

A SURVEY OF DAIRY-GOAT KEEPING IN ZANZIBAR**Stone TF^{1,2*}, Francis CA^{2,3} and LO Eik¹****Stone Tiffanie**

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ABSTRACT

Dairy goats with improved genetics for milk production were recently introduced onto small-scale farms in Zanzibar through governmental and non-governmental projects. These projects were meant to support small-scale farmers by improving both income and household nutrition through milk production. No follow up had been conducted to understand what effects dairy goat keeping had on these small-scale farms, or how they could be improved. A survey of 193 dairy goat farmers in Zanzibar was conducted, including 30% and 60% of all dairy goat farmers on Unguja and Pemba, the two largest islands, respectively. The objective was to understand the impact keeping dairy goats has on small-scale farming systems, current husbandry practices including feed supply (production and environmental concerns), perceived benefits and challenges of dairy goat keeping (economics), and how to design appropriate extension programs to increase sustainability (education). The survey with 116 questions explored topics including dairy goat feeding practices, goat health, current milk production practices, sale and family consumption, and education. Qualitative and quantitative information from the survey led to a more holistic understanding of dairy goats in the farm system. The survey established the key challenges limiting dairy goat production to be diseases (57% of respondents), feed shortage during dry season (49%), economic constraints (21%), lack of healthcare (18%), and lack of dairy goat husbandry information which would help farmers address the other challenges listed above (14%). Two challenges identified through later workshops were uncontrolled crossbreeding and lack of records. Key benefits of dairy goat keeping are increased income from selling live animals and milk (35%), manure (33%), milk (18%), and improved household nutrition (15%). Twelve percent of respondents reported no benefit from keeping dairy goats. Average milk production for dairy goats was 0.92 L per day for three months of the year, whereas local meat goats milk production peaks at about 0.3 L per day, only enough milk to feed their young. To make dairy goat keeping worthwhile, small-scale farmers need access to appropriate animal health care, milk markets, and additional dairy goat husbandry training. The findings of this survey will guide design of education and improvements to the overall profitability and sustainability of dairy goat integration in Zanzibar and provide a model for the humid tropics.

Key words: dairy goat, tropical husbandry, small-scale farming systems, sustainability, agroecology



List of Acronyms:

ASDP-L – Agricultural Sector Development Program - Livestock

ASSP – Agricultural Services Support Programme

CAHW – Community Animal Health Worker

FFS – Farmer Field School

IFAD – International Fund for Agricultural Development

KATI – Kizimbani Agricultural Training Institute (now part of SUZA)

MANR – Ministry of Agriculture and Natural Resources

MLF – Ministry of Livestock and Fisheries

NMBU – Norwegian University of Life Sciences

NOREC – Norwegian Agency for Exchange Cooperation

PADEP – Participatory Agricultural Development and Empowering Program

SUA - Sokoine University of Agriculture

SUZA – State University of Zanzibar

INTRODUCTION

Located off the coast of East Africa, Zanzibar is a semi-autonomous part of Tanzania with two major islands, Pemba and Unguja. Zanzibar has a population of 1.3 million [1], a high population density, and a growing tourism sector. In rural areas, 73.3% of people live below the food poverty line, making less than 7.78 USD per day [2]. With increased tourism, food imports, and urbanization, farming sustainably and increasing food sovereignty are growing challenges.

Farmers in the humid tropics have the potential to improve stewardship of land, food production, and profitable use of renewable resources through dairy goat production. Farmers in East Africa have been raising goats for meat production for many generations. The Small East African breed is a hardy indigenous meat goat producing only the milk required to keep their young healthy. Well suited to tropical climate and disease, they require few inputs and typically graze extensively. Over the past 35 years, European dairy breeds with increased milk production have been introduced into Tanzania. Imported strains are less tolerant of tropical diseases, making their management more time- and resource-intensive than local meat goats [3]. Some have been crossed with hardy local stock to improve their adaptation to tropical conditions, initially, at the expense of milk production. Dairy goats with higher milk production potential require adequate and appropriate nutrition to perform effectively.

Dairy goats with higher nutrient requirements may cause negative environmental impacts by increasing both imports of supplemental feed and local forage cuttings to maintain milk production, especially during the dry season and lactation period. Raising exotic goat breeds demands planning, management, and an adequate gene pool [4]. To help resolve these challenges, government and non-governmental dairy goat projects have been implemented to support small-scale farmers in Zanzibar and elsewhere in the humid tropics [5].

Farmers are interested in dairy goat keeping in the humid tropics because of the increased milk production and reliable protein source. Goats have shorter gestation periods and lower nutritional requirements than cattle due to their smaller size [4]. Increasing land pressure and urbanization make dairy goats a potentially sustainable option for smallholders in rural and semi-urban areas [6]. In systems where farmers cut and carry forage for confined goats, manure can easily be collected and spread onto vegetable gardens or nearby fields, increasing soil organic matter and fertility in these critical food production areas [7].

To increase sustainable benefits for small-scale dairy goat farmers, it is important to consider economic, environmental, and social impacts. In addition to inputs and outputs of the farming system, we must consider cause and effect relationships and how factors interact [9]. We define sustainability as the farmers' ability to supply food to meet present needs without neglecting the needs of future generations [8]. Government and international dairy goat projects were initiated three decades ago to support farmers in Zanzibar but impacts of these projects were not recorded before this study. Gathering information on dairy goat husbandry practices at the farm system level and identifying

benefits and challenges according to farmer's experiences and perceptions are valuable for designing effective support in the future. The objective of this study was to answer the following research questions: 1) what are current dairy goat husbandry practices in Zanzibar; 2) what are the perceived benefits and challenges of improving dairy goat keeping; and 3) how can improving production practices and education increase sustainability of dairy goat keeping?

MATERIALS AND METHODS

This study uses systems thinking, a holistic framework that encourages farmer participation and qualitative feedback [10], and it requires viewing systems through a multidisciplinary lens that includes farmers' and communities' perceptions. A baseline study of 193 dairy goat farmers from all nine districts of Zanzibar was conducted in 2013. Twenty-nine *shehias*, the smallest governmental unit, were included, each made up of one to several villages. One hundred forty dairy goat farmers in Unguja (30% of households with dairy goats) from 18 *shehias*, and 53 dairy goat farmers in Pemba (60% of households with dairy goats) from 11 *shehias* were interviewed. Dairy goat farmers were randomly selected using an online random number generator based on the percentage of total population that district represented [11]. The interviews took 24 days to complete, and each interview lasted about two hours.

An extensive questionnaire with 10 sections and 116 questions was administered by teachers from the Kizimbani Agricultural Training Institute (KATI) in Unguja, and by employees of the Ministry of Livestock and Fisheries (MLF) in Pemba. The questionnaire was designed and translated to Swahili in collaboration with professors and teachers from the Norwegian University of Life Sciences (NMBU), Sokoine University of Agriculture (SUA) and KATI, by specialists in disciplines related to animal science, agroecology and rural development.

All questionnaire data, both quantitative and qualitative, were compiled into an Excel spreadsheet. Farmers were encouraged to give as many responses as they could, listing several types of fodder or challenges, and not constrained to one response to each question. To highlight the most important results, only data with statistically significant differences are reported. Statistical Package for Social Science (SPSS) 6.1 was used to determine significant relationships between milk production and key quantitative factors [12]. All correlations to milk production were tested using a T-test assuming unequal variance. One-sided p-values at a 0.05 significance level or less are reported as significantly correlated. Interview results were supplemented by information gained in workshops with farmers and future extension agents. These workshops were organized to provide platforms for farmers, future agricultural extension agents and facilitators to exchange knowledge and design meaningful outreach. The workshops provided additional information to answer the key research questions.

RESULTS AND DISCUSSION

Among the 193 farmers interviewed, 52% percent were female and 48% were male. Average age of farmers interviewed was 40 – 49 years ($n= 70$), with a range of 19 to 79 years. Eighty percent of interviewees were married; the average number of children per household was 5.5. The number of years of education for the dairy goat farmers ranged from 0 to 15 years, with an average of 7.5 years. One respondent had education beyond basic secondary (11 years), completing a four-year teacher training (15 years of education). Sixty-two percent of respondents entered basic secondary (8 –11 years), 23% entered primary school (1 – 7 years), and 15% completed 0 years of formal education, characteristics of respondents are summarized Table 1. In some dairy goat projects, inclusion of women was an important objective. For this study, the person primarily responsible for the dairy goats on each farm was interviewed, irrespective of gender.

Factors Correlated with Milk Production

Milk production is an important potential economical and nutritional benefit of dairy goat keeping. The dairy goat management factors with a positive correlation to milk production in this study were record keeping (p -value= 0.0149) and growing fodder for use in the dry season (p -value= 0.0275). Milk production was not positively correlated with Farmer Field School membership (p -value= 0.451), or with dairy goats reported as pure bred (p -value= 0.459).

Important challenges identified by dairy goat farmers in the survey included diseases (57%), feed shortage during dry season (49%), lack of funds (21%), and lack of healthcare (18%) as well as poor support and information deficits (14%). Two additional key challenges identified through later workshops were uncontrolled crossbreeding and lack of records. Understanding key challenges for dairy goat farmers will inform development of goals that will contribute to sustainable livelihood improvements for farmers in Zanzibar and elsewhere. Challenges reported from the survey are summarized in Table 2.

Diseases and Lack of Healthcare

Dairy goat farmers in Zanzibar reported disease as the most important challenge to their operation. Inaccessible animal healthcare was the fourth most important challenge reported. This is not surprising; responses reflected the high rate of dairy goat mortality. In total, 283 dairy goats die annually on the farms surveyed, averaging 1.5 goat deaths per farmer. Survey results showed that 67% of farmers had at least one goat death in the past year, and 37% did not know the cause of death. The number of dairy goat miscarriages recorded in this study was 131. In addition, 38% of farmers had one or more goats that miscarried, and of those farmers 70% did not know the reason for the miscarriages. Almost all dairy goat farmers (99%) had access to medicines, but only 46% had access to vaccines. Though 85% of farmers reported they had access to veterinary services, only 56% use veterinarians to treat their dairy goats. Table 3 provides a list of common dairy goat diseases reported by farmers in Zanzibar. No previous studies on dairy goat diseases in Zanzibar were found in the literature. Goat diseases common in the East African region include Rift Valley fever, Oestrosis, contagious goat pleuropneumonia (PRR), and mange [4]. Both PRR (described as pneumonia) and mange

(described as skin diseases) were reported by farmers, though it can be difficult to distinguish between diseases based on symptoms alone. For example, both PRR and Rift Valley fever have fever as a common symptom and may both have been reported as pneumonia. Diseases affect dairy goat sustainability in the tropics by increasing medical costs and mortalities. In this study, 24% of farmers reported at least one death caused by disease over the past year.

Feed Shortage

Dairy goats need adequate nourishment to produce milk. During the dry season and lactation period in particular, supplemental feeds are an important source of nutrients to maintain milk production. According to our survey, 60% of farmers give their dairy goats supplemental feed, 2.2 kg goat⁻¹week⁻¹ on average. Of the farmers who fed supplemental feed to their dairy goats 88% of them fed maize bran. Maize bran is expensive and mostly imported from mainland Tanzania. Many farmers (45%) with access to land grow fodder to feed their dairy goats; 88% grow elephant grass for use during the dry season. This grass is high in carbohydrates (79.6% total carbohydrates) but not in protein (5.0% crude protein) [13]. The overall ration of a dairy goat would optimally contain between 15 – 17 % crude protein [14].

The average dairy goat farmer has just 0.65 hectares of land individually, although 54% have communal land available. Instead of growing fodder, the majority cut and carry fodder from communal areas. Manure is easily collected in the cut and carry systems and was utilized by 60% of farmers. Manure was the most important non-economic benefit of keeping dairy goats (primarily used as fertilizer in home gardens) according to 156 farmers, ranking above household consumption of milk.

Economic Constraints

The average price per liter of goat milk is 0.87 USD. Milk is highly perishable, and there is no formal market for goat milk in Zanzibar. For many farmers, it is difficult to sell the small quantity of milk produced. Average milk production is only 0.92 L per doe per day. This number excludes 32% of farmers who did not milk their dairy goats at any point in the year. During the dry season, farmers in this study reported 0.44 L of milk per goat per day, while 0.65 L production/day was reported during rainy season. The seasonal yields are lower because does that kidded but were not milked at any point in the year were included for context. In Zanzibar, dairy goats are milked for three months on average. Farmers instead focus on producing live animals that can be sold at a higher price and on a more flexible time frame than milk.

Milk production is not a priority for most farmers in this study. For this reason, many farmers have their dairy goats give birth twice instead of once per year, reducing the milk producing period. Currently, the number of dairy goats in Zanzibar is increasing rapidly. In Tanzania, the dairy goat population has been increasing at a rate of 6% per year [15]. Dairy goat purchase price is extremely variable, between 12 to 217 USD based on perceived quality, age, sex, and location of sale. The average price for a dairy goat was 65 USD when sold from the farmer directly and 87 USD when sold through a middleman. The most important markets for live dairy goats were projects looking to provide dairy goats to other farmers. Most projects have come to an end, and dairy goats are not

sustainable to keep for meat production when local meat goat breeds take less time and resources. Once the market becomes saturated, selling dairy goats becomes economically unsustainable.

Household milk consumption is an important benefit for smallholders. On average, 0.44 L of the milk farmers produce each day in Zanzibar is consumed at home, improving the health of the entire family [3]. Several farmers (n= 4), 2 % of the total respondents in our study, reported producing 3 L of milk per doe per day. This was three times the average production, showing the potential for increased yield with improved management. For comparison, native zebu cattle produce 2.13 L on average during the rainy season [18]. Goat milk has the potential to provide consistent and sustainable economic benefits to farmers if markets are accessible. Most farmers (82%) reported to receive substantial economic benefits from dairy goat keeping. When asked if they wanted to expand their dairy goat keeping operation, 88% responded in the affirmative. Despite the high demand for milk in Zanzibar [19], there is no significant milk processing or value-adding activity for goat milk. Only three farmers who took part in the survey added value by producing yoghurt. Processing milk into value-added products like yogurt could increase the price and offer a more consistent market for goat milk.

Support and Information Deficits

The Agricultural Services Support Programme (ASSP) funded by the International Fund for Agricultural Development (IFAD) gave 93% of the farmers surveyed a dairy goat. The Participatory Agricultural Development and Empowerment Project (PADEP) supported by the World Bank and administered by the Ministry of Agriculture, Livestock and Natural Resources (MANR) in Zanzibar gave dairy goats to 115 of the farmers interviewed. It (PADEP) concluded operations in June 2010 [18]. The Agricultural Sector Development Programme – Livestock (ASDP-L) supported 25 of the farmers interviewed with a dairy goat; also coordinated by MANR, the programme incorporated a Farmer Field School model.

When asked what kind of support projects provided, 54% said the project simply gave them a goat. Only 28% percent said the project offered any training or knowledge about dairy goat keeping. The extent of this knowledge varied widely and appeared to affect dairy goat husbandry practices. Some projects provided only two days of training, with no practical hands-on learning or follow-up meetings with facilitators. Farmer field schools (FFSs) helped to fill the gap; 69% of farmers were part of an FFS. However, only 18% of groups worked collectively, meaning anything from exchanging ideas to physically caring for dairy goats as a community. Other sources of knowledge about dairy goats included: extension agents 38%, personal experiences 9%, and veterinarians 7%. Trimming hooves is a great example of lack of good livestock husbandry practice understanding, since lack of trimming is one of the most important causes of lameness [19]. Overgrown dairy goat hooves were a common sight on farms surveyed. Although trimming requires no special equipment or training, farmers needed to know how and why it is important.

Cross Breeding Challenges

Crossing local goats with pure imported dairy goats is one strategy to improve survival and sustainability because incorporating local goat traits increases disease resistance, thus decreasing mortalities [7]. In Kenya, crosses between dairy and local goats produced 1.5 to 3 L of milk per goat per day [20]. In Zanzibar, production is much lower. Farmers in a dairy goat husbandry workshop following the survey indicated that finding a high quality, unrelated dairy goat buck is increasingly difficult due to the small population size of dairy goat bucks. Most farmers surveyed reported access to a dairy goat buck: 50% borrowed a buck from a neighbor, a cooperative, or a project, 25% used their own buck, and 16% rented a dairy goat buck for breeding. Records on the buck's lineage, milk production of the buck's mother and sisters, are essential to know whether the buck could increase or decrease milk production [21]. Developing dairy goat breeding programs in Zanzibar will be difficult if records are not maintained by farmers and government officials alike [5].

Lack of Record Keeping

The dairy goat farmers in this study did not keep records of their farming operation. Forty-nine percent of farmers surveyed did not keep records of their dairy goat production: 45% of farmers said it was due to lack of education, and 22% did not think it was important to keep records of their dairy goat farming activities. Fifteen percent of dairy goat farmers in this study did not have any formal education. Record keeping and years of formal education are positively correlated; the correlation between record keeping and milk production is also positively and statistically significant (p -value = 0.0149). For those who kept records mean milk production was 0.74 L compared to 0.53 L for farmers not keeping records.

General Discussion

Dairy goats could be a sustainable part of small-scale farming systems in Zanzibar. After surveying husbandry practices and reviewing the literature, we conclude that farmers face important external (drought and lack of healthcare) and internal (lack of records and funds) challenges throughout the humid tropics. Here we highlight examples of effective extension and community efforts that could help alleviate some of the challenges facing small-scale farmers.

Disease was the most important challenge identified by farmers in this study. Although community animal health workers (CAHWs) help improve poor farmers' access to medicines [18], this support is insufficient. Farmer and CAHW trainings need to increase alongside veterinary and extension support to improve sustainability of dairy goat production in the humid tropics [21]. An excellent example of a preventable dairy goat disease is intestinal worms. Imported dairy goats do not tolerate tropical intestinal worms the way local breeds do. Therefore, timely deworming is essential for dairy goat health and well-being. A substantial number of farmers in the interviews and subsequent workshops did not deworm their dairy goats regularly, resulting in unnecessary illness and mortality. Many farmers wanted more training on dairy goat disease prevention and detection. These projects and extension should be demand-driven and participatory to effectively transfer appropriate technologies and information. Providing proper information and training on detecting symptoms for common diseases and disease

prevention measures would create awareness among farmers, technicians and CAHW to help them become better prepared to control common illnesses in dairy goats.

Goats are browsers; trees and shrubs are widespread in Zanzibar, especially in coral rag areas. Coral rag is made up of ancient dried up coral reefs that now house generally unproductive soils. These areas can still sustain drought-tolerant trees and shrubs, which can potentially improve dairy goat health and milk production, especially during dry periods [22]. Leguminous trees and shrubs, including *Gliricidia sepium*, which contain 18-30% crude protein and is commonly grown in Zanzibar, could be a sustainable protein source for dairy goats [23]. These forages provide another way for farmers to improve nutrient intake and maintain milk production while reducing need for purchasing supplemental feed [22]. Knowledge regarding digestibility and crude protein availability in different fodder types could help farmers to select high quality forage species, improving dairy goat health and production. One site visited during this study used bran from a community rice mill to improve dairy goat feeding practices. The mill was built as part of a PADEP project and dairy goat farmers were able to buy the rice bran by-product at a very low price. Rice farmers in the village saved time and money by processing rice at the community mill and livestock keepers used the bran as a local feed source to improve dairy goat health. Utilizing local feed sources, such as rice polish, copra, fish meal and leguminous tree leaves could increase the quality and affordability of supplemental feeds. Using local supplemental feeds would also decrease environmental impacts, providing an improvement across all three spheres of sustainability: economic, environmental, and social.

Projects that sponsored dairy goat integration were cited as important sources of husbandry information. In Zanzibar, informational support will likely need to come from other sources such as extension agents, CAHWs, and experienced dairy goat farmers. This is especially the case for development projects involving new breeds and practices. Management topics were not adequately covered by current outreach that promoted dairy goat integration into farming systems. Survey results and a follow-up workshop increased participation and feedback, with farmers helping identify and develop appropriate extension objectives.

In Zanzibar, 54% of the population in general and 73% of people in rural areas live below the basic needs poverty line [6]. A rapidly expanding tourist market increases demand for value-added products like goat cheese and yoghurt. Goat milk processing could benefit farmers' sustainable livelihoods through a self-sufficient farmer cooperative. As dairy goat projects develop, considering who will benefit from initiatives is essential. For example, developing milk processing units could reduce or eliminate home consumption, taking the nutritional benefits of goat milk away from these rural families. Although the increase in farmers' income could be used to fill this nutrient gap, farmers may not know the important nutritional role of goat milk.

For social sustainability, it is critical to ensure that families receiving dairy goats like the taste of goat milk and know how to prepare it. Many farmers in Zanzibar use goat milk in their morning tea. If goat milk products are affordable, there is great potential for developing cooperatively owned small-scale processing units and community school



feeding programs. This would require less capital to start, improve rural nutrition, and is potentially more sustainable because it would not be connected to volatile tourist markets.

Without proper facilitation or follow-up, it was a major challenge for many new dairy goat farmers to find sound husbandry information. For this reason, some dairy goats were kept like local goat breeds, and farmers were disappointed when their goats did not produce milk at expected rates. Some dairy goats provided by projects were crossbred with local goat breeds, according to farmers. This represented a major challenge because first generation dairy goats crossed with local breeds produce little milk, thus discouraging farmers. Farmers were not given records or background information on the dairy goats they received. For improvements to be sustainable, it is important to implement projects that involve communities, and use a holistic and participatory approach to improve management at the farming system level [10]. A holistic approach would include more than giving goats to farmers. For farmers to continue raising their goats sustainably, they need good information about the genetics of their dairy goats.

Government support and commitment to breeding plans will decrease risk for smallholder farmers and increase dairy goat project's sustainability by incorporating local genetics [21]. Small-scale farmers alone are unlikely to manage crossbred dairy goats without the benefit of adequate milk production. Many farmers in this study thought poor dairy goat breeds were the main reason for low milk production. However, milk production is influenced by a variety of factors. Although crossbred goats produce less milk on average, 0.50 L for crossbred compared to 0.64 L for purebred, the difference was not statistically significant in our study. Factors positively correlated with milk production were growing fodder and record keeping. More research on crossbreeding goats in Zanzibar is necessary to understand its significance.

Farmers need working knowledge of dairy goat nutrition, health, and breeding in the tropics in order to practice good husbandry. Although FFS groups help to spread dairy goat husbandry knowledge, more support and new information is needed to confront daily challenges. Though a wide range of dairy goat husbandry books are available, including hard copies and online versions of other learning materials, most of those materials are not accessible to farmers or available in Swahili. Information based on recall and lack of records are major sources of error in this study.

A positive correlation between milk production and record keeping suggests that records improve management. Keeping track of important dairy goat information helps farmers make informed decisions, improving their husbandry practices. Illiterate farmers are at a disadvantage because it is more difficult for them to access written information and keep records. Literacy and appropriate record keeping systems should be prioritized in future projects because they help farmers track and manage their farming systems effectively, enabling them to confront, understand, and solve important challenges.

Increasing the use of records at the farming system level would increase the government's ability to develop adequate support, including the promotion of workable breeding programmes. Identifying simple, time-saving record keeping systems is essential to



sustainable breeding practices [24]. Due to the low productivity and high disease resistance of existing goats in Tanzania, more control will be needed to select for both improved milk production and disease resistance. Successful dairy goat keeping will require a sustainable supply of quality stock, and good record keeping [24].

CONCLUSION

Analyzing current dairy goat husbandry practices in Zanzibar uncovered both benefits (income and poverty reduction, manure, milk, and improved household nutrition) and challenges (feed shortages, economic constraints, lack of healthcare, and lack of information). Farmers, the community, and government all need to cooperate to create and apply appropriate solutions to confront these challenges. At the farm level, dairy goat farmers need to keep records and provide appropriate nutrition, including high quality fodder species. Developing an effective breeding plan, providing relevant and accessible veterinary and extension services, and improving dairy goat husbandry information and feedback to farmers is essential at the government and community levels.

Participatory research and extension could play an important role in improving dairy goat production. Providing clear and accessible information after project completion, researchers, farmers, and other key stakeholders could work hand in hand to put this to use, improving dairy goat sustainability. Dairy goat research needs to consider the specific challenges smallholders face. Both labor and risk must be addressed if innovations are meant to be adopted by smallholders. Focusing on outcomes instead of outputs is another important change that could bring about long-term improvements, increasing effectiveness of dairy goat research and the sustainability of dairy goat keeping [25]. Dairy goats have potential to improve the livelihoods of small-scale farmers in Zanzibar and across the humid tropics. Providing appropriate and accessible participatory projects, plus extension and feedback, will help to empower farmers and families to improve health and livelihoods, now and in the future.

ACKNOWLEDGEMENTS

We wish to recognize important contributions from NOREC, Tor Arvid Breland (NMBU), Dismas Mwaseba (SUA), Adi Diwan (MLF), Mohamed Rashid (SUZA), Tuva Myklestad (NOREC), and all staff at SUZA and NMBU.



Table 1: Characteristics of Dairy Goat Farmers Surveyed (N=193)

Age	Number of Farmers reporting (193)	Percent of Farmers (%)
0 - 19	4	2
20 - 29	24	12
30 - 39	37	19
40 - 49	70	36
50 - 59	38	20
60 – 69	18	9
70 - 79	2	1
Gender	Number of Farmers reporting (193)	Percent of Farmers (%)
Female	100	52
Male	93	48
Years of Formal Education	Number of Farmers reporting (193)	Percent of Farmers (%)
0	29	15
1 - 7	44	23
8 - 11	119	62
12 +	1	1

Table 2: Challenges of Dairy Goat Keeping in Zanzibar as Reported by Farmers (N=193)

Challenge	Number of Farmers reporting (193)	Percent of Farmers (%)
Disease	110	57
Feed Shortage	94	49
Economic Constraints	41	21
Lack of Healthcare	35	18
Support and Information Deficit	27	14

Farmers provided multiple responses to some questions, thus 307 total responses

Table 3: Common Dairy Goat Diseases in Zanzibar as Reported by Farmers (N= 193)

Disease	Number of farmers reporting (193)	Description
Worms	91	A group of eukaryotic parasitic worms
Influenza	40	A viral infection commonly known as the flu
Nematodes	40	Gastrointestinal nematodes, reported by farmers but not likely
Pneumonia	36	A lung infection caused by fungi, bacteria, or viruses
Diarrhea	34	Loose or liquid bowel movements, many possible causes
Skin diseases	23	Rashes and other external abnormalities

Farmers provided multiple responses to some questions, thus 341 total responses

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