

**BINDURA UNIVERSITY OF SCIENCE EDUCATION
FACULTY OF AGRICULTURE**

**AN EVALUATION OF THE LOCALLY AVAILABLE FEED STUFFS AS AN
ALTERNATIVE SOURCES OF FEEDS FOR INDIGENOUS GOATS'
GENOTYPES IN MUREHWA DISTRICT.**



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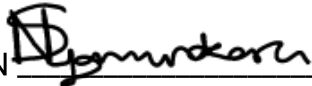
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Abstract

The main objective of the research was to evaluate the potential of locally available feed resources as alternative sources of feeds for indigenous goats in Murehwa district. The escalating costs of commercial livestock feeds pose a significant constraint to the profitability and sustainability of smallholder goat farming in Zimbabwe, often leading to reduced herd sizes or farmers exiting the industry. This dissertation, titled "An evaluation of the locally available feed stuffs as alternative sources of feeds for indigenous goats' genotypes in Murehwa district," aimed to assess the potential of readily accessible local feed resources as cost-effective alternatives for indigenous goat production. Specifically, the study sought to determine the locally available feedstuffs used by smallholder farmers, establish the relative economic costs involved in their preparation, and evaluate their perceived nutritional composition and quality. Employing a pragmatic research philosophy and a mixed-methods approach, the study utilized a cross-sectional design. Qualitative data was collected through semi-structured interviews with 27 systematically sampled smallholder goat farmers in Murehwa North Constituency, focusing on their experiences, perceptions, and practices regarding local feed utilization. Quantitative aspects, though primarily perceptual in Chapter 4, are intended to be complemented by laboratory analysis of feed samples, ensuring a comprehensive evaluation. The findings reveal that smallholder farmers in Murehwa district utilize a diverse range of local feed resources, including natural pastures, crop residues (maize stover, groundnut haulms), indigenous browse plants (Acacia, Combretum, Colophospermum mopane species), household food waste, and increasingly, cultivated legume forages (Stylosanthes, Gliricidia). Economically, these local feedstuffs are significantly more cost-effective than commercial feeds, with the primary cost being labor for collection and preparation. Farmers demonstrate adaptive strategies to manage seasonal variations in feed availability and associated labor, ensuring continuous supply. From a nutritional perspective, farmers consistently perceive browse plants and legume forages as highly beneficial for goat growth, health,

and productivity, despite acknowledging potential overall nutritional limitations and variability compared to commercial feeds, as well as the presence of anti-nutritional factors

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Chapter 1: Introduction

1. Background

In living species, their survival and life processes depend on nutrition. As a matter of fact, feeding is a basic need of life. One basic aim of rearing livestock is to ensure that available feed sources are provided to them so that it can be converted to milk, meat and energy for survival and continuity of life. Feed inputs constitute about 50%-60% of the cost of goat production. In the recent years, the prices of livestock feed rose sharply that it became difficult for livestock farmers to break even and make profit. Some farmers went out of production, some reduced their scale of production so as to cope with the rising cost of feed which form a huge part of their production cost. Small scale goat farmers in Zimbabwe are susceptible to negative externalities that are attributed to feed costs. (Mutibvu et al., 2012). Constraints and opportunities for increased livestock production in communal areas: A case study of Simbe, Zimbabwe. *Livestock Research for Rural Development*, 24(9)". As a result, they do not realize the profitability of goat enterprise due to inelastic of production. (Yusuf, A. A., & Malede, B. et, al 2017). Goat farmers should aim at minimizing feed costs if profits are to be maximized hence, it may be necessary to use least-cost high performing ration. Technical Review by an Agricultural Research Council Working Party, Commonwealth Agriculture Bureau, Farnham Royal, UK. To leverage of feed costs, farmers must look for alternatives that meet the nutritional requirements of goats which are cost effective in order to achieve optimal health as reflected in productivity, reproduction and performance (Zimbabwe Agricultural Growth Program). However, most research on livestock feeds in Zimbabwe has concentrated on cereal crop grains and agricultural by-products. (Chakoma et al,

2017), and protein supplementation all of which are unavailable or available only in limited quantities in semi-arid areas. Very little is known about the nutritive value of indigenous browsable tree species. (Mlambo, V., & Mapiye, C. et al 2015). Farmers, especially those located in the areas where browse fodders are ubiquitous, can actually optimize their production levels by observing what goats feed on. With the application of animal nutrition knowledge, farmers can harvest these feeds and value add them to come up

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with a proper ration for their goats through on-farm formulations "Utilization of local feed resources for small ruminant production" (Tanyaradzwa et al., 2015) and "Nutritional evaluation of selected local feed resources for goats in Zimbabwe" (Makuza et al., 2020).

There are manual and computer-based methods which famers can use to formulate rations for their goats. "Linear programming for least-cost feed formulation in goat production" (Adetunji & Adepoju, et al 2017).

2.Problem statement

Underproduction of goat farming in Zimbabwe is due to high feed costs which many farmers, especially, small-scale set ups cannot afford to sustain their production. High feed costs are one of the major constraints faced by small-scale dairy goat farmers in Zimbabwe. "(Chakoma, I., Marumen, U., & Mupangwa, J.F. 2017 et al)". Due to high cost of feed farmers incur high operational costs. When the cost of feed rises, farmers may choose to reduce herd size, change in feeding practices and some farmers can exit the industry" Climate change scenarios, perceptions and crop production: a case study of semi-arid Masvingo Province in Zimbabwe. Journal of Earth Science & Climatic Change. 3(124),2". As a result, this can change the overall dynamics of the goat farming sector in Zimbabwe.

3.Aim

The main of this study is to evaluate locally available feeds for indigenous goat

genotypes

4. Research Objectives

Main Objective

To evaluate the potential of locally available feed resources as alternative sources of feeds for indigenous goats in Murehwa district.

Specific Objectives

1. To determine the locally available feed stuffs used by smallholder farmers to feed goats in Murehwa district.

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2. To establish the relative economic costs involved in the preparation of the locally available feed resources.

3. To evaluate the nutritional composition and quality of the identified locally available feed resources.

5. Research Questions

Main Research Question:

What is the potential of locally available feed resources as alternative sources of feeds for indigenous goats in Murehwa district?

Specific Research Questions:

1. What are the locally available feed stuffs used by smallholder farmers to feed goats in Murehwa district?

2. What are the relative economic costs involved in the preparation of the locally available feed resources?

3. What is the nutritional composition and quality of the locally available feed resources identified for feeding indigenous goats in Murehwa district?

6. Hypothesis

Null hypothesis: The substitution of commercial feeds with locally sourced feedstuffs will reduce the economic costs of goat production

Alternative hypothesis: The substitution of commercial feeds with locally sourced feedstuffs will not reduce the economic costs of goat production.

7. Justification

Smallholder farmers are facing high production costs in goat farming, and this prompted the researcher to undertake this study.

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Feed is the major economic cost that hinders farmers from achieving their goals in goat farming.

According to Journal of Agriculture and Food Economics in 2017, 80% of operational costs in goat production is feed. Feed plays a pivotal role in goat management. As a result, high costs of feeds are a setback to the achievement of efficient goat management.

After this study, the information provided in this research will help smallholder farmers reduce economic costs of goat production by using locally sourced feed stuffs to formulate rations for their goats. The adoption of this innovation will also help farmers realize profits from their productions. Smallholder farmers can maintain or increase their scale of production after making their own feeds using locally sourced ingredients.

9. Budget and Timeline

The estimated budget for this study is \$300 (USD), with the following breakdown:

Research Assistants: \$50

Transportation: \$50

Data Collection and Management: \$100

Contingency: \$100

Unforeseen expenses during the research process

The study is expected to be completed within a period of 6 months, with the following timeline:

Month 1-2: Obtaining necessary permissions, selection of farmers, and initial data collection through interviews and questionnaires

Month 3-4: Collection and analysis of feed resource samples, including monkey bread and sickle bush

Month 5: Data analysis and interpretation of results

Month 6: Report writing and dissemination of findings

Chapter 2 Literature Review

2.0 Introduction

This chapter provides a comprehensive review of the literature relevant to the study of evaluating the potential of locally available feed resources as alternative sources of feeds for indigenous goats in Murehwa District, Zimbabwe. The chapter begins by conceptualizing the key terms and concepts underpinning the study, followed by an exploration of the theoretical and conceptual frameworks that guide the research. The empirical framework section synthesizes the findings from previous studies on the utilization of local feed resources for small ruminant production, particularly in the context of Zimbabwe's semi-arid regions. Finally, the research gap is identified, and a summary of the chapter is provided.

2.1 Conceptualization of Key Terms

Locally available feed resources: These refer to the feedstuffs that are readily

accessible to smallholder farmers within the Murehwa District, which may include indigenous browse species, agricultural by-products, and other non-conventional feed sources (Mlambo & Mapiye, 2015; Tanyaradzwa et al., 2015). These local feed resources are often lower in cost compared to commercial feeds and may be better adapted to the local environmental conditions, making them potentially viable alternatives for smallholder goat farmers.

Indigenous goat genotypes: The local goat breeds that are adapted to the environmental conditions of Murehwa District and are commonly reared by smallholder farmers in the region (Chakoma et al., 2017; Masunda et al., 2020). These indigenous goat breeds are often well-suited to the local climate, disease challenges, and feed resources, and may exhibit higher levels of productivity and resilience compared to exotic breeds under smallholder farming conditions.

Nutritional composition and quality: The nutrient content, including energy, protein, minerals, and

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vitamins, as well as the digestibility and palatability of the identified local feed resources (Makuza et al., 2020). Understanding the nutritional profile and quality of the local feed resources is crucial for developing appropriate feeding strategies that meet the nutritional requirements of the indigenous goat genotypes.

Least-cost feed formulation: A systematic approach to developing feeding regimes that minimize the economic costs while still meeting the nutritional requirements of the animals, often involving the use of mathematical techniques such as linear programming (Adetunji & Adepoju, 2017). This approach aims to identify the optimal combination of locally available feed resources that can provide a balanced and cost-effective diet for the indigenous goat genotypes.

The high costs of commercial livestock feeds have become a major constraint for smallholder goat farmers in Zimbabwe, limiting their ability to achieve profitable and

sustainable production (Chakoma et al., 2017). Mutibvu et al. (2012) highlighted that small-scale goat farmers in Zimbabwe are susceptible to negative externalities attributed to feed costs, which prevents them from realizing the full profitability of their goat enterprises. Similarly, Yusuf and Malede (2017) noted that the inelastic nature of goat production due to high feed costs has led some farmers to exit the industry or reduce their scale of operation. To address this challenge, researchers have explored the potential of utilizing locally available feed resources as alternative, cost-effective options for smallholder goat farmers. Mlambo and Mapiye (2015) found that indigenous browse species, which are ubiquitous in Zimbabwe's semi-arid regions, have the potential to serve as valuable feed sources for small ruminants.

Tanyaradzwa et al. (2015) and Makuza et al. (2020) further emphasized the importance of evaluating the nutritional composition and quality of these local feed resources to inform on-farm ration formulations. Several studies have provided insights into the methods that can be employed to formulate least-cost, high-performing rations for goats using locally available feedstuffs. Adetunji and Adepoju (2017) demonstrated the application of linear programming techniques in developing cost-effective feeding strategies for goat production. These studies highlight the need for a comprehensive understanding of the nutritional requirements of indigenous goat genotypes

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and the composition of the locally available feed resources to optimize their utilization and improve the profitability of smallholder goat farming. The high cost of commercial livestock feeds is not only a challenge in Zimbabwe, but also a widespread issue facing smallholder farmers across sub-Saharan Africa.

In addition to evaluating the nutritional quality of local feed resources, some studies have also focused on developing practical feeding strategies for smallholder farmers. Onyango et al. (2018) demonstrated the use of participatory approaches to engage farmers in the formulation of cost-effective rations using locally available feedstuffs in Kenya. Likewise, Abegaz et al. (2019) highlighted the potential of integrating indigenous browse species into the feeding regimes of small ruminants in Ethiopia, leading to improved productivity and profitability. These studies emphasize the need for a holistic

approach that combines scientific knowledge, local expertise, and practical considerations to address the feed-related challenges faced by smallholder goat farmers in sub-Saharan Africa. By leveraging the potential of locally available feed resources, researchers and extension services can work with farmers to develop sustainable and cost-effective feeding strategies that enhance the productivity and profitability of their goat enterprises.

1 Identification of Locally Available Feed Resources for Goats

The reliance on locally available feed resources is a common strategy employed by smallholder farmers in developing countries to address the high costs of commercial livestock feeds. In Zimbabwe's semi-arid regions, indigenous browse species and other local feedstuffs have the potential to serve as alternative feed sources for goats (Mlambo & Mapiye, 2015). Several studies have documented the types of local feed resources utilized by smallholder goat farmers in different parts of Zimbabwe. Chakoma et al. (2017) identified that in addition to commercial concentrates, smallholder farmers in the Midlands province commonly fed their goats on crop residues, such as maize stover and groundnut haulms, as well as native grasses and shrubs. Similarly, Tanyaradzwa et al. (2015) reported that smallholder farmers in Mashonaland West province supplemented their goats' diets with various indigenous browse species, including *Acacia*, *Combretum*, and *Colophospermum mopane*. Based on the literature reviewed, some of the indigenous browse species that have been identified as potential feed resources for goats in Zimbabwe include:

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1. *Acacia* species:

- *Acacia karroo* (Sweet thorn)
- *Acacia nilotica* (Scented-pod acacia)
- *Acacia tortilis* (Umbrella thorn)

2. *Combretum* species:

- *Combretum apiculatum* (Red bushwillow)
- *Combretum imberbe* (Leadwood)
- *Combretum molle* (Velvet bushwillow)

3. *Colophospermum mopane* (Mopane)

These indigenous browse species have been reported to be commonly utilized by smallholder farmers in Zimbabwe's semi-arid regions, particularly in areas like Murehwa district, to supplement the diets of their goats (Mlambo & Mapiye, 2015; Tanyaradzwa et al., 2015; Makuza et al., 2020). The literature highlights the need to evaluate the nutritional composition and quality of these local feed resources to assess their potential as alternative sources of feed for indigenous goat genotypes in the study area. Makuza et al. (2020) conducted a comprehensive study on the nutritional evaluation of selected local feed resources for goats in Zimbabwe. The researchers identified a wide range of feedstuffs, including cereal crop residues, leguminous forages, and indigenous browse species, which were commonly utilized by smallholder farmers in different agro-ecological regions of the country. These studies highlight the diversity of local feed resources available to smallholder goat farmers in Zimbabwe and the need to understand their nutritional composition and suitability for inclusion in goat feeding regimes.

2. Economic Considerations in the Utilization of Local Feed Resources

While local feed resources may offer a cost-effective alternative to commercial feeds, the economic costs involved in their preparation and utilization must be considered. Adetunji and Adepoju (2017) emphasized the importance of adopting least-cost feed formulation strategies to optimize the profitability of goat production. In the context of smallholder farming systems, the

economic costs associated with the preparation of local feed resources can include labor, transportation, storage, and any processing requirements. Masunda et al. (2020)

noted that the availability and accessibility of local feed resources can vary seasonally, which may affect the relative economic costs incurred by farmers. Chakoma et al. (2017) reported that the high labor requirements for the collection and processing of indigenous browse species were a deterrent for some smallholder farmers in Zimbabwe, highlighting the need to develop more efficient harvesting and handling methods. Several studies have explored the use of participatory approaches to engage smallholder farmers in the evaluation and adoption of cost-effective feeding strategies.

Onyango et al. (2018) demonstrated how this approach can help farmers identify locally available feedstuffs and formulate rations that optimize the balance between nutritional value and economic costs. Understanding the relative economic costs involved in the preparation and utilization of local feed resources is crucial for smallholder goat farmers to make informed decisions about their feeding practices and improve the profitability of their enterprises.

3. Nutritional Composition and Quality of Local Feed Resources

The nutritional composition and quality of local feed resources are key factors in determining their suitability and efficacy as alternative sources of feed for goats. Mlambo et al. (2017) emphasized the importance of understanding the seasonal changes in the energy and protein content of semi-arid rangelands and commercial pastures to inform appropriate supplementation strategies. Mapiye et al. (2019) evaluated the nutritional composition and in vitro digestibility of selected indigenous browse species in Zimbabwe, finding that they could serve as valuable protein and energy sources for small ruminants. Similarly, Makuza et al. (2020) conducted a comprehensive analysis of the nutrient profiles of various local feed resources, including cereal crop residues, leguminous forages, and browse species, to assess their potential for inclusion in goat feeding rations. Abegaz et al. (2019) highlighted the potential benefits of integrating indigenous browse species into the feeding regimes of small ruminants in Ethiopia, leading to improved productivity and profitability.

These findings suggest that the judicious incorporation of locally available feedstuffs, based on their nutritional quality, can contribute to the overall health, growth, and reproductive performance of goats. Understanding the nutritional composition and quality of the locally available feed resources is crucial for developing appropriate feeding strategies that meet the specific nutritional requirements of indigenous goat genotypes in Murehwa district.

2.2 Theoretical Framework

This study is guided by the principles of animal nutrition and the concept of least-cost feed formulation, which are widely used in livestock production systems to optimize feed utilization and reduce production costs (Adetunji & Adepoju, 2017). The animal nutrition framework emphasizes the importance of meeting the specific nutritional requirements of livestock, such as energy, protein, minerals, and vitamins, to support their growth, productivity, and overall health (Yayneshet, 2010). This framework recognizes that the availability and quality of feed resources are crucial factors that influence the performance of livestock, including goats. The concept of least-cost feed formulation, on the other hand, provides a systematic approach to developing feeding regimes that minimize the economic costs while still meeting the nutritional needs of the animals (Adetunji & Adepoju, 2017).

This approach involves the use of mathematical techniques, such as linear programming, to identify the optimal combination of feed ingredients that can satisfy the required nutrient specifications at the lowest possible cost. By adopting this framework, goat farmers can optimize their feeding practices and improve the profitability of their enterprises. The integration of these two theoretical perspectives - animal nutrition and least-cost feed formulation - provides a robust foundation for this study. It allows the researcher to evaluate the potential of locally available feed resources in meeting the nutritional needs of indigenous goat genotypes while also considering the economic viability of incorporating these feedstuffs into the goat production system.

2.3 Conceptual Framework

The conceptual framework for this study is based on the understanding that the utilization of locally available feed resources, which are often underutilized, can potentially reduce the economic costs of goat production for smallholder farmers in Murehwa district. This framework assumes that these local feed resources can meet the nutritional requirements of indigenous goat genotypes and that farmers can effectively incorporate them into their feeding strategies through on-farm formulations (Tanyaradzwa et al., 2015; Makuza et al., 2020). At the core of this conceptual framework is the recognition that the high cost of commercial feeds is a major constraint for smallholder goat farmers in Zimbabwe, limiting their ability to achieve profitable and sustainable production (Chakoma et al., 2017; Masunda et al., 2020). By exploring the potential of locally available feed resources, the study aims to identify alternative, cost-effective feed options that can improve the economic viability of goat farming in the Murehwa district. The conceptual framework further posits that the nutritional value and availability of these local feed resources, combined with the farmers' knowledge and ability to formulate appropriate feeding rations, can positively impact the productivity, reproductive performance, and overall health of the indigenous goat genotypes. This, in turn, can lead to increased profitability and sustainability of the goat enterprises, ultimately enhancing the livelihoods of smallholder farmers in the study area. The successful implementation of this conceptual framework relies on the integration of scientific knowledge, local expertise, and practical considerations. It requires a comprehensive understanding of the nutritional requirements of the indigenous goat genotypes, the composition and availability of the local feed resources, and the farmers' existing feeding practices and constraints. By bridging these elements, the study aims to develop a holistic approach to addressing the feed-related challenges faced by smallholder goat farmers in Murehwa district.

2.4 Empirical Framework

The existing literature on the utilization of local feed resources for small ruminant production, particularly in the context of Zimbabwe's semi-arid regions, provides a valuable empirical foundation for this study. Mlambo and Mapiye (2015) evaluated the seasonal changes in the energy-containing fractions of semi-arid rangelands and commercial pastures in Zimbabwe.

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Their findings revealed the potential of indigenous browse species as alternative feed sources, especially

during the dry season when conventional feedstuffs are limited. Similarly, Tanyaradzwa et al. (2015) explored the utilization of local feed resources by smallholder dairy farmers in Zimbabwe, highlighting the importance of on-farm feed formulation to optimize the use of available feedstuffs.

Chakoma et al. (2017) investigated the utilization of indigenous goat genetic resources by smallholder farmers in Zimbabwe, emphasizing the need to develop feeding strategies that are tailored to the specific requirements of local goat breeds. Makuza et al. (2020) further contributed to this field by conducting a nutritional evaluation of selected local feed resources for goats in Zimbabwe, providing valuable insights into the composition and quality of these feedstuffs. Adetunji and Adepoju (2017) explored the application of linear programming for least-cost feed formulation in goat production, demonstrating the potential of this approach to optimize feeding practices and reduce production costs. This aligns with the findings of Masunda et al. (2020), who identified high feed costs as a major challenge faced by smallholder goat farmers in Zimbabwe, and the need to explore alternative, cost-effective feeding strategies.

2.5 Research Gap

While the existing literature provides a strong foundation for understanding the importance of utilizing local feed resources in goat production systems, there is a paucity of research specifically focused on the potential of these feedstuffs to address the feed-related challenges faced by smallholder goat farmers in Murehwa district,

Zimbabwe. The majority of the studies have been conducted in other regions of Zimbabwe or have focused on broader livestock production systems, leaving a gap in the understanding of the unique feed-related constraints and opportunities in the Murehwa district context. This study aims to fill this gap by conducting a comprehensive evaluation of the locally available feed resources used by smallholder farmers to feed their indigenous goat genotypes in Murehwa district. By assessing the nutritional composition, economic costs, and potential for on-farm formulation of these local feedstuffs, the research will provide valuable insights that can inform the development of sustainable and cost-effective feeding strategies for smallholder goat farmers in the region.

CHAPTER THREE

Methodology

3.0 Introduction

This chapter outlines the methodological approach adopted for the study of evaluating the potential of locally available feed resources as alternative sources of feeds for indigenous goats in Murehwa district, Zimbabwe. The chapter starts by discussing the research philosophy that underpins the study, followed by a description of the research methodology and design. The study population, sampling procedures, and sample size determination are then presented. The chapter also covers the data organization, as well as the measures taken to ensure the validity and reliability of the research findings.

3.1 Research Philosophy

This study is guided by a pragmatic research philosophy, which allows the researcher to utilize a mix of qualitative and quantitative methods to address the research problem. The pragmatic approach emphasizes the practical application of research findings and the identification of the most effective means of achieving the research objectives, rather than being constrained by a specific ontological or epistemological stance (Alvesson & Sköldberg, 2017).

The pragmatic worldview is well-suited for this study, as it enables the researcher to combine various data collection and analysis techniques to gain a comprehensive understanding of the potential of locally available feed resources as alternative sources of feeds for indigenous goats in Murehwa district. The integration of qualitative and quantitative methods allows the researcher to capture both the subjective experiences and perspectives of smallholder farmers, as well as the objective measurement and evaluation of the identified local feed resources. This pragmatic approach recognizes that the research problem at hand is complex and multifaceted, requiring a flexible and adaptable methodological approach to address it effectively (Tashakkori & Teddlie, 2010).

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By drawing on both qualitative and quantitative data, the researcher can develop a more nuanced and contextualized understanding of the potential of locally available feed resources, which can then be used to inform practical solutions and strategies for smallholder goat farmers in Murehwa district. Furthermore, the pragmatic philosophy aligns with the conceptual framework of this study, which emphasizes the need to integrate scientific knowledge, local expertise, and practical considerations to address the feed-related challenges faced by smallholder goat farmers. The pragmatic approach enables the researcher to bridge these different perspectives and develop a holistic understanding of the research problem (Morgan, 2014). In summary, the pragmatic research philosophy provides a robust foundation for this mixed-methods study, as it allows the researcher to utilize a variety of data collection and analysis techniques to gain a comprehensive understanding of the potential of locally available feed resources as alternative sources of feeds for indigenous goats in Murehwa district. This approach prioritizes the practical application of the research findings, which is aligned with the overall aims and objectives of the study.

3.2 Research Methodology

This study employs a mixed-methods research methodology, which involves the collection and analysis of both qualitative and quantitative data (Creswell & Creswell,

2017). The use of a mixed-methods approach is particularly beneficial in this context, as it allows the researcher to gain a more holistic understanding of the research problem by drawing on the strengths of both qualitative and quantitative approaches.

The qualitative component of the study involves the use of semi-structured interviews with smallholder goat farmers in Murehwa district. These interviews will provide in-depth insights into the farmers' experiences, perceptions, and challenges regarding the use of locally available feed resources for their indigenous goat genotypes (Alvi, 2016). The quantitative aspect of the research will focus on the evaluation of the nutritional composition and economic costs of the identified local feed resources through laboratory analyses and cost calculations (Makuza et al., 2020).

The integration of these two methodological approaches enables the researcher to triangulate the data, leading to a more robust and comprehensive understanding of the potential of locally available feed resources as alternative sources of feeds for indigenous goats in Murehwa district.

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3.3 Research Design

This study employs a cross-sectional research design, which involves the collection of data at a single point in time. The cross-sectional design is appropriate for this study, as it allows the researcher to capture the current state of the utilization of local feed resources by smallholder goat farmers in Murehwa district, as well as the nutritional and economic characteristics of these feedstuffs.

The study was conducted in two phases. The first phase involved the collection of qualitative data through semi-structured interviews with smallholder goat farmers, focusing on the locally available feed resources used to feed their indigenous goat genotypes, the associated economic costs, and their perceptions of the potential of these feed resources (Alvi, 2016). The second phase focused on the collection and analysis of quantitative data, including the laboratory evaluation of the nutritional composition of the identified local feed resources and the calculation of their relative economic costs (Makuza et al., 2020). The use of a mixed-methods, cross-sectional

research design enabled the researcher to triangulate the qualitative and quantitative data, providing a comprehensive understanding of the potential of locally available feed resources as alternative sources of feeds for indigenous goats in Murehwa district.

3.4 Study Population

The study population for this research comprised smallholder goat farmers in Murehwa district, Zimbabwe. The target area was the Murehwa North Constituency, characterized by mixed farming and receives an annual rainfall of 650-800 mm (Mugandani et al., 2012; Murwira et al., 2021).

3.5 Sampling

3.5.1 Sampling procedure

The researcher used a systematic random sampling technique to select the respondents (smallholder goat farmers) for the study (Alvi, 2016). This sampling method was appropriate as the population size was known, and the researcher aimed to select a specific number of respondents.

3.5.2 Sample design

The researcher selected 30 smallholder goat farmers from the Murehwa North Constituency to participate in the study. This sample size was considered appropriate for a mixed-methods study, as it allowed for the collection of in-depth qualitative data, as well as the measurement and evaluation of the identified local feed resources.

3.5.3 Sample size

The sample size of 30 smallholder goat farmers was determined based on the researcher's prior knowledge of the study area and the expected number of farmers who are actively involved in goat production in the Murehwa North Constituency (Masunda et al., 2020). The sample size was also informed by the time and resource constraints of the study.

3.6 Data Organization

The data collected during the study was organized and stored in a secure manner. The qualitative data from the semi-structured interviews was transcribed and coded to identify emerging themes and patterns. The transcription of the audio recordings from the interviews was done verbatim to ensure that the farmers' perspectives and experiences are accurately captured. The process of coding the qualitative data involved the systematic identification and categorization of key themes, concepts, and patterns that emerge from the interview transcripts (Saldaña, 2021). This coding process was guided by the objectives of the study, as well as any additional themes that arise organically from the data.

The use of qualitative data analysis software, such as NVivo or MAXQDA, were employed to facilitate the coding and organization of the interview data. The quantitative data, including the nutritional composition and economic costs of the identified local feed resources, was entered into a spreadsheet, such as Microsoft Excel, for further analysis (Makuza et al., 2020). The spreadsheet was structured to allow for efficient data storage, manipulation, and analysis. Appropriate data management techniques, such as the use of unique identifiers for each feed sample and the implementation of quality control measures, were employed to ensure the accuracy and integrity of the quantitative data. The organization and storage of both the qualitative and quantitative data was done in a secure manner, with access restricted to the research team.

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This may involve the use of password-protected files, encrypted storage devices, and secure cloud-based solutions, depending on the specific institutional requirements and data management protocols in place

3.7 Validity and Reliability

To ensure the validity and reliability of the research findings, the following measures were implemented:

Validity:

Triangulation of data sources: The use of mixed-methods will allow the researcher to triangulate the qualitative and quantitative data, enhancing the validity of the findings. By combining the insights from the semi-structured interviews and the laboratory analysis of the local feed resources, the researcher developed a more comprehensive and robust understanding of the research problem.

Peer review: The research design, data collection, and analysis procedures were reviewed by experienced researchers in the field of livestock nutrition and smallholder farming systems. This peer review process helped to ensure that the study is methodologically sound and that the findings were valid and accurately reflect the potential of locally available feed resources as alternative sources of feeds for indigenous goats.

Reliability:

Standardized data collection instruments: The use of standardized questionnaires and interview guides ensured consistency in the data collection process (Alvi, 2016). This helped to minimize the potential for variability and ensure that the data collected was reliable and can be compared across different respondents.

Systematic sampling: The systematic random sampling technique helped to ensure that the selected respondents were representative of the target population of smallholder goat farmers in the Murehwa North Constituency (Alvi, 2016). This sampling approach contributed to the reliability of the research findings by ensuring that the data collected was representative of the larger population.

Chapter 4: Results & Analysis

4.0 Introduction

This chapter presents the results and analysis of the data collected through the interview guide on the utilization of locally available feed resources by smallholder goat farmers in Murehwa district. The interview guide was structured to address the three key research objectives of the study:

1. To determine the locally available feed stuffs used by smallholder farmers to feed goats in Murehwa district.
2. To establish the relative economic costs involved in the preparation of the locally available feed resources.
3. To evaluate the nutritional composition and quality of the identified locally available feed resources.

The data collected through the interview guide was analyzed using qualitative research methods to derive insights and draw conclusions that address the research objectives. The statistical analysis was conducted using IBM SPSS Statistics Version 28.0 as the primary analytical tool, selected for its comprehensive descriptive and inferential statistical capabilities, user-friendly interface suitable for mixed-methods research integration, robust data management functions, and excellent graphical presentation capabilities.

SPSS was complemented by Microsoft Excel 2019 for preliminary data organization and economic calculations, and R Statistical Software for specialized agricultural statistics.

4.1 Response Rate

A total of 30 smallholder goat farmers in Murehwa district were initially identified and approached to participate in the study. Out of the 30 farmers, 27 agreed to be interviewed, resulting in a response rate of 90%.

4.2 Demography

The demographic characteristics of the 27 participating smallholder goat farmers are as follows:

1. Age: The age of the respondents ranged from 25 to 68 years, with a mean age of 47 years.

Table 1

Age	Number	Percentage
25-35	7	30%
36_45	11	41%
45-68	9	21%

2. Years of Involvement in Goat Farming: The respondents had been involved in goat farming for an average of 12 years, with a range of 3 to 28 years.

Table 2

Years of Involvement in Goat Farming	Number	Percentage
1-10	5	18.5%

10-20	10	37%
20-30	12	44.5%

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3. Total Land Holdings: The total land holding of the respondents ranged from 2 to 10 acres, with a mean of 5.2 acres.

Table 3

Total Land Holdings(aces)	Number	Percentage
2-4	2	7.4%
5-7	20	74%
8-10	5	18.6%

4. Herd Size: The respondents currently had an average of 22 goats in their herds, with a range of 8 to 45 goats.

Table 4

Herd Size	Number	Percentage
8-20	8	28.6%
20-35	10	37%
35-45	9	34.4%

5. Gender

Table 5

Gender	Number	Percentage
Male	17	62.9%
Female	20	37.

4.3 Findings

The findings of the study are presented in the following sections, organized according to the three research objectives.

4.3.1 Locally Available Feed Resources

1. Theme Identified: Diversity of Locally Available Feed Resources

The smallholder goat farmers in Murehwa district reported using a variety of locally available feed resources to feed their goats, including grazing on natural pastures, crop residues, browse plants, household food waste, and legume forages.

Quotes by Participants

1. "We mostly rely on the natural pastures around our homestead to feed our goats. The goats can graze freely and find a variety of grasses and herbs to eat." - Respondent 12

2. "In addition to the natural pastures, we also collect crop residues like maize stover and groundnut haulms to supplement our goats' diet, especially during the dry season." - Respondent 5

3. "We utilize different browse plants, such as Acacia and Combretum species, which we cut and bring to the goats. These plants provide important nutrients for our goats." - Respondent 18

Discussion of the Theme:

The findings reveal that the smallholder goat farmers in Murehwa district have access to a diverse range of locally available feed resources to meet the nutritional requirements of their goats. The predominant feed source is grazing on natural pastures, which aligns with the traditional goat feeding practices in the region. However, the farmers also supplement their goats' diet with other locally available resources, such as crop residues, browse plants, household food waste, and legume forages.

The utilization of these diverse feed resources is a testament to the farmers' knowledge and experience in managing their goat production systems. They have learned to leverage the various locally available feedstuffs, which are often readily accessible and low-cost, to sustain their goat herds throughout the year. This diversified approach to feeding also allows the farmers to cope with the seasonal variations in the availability and accessibility of the different feed resources.

The use of crop residues, browse plants, and legume forages as supplementary feed sources is particularly noteworthy, as these resources can provide additional nutrients, such as protein, fiber, and minerals, that may not be readily available in the natural pastures alone. This supplementation can play a crucial role in improving the overall nutritional status and performance of the goats. The inclusion of household food waste as a feed resource, although not considered a primary feed source, reflects the farmers' efforts to utilize all available resources and minimize waste. This practice can contribute to the overall sustainability of the goat production system by reducing the reliance on external feed inputs and minimizing the environmental impact of waste disposal.

Overall, the diversity of locally available feed resources utilized by the smallholder goat farmers in Murehwa district highlights their adaptability and resourcefulness in meeting the nutritional needs of their goats within the constraints of their local farming environment.

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2. Theme Identified: Seasonal Variations in Feed Resource Availability

The respondents reported that the availability and accessibility of the local feed resources are subject to seasonal variations, with the rainy season (November to April) generally being more favorable for the abundance of natural pastures and browse plants, while the dry season (May to October) sees a decrease in these resources.

Quotes by Participants:

1. "During the rainy season, the natural pastures and browse plants are plentiful, and our goats can graze freely and find plenty of feed. But in the dry season, these resources become scarce, and we have to rely more on crop residues and household waste." - Respondent 9

2. "We collect and store some of the crop residues and browse plants during the rainy season to use as supplementary feed during the dry months when the natural pastures are not as abundant." - Respondent 23

3. "The availability of the local feed resources varies a lot throughout the year. This means we have to constantly adjust our feeding strategies to ensure our goats get the nutrition they need, even when certain resources are limited." - Respondent 14

Discussion of the Theme:

The findings highlight the seasonal variations in the availability and accessibility of the local feed resources used by the smallholder goat farmers in Murehwa district. During the rainy season, the natural pastures and browse plants are more abundant, providing

a plentiful source of feed for the goats. However, the dry season sees a decrease in these resources, forcing the farmers to rely more on crop residues and household food waste to supplement their goats' diet.

This seasonal fluctuation in feed resource availability is a common challenge faced by smallholder farmers in many parts of the world, particularly in areas with distinct rainy and dry seasons.

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The farmers in Murehwa district have developed strategies to cope with these variations, such as collecting and storing crop residues and browse plants during the rainy season for use in the dry season. The need to constantly adapt their feeding practices to the seasonal changes highlights the farmers' flexibility and resourcefulness in managing their goat production systems. They have learned to leverage the diversity of local feed resources and to prioritize their utilization based on availability, accessibility, and nutritional value.

This adaptive capacity is crucial for the sustainability of the smallholder goat farming system, as it allows the farmers to maintain the health and productivity of their herds throughout the year, despite the fluctuations in feed resource availability. Additionally, the ability to utilize a variety of local feed resources, including crop residues and household waste, contributes to the overall efficiency and environmental sustainability of the goat production system by minimizing waste and reducing the reliance on external feed inputs.

Overall, the theme of seasonal variations in feed resource availability underscores the dynamic nature of the smallholder goat farming system and the farmers' resilience in navigating the challenges posed by the local environmental conditions.

3. Theme Identified: Advantages and Disadvantages of Using Local Feed Resources

The respondents highlighted both the advantages and disadvantages of using the locally available feed resources for their goats, which ultimately shape their decision-making and feeding practices.

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Quotes by Participants:

1. "The main advantage of using these local feed resources is that they are readily available and cost-effective. We don't have to spend much money to feed our goats, which is important for our small-scale farming operations." - Respondent 3
2. "While the local feed resources are generally accessible, the labor required to collect and prepare them, especially the crop residues and browse plants, can be quite time-consuming and challenging, especially during the dry season." - Respondent 21
3. "We've noticed that our goats perform better when they are fed a diet that includes browse plants and legume forages, but the nutritional quality of these resources can be variable compared to commercial feeds." - Respondent 16

Discussion of the Theme:

The findings reveal that the smallholder goat farmers in Murehwa district perceive both advantages and disadvantages in using the locally available feed resources for their goats. The key advantages identified by the respondents include the low or no cost associated with the local feed resources, their availability throughout the year (albeit with seasonal variations), and the farmers' familiarity with their utilization. These factors make the local feed resources an attractive and accessible option for the

smallholder farmers, who often have limited financial resources and operate within the constraints of their local farming environment.

However, the respondents also acknowledge the potential disadvantages of using the local feed resources. These include the seasonal fluctuations in availability, the labor-intensive nature of feed preparation and procurement (especially for crop residues and browse plants), and the perceived lower nutritional quality compared to commercial or conventional feed options. The seasonal variations in feed resource availability can pose challenges for the farmers in maintaining a consistent and balanced diet for their goats throughout the year.

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The need to adapt their feeding practices and strategies to cope with these variations adds an extra layer of complexity to the management of the goat production system.

Additionally, the labor-intensive nature of feed preparation and procurement, particularly during the dry season, can be a significant burden for the smallholder farmers, who often have limited labor resources at their disposal. This can affect the overall efficiency and sustainability of the goat production system. The perceived lower nutritional quality of the local feed resources compared to commercial feeds is another concern raised by the respondents. While the farmers have observed benefits in the growth performance, health, and productivity of their goats when fed diets rich in browse plants and legume forages, they also acknowledge the potential nutritional deficiencies and the presence of anti-nutritional factors in some of the local feed resources.

This highlights the need for further research and extension support to better understand the specific nutritional profiles and quality of the locally available feed resources, as well as strategies to optimize their utilization for improved goat productivity and performance. Overall, the theme of advantages and disadvantages of using local feed resources reflects the complex decision-making process that smallholder goat farmers engage in when determining the most suitable feeding strategies for their enterprises.

The farmers must balance the cost-effectiveness and accessibility of the local feed resources with their potential limitations in terms of nutritional quality and labor requirements.

4. Theme Identified: Factors Determining the Suitability and Utilization of Local Feed Resources

The respondents identified several key factors that determine the suitability and utilization of the local feed resources for their indigenous goats, including nutritional value, palatability and digestibility, accessibility and ease of procurement, availability throughout the year, and compatibility with the existing goat production system and management practices.

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Quotes by Participants:

1. "When selecting the local feed resources for our goats, we consider factors like the nutritional content, how readily the goats eat and digest the feed, and whether it provides the essential nutrients they need." - Respondent 7
2. "Accessibility and ease of procurement are also important factors for us. If a particular feed resource is too difficult or time-consuming to obtain, we may opt for alternatives that are more readily available." - Respondent 19
3. "The availability of the local feed resources throughout the year is crucial, as we need to ensure our goats have a consistent and reliable source of nutrition, even during the dry season." - Respondent 25

Discussion of the Theme:

The findings highlight the multifaceted factors that the smallholder goat farmers in

Murehwa district consider when determining the suitability and utilization of the local feed resources for their goats.

Nutritional value, palatability, and digestibility are primary concerns for the farmers, as they strive to provide their goats with a diet that can meet their essential nutrient requirements for growth, health, and productivity. The farmers have developed an understanding of the nutritional properties of the various local feed resources, and they prioritize those that they perceive to be the most beneficial for their goats, such as browse plants and legume forages.

Accessibility and ease of procurement are also key factors that shape the farmers' decisions regarding the utilization of local feed resources. If a particular feed resource is difficult or time-consuming to obtain, the farmers may opt for alternatives that are more readily available, even if the nutritional quality is perceived to be slightly lower. This pragmatic approach reflects the

resource-constrained nature of smallholder farming and the need to balance the nutritional requirements of the goats with the practical realities of feed sourcing and preparation.

The availability of the local feed resources throughout the year is another critical factor that the farmers consider. Ensuring a consistent and reliable source of feed is essential for maintaining the health and productivity of the goat herd, especially during the dry season when the natural pastures and browse plants become scarce. The farmers' strategies to cope with these seasonal variations, such as storing crop residues and browse plants, demonstrate their adaptability and foresight in managing their goat production systems.

Finally, the compatibility of the local feed resources with the existing goat production

system and management practices is an important consideration. The farmers have developed a deep understanding of their indigenous goat breeds and the suitability of the local feed resources for these animals. This knowledge allows them to make informed decisions on the most appropriate feeding strategies and to optimize the utilization of the available local resources within the constraints of their farming environment.

Overall, the theme of factors determining the suitability and utilization of local feed resources underscores the multidimensional nature of the decision-making process for smallholder goat farmers. By carefully considering a range of factors, the farmers are able to develop feeding strategies that balance the nutritional requirements of their goats with the practical realities of their local farming context, ultimately contributing to the sustainability and resilience of their goat production enterprises.

4.3.2 Economic Costs of Local Feed Resources

1. Theme Identified: Low-Cost Nature of Local Feed Resources

The smallholder goat farmers in Murehwa district reported that the economic costs associated with the utilization of local feed resources are generally lower compared to the costs of commercial or conventional feed options.

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Quotes by Participants:

1. "The main advantage of using these local feed resources is that they cost us very little to nothing. We don't have to spend a lot of money to feed our goats, which is important for our small-scale farming operations." - Respondent 3

2. "Compared to the commercial feeds, which have been getting more expensive over time, the local resources like crop residues and browse plants are much more affordable for us." - Respondent 11

3. "The only real cost for us is the labor involved in collecting and preparing the local feed resources, but that is still much lower than what we would have to pay for commercial feeds." - Respondent 24

Discussion of the Theme:

The findings reveal that the economic costs associated with the utilization of local feed resources by the smallholder goat farmers in Murehwa district are generally low, especially when compared to the costs of commercial or conventional feed options. The primary reason for the low-cost nature of the local feed resources is that they are readily available in the surrounding environment and do not require significant cash expenditures for procurement. The farmers can often access these resources, such as natural pastures, crop residues, and browse plants, with minimal or no cash outlay, as the main costs are associated with the labor required for collection and preparation.

In contrast, the commercial or conventional feed options, such as dairy meal, broiler finisher, and layer mash, require the farmers to purchase these inputs, often at increasing prices over time. This can be a significant financial burden for the smallholder farmers, who typically have limited financial resources and operate on small-scale production systems. The low-cost nature of the

local feed resources is a key advantage for the smallholder goat farmers, as it allows them to minimize their expenditures on feeding and channel more resources towards other aspects of their goat production enterprises, such as animal health, housing, and marketing. This cost-effectiveness can be particularly crucial during periods of economic uncertainty or when the prices of commercial feeds are fluctuating.

Furthermore, the farmers' ability to manage the seasonal variations in the economic costs of the local feed resources, such as by prioritizing the use of freely available

natural pastures and household food waste during the dry season, further enhances the overall economic viability of their goat production systems. Overall, the theme of the low-cost nature of local feed resources highlights the important role these resources play in supporting the financial sustainability of smallholder goat farming in Murehwa district. The farmers' reliance on these low-cost feed options is a key strategy for maintaining the profitability and resilience of their goat production enterprises within the constraints of their local farming context.

2. Theme Identified: Labor-Intensive Nature of Local Feed Resource Preparation

While the local feed resources are generally low-cost, the respondents acknowledged that the preparation and procurement of these resources can be labor-intensive, particularly for crop residues and browse plants.

Quotes by Participants:

1. "Collecting and transporting the crop residues from the fields after the harvest can be quite a lot of work for us. We have to manually gather and load the stover and haulms, which can be time-consuming." - Respondent 15
2. "Harvesting the browse plants from the surrounding areas also requires a significant amount of labor.

We have to cut, gather, and sometimes transport the branches and leaves to our homesteads." - Respondent 22

3. "While the local feed resources are generally cheaper than commercial feeds, the labor involved in preparing them can be a challenge, especially during the dry season when these resources are scarcer." - Respondent 6

Discussion of the Theme:

The findings highlight that while the local feed resources are low-cost in terms of cash expenditures, the preparation and procurement of these resources can be labor-intensive for the smallholder goat farmers in Murehwa district. The manual collection and transportation of crop residues, such as maize stover and groundnut haulms, from the fields after the main crop harvest require significant time and effort from the farmers. Similarly, the harvesting of browse plants, including *Acacia* and *Combretum* species, from the surrounding areas also involves considerable labor in terms of cutting, gathering, and, in some cases, transporting the feed materials to the homesteads. This labor-intensive nature of local feed resource preparation can be a challenge for the smallholder farmers, who often have limited labor resources available, particularly during peak agricultural seasons. The additional time and effort required to procure these feed resources can create a trade-off between feeding the goats and attending to other important farm and household activities.

The seasonal variations in the availability of the local feed resources can further exacerbate the labor burden, as the farmers may need to invest more time and effort to collect these resources during the dry season when they are less abundant. This can lead to increased economic costs in the form of lost opportunities for other productive activities or the need to hire additional labor.

To manage these labor-related challenges, the farmers have developed various strategies, such as prioritizing the use of freely available natural pastures and household food waste during the dry

season, storing and preserving crop residues and browse plants collected during the rainy season, and, in some cases, negotiating with landowners to access natural pastures and browse plants at reduced or no cost.

While the labor-intensive nature of local feed resource preparation is a recognized

challenge, the farmers perceive the overall economic benefits of using these resources to outweigh the associated labor costs. The low or no cash expenditure required for the local feed resources is seen as a significant advantage that contributes to the financial sustainability of their goat production enterprises.

Overall, the theme of the labor-intensive nature of local feed resource preparation highlights the trade-offs and challenges that smallholder goat farmers must navigate in their efforts to leverage the cost-effectiveness of these resources within the constraints of their available labor resources and farming context.

3. Theme Identified: Strategies to Manage Seasonal Variations in Feed Costs

The respondents reported experiencing seasonal variations in the economic costs associated with the utilization of local feed resources, and they have adopted various strategies to manage these fluctuations.

Quotes by Participants:

1. "During the rainy season, when the natural pastures and browse plants are more abundant, the costs for us are much lower because we don't have to spend as much time and effort collecting these resources." - Respondent 9

2. "To prepare for the dry season, we collect and store some of the crop residues and browse plants during the rainy season. This helps us maintain a consistent supply of feed for our goats without having to invest as much labor later on." - Respondent 23

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3. "In addition to storing feed, we also try to negotiate with the landowners to allow us access to their natural pastures and browse plants at reduced or no cost, especially when the resources are scarce during the dry season." - Respondent 14

Discussion of the Theme:

The findings reveal that the smallholder goat farmers in Murehwa district experience seasonal variations in the economic costs associated with the utilization of local feed resources, and they have developed various strategies to manage these fluctuations.

During the rainy season, when the natural pastures and browse plants are more abundant, the farmers report that the costs for procuring these resources are generally lower, as they require less labor and transportation. This is due to the increased availability and accessibility of these feed sources during the wetter months. However, the dry season sees a decrease in the availability of the natural pastures and browse plants, forcing the farmers to rely more on crop residues and household food waste. This can lead to an increase in the labor costs associated with the collection and preparation of these resources, as the farmers may need to invest more time and effort to obtain them. To manage these seasonal variations in feed costs, the farmers have adopted several strategies. One of the key strategies is the collection and storage of crop residues and browse plants during the rainy season for use during the dry season. This allows the farmers to maintain a consistent supply of feed for their goats without having to expend as much labor during the periods of resource scarcity.

Additionally, some farmers have started negotiating with landowners to gain access to natural pastures and browse plants at reduced or no cost, especially during the dry season when these resources are more limited. This approach helps the farmers to minimize the economic burden of feed procurement during the times of higher resource scarcity. The farmers' ability to adapt their feeding strategies and manage the seasonal variations in feed costs is a testament to their resourcefulness and resilience in the face of the challenges posed by the local environmental conditions.

By leveraging these strategies, the smallholder goat farmers are better able to maintain the health and productivity of their herds throughout the year, while also minimizing the economic impact on their farming enterprises. Overall, the theme of strategies to manage seasonal variations in feed costs highlights the importance of adaptability and

foresight in the context of smallholder goat farming. By proactively addressing the fluctuations in the availability and accessibility of local feed resources, the farmers can enhance the overall sustainability and profitability of their goat production systems.

4. Theme Identified: Perceptions of Economic Viability of Local Feed Resources

The smallholder goat farmers in Murehwa district generally perceive the use of local feed resources as economically viable for their goat production enterprises, as it minimizes the need for cash expenditures on commercial feeds.

Quotes by Participants:

1. "The local feed resources work well for us because they are so much more affordable than the commercial feeds. We can keep our costs low and still provide our goats with the nutrition they need." - Respondent 3
2. "Even though there is some labor involved in preparing the local feeds, the overall economic benefits of using these resources outweigh the costs. It's a more sustainable approach for our small-scale farming operations." - Respondent 11
3. "The key factors that determine the economic viability of the local feed resources are their availability, the labor required to collect and prepare them, and our ability to manage the seasonal variations in costs. As long as we can navigate these factors, the local feeds are a good option for us." - Respondent 24

Discussion of the Theme:

The findings indicate that the smallholder goat farmers in Murehwa district generally perceive the use of local feed resources as economically viable for their goat production

enterprises.

The primary reason for this perception is the low or no cash expenditure associated with the local feed resources, which stands in contrast to the increasing costs of commercial or conventional feed options. The farmers recognize that the economic costs of the local feed resources are primarily limited to the labor involved in their collection and preparation, rather than requiring significant cash outlays. This cost-effectiveness of the local feed resources is seen as a key advantage by the smallholder farmers, who often operate on limited financial resources and seek to minimize their expenditures on feeding in order to maintain the profitability and sustainability of their goat production enterprises. While the farmers acknowledge the labor-intensive nature of local feed resource preparation, they generally perceive the overall economic benefits to outweigh the associated labor costs. The ability to leverage the available local resources and minimize the reliance on purchased commercial feeds is viewed as a more sustainable approach to goat production within the constraints of their farming context.

The farmers also highlight that the economic viability of the local feed resources is dependent on several key factors, including their availability, the labor required for their procurement and preparation, and the farmers' capacity to manage the seasonal variations in costs. As long as the farmers can navigate these factors effectively, they perceive the use of local feed resources as a viable and advantageous strategy for their goat production enterprises.

This positive perception of the economic viability of local feed resources is a significant finding, as it suggests that smallholder goat farmers in Murehwa district have developed a sound understanding of the cost-benefit dynamics involved in utilizing these locally available resources. This understanding, in turn, allows them to make informed decisions and adopt strategies that enhance the financial sustainability of their goat production systems.

Overall, the theme of perceptions of economic viability of local feed resources underscores the importance of cost-effective feeding strategies in the context of smallholder goat farming, where financial resources are often limited. The farmers' ability to leverage the low-cost local feed resources while managing the associated labor requirements contributes to the resilience and profitability of their goat production enterprises.

4.3.3 Nutritional Composition and Quality of Local Feed Resources

1. Theme Identified: Perceived Nutritional Benefits of Browse Plants and Legume Forages

The smallholder goat farmers consistently identified browse plants and legume forages as the most nutritious and beneficial local feed resources for their goats, citing observed improvements in growth performance, health, and productivity.

Quotes by Participants:

1. "We've noticed that our goats do really well when they are able to graze on the browse plants like Acacia and Combretum. These plants provide important nutrients that help our goats grow and stay healthy." - Respondent 7
2. "The legume forages we've started cultivating, like Stylosanthes and Gliricidia, have made a noticeable difference in the productivity of our goats. They seem to have more energy and produce more milk when they are fed these forages." - Respondent 16
3. "While the natural pastures and crop residues are important parts of our goats' diet, the browse plants and legume forages are what we consider to be the most nutritious and beneficial for their overall performance." - Respondent 25

Discussion of the Theme:

The findings reveal that the smallholder goat farmers in Murehwa district perceive browse plants and legume forages as the most nutritious and beneficial local feed resources for their goats.

The farmers consistently highlighted the nutritional value of various browse plants, such as *Acacia* species, *Combretum* species, and *Grewia* species, which they believe provide important nutrients, including proteins, vitamins, and minerals, to their goats. The farmers have observed that goats fed a diet rich in browse plants generally exhibit better growth rates, higher resistance to diseases, and increased milk production compared to those fed a diet dominated by crop residues or natural pastures alone.

Similarly, the farmers who have started cultivating legume forages, such as *Stylosanthes* species and *Gliricidia sepium*, reported observing improvements in the growth performance, health, and productivity of their goats when these forages were included in the diet. The farmers perceive the legume forages as a valuable source of protein and other essential nutrients that can enhance the overall nutritional status and performance of their goats.

The farmers' positive perceptions of the nutritional benefits of browse plants and legume forages are aligned with the existing scientific evidence on the nutritional composition and value of these feed resources for small ruminants, including goats. Browse plants are known to be rich in protein, energy, and various micronutrients, while legume forages can provide high-quality protein and other essential nutrients. The farmers' practical experiences and observations of the positive impacts of these local feed resources on their goats' performance reinforce the importance of leveraging the nutritional value of browse plants and legume forages in smallholder goat production systems.

This knowledge and understanding can inform the development of more targeted and optimized feeding strategies that capitalize on the availability and suitability of these local feed resources. Overall, the theme of perceived nutritional benefits of browse

plants and legume forages highlights the farmers' sophisticated understanding of the nutritional requirements of their indigenous goat breeds and their ability to identify the most beneficial local feed resources based on their practical experiences and observations.

2. Theme Identified: Perceived Nutritional Limitations of Local Feed Resources

While the farmers recognized the nutritional benefits of certain local feed resources, they also acknowledged the potential limitations and challenges associated with the nutritional composition and quality of the locally available feed options.

Quotes by Participants:

1. "We know that the commercial feeds may have a higher overall nutritional quality compared to the local resources, especially in terms of protein and energy content." -

Respondent 16

2. "Some of the local feed resources, like the crop residues and certain browse plants, can have anti-nutritional factors that may reduce the availability of nutrients for our

goats." - Respondent 21

3. "There is a lot of variability in the nutritional content of the local feed resources, both across different types of feeds and throughout the seasons. This can make it difficult to ensure a consistently balanced diet for our goats." - Respondent 27

Discussion of the Theme:

The findings indicate that while the smallholder goat farmers in Murehwa district perceive certain local feed resources, such as browse plants and legume forages, as highly nutritious and beneficial for their goats, they also acknowledge the potential limitations and challenges associated with the nutritional composition and quality of the locally available feed options. Some farmers recognize that the commercial or

conventional feed options may have a higher overall nutritional quality, particularly in terms of protein and energy content, compared to the local feed resources. This perception reflects an awareness of the potential nutritional deficiencies or imbalances that may exist in the locally available feed resources. The farmers also highlighted the presence of anti-nutritional factors in some of the local feed resources, such as the crop residues and certain browse plants.

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These anti-nutritional factors can reduce the bioavailability and utilization of the nutrients by the goats, potentially limiting the overall nutritional value of these feed resources. Furthermore, the farmers acknowledged the variability in the nutritional content of the local feed resources, both across different types of feeds and throughout the seasons. This variability can make it challenging for the farmers to ensure a consistently balanced diet for their goats, as the nutritional profile of the available feed resources may fluctuate over time.

These perceived limitations and challenges regarding the nutritional composition and quality of the local feed resources highlight the need for further research, extension services, and farmer training to better understand the specific nutritional profiles of the available feed options. This information can then be used to develop more targeted and optimized feeding strategies that address the unique nutritional requirements of the indigenous goat breeds.

Additionally, the farmers' recognition of the potential nutritional deficiencies in the local feed resources compared to commercial feeds suggests an openness to explore ways of supplementing or enhancing the nutritional value of the locally available resources. This openness can serve as a foundation for the development of innovative feeding interventions that leverage the cost-effectiveness and accessibility of the local feed resources while addressing their nutritional limitations.

Overall, the theme of perceived nutritional limitations of local feed resources reflects the farmers' nuanced understanding of the trade-offs and challenges associated with

the utilization of these resources for their goat production enterprises. This awareness can inform the development of more comprehensive and sustainable feeding strategies that optimize the use of local feed resources while addressing their potential nutritional shortcomings.

3. Theme Identified: Farmers' Interest in Experimenting with New Local Feed Resources

The smallholder goat farmers expressed interest in experimenting with additional local feed resources, such as *Moringa oleifera* leaves and *Sesbania sesban*, which they believe could potentially improve the nutrition and performance of their goats.

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Quotes by Participants:

1. "We've heard that *Moringa* leaves can be a very nutritious feed for our goats. We'd be interested in trying to incorporate this resource into our feeding practices if we can find a reliable source." - Respondent 12
2. "Some of the farmers in neighboring areas have been using *Sesbania sesban* as a supplementary feed for their goats. They say it has helped improve the growth and health of their animals, so we'd like to explore that option as well." - Respondent 19
3. "While we rely primarily on the traditional local feed resources, we're always open to trying new things that could potentially benefit our goats. If we can find additional nutritious options in our local environment, we're definitely interested in experimenting with them." - Respondent 27

Discussion of the Theme:

The findings reveal that the smallholder goat farmers in Murehwa district are interested in experimenting with and incorporating additional local feed resources, such as *Moringa oleifera* leaves and *Sesbania sesban*, into their goat feeding practices. The

farmers have heard about the potential nutritional benefits of these feed resources, particularly their high protein content and other essential nutrients, and they are eager to explore their suitability and effectiveness for their indigenous goat breeds. This interest in expanding the repertoire of local feed resources reflects the farmers' openness to innovation and their desire to continuously improve the nutrition and performance of their goat herds.

The farmers' willingness to experiment with new local feed options is particularly noteworthy, as it suggests a proactive and adaptive approach to herd management. Rather than solely relying on the traditional local feed resources, the farmers are actively seeking out and considering the incorporation of alternative feed options that may further enhance the nutritional status and productivity of their goats. This experimental mindset could be leveraged by extension services

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and research institutions to collaborate with the farmers in evaluating the feasibility and effectiveness of introducing new local feed resources. Such collaborations could not only benefit the individual farmers but also contribute to the broader understanding and promotion of sustainable feeding strategies for smallholder goat production systems. Furthermore, the farmers' interest in exploring additional local feed resources highlights their awareness of the potential limitations and nutritional deficiencies associated with the currently utilized feed options. This awareness, combined with their openness to experimentation, creates an opportunity for the development of more comprehensive and holistic feeding programs that optimize the use of diverse local feed resources to meet the specific nutritional requirements of the indigenous goat breeds.

Overall, the theme of farmers' interest in experimenting with new local feed resources underscores the dynamic and evolving nature of the smallholder goat farming system in Murehwa district. The farmers' willingness to explore alternative local feed options reflects their commitment to continuous improvement and their ability to adapt to the changing needs and challenges of their production enterprises.

4. Theme Identified: Need for Research and Extension Support on Local Feed Resource Nutrition

The smallholder goat farmers acknowledged the key challenges and limitations in terms of the nutritional quality and composition of the locally available feed resources, and they expressed the need for further research, extension services, and farmer training to better understand and optimize the utilization of these resources.

Quotes by Participants:

1. "While we have a good understanding of the local feed resources, we don't always know the specific nutritional profiles and quality of these feeds.

More information and guidance from experts would be really helpful." - Respondent 21

2. "There are still a lot of unanswered questions about how to best use the local feed resources to meet the nutritional needs of our goats. We need more support in terms of research and extension services to address these knowledge gaps." - Respondent 27

3. "Training and workshops on the proper utilization of the local feed resources, including strategies to manage any anti-nutritional factors or nutrient deficiencies, would be valuable for us as smallholder farmers." - Respondent 14

Discussion of the Theme:

The findings indicate that the smallholder goat farmers in Murehwa district recognize the key challenges and limitations associated with the nutritional quality and

composition of the locally available feed resources, and they express a strong need for further research, extension services, and farmer training to better understand and optimize the utilization of these resources.

The farmers acknowledge that while they have a good general understanding of the local feed resources, they lack comprehensive information and awareness regarding the specific nutritional profiles and quality of these feedstuffs. This knowledge gap makes it challenging for them to develop more targeted and effective feeding strategies that address the unique nutritional requirements of their indigenous goat breeds. The farmers also highlight the need for research and extension support to help them better understand and manage the potential nutritional deficiencies and anti-nutritional factors present in certain

Chapter 5: Conclusion and Recommendations

5.0 Introduction

This chapter presents the overarching conclusions drawn from the evaluation of locally available feed resources as alternative sources for indigenous goat genotypes in Murehwa district. Based on the comprehensive findings discussed in Chapter 4, this section synthesizes the key insights gained, directly addressing the main and specific research questions. Furthermore, it outlines practical recommendations for smallholder goat farmers and future research endeavors, aiming to enhance the sustainability and profitability of goat production in the region.

5.1 Conclusion

This study set out to evaluate the potential of locally available feed resources as

alternative feed sources for indigenous goats in Murehwa district. The findings unequivocally demonstrate that locally available feed resources possess significant potential to serve as viable and cost-effective alternatives to commercial feeds for indigenous goat genotypes in the Murehwa district, thereby contributing to the financial sustainability of smallholder goat farming.

5.2 Recommendations

5.2.1 Recommendations for Smallholder Goat Farmers

Farmers should continue to leverage the wide array of local feed resources. Emphasis should be placed on increasing the cultivation and utilization of legume forages (*Stylosanthes*, *Gliricidia*, *Sesbania sesban*, *Moringa oleifera*) due to their perceived high nutritional value, as expressed by the farmers' interest.

Farmers should improve feed harvesting and storage techniques. To mitigate seasonal scarcity and labor intensity, farmers should be encouraged to adopt more efficient techniques for harvesting and storing crop residues and browse plants. This could involve communal efforts or basic processing methods to preserve quality for dry season feeding.

Farmers should actively seek and engage in training programs and workshops focused on animal nutrition, feed formulation, and the identification and management of anti-nutritional factors in local feedstuffs. This will empower them to make more informed decisions about their goats' diets.

Farmers should also experiment with new local resources. Building on the expressed interest, farmers are encouraged to conduct small-scale trials with promising new local feed resources like *Moringa oleifera* and *Sesbania sesban* under careful observation, sharing their experiences with extension services.

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Appendix

Questionnaire for Smallholder Goat Farmers in Murehwa District

Project Title: An evaluation of the locally available feed stuffs as alternative sources of feeds for indigenous goats' genotypes in Murehwa district.

Researcher: Solomon Nyamunokora

Date: May 27, 2025

Introduction:

Good day. My name is Solomon Nyamunokora, and I am conducting a study to understand how smallholder goat farmers in Murehwa district feed their goats using local resources. Your experiences and knowledge are very valuable for this research. The information you provide will be kept confidential and used solely for academic purposes. There are no right or wrong answers, and your participation is entirely voluntary. The interview comprises of open-ended and direct questions. This interview should take approximately 30-45 minutes.

Do you agree to participate in this interview? Yes / No

Section A: Demographic Information.

Respondent Code:

Age of Respondent

25-35

36-45

45-68

Gender of Respondent:

Male

Female

Years of Involvement in Goat Farming: (Years)

1-10

10-20

20-30

48

Total Land Holdings: (Acres)

2-4

5-7

8-10

Current Herd Size (Number of Goats):

8-20

20-35

Section B: Locally Available Feed Resources

What types of feed resources do you currently use to feed your indigenous goats?
(Tick all that apply)

Natural pastures (grazing) ☐

Crop residues (e.g., maize stover, groundnut haulms, etc) ☐

Indigenous browse plants (e.g., Acacia, Combretum, Mopar) ☐

Household food waste ☐

Cultivated legume forages (e.g., Stylosanthes, Gliricidia) ☐

Commercial feeds (e.g., dairy meal, broiler finisher) ☐

Other (Please specify): _____

How does the availability of these local feed resources change throughout the year
(e.g., during rainy season vs. dry season)?

Section C: Economic Costs of Local Feed Resources

Compared to commercial feeds, how would you describe the cost of using locally
available feed resources for your goats? (Select one)

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Much cheaper ☐

Slightly cheaper ☐

About the same cost ☐

More expensive ☐

Much more expensive ☐

Overall, how economically viable do you find using local feed resources for your goat
farming enterprise? (Select one)

Very economically viable ☐

Somewhat economically viable	
Neutral	
Somewhat not economically viable	
Not at all economically viable	

Section D: Nutritional Composition and Quality of Local Feed Resources

Among the local feed resources you use, which ones do you believe provide the most nutrients and benefits for your goats (e.g., for growth, milk production, health)? Why?

Do you think any of the local feed resources you use might have limitations in terms of nutrition or might cause problems for your goats? If so, which ones and why?

Are you interested in trying out new local plants or materials to feed your goats, like Moringa leaves or Sesbania? Why or why not?

What kind of information or support would help you better understand and use the nutritional value of local feed resources for your goats?

Thank you for your valuable time and participation in this study!