) Level of drainage……

c) State of ventilation and lighting…….

d) Space for each cubicle…….

5. Quality of water seen in the water troughs…….

6. Quality of feed**…….**

Appendix 2

QUESTIONNAIRE FOR THE FARMER.

1) What type of keeping do you practice? ( )Zero grazing . ( )Grazed. ( )Mixed (Zero grazing and grazed)
2) What is the current average output of milk per animal per day in liters (*Use previous week's records*)…….
3) Do you think your cow can produce more than what it currently produces?.....
4) Has the cow ever experienced any significant drop in milk yield ?.....
5) Did you manage to identify the cause of the drop? ( )Yes ( )No If yes, please give the cause you identified …….
6) Has there been any incidence of mastitis at your farm?.....
7) If "yes", how did you note the mastitis case?.....
8) Do you do any tests for mastitis at your farm before milking?.....
9) Do you take any measures to control mastitis at your farm?( )Yes ( )No Please state if "yes"…… …… …… ……
10) What do your animals feed on?..... ....
11) Do you provide any commercial feed for the cows……
12) If yes, what is the rationale for the commercial feed?……..…….
13) Do you provide them with mineral supplements?.....

14) Have the cows experienced any health problems during this lactation period apart from mastitis?.....

If yes, is there any effect to the milk level?.....