

**Performance Evaluation of NAGRC Community-Based Animal Breeding Program on
Dairy Farming in Kikatsi Sub County Kiruhura District**

By

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**A Research Dissertation Submitted to the Directorate of Graduate Studies,
Research and Innovations in Partial Fulfillment of the Requirements
for the Award of Masters of Agriculture and Rural Innovations of
Bishop Stuart University**

December, 2024

Declaration

I hereby declare that this dissertation titled, "*Performance Evaluation of NAGRIC Community-based Animal breeding Program among Dairy Farmers in Kikatsi Sub County, Kiruhura District*", is an original work and has never been submitted anywhere for any award.

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Approval

I hereby approve that this proposal titled, "*Performance Evaluation of NAGRC Community-Based Animal Breeding Program among Cattle dairy Farmers in Kikatsi Sub county, Kiruhura District*", is an original work and has never been submitted anywhere for any award and has been done under my supervision.



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Dedication

This work is dedicated to my wife and my children for their love, spiritual and moral support they have had throughout my entire academic life.

Acknowledgements

First of all, I need to thank the almighty God for the love and protection He has shown me in my academic endeavors. Without his mercy, it would have been hard to come up with this piece of work.

I also need to acknowledge the great work done by my supervisors Mr. Bahame David and Dr. Mwebembezi William for their consistent encouragement and support to give my work academic shape. Your advices have contributed immensely to the completion of this work.

I also need to thank my family for the consistent prayers and encouragement that kept me motivated to continue with my work.

Lastly, I need to appreciate my respondents who are the farmers and leaders in Kikatsi Sub County for the commitment and acceptance to give me data that I used to write this report. The value of this report is based on the information you gave me and do not take your time for granted.

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List of Acronyms

AI	:	Artificial Insemination
CBABP	:	Community Based Animal Breeding Programs
CBB	:	Community-based breeding
FAO	:	Food and Agricultural Organization
IFAD	:	International Federation of Agricultural Development
MAAIF	:	Ministry of Agriculture, Animal Industry and Fisheries
NARO	:	National Agriculture Research Organization
SSA	:	Sub-Saharan Africa
UBOS	:	Uganda Bureau of Statistics

Abstract

Community Based Animal Breeding Programs (CBABP) have gained considerable attention recently and are being viewed as a viable approach to increase livestock productivity in low-input and smallholder settings particularly in Uganda's cattle corridor in general and Kiruhura district in particular. Despite the implementation of NAGRIC community-based animal breeding program, there remains a significant gap in the comprehensive evaluation of its performance in dairy farming systems. This study therefore was intended to evaluate the performance of NAGRIC communitybased animal breeding program to determine its effectiveness in achieving the desired outcomes. The study specifically aimed at assessing the level of farmer engagement and participation in NAGRIC-CBABP, analyse the influence of NAGRIC-CBABP on cattle-breed improvement and milk production and evaluate the Sustainability of NAGRIC-CBABP in Dairy Farming communities in Kikatsi sub-county, Kiruhura district. To achieve the objectives, a cross-sectional study design was adopted rooted in the quantitative approach. The study population comprises of dairy farmers, government leaders, local leaders and other leaders in Kikatsi Sub County, Kiruhura district. The sample size included 59 respondents. A structured questionnaire with multiple-choice questions was used to collect quantitative data from farmers while semi-structured interviews were held with key informants in this case leaders. The collected data was analyzed by generating descriptive statistics. From the analysis, the study revealed that the level of farmer engagement and participation in NAGRIC-CBABP is still low where about 72.5% of the farmers are still reliant on natural breeding methods with limited participation in modern breeding methods such as artificial insemination. Community-Based Animal Breeding Program has had a positive influence on cattle-breed improvement and milk production in Kikatsi Sub County since they are perceived by most farmers to be highly beneficial in terms of genetic improvement, increased availability of quality and improved breeds. However, there was concern among most farmers about scarcity of highly productive breeds in terms of milk production and lack of tick and disease resistant breeds. Other concerns were about the high cost of semen, limited knowledge about artificial insemination and lack of semen that specifically breeds heifers. Despite of the Government intervention most dairy communities in Kikatsi Sub County have not sustainably benefitted from NAGRIC-CBABPs since utilization of services provided under this program is still low. Addressing these challenges is therefore critical to improve farmer engagement and participation in NAGRIC-CBABPs hence contributing significantly to the sustainability of these programs. The study therefore recommended Government through the NARO and MAAIF to make thorough research into the breeds of dairy cattle that are highly productive and resistant to ticks and diseases as well as the most effective acaricides and drugs for ticks and diseases respectively. The Government should also provide subsidy on the cost of semen used in artificial insemination and train and employ more agriculture extension officers to scale up sensitization.

CHAPTER ONE

1.0 Introduction

Harnessing the potential of community-based projects has become a game-changing strategy for sustainable development in the constantly changing world of agriculture. Due to its importance for society, the food supply, and the economy, dairy farming has become increasingly important during this shift. The establishment of Community Based Animal Breeding Programs (CBBPs), a dynamic strategy that incorporates local people into the process of improving livestock genetics and dairy productivity, is a crucial aspect of this change. This chapter introduces the background of the study on Performance Evaluation of Nagric Community-Based Animal Breeding Program on Dairy Farming in Kikatsi Sub-county Kiruhura District. This chapter also includes the problem statement, the purpose, objectives followed by research questions and hypothesis of the study, the study scope, conceptual framework, justification as well as significance of the study (*JP Mueller, et al., 2019*).

1.1 Background of the study

Community Based Breeding efforts (CBBP) are created to efficiently enable ownership and sustainability of genetic improvement efforts. Village/community-based breeding initiatives are planned, developed, and carried out by smallholder farmers alone or in collaboration with technical players to enhance the genetics of their livestock. Improvement of livestock is accomplished in developing countries by vigorous engagement of livestock owners. These farmers are frequently stigmatized and resource poor. A Community-based Animal breeding Program was set up with an emphasis on native breeds appropriate for smallholder environments. (*Kahi et al., 2005*)

Community-Based Animal Breeding Programs (CBBPs) have gained considerable attention recently and are being viewed as a viable approach to increase livestock productivity in low-input and smallholder settings. (*Kosgey et al., 2006, Wurzinger et al., 2021, Mueller et al., 2015*). Community-based breeding initiatives are planned breeding operations that are planned, devised, and carried out by smallholder farmers alone or in collaboration with technical players to enhance the genetic performance of their livestock. This often applies to low-input systems with farmers sharing and improving their genetic resources in a common interest (*Wurzinger et al., 2021*). Community-Based Breeding (CBB) is an established idea that has been used as a tool in agricultural research since 1970 (*Omoro et al., 2008*). According to *Haile et al., 2010*), CBB uses simple

treatments to boost the production and profitability of native breeds and variations without sacrificing their resilience or genetic integrity. CBBPs have been adopted worldwide, an example in Bangladesh shows that CBBPs have been used sparingly so far. With small ruminant species and chicken, some initiatives have had more success and shown encouraging results. The scientific community has come to the conclusion and reached a broad consensus that farmers' participatory breeding programs may be a worthwhile alternative for the conservation and improvement of indigenous livestock genetic resources as a result of the lessons learned from reviewing the current breeding practices of Bangladesh. However, Bangladesh does not yet have the social, technological, or economic capacity to undertake self-sufficient breeding programs. The viability of breeding programs depends on farmers' long-term commitment, the creation of farmers' organizations, and support services provided by research organizations, government offices responsible for livestock development, cooperatives, and agribusiness representatives. (*Bhuiyan et al., 2017*).

A fifth of the world's cattle are raised in Africa, where there are around 300 million heads of cattle. In 2017, there were over 74.3 million cattle in West Africa alone. On the continent, cattle play important social, economic, and cultural roles. They provide as a significant supply of protein (milk and meat), as well as fuel, fertilizer, and draft power for crop production. (*Ouédraogo, 2021*). Africa's farmers rely heavily on the production of cattle for their livelihood. Numerous breeding techniques and policies have been implemented in West Africa to increase cattle productivity. West African states, like many other emerging nations, have mostly embraced centralized breeding programs that are fully run by governments with little to no involvement from farmers. However, only a few of Sub-Saharan Africa's cattle breeding programs have been successful. (*K Marshall, 2019*).

East coast fever, Foot and Mouth Disease, Brucellosis, and other livestock illnesses are difficult to control when using livestock systems like pastoralism and free-range grazing *Fischer et al., 2018*. Even though the cattle industry contributes significantly to Uganda's economy, it is still underdeveloped and operates at a much lower capacity. Due to limited access to high-quality breeds and improved management techniques, the farmers' production is limited. Salami, *Kamara, and Brixiova (2010)*. According to research, Uganda's adoption of better dairy breeds increases milk output by 147% (*Kabunga et al., 2014*).

According to *Mustefa (2023)*, increasing animal productivity while reversing the trends of the ongoing potential threats to their diversity is urgently required because indiscriminate crossbreeding for increased productivity as well as natural and man-made disasters are among the identified potential threats deteriorating the diversity of small ruminant genetic resources in Ethiopia. Numerous genetic enhancement projects have been used thus far, but they have not been able to achieve the desired results because of the nation's generally low input system and the lack of community participation. The use of indigenous animals with active member engagement and decision-making from the start of the implementation period has been the emphasis of the community-based breeding program (CBBP), which was created for minimal input systems (*Mustefa, 2023*).

Through the genetic improvement of livestock and the preservation of regional breeds, CBBPs have been marketed as a tool for economic and livelihood development in developing nations (*Kosgey et al., 2006; Haile et al., 2011*). A thorough assessment of these initiatives is lacking despite the fact that a number of case studies from the field and their achievements, obstacles, and failures have been recorded (*Sölkner et al., 1998; Mueller et al., 2015*). The significance of a systematic assessment of the effectiveness and impact of CBBPs is mentioned by a number of writers (*FAO 2010, Haile et al., 2011, Mueller et al., 2015*) in order to determine if the promised improvements have really been made. Additionally, these authors offer broad suggestions for potential evaluation indicators, but they don't go into specifics about how such an evaluation should be conducted.

With a national herd estimated to be 49 million cattle, 25 million sheep, 22 million goats, and 9 million pack animals, Ethiopia has one of the greatest livestock resources in Africa (*EATA, 2013*). 80% of rural residents depend on livestock for their livelihoods. Between 35 and 40 percent of all livestock are kept in pastoral regions, while female cattle make up around 55.5% of the national herd. (*MoARD, 2007*). However, here is a lack of information regarding breeding practices, the significance of farmers' breeding objectives, preferences for various traits, selection criteria for dairy breeds, and mating systems as breed improvement strategies under low-input systems for smallholder dairying in the Tigray region, particularly in the central zone of Tigray (*T Aseged, 2022*).

Genotypes of dairy in the *tropics Rege (1998)* demonstrated that hybrids of several exotic breeds performed differently at the same degree of indigenous gene inheritance, demonstrating that no

particular breed, crossbreed, or crossbreeding method will have superior aggregate performance in all production conditions. (*Amole, 2022*). Because farmers adopt and adapt genotypes to their needs and circumstances, their knowledge of and preferences for the genotypes should therefore be a key component of breed improvement *efforts* (*Bebe et al., 2000*). For instance, despite the fact that the total productivity due to reproduction and output may be poor, farmers may have a tendency to upgrade to better exotic grades and/or Friesian based on cross breeding for higher milk yields. Additionally, in production systems like those found in Kenya, where milk is sold on a volume basis, large dairy breeds are likely to be more popular than smaller breeds due to their high milk yields. (*Bebe, 2003*).

The majority of the improved cattle breeds are raised in Uganda by smallholder units that have 10 or less animals (*Kamanyire, 2016*). Despite the persistent efforts to upgrade the national dairy herd, animal genetic improvement offers one of the fastest and most effective ways to increase the productivity of cattle herds, but its effective exploitation has not been achieved due to the lack of a well-planned and executed breeding program. Improved cow breeds (exotics and crosses), according to the Uganda Bureau of Statistics (*UBOS, 2017*), only make up 6.4% of the nation's cattle herd. Due to the ineffective utilization of the progeny of excellent dairy cattle, precious genes have been wasted. Most dairy producers have a multifaceted farming strategy, and one of those strategies includes prioritizing other livestock benefits above the value of keeping cows for their milk production. This is demonstrated by the breed selection and breeding methodology, which minimize the significance of features related to milk production. (*A Mugisha, 2014*).

High milk-producing cattle are favored by market factors, especially in close proximity to big cities. Land use practices have altered in certain places. By 2025, the urban market for the affluent population is expected to grow by 25%. They have favorable spending power, eating preferences, and lifestyles. (*A Mugisha, 2014*). Following this change in land use, breeding techniques should be used to maintain a small number of superior animals that can guarantee adequate returns. Additionally, it restricts unrestrained breeding and makes it possible to take advantage of enhanced breeding techniques. (*E Ssewanyana, 2004*)

At the farm level, specific qualities, features, or characteristics are desired in the semen. They are the ones that best meet the farmers' objectives or satisfy their interests. The availability and accessibility of the desired genes and their distribution methods (breeding services) are influenced

by a number of circumstances since the farmer is not acting in isolation but rather as a component of a production system. (*Isaac Sanga, 2004*). Farmers may today choose from a range of dairy breeding services, including AI and natural services. Whether the farmers can choose the service or are limited in what they can choose is a crucial factor. Access to enhanced breeding services, however essential for further dairy growth, is allegedly limited in Uganda, with rates averaging between 2% and 15% and likely being mostly focused in the central area. Low availability, high cost, and iffy reliability are the main causes of the suboptimal use of AI, according to *Staal et al., 2014*.

Due to the bovine spongiform encephalopathy (BSE) scandal in 1997, a two-year import restriction on animal goods and genetic resources, including semen and embryos, was put in place, necessitating the creation of local semen. Lack of progeny tested bulls as a result of an uneven herd recording procedure, however, has made this difficult. (*Ouédraogo, 2021*). When carefully thought out, systematic crossbreeding programs involving tropical and temperate breeds have shown to be very beneficial (*McDowell, 1985*). Although crossbreeding has been practiced in SSA for more than a century, the majority of dairy farmers in the smallholder dairy sector have been unable to reap the benefits. Lack of clear breeding techniques, environmental and genotype mismatches, and lack of farmer involvement in breeding program design are the main limitations. (*Galukande et al., 2013*).

A breeding program's assessment might have two main benefits. First, as a quality management tool for implementing institutions to track and assess ongoing CBBP operations and spot any snags in a program's implementation. Such an assessment procedure may produce a learning environment that motivates and assists people participating in the program to critically evaluate the progress, learn from errors, and provide suggestions for program improvement (*IFAD 2002*). Second, the assessment can operate as a roadmap for (external) funding organizations to gauge the effect on farmers' and other stakeholders' quality of life along the value chain in order to promote technical and financial support. (*D. Lamuno, 2018*).

However, various evaluation objectives call for various evaluation standards (*FAO 2010*). If the goal is profit or return on investment, *FAO (2010)* advises that breeding programs be assessed using technical criteria, socioeconomic criteria, and a cost-benefit analysis. CBBPs may be evaluated using factors that are significant at the community level, such as socioeconomic factors based on

improving household food security, welfare, and income. (FAO 2010, Haile *et al.*, 2011). Due to the complexity of CBBPs in their local settings and their connections to specific socioeconomic and cultural elements, it may be extremely challenging to quantify some of the results and repercussions that go beyond basic economic criteria. Additional criteria that take into account less tangible and hard to quantify outputs may be used to address this. (FAO 2010).

1.2 Problem statement

The dairy industry plays a vital role in ensuring food security and economic development, particularly in regions where dairy farming serves as the primary livelihood for small-scale farmers. To enhance dairy productivity and sustainability, community-based animal breeding programs have been introduced as a means to systematically improve the genetic potential of dairy animals, leading to higher milk yields, better disease resistance, and other desirable traits. These programs operate within the context of limited resources, varying farming practices, and diverse socio-economic conditions, making it essential to understand their impact on dairy farming within these specific contexts. A new strategy for enhancing cattle populations and owners' livelihoods is community-based breeding initiatives. These have been implemented in dairy farming systems with the aim of improving genetic traits and milk production in dairy animals. These programs typically involve targeted interventions such as selective breeding, mating strategies, and breeding goal setting within local farming communities. The rate of genetic improvement for milk and meat productivity from native breeds in Sub-Saharan Africa (SSA) is modest, ranging from 0% to 0.15% year, according to earlier study. Native and exotic dairy and meat breeds have frequently interbred inadvertently to create a variety of cattle with various genetic make-ups. (Chawala *et al.*, 2021). In the Ugandan context, farmers have access to a range of cattle breeding services, from natural service to artificial insemination (AI) although it is estimated that access to improved community breeding services, such as the use of AI, is low in Uganda, with rates averaging between 2% and 15%. (Mugisha *et al.*, 2014) yet they are considered crucial for long-term dairy and meat development. Despite the implementation of NAGRIC community-based animal breeding program, there remains a significant gap in the comprehensive evaluation of its performance in dairy farming systems. Existing research often focuses on specific aspects of the programs, such as genetic improvement or milk production, without providing a holistic assessment of their overall effectiveness and impact. Additionally, there is a lack of in-depth studies that analyze the sustainability aspects of these programs, including their economic viability, social implications, and environmental consequences.

This gap in knowledge hinders the development of evidencebased policies and strategies to optimize the outcomes of community-based animal breeding programs, which is crucial for supporting the sustainable development of dairy farming communities. There is therefore need to assess and evaluate the performance of NAGRIC community-based animal breeding program to determine its effectiveness in achieving the desired outcomes.

1.3 Objectives of the Study

1.3.1 Main Objective

The main objective of the study is to evaluate the performance of NAGRIC Community-based Animal breeding Program on Dairy farming in Kikatsi Sub County, Kiruhura District in relation to its contribution on livestock breeding improvement and milk production.

1.3.2 Specific Objectives

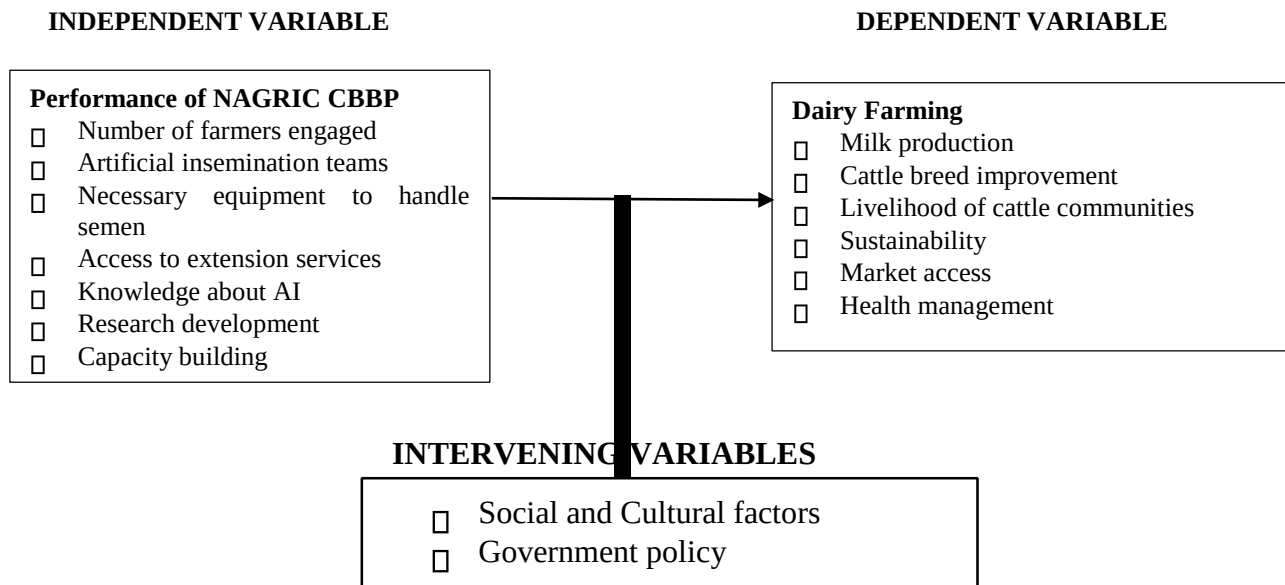
1. To assess the level of farmer engagement and participation in NAGRIC CommunityBased Animal Breeding Programs in Kikatsi Sub County, Kiruhura District.
2. To assess the influence of NAGRIC Community-Based Animal Breeding Program on cattle-breed improvement in Kikatsi Sub County, Kiruhura District.
3. To assess the Influence of NAGRIC Community-Based Animal Breeding Programs on Milk Production in Kikatsi Sub County, Kiruhura District.
4. To evaluate the Sustainability of NAGRIC Community-Based Animal Breeding Programs in Dairy Farming communities in Kikatsi sub-county, Kiruhuura district.

1.4 Research Questions

1. What is the level of farmer engagement and participation in NAGRIC Community-Based Animal Breeding Programs in Kikatsi Sub County, Kiruhura District?
2. What is the influence of NAGRIC Community-Based Animal Breeding Program on cattlebreed improvement in Kikatsi Sub County, Kiruhura District?
3. What is the Influence of NAGRIC Community-Based Animal Breeding Programs on Milk Production in Kikatsi Sub County, Kiruhura District?

4. What are the Sustainability of NAGRIC Community-Based Animal Breeding Programs in Dairy Farming communities in Kikatsi Sub County, Kiruhuru district?

1.5 Conceptual Framework



Source: General Systems Theory by *Von Bertalanffy (1973)*

Figure 1.1: Conceptual framework Schema

The conceptual framework is based on the general systems theory as stipulated by Ludwig *Von Bertalanffy (1973)*, this states that in order to fulfil a desired objective entities and individuals come together for the purpose. The conceptual framework is based on a three-factor general systems model by consisting of i) independent variables, ii) dependent variables and iii) intervening variables. The independent variables consist of the activities and efforts geared at establishing the NAGRIC community based cattle breeding programme, while the dependent variables consist of the outcomes of NAGRIC community-based breeding program on dairy farming. In the third factor they are the conditions appearing in the environment where community breeding programmes take place which might affect the relationship between the performance of NAGRIC communitybreeding program and its effect on Dairy farming.

1.6. Significance of the study

The study will contribute to the existing body of knowledge by addressing the research gaps in evaluating NAGRIC Community-based Animal breeding Programs. The findings can serve as a resource for future studies, allowing researchers and policymakers to build upon the findings and

explore additional aspects of livestock breeding improvement. The results of this study will aid local farmers in understanding the intricate reasoning behind community-based breeding and how it may assist them perform at their highest level. The results of this study will also aid decisionmakers in determining what can be done to assist local farmers in maintaining the desirable breeds and qualities on their farms. This study is crucial for Uganda and other nations with comparable situations. By evaluating the performance of the Community-based Animal breeding Program, the study can shed light on the program's actual contribution to livestock breeding improvement. This can help identify successful strategies and practices that can be replicated or scaled up to enhance breeding outcomes and genetic quality of the livestock population.

1.7 Scope of the study

1.7.1 Geographical Scope

The study was conducted in Kikatsi Sub-County, Nyabushozi County, Kiruhura District, Western Region, Uganda, Latitude: 0° 21' 48" S, Longitude: 30° 43' 41" E Lat/Long (dec): 0.36361, 30.72806 Köppen climate type. This geographical area was chosen because its among the areas where the NAGRIC community breeding program has been implemented and it is a cattle community where dairy farming is the major source of livelihood of the communities.

1.7.2 Content Scope

The study focused on performance evaluation of CBBP for dairy cattle and using key performance indicators for production levels and livelihood management. The study covered the following objectives; to assess the level of farmer engagement and participation in NAGRIC CommunityBased Animal Breeding Programs; to analyse the influence of NAGRIC Community-Based Animal Breeding Program on cattle-breed improvement; to analyze the Influence of NAGRIC Community-Based Animal Breeding Programs on Milk Production and to evaluate the Sustainability of NAGRIC Community-Based Animal Breeding Programs in Dairy Farming communities in Kikatsi sub-county, Kiruhuura district.

1.7.3 Time scope

This study time scope was between 2020 and 2023. This is a period when the National Animal Genetic Resource Centre was launched in western Uganda and therefore the study was based on statistics of NAGRIC community-breeding program.

CHAPTER TWO

LITERATURE REVIEW

2.1 Community-based breeding programmes

Community-based livestock breeding programs are initiatives that involve local communities in the management, selection, and improvement of livestock breeds. These programs aim to address the specific needs and challenges of communities by engaging them in the process of breeding animals that are adapted to their local conditions and meet their desired traits and goals (Rekik et al., 2019). Community-based breeding programs have proved highly successful in Bolivia, Ethiopia, Mexico, and Peru. The same approach can be used in other countries, to improve the incomes and livelihoods of poor communities in remote areas.

Improved cattle breeds hold significant importance to African farmers for several reasons; the adoption of improved cattle breeds allows African farmers to achieve higher productivity, improve livestock health, enhance market opportunities, and build resilient and sustainable livestock systems. It can contribute to poverty reduction, food security, and economic development in rural communities (*Jabbar et al., 2003.*) Over the past decade, community-based breeding programs (CBBPs) have been promoted as a viable approach to improving smallholder livelihoods through a systematic livestock breeding. CBBPs aim to initiate systematic breeding at the community level, including an organized animal identification and recording of performance and pedigree data. To ensure the breeding programs' continuity, building capacities, and ownership among participants are essential to the approach. (*Maria Wurzinger, 2021*)

However, the rate of genetic improvement for milk output from indigenous breeds is low in SubSaharan Africa (SSA), ranging from 0% to 0.15% each year (*Galukande et al., 1962; Mahadevan et al., 1962; Marshall et al., 2019*). This has been verified by earlier study. The native and exotic dairy breeds have frequently interbred inadvertently to create a diversity of cattle with different genetic make-ups. (*Mujibi et al., 2019*).

2.2 Contextual Analysis

Management, production, feeding and nutrition, breeding and selection, managing health and diseases, preserving records of performance, value chain, and marketing all need to be studied.

Urban/peri-urban farming, which is sometimes described as farming conducted in a town or city and the immediate surrounding region, has also offered an opportunity for dairy farmers to transition from subsistence farming to commercial activity (*Nassuna et al., 2015*)

In situ conservation of boran cattle through community/cooperative bull scheme based breeding program in Borana, Ethiopia, As soon as the decision was made on the appropriate community based breeding program to be used, pastoralists were organized into groups based on utilization of common grazing areas. As it is described by *Mueller et al., (2015)* every community based breeding program is related to low-input systems with livestock keepers within geographical boundaries having a common interest to work together for improvement of their genetic resource.

Both high-producing and low-intensive dairy systems in sub-Saharan Africa depend on reproduction to ensure sustainable economic output. However, there is a lack of related information regarding reproductive performance and the variables that affect it in sub-Saharan African UPU dairy farming. The creation of plans for improving the production of herds must start with such fundamental data. (*Wollny et al., 2003*).

Urban/peri-urban farming, often defined as farming taking place in a town or city and in the immediate area surrounding the city, has also created an opportunity to transform from subsistence rural lifestyles of dairy farming to commercial engagement (*Henriksen Jet al., 2014*). In smallholder agricultural regions, producers frequently employ bulls for breeding rather than artificial insemination (*Megersa et al., 2011*). However, the adoption of AI in Kenya's smallholder dairy industry is at least twice as high (*Megersa et al., 2011*). Kenya's comparatively high adoption of AI is a benefit of the extensive governmental subsidies towards AI that began in the middle of the 1960s. This improved smallholder dairy producers' access to and cost of AI.

The few programs that have attempted to revitalize the smallholder dairy industry after 2009 have mostly focused on increasing the supply of breeding cows and heifers, with varying degrees of success. There are fewer sources of semen that is suitable. The majority of sources for dairy cattle are industrial dairy farms, where feed supplies and management practices are generally at their best. Transferring cattle from these ideal habitats for growing them to inadequate ones constantly presents difficulties that put the imported cow's survival in danger. (*Phillips et al., 2018*)

The losses caused by treatable illnesses, such as tick-borne illnesses and ectoparasites like dermatophilosis, show that every breeding effort should be backed by a robust disease prevention and control program, as shown in our breeding pillars. (Perry *et al.*, 2009).

The widespread use of hired bulls highlights a number of concerns, including the transmission of venereal diseases, the possibility of inbreeding, missed heats that lengthen calving intervals, and the expense of maintaining the bulls (Crowe *et al.*, 2021). It is hardly unexpected that the bull programs at Mayfield, Umzingwane, and Guruve failed since the money generated from renting out bulls was insufficient to pay for maintenance (Chikanza, S., 2014). Realistically, most farms cannot afford to keep producing bulls because of the enormous expense of raising one (Ducrocq *et al.*, 2015). In addition to the initial purchase price, raising breeding bulls on a farm is restricted by the lack of land resources for the production of feed. A well-designed AI software would probably cause fewer problems and have benefits like healthier semen and preventing venereal disease. (Coffey *et al.*, 2021).

On the cow front, farmers originally purchased purebred and crossbred cows in an aim to boost milk output, partly thanks to DDP assistance. The best breeds for crossbreeding and the percentage of each cross's genetic makeup that corresponds to the genetic makeup of the parent breed were topics of unending discussion. It was concerning that farmers insisted on buying high-yielding Holstein-Friesian cows despite recommendations that preferred the Jersey breed. It was stated that the small-framed Jersey is the best choice for smallholder farms' constrained feed supplies and inexperienced dairy herd managers (Dzama *et al.*, 2007). The Jersey's tiny stature, sluggish development, low milk output in comparison to the Holstein-Friesian, and poorer meat quality, on the other hand, did not sit well with the majority of farmers (Frink, J. L. 2021).

The Red Dane breed became a contender during this argument (Joshi *et al.*, 2001). Red Dane Farm heavily pushed the breed as a choice that would provide farmers an animal that could serve both purposes. Sahiwal was one of the additional breeds that was introduced and tested. The plan was to introduce animals that could serve two purposes: producing high milk yields and having high quality meat. These cattle would be harsher than traditional dairy breeds. (Haile, A. 2011). In the end, these programs mostly aimed to help farmers get better cows. There were worries that because these efforts concentrated solely on breeding and herd quality enhancement while ignoring marketing, nutrition, and animal health, they were unable to meet their breeding objectives.

Recently, Milk Zim Ltd. unveiled a variation on a group cattle management plan. (*Tadesse et al., 2015*). According to this strategy, farmers give their cows to a central cattle farm where they are milked and fed in groups. At the central facility, all routine disease prevention and control procedures are carried out, and costs are deducted using a milk payment check-off system. (*Tadesse et al., 2015*). The farmer receives payment based on the output of his cow. Breeding services, including AI, are provided centrally, with check-off systems used to deduct the associated expenses.

Even if this system offers advantages, it must nonetheless endure the test of time. Obtaining the necessary number of participants for a profitable commercial operation, protecting against the loss of a farmer's cow, gaining farmer trust in the fairness of business dealings, and establishing procedures for farmer scheme ownership are challenges with this strategy (*Barrado et al., 2006*). AI should serve as the foundation of every dairy breeding program that succeeds. Significant benefits from AI are anticipated to be attained if improvements in milk quality and supply are to be achieved (*Gebremedhin, B. 2013*).

2.3 Farmer engagement in the Use of Community-Based Breeding Services.

Based on this objective the researcher highlights the need for further research to identify the specific factors affecting the use of community-based breeding services. Previous research suggests that factors such as access to information, genetic testing, and phenotypic data play a role in adoption, but further investigation is needed to explore the broader factors affecting the use of breeding services. Despite the strong economies, significant public and private investments in modern breeding programmes and consistent seed availability in the Global North, PPB projects are employed to address farmers needs throughout the region. This raises the question of what is driving researchers and farmers to collaborate.

Typically, the CBBP program involves a large number of stakeholders. The working group, which should include farmers who are the main beneficiaries financial institutions, colleges that offer education and training, government organizations, extension organizations, and market operators must be evaluated. The various functions and duties of each individual person must be made explicit in the organigram (*FAO 2010*). Individual commitment should be backed up by contracts and formal agreements between several parties. This strategy demonstrates a more formalized level of cooperation and can help to reduce the issue of worker turnover because the institution is committed

to finding a suitable replacement. An important factor to examine while assessing the breeders' association's by-laws is how they regulate the rights and obligations of each member. These by-laws must be in writing and officially approved. These bylaws could include features that need to be assessed, including breeding animal exchange, adherence to sanitary rules, data recording, potential sanctions for corruption or fraud, association structure, and election procedures.

The Community Based Breeding Programs for indigenous sheep in Ethiopia were started after detailed and comprehensive studies. Comprehensive characterization of the production system and market analysis in various agro-ecological zones were initially conducted and results were widely communicated (*For example: Edea, 2008; Getachew et al., 2010; Terfa et al., 2013*). Findings from these studies and the participatory research with farmers revealed shortages of breeding rams, inbreeding, and negative selections as some of the problems in sheep breeding practice.

Village/community-based breeding initiatives are planned, developed, and carried out by smallholder farmers individually or in collaboration with technical players to enhance the genetics of their livestock (*Bob Karnuah, 2018*). As a distinguishing trait of CBBPs, participation has been proposed (*Haile et al. 2011, Wurzinger et al. 2011, Mueller et al. 2015*). Based on Pretty (1995), Cornwall (2008) expanded on the idea of participation in development. She suggests striking a balance between inclusion, or incorporating all important stakeholders in a particular activity, and depth, or engaging them in various stages of the process, to ensure maximum engagement.

In CBBPs, the level of farmer participation varies depending on the program's various stages (e.g., high participation during the identification of breeding objectives, low participation during the evaluation of breeding values). Optimal participation, however, should be examined, and if there is little to no direct involvement, it must be determined if farmers are consulted, informed of all phases, and given enough information. It is necessary to evaluate gender representation, roles, and the equity of benefit distribution. Avoiding gender inequities in CBBP is especially important to ensure that women, young people, men, individuals with disabilities, and seniors all have an equal opportunity to participate and gain from the program. In order to make breeding objectives meaningful for the local population within a specific production system, it is crucial to define breeding goals in a participatory manner (*Kosgey et al., 2006, Kosgey et al., 2007, Haile et al., 2011*). However, if there is little to no direct involvement, it must be established whether farmers are consulted, adequately informed of all stages, and given the right amount of participation. Evaluations of gender

representation, roles, and benefit distribution equity are required. To guarantee that women, young people, men, people with disabilities, and elders all have an equal opportunity to participate in and benefit from the program, it is crucial that the CBBP avoid gender disparities. It is essential to set breeding goals in a participatory manner in order to make breeding objectives meaningful for the local community within a particular production system (*Kosgey et al., 2006, Kosgey et al., 2007, Haile et al., 2011*).

According to *Lamuno et al., (2018)*, indicators to evaluate program outreach, acceptability, and farmers' willingness to take on the breeding work include the number of farmers recruited in the CBBP, dropout rate of farmers over time, increased market demand for breeding animals, and the establishment of a formally or informally recognized farmers' breeding association. These metrics are essential for potential upscaling plans. Findings from a study done by *Wurzinger et al., (2013)* indicate that farmers were enthusiastic in taking part in a community-based breeding program, open-minded, and innovative in their problem-solving. The management of the program must be planned in accordance with the level of knowledge and cooperation of the farmers to ensure that they take ownership of the program. A community-based breeding program can be successful, but it requires some technical assistance to get going and ongoing technician support, which may diminish over time.

2.4 Influence of Community-Based Animal Breeding Program on Cattle-Breed Improvement

Community-based livestock breeding programs (CBBPs) have gained some attention in recent years and are being looked at as a viable option to increase livestock output in low-input systems and for smallholders (*Kosgey et al., 2006, Wurzinger et al., 2011, Mueller et al., 2015*). Through the genetic enhancement of livestock and the preservation of regional breeds, CBBPs have been marketed as a tool for economic and livelihood development in underdeveloped nations (*Kosgey et al., 2006; Haile et al., 2011*). A thorough assessment of these initiatives is lacking despite the fact that a number of case studies from the field and their achievements, obstacles, and failures have been recorded (*Sölkner et al., 1998; Mueller et al., 2015*).

The production of Ethiopian goats is below expectations despite a variety of genotypes that are tolerant of the country's severe environment and big goat populations. This is brought on by a lack of feed, a high prevalence of diseases, subpar genotypes, a bad marketing system, and inadequate infrastructure (*Gizaw et al., 2010; Abegaz 2014*). As a result, numerous initiatives have been made

to increase goat output and productivity, although they have had mixed results. Crossbreeding was the main initiative that had concentrated on using exotic breeds for a number of years. However, it has failed since there isn't a well-defined breeding and distribution plan, and there isn't much thought given to farmers' requirements or traditional traditions (*Haile et al. 2011*). Recent suggestions for creating appropriate breeding programs were made by the Ethiopian government as part of the Livestock Master Plan (LMP) with feed and health service interventions.

Community based breeding programmes have been developed all around the world for small ruminants, *Kosgey et al., (2006)* reviewed some of them; a lot of new experiences have been reported since). However, they have attracted little attention to beef cattle farmers. In order to support sustained cow genetic development in smallholder dairy farming in Tanzania and other areas of Sub Saharan Africa, appropriate breeding methods must be devised based on these indicators. (*AR Chawala, 2021*). Although crossbreeding has been practiced in Sub Saharan Africa for more than a century, the majority of dairy farmers in the smallholder dairy sector have been unable to reap the benefits. Lack of clear breeding techniques, environmental and genotype mismatches, and lack of farmer involvement in breeding program design are the main limitations. (*Galukande et al., 2013*).

The review done by *Omer (2022)*, demonstrated how widely indigenous breeds and exotic breeds have been crossed for genetic improvement, but that this practice has mostly failed under lowinput traditional production circumstances since the crossbred animals cannot survive in severe surroundings and are poorly managed. With little involvement from farmers, most within-breed selection procedures have been implemented through centralized breeding schemes run by governmental organizations. A community-based breeding scheme that enables farmers to participate in breeding efforts was recommended based on the literature review.

The same review by *Omer et al., (2022)* simulated alternative breeding plans for genetic improvement of Butana cattle under smallholder production conditions using the survey results. A stochastic simulation tool (AlphaSimR) was used to model a total of three breeding plans, including the employment of farm bulls, village bulls, and the rotational usage of village bulls within village groups. Three selection techniques were taken into consideration for each breeding program. According to the findings for the village bull breeding program, when farmers from the same village work together, the annual genetic gain (SD units) ranges from 0.01 to 0.21 (phenotypic selection)

and 0.014 to 0.45 (selection based on EBV). In the farm bull breeding program, the annual genetic gain varied between 0.014 and 0.39 (selection based on EBV) between 0.01 and 0.19 (phenotypic selection). Of all the bull selection techniques, the rotating use of village bulls produced the lowest annual genetic increase. However, compared to farm or village bull breeding schemes, it conserved more genetic variation. Overall, the most promising breeding strategy for attaining the breeding objective is the village bull breeding program with selection based on EBV of young bulls.

Another crucial condition is the prevention of inbreeding by preventing related animals from mating. Calculating inbreeding rates is necessary. To reduce the danger of genetic diseases and inbreeding depression, FAO (2010) suggests that the inbreeding rate be kept below the range of 0.5 - 1% year. Therefore, the program should take into account efforts to prevent unfavorable increases in inbreeding rates. Each CBBP should include an evaluation of genetic progress, and genetic trends for economically important traits should be evaluated on a regular basis. This aids in determining whether the program is moving in the proper direction. Indicators of genetic advancement include selection pressure, replacement rate, generation time, and the quantity and utilization of breeding males.

According to *Gavigan et al., (1997)*, cattle farmers typically give morphological selection factors (subjective selection) a higher priority than productivity selection criteria. Breeding goals should be determined within the frames of the nation's or region's overall development policies, be farmer-driven, and be subject to periodic evaluations (*Philipsson et al. 2006*). Thus, a study was conducted to look at local knowledge about goat breeding, management, and selection procedures used by farmers in Ethiopia's Konso and Meta-Robi regions.

According to the research done by *Ouédraog et al., (2020)*, there is some modest inbreeding, equivalent to some well-managed European dairy and beef cow breeds. It should be highlighted that significant levels of inbreeding are the consequence of conventional breeding, not the too recently adopted community-based breeding schemes. Farmers have been urged to swap out a few bulls after the installation of community-based breeding programs to reduce the mating of related animals.

2.5 Influence of Community-Based Animal Breeding Programs on Milk Production Kabunga (2017) discovered that enhanced dairy cows raised milk output of adopters by over 200% at the

company level. While there have been significant increases in milk production, they are still below the genetic potential of the region's and Uganda's known improved breeds. For instance, earlier studies shown that enhanced cattle breeds may produce over 990 liters of milk per year as opposed to only 400 litres for indigenous varieties, which is a 148% increase in milk production. (Kabunga, N.S., 2017). An indigenous zebu cow in Kenya produces 100–200 liters per year, but an upgraded dairy breed produces 1,400–1,700 liters per year. Therefore, it is undeniable that the adoption of improved dairy cows has the potential to increase milk productivity. (JA Odero Waititu, 2014). However, the existence of a structured breeding program focusing on animal traits identified by the farmers themselves would be necessary for genetic improvement to succeed (Chawala et al., 2019).

CBBP refer to cooperative village-based breeding programs with technical assistance. According to Mueller et al. (2015), it is a promising approach for genetic improvement in low input production systems. To increase the production of meat and milk, several native goat populations, such the Abergelle goat in Ethiopia, have undergone selective breeding (Gizaw 2013; Alemu 2015). Based on choosing phenotypically superior bucks and farmers' preferences, this selective breeding has been practiced in the villages of Tanqua-Abergele and Ziquala districts since 2013 (Dessie et al., 2014). To propagate the technique as well as an elite animal as a parent or founding flock in the larger population of a given breed, any breeding program should be reviewed (FAO 2015). However, there is little data available on how well the existing breeding initiatives are doing.

Birhanie et al., (2018) evaluated the body weight and milk yield improvements performance of Abergelle goat population in the CBBP and concluded that Improvements in body weight and milk yield under the sire line selective breeding scheme fell far short of expectations. Under the CBBP, the main determinants of body weight and milk yield were district, birth type, and season. Only the weight at birth in all areas and at three and six months in Tanqua-Abergele district showed a significant difference. This suggests that more time and generations was needed to witness improvement due to environmental influence changes or improper CBBP selective breeding practices. In the second generation, the results of selective breeding indicated a modest improvement in body weight. The milk production of the offspring of particular bucks was less than that of the basic flock. This implies that, depending on the breeding objectives, the selection criteria for breeding bucks should be revised and reset. Overall, taking into account subsequent generations may reveal details about the genetic advancement that such programs of selective

breeding may be able to bring about. Additionally, a comprehensive implementation and optimization process that considers genetic parameters, variance components, and their interactions with the environment may offer insights on how to map breeding goals more effectively (*Birhanie et al., 2018*).

In order to ascertain the advancements made through five decades of selection management, a second study was carried out to assess the performance of the Butana herd in a research station run by the government. Findings of *Omer et al., (2022)* portray that milk production increased significantly between 2001 and 2010, rising from 1209 kg/lactation between 1961 and 1970 to 1689 kg. Between 2001 and 2010, the age at first calving considerably dropped from 55.6 months to 45.9 months. Some bulls with numerous daughters had negative genotypic values, which indicated that the selection criteria weren't being met. Intense selection for quick genetic advancement in milk yield may be possible given the current low age at first calving and the wide diversity in lactation milk yield. Better management and selection criteria are necessary, nevertheless.

Omer et al., (2022) indicate that Milk yield was ranked as the most crucial attribute for future improvement by farmers, followed by growth efficiency and lactation duration. The high cost of concentrate feed, a lack of financial support, a lack of genetic improvement services, and a high incidence of illnesses were all obstacles to cattle productivity in the research locations. About 67% of farmers were willing to trade breeding bulls and develop farmers' associations as relevant features for future breed improvement, which could be helpful for the establishment of a community-based breeding program. Over 98% of farmers were open to exchanging information.

2.6 Sustainability of Community-Based Animal Breeding Programs in Dairy Farming communities

The significance of a systematic assessment of the effectiveness and impact of CBBPs is mentioned by a number of authors (*FAO 2010, Haile et al. 2011, Mueller et al., 2015*) in order to determine whether the promised changes have actually been made. Additionally, these writers offer broad suggestions for potential evaluation indications, but they don't go into specifics about how such an evaluation could be conducted. *Lamuno et al., (2018)*, came up with an evaluation framework with clear indicators to assess whether the NAGRIC community breeding services are achieving the

intended objectives. Such a thorough assessment is required to determine if there is a significant impact as a result of the services so that they could be sustained.

The effectiveness and long-term sustainability of research and development programs have been argued by authors from several fields to depend on farmers' input in the decision-making processes (*Neef et al., 2011; Pretty 1995*). Experiences from these and other CBBPs show that complete independence and self-sustained programmes are nearly impossible in smallholder systems and that technical support and external funding will always be required (*Iniguez 1998; Kosgey et al., 2007; Wurzinger et al., 2011; Iniguez et al., 2013*). Sustained support as well as upscaling and outscaling of programmes are also essential.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Area of study

The study area selected for this research was Kikatsi Sub County, located in Kiruhura District, Uganda. This because it is a cattle community area and dairy farming is the main source of livelihood for people in Kikatsi sub-county, Kiruhura district. More so the area is one of the beneficiaries of the NAGRIC community-based animal breeding program and therefore the community is the best target for providing resourceful information necessary for providing actionable insights into the program's impact on milk yield, genetic diversity, and farmer income.

3.2 Study design

A cross-sectional study design was adopted rooted in the quantitative approach. This design has the advantage of measuring current attitudes or practices. It also provides information in a short amount of time, such as the time required for administering the survey and collecting the information. It can examine current attitudes, beliefs, opinions, or practices. This design was used because it allowed the researcher to collect data at a specific point in time and examine the relationship between exposure (in this case, the use of community-based breeding services) and outcome (factors influencing their use) (*Wang et al. 2020*). In a cross-sectional study, data was collected through surveys or interviews administered to the target population, which in this case was the cattle farmers in the study area. The survey or interview questionnaire included questions related to the farmers' utilization of community-based Animal breeding services and their perceptions, attitudes, knowledge, socioeconomic factors, and other relevant variables that may influence their decision to use these services. (*Nyariki, D. M. 2009*).

3.3 Target Population

This study targeted Kikatsi sub-county which has a good number of participants and some involved in CBABP for dairy farming. This study targeted farmers, government leaders, local leaders and veterinary professionals. Farmers were targeted because they are direct beneficiaries of NAGRIC community breeding and would provide resourceful information towards farmer engagement, cattle breed improvement and milk production. The local and government leaders were targeted because

they introduced and were the direct implementers of NAGRIC community breeding program. The study also targeted 59 participants in the sub-county of Kikatsi.

3.4 Sample size determination

According to *Sandelowski (1995)*, Sample size is defined as the number of entities in a subset of a population selected for analysis. A sample size of 59 respondents was chosen to participate in the study from a population of 70 respondents from the entire sub county. The sample size was determined using *Krejcie and Morgan table (1970)* statistical power analysis as shown below. This was done to enable the researcher reduce on the costs since studying the entire population is costly.

3.5 Sample selection

The sample for this study was selected using a stratified random sampling technique. The population of interest, cattle farmers in Kikatsi Sub County, Kiruhura District, was divided into strata based on administrative zones (parishes).

Categories of respondents	Target
Farmers	40
Government representatives	3
Veterinary professionals and representatives for dairy cooperatives	9
Local authorities	7
Total	59

From each stratum, a random sample of farmers was selected to ensure representation from different areas within the sub county. The sample size was determined using a margin of error of 5%.

3.6 Data Collection Methods and Tools

3.6.1 Methods

The data for this study was collected using a combination of data collection methods and tools. A survey was administered to gather quantitative data from a sample of participants, utilizing a structured questionnaire with Likert-scale and multiple-choice questions. Additionally,

semistructured interviews were conducted with a subset of participants to obtain in-depth qualitative insights for purposes of triangulation of data.

3.6.2 Tools

Data collection tools such as standardized interview guides and survey questionnaires were utilized to ensure accuracy and consistency in data collection. The use of multiple data collection methods and tools allowed for a comprehensive approach to gather diverse perspectives and obtain rich data for analysis.

3.7 Data Analysis

The collected data was subjected to thorough data analysis using a combination of descriptive statistical methods. Descriptive statistics were calculated to summarize the key characteristics of the variables of interest. Data visualization techniques, including charts and graphs, were utilized to present the findings in a clear and concise manner. The data analysis process was carried out using statistical software (SPSS version 26) to ensure accuracy and facilitate efficient analysis. The in-depth data was analyzed using thematic analysis. The results of the data analysis provided valuable insights that would contribute to addressing the research objectives and research questions posed in this study.

3.8 Ethical Considerations

Ethical clearance was sought from Bishop Stuart University Research Ethics Committee. According to *Amin (2005)*, ethics refers to the moral principles or ideals that often guide a person's or a group's behavior. To protect both privacy and the security of the farm, it was vital to take ethical considerations into account of privacy, anonymity and confidentiality of the both the participants and their information. Farmers and leaders provided their consent before taking part in the research upon the researcher's explanation of the purpose of the research, benefits and risks of participating in the research. Furthermore, participants were informed of their right to withdraw from the research at any point without any compromise or threat for the loss of research benefits.

The researcher endeavored to compensate for the participants' time for participating in the research.

3.9 Community Engagement Plan

Before the study, the researcher obtained permission from responsible leaders to allow him conduct a study in the targeted area. The researcher introduced the topic to the targeted participants explaining the importance of the study, its potential benefits, and the need for community involvement, from there he identified relevant key stakeholders such as farmers, dairy cooperatives, local authorities, veterinary professionals, and researchers who were interested or involved in dairy farming and animal breeding. The researcher reached out to them personally to discuss the study's objectives and seek their input. During the study, the researcher involved community members actively in the study, collaborated with local farmers and cooperatives to collect data, perform observations, and gathered insights on the animal breeding program's performance. After the study, the researcher will share the results of the study through presentations at workshops, publishing the study's findings and outcomes and also making the results accessible and easy to understand for all community members. The researcher also discussed potential follow-up actions based on the study's results, sought community input on how to improve the animal breeding program and address any challenges highlighted by the study and lastly recognized and appreciated the community's contribution throughout the study.

3.10 Covid-19 and Ebola risk Mitigation Plan

In regard to the recent Covid-19 pandemic, stringent adherence to public health recommendations, such as social isolation, mask use, routine hand sanitization, and minimal physical contact, were upheld throughout the course of the study. Additionally, procedures were established to quickly adjust to any modifications in regional health legislation. Additionally, the mitigation plan included knowledge gained from earlier outbreaks to put community safety first, taking into account the historical impact of the Ebola virus. Participants received thorough instruction on disease prevention and control strategies. The strategy was fluid and dynamic, and lines of constant contact were set up to keep the community informed and involved while preserving both its members' health and the objectivity of the research process.

3.11 Quality Control

3.11.1 Validity

Content validity of the survey questionnaire was ensured by consulting subject matter experts (supervisor) who reviewed and provided feedback on the questionnaire items to ensure their relevance and coverage of the research construct. Face to face validity was also upheld upon expert judgment of the instruments.

3.11.2 Reliability

Reliability of the questionnaire was determined by testing and re-testing of the tool and Cronbach's Alfa Coefficient computed to at least (0.7 – 0.8) was considered to determine the consistency in the items of a questionnaire (*Hair et al., 2010*).

3.11.3 Data Management

Data was collected and recorded in a structured format to facilitate efficient data management and analysis. Quality control measures were implemented to monitor the accuracy and completeness of the data. Participant confidentiality was strictly maintained throughout the research process. No personal identification to protect the privacy of participants. Data access was restricted to authorized personnel only, and strict confidentiality was in place to safeguard the privacy of participants and maintain compliance with ethical standards and relevant regulations. All collected data was securely stored in password-protected electronic databases, with restricted access granted only to only authorized personnel involved in the research.

CHAPTER FOUR

PRESENTATION AND INTERPRETATION OF FINDINGS

4.1 Breeding Practices

The study assessed whether the farmers use NAGRIC Community based animal breeding services in the study area, the breeding methods used in the livestock farming, size of the livestock herd, whether the farmer maintains records of breeding activities, such as mating and pedigrees, number of herds that are products of community based animal breeding services and number litres of milk got from milking NAGRIC breeds. All these are presented in the table 4.1 below; **Table 4.1: Breeding practices**

Breeding practices	Category	Frequency	Percent
Do you have NAGRIC Community based	Yes	38	95.0
	No	2	5.0
	Total	40	100.0
Whether community breeding services and resources are accessible in the area	Yes	35	87.5
	No	5	12.5
	Total	40	100.0
Breeding practices	Category	Frequency	Percent
animal breeding services in this area	Natural	29	72.5
	Artificial Insemination	3	7.5
	Both	8	20.0
Size of livestock herd	Less than 10 cows	7	17.5
	10-30 cows	13	32.5
	More than 30 cows	20	50.0

The farmer maintains records of breeding activities, such as mating and pedigrees	Yes		11	27.5
	30-50 cows		8	20.0
	Above 50 cows		12	30.0
	Total		40	100.0
	No	29	72.5	
Number of cows that are products of	Less than 10		38	95.0
	Total		40	100.0
	10-30	2	5.0	
community based animal breeding services	Less than 20		10	25.0
	Total		40	100.0
Number litres of milk got from milking	30-50	20	50.0	
NAGRIC breeds	Above 50	10	25.0	
Total			40	100.0

Source: Field data, 2024

The results in table 4.1 above indicate that majority (95.0%) of the respondents reported that NAGRIC Community based animal breeding services are available in Kikatsi Sub County, Kiruhura District while only 5% reported that NAGRIC Community based animal breeding services are not available in the study area. This is partly attributed to the presence of services at Ruhengyere field station which is one of the breeding centres introduced by The National Animal Genetic Resources Centre and Data Bank (NAGRC&DB). Majority (87.5%) of the farmers reported that they have access to community breeding resources including improved or highquality semen. Responses from interview guide also revealed that there is high accessibility of high quality semen from Ruhengyere field station which is the nearest service station in the area. Presence of cheap semen at Ruhengyere field station was actually reported among the factors contribute to the acceptance of farmers to use community-based breeding services. In addition, the presence of nearby service centre that is,

Ruhengyere Field Station was also reported among the factors contribute to the acceptance of farmers to use community-based breeding services in Kikatsi sub county.

Despite the increased availability and accessibility of improved animal breeding services in the study area, the results of this study indicate that majority (72.5%) of the farmers are still using natural breeding methods in the livestock farming activities. Only 7.5% use artificial insemination while 20% use both natural and artificial insemination in animal breeding.

The results also indicate that only less than 10 cows are products of community based animal breeding services for almost 95% of the farmers yet majority (82.5%) of the farmers have more than 10 cows. Despite the limited number of cows that are products of community based animal breeding services, the results indicate that about half (50%) of the farmers produce 30-50 litres of milk from milking NAGRIC breeds, 25% produce less than 20 litres and the same percentage produced above 50 litres. About 72.5% (different from what is in the table above) of the farmers do not maintain records of breeding activities, such as mating and pedigrees while only 27.5% maintain records of breeding activities. While community based animal breeding services exist in the study area.

4.2 Perceptions and Benefits of Community-Based Breeding Initiatives

The benefits of Community-Based Breeding initiatives and characteristics prioritized when selecting semen are presented in table 4.2 below;

Table 4.2: Perceptions of Community-Based Breeding Initiatives

Perceptions of Community-Based Breeding Initiatives		Frequency	Percent
Perceived benefits of community-based breeding initiatives	Genetic improvement	14	35.0
	Increased availability of quality animal products	12	30.0
	Increased production and income generation	10	25.0
	Improved community participation	4	10.0
	Total	40	100.0

Milk production	18	45.0
Disease resistance	10	25.0
Fertility and reproductive Characteristics prioritized performance when selecting semen	3	7.5
Growth rate	4	10.0
Adaptability to local conditions	5	12.5
Total	40	100.0

Source: Field data, 2024

Farmers in Kikatsi Sub County perceived Community-Based Breeding initiatives to be beneficial in terms of genetic improvement (35%), increased availability of quality animal products (30%), increased production and income generation (25%) and improved community participation (10%). When selecting semen, most farmers (45%) prioritized breeds that result to an increase in milk production and disease resistance (25.0%). Others farmers however prioritized adaptability to local conditions (12.5%), growth rate (10.0%) and fertility and reproductive performance (7.5%) as the major characteristics of a good semen.

4.3 Awareness and Knowledge of Community-Based Breeding Services

Data about the level of awareness and knowledge of community-based breeding services is presented in table 4.3 below;

Table 4.3: Awareness and Knowledge of Community-Based Breeding Services

Awareness of Community-Based Breeding Services		Frequency	Percent
Period in years spent in livestock farming	1-5 years	1	2.5
	6-10 years	6	15.0
	More than 10 years	33	82.5
	Total	40	100.0
The farmer is aware of any community-based breeding services available in the area			
Yes		34	85.0
No		6	15.0
Total		40	100.0

Have you personally ever utilized community-based breeding services for the livestock	Yes	13	32.5
	No	27	67.5
	Total	40	100.0
Respondent's rating of the overall satisfaction with the community-based breeding services you have used	Very Dissatisfied	14	35.0
	Dissatisfied	12	30.0
	Neutral	9	22.5
	Satisfied	5	12.5
	Total	40	100.0
Reasons you have not utilized community-based breeding services	Lack of trust	14	35.0
	Poor results	7	17.5
	Lack of awareness	6	15.0
	Cost	6	15.0
	Lack of information	4	10.0
	Distance	3	7.5
	Total	40	100.0

Source: Field data, 2024

Majority (82.5%) of the farmers had spent more than 10 years in livestock farming. This is a long time to enable them have basic knowledge on improved animal breeding methods. The results show that majority (85%) of the farmers are aware of community-based breeding services being available in their area. Despite the high level of awareness about these services, majority (67.5%) have never utilized community-based breeding services for the livestock. Only 32.5% reported having ever utilized community-based breeding services. This is partly explained by farmers' attitudes towards these services since 35% of the farmers reported their dissatisfaction with community-based breeding services. Other reasons for not utilizing community-based breeding services include; lack of trust (35%), poor results (17.5%), lack of awareness (15%), cost (15.0%), lack of information (10%), and long distance from AI service centre (7.5%).

Responses from the interviews with key informants have also revealed lack of trust among the reasons for not utilizing community-based breeding services. The following were some of the narratives from the local leaders, cooperative members and veterinary officials;

“As a leader, I have made the community members aware of the services but the farmers have not trusted the services” (respondent at, Kikatsi Ngiira dairy cooperative, 4/3/2024)

“The farmers trust their bulls more than artificial insemination” (respondent at Rugaaga Cooperative society 04/03/2024)

“The farmers are reluctant on adopting the breeding services because they don’t trust them” respondent Kikatsi Coop 4/3/2024)

“The farmers are still conservative as they like their bulls so much” (. leader of a cooperative 01/03/2023)

Responses from interviews have also revealed that farmers have been reluctant on embracing community based animal breeding services because of the poor results experienced even after adopting improve breeds. The poor results are manifested in low milk yield, high mortality rate, low conception rates and low adaptability to ticks and diseases. The following are some of the narratives backing this;

“The Kikatsi farmers have adopted but they have not seen the increase in productivity due to the adoption”. (Member Rugaaga Farmers Coop 04/03/2024)

In my view much as farmers are participating in this program, the biggest setback is low levels of conception among inseminated cows which has resulted in few animals produced by the program; the new improved breeds born don’t get better feeds/ pastures combined with diseases and farmers therefore find the program’s performance on dairy farming not very successful (Veterinary.

Officer, 6/03/2024).

Tick borne diseases like East Coast Fever have contributed to reluctance of farmers to adopt the services due to intolerance of the breeds to the diseases (Veterinary Officer, Kikatsi 03/03/2024)

Lastly, the interview responses also highlighted poor infrastructure and transport as one of the factors hindering effective utilization of improved animal breeding services as highlighted in the narratives below;

Poor transport means like roads hinders service delivery (. member Kikoona Cooperative 3/3/2024)

There is poor infrastructure like roads connecting to villages in Kikatsi (LCII, Kikatsi).

4.4 Factors Influencing the Use of Community-Based Breeding Services

The factors influencing the use of community-based breeding services are summarized in table 4.5 below;

Table 4.4: Factors Influencing the Use of Community-Based Breeding Services

Factors	Not important	Somewhat important	Important	Very important
Cost-effectiveness	0(0%)	38(95.0%)	0(0%)	0(0%)

Quality and availability of semen	0(0%)	39(97.5%)	0(0%)	0(0%)
Accessible location and convenience	1(2.5%)	39(97.5%)	0(0%)	0(0%)
Trust and reputation of the service providers	1(2.5%)	39(97.5%)	0(0%)	0(0%)
Expertise and knowledge of service providers	1(2.5%)	39(97.5%)	0(0%)	0(0%)
Provision of follow-up support and guidance	1(2.5%)	39(97.5%)	0(0%)	0(0%)

Source: Field data, 2024

The results in table 4.4 above indicate that cost-effectiveness, quality and availability of semen, accessible location and convenience, trust and reputation of the service providers, expertise and knowledge of service providers and provision of follow-up support and guidance are somewhat important factors influencing the use of community-based breeding services as reported by over 90% of the farmers. This implies that farmers are able to utilize community-based breeding services if they are somewhat cost-effective, of good quality, available, accessible, convenient, and provided by trusted, reputable, knowledgeable and supportive service providers.

During interviews with local leaders, veterinary officers and cooperative members, the issue of cost, location, trust, knowledge and support/guidance were highlighted by most participants. About half (50%) of the interviewees report availability of skilled inseminators as one of the factors affecting use of community-based breeding services. This increases the farmers' perceived trust and reputation of the service providers knowing that the services are provided by experts and knowledgeable service providers. This also implies that farmers can be assured of follow-up support and guidance from these experts wherever and whenever they need them. The following narrations support this argument;

The presence of skilled artificial inseminators at Ruhengyere field station who have effectively helped the farmers in service delivery has attracted the farmers to use community-based breeding services (Secretary to LC1, Kikatsi 03/03/2024)

“Presence of trained inseminators at Ruhengyere field station helps farmers to access quality services” (member, Kikatsi Ngiira Dairy Coop, 4/3/2024)

“There is training of more technicians at Ruhengyere field station to support and guide farmers on artificial insemination” (Youth Councilor, Kayonza, 05/03/2023)

Eight (8) participants highlighted the issue of cost and availability of semen as one of the factors affecting the use of community-based breeding services. This is highlighted in the narrations below;

“Farmers can easily accept the program if there is cheap services” (N.D member, Kikatsi Ngiira dairy cooperative, 4/3/2024)

“Most farmers prefer cheap semen” (member Kikoona Coop., 2/3/2024)

“There is cheap semen at Ruhengyere field station” (Member Kikatsi Cooperative 4/3/2024)

“The presence of cheap semen has increased on the acceptance of services” (Chairperson LC1 Kayonza 03/03/2024)

“Availability of cheap semen at Ruhengyere Field Station” (Chairperson LC1 Kayonza 03/03/2024)

Four (4) participants highlighted the issue of accessibility to be a major factor associated with utilization of community-based breeding services in Kikatsi Sub County. This is indicated in the following narrations;

“Presence of nearby service centre that is, Ruhengyere Field Station assists farmers to access the services at any time” Youth Councilor, Kayonza, 05/03/2023)

“Poor transport means like roads hinders service delivery within the area” (member Kikoona Coop 3/3/2024)

“There is poor infrastructure like roads connecting to villages in Kikatsi which hinder effective delivery of breeding services” (LC2, Kikatsi)

4.5 Community Engagement and Support

The results pertaining the level of community engagement and support from NAGRIC communitybased breeding service providers in Kikatsi Sub County are presented in table 4.5 below;

Table 4.5: Community Engagement and Support

Community Engagement and Support		Frequency		Percent
Have you received any support or training from community-based breeding service providers?	Yes	36		90.0
	No	4		10.0
	Total	40		100.0
How frequently do you participate in community meetings or workshops related to livestock breeding in a year	None	4		10.0
	Once a year	36		90.0
	Total	40		100.0
Do you think NAGRIC CBBP has been effective in meeting the specific needs of livestock farmers in your area	Not true	2		5.0
	Somehow true	30		75.0
	True	5		12.5
	Very True	3		7.5
	Total	40		100.0

Source: Field data, 2024

Majority (90%) reported that they have received support or training from community-based breeding service providers. However, the frequency with which these trainings are held is very low since most farmers (90%) participated in community meetings or workshops related to livestock breeding only once a year. Nevertheless, majority of the farmers (75%) recognized that community-based breeding services are somewhat important in meeting the specific needs of livestock farmers in the study area.

Responses from the interviews with key informants indicate significant improvements in trainings and awareness campaigns being provided to farmers from Ruhengyere field station. The following narrations portray the intensity of training and sensitization in the study area;

“Training of more inseminators is taking place in Ruhengyere field station” (member Kikoona Cooperative., 2/3/2024)

“There is training of more technicians at Ruhengyere Field Station” (Youth

Councilor, Kayonza, 05/03/2023)

“My role is gathering the farmers in the sub county to get information concerning services from the technicians” Member Rugaaga

Cooperative04/03/2024)

“I have played a key role is bringing service providers to the cooperative meetings to inform the farmers about breeding services” (KM 06/03/2024)

Table 4.6: Improvements or additional support that farmers would like to see in communitybased breeding services

Improvements or additional support	Frequency	Percent
I suggest farmers be sensitized on better feeding for the improved breeds	10	25.0
Increased number of inseminators	9	22.5
Experts should bring us semen that breeds heifers only	6	15.0
They introduce breeds that are tick resistant	3	7.5
Government should look for better acaricides for ticks	1	2.5
Total	40	100.0

Source: Field data, 2024

The results in table indicate the additional improvements or support that farmers would like to see in community-based breeding services. Ranked in their order, the following themes are developed;

Sensitization

The results also indicate that most farmers (25%) need to be sensitized the benefits of artificial insemination. Farmers also demanded sensitization about the different breeds for artificial insemination and the best quality breeds. One farmer recommended that service providers should show farmers pictures of good bulls for artificial insemination. Another farmer demanded that service providers should teach farmers about the most effective animal feeds for the animals that have been bred through artificial insemination as well as the best breeds for high milk production. Different stakeholders including local leaders, cooperative leaders and members as well as veterinary officers played a critical role in sensitization of farmers on artificial insemination and other breeding services.

“Creating awareness among the farmers in Kikatsi Sub County” (member,

Kikatsi Ngiira dairy cooperative, 4/3/2024)

“Extending awareness to the cooperative members” (member Kikoona Coop., 2/3/2024)

*“I have involved youth in the awareness programmes concerning breeding services”
(Youth Councilor, Kayonza, 05/03/2024)*

*“As a leader, I have made the community members aware of the services” (Chairperson
LC1 Kayonza 03/03/2024)*

*“I am an adopter as I have already started benefiting from the services also.
Therefore, I have played a role of informing and extending awareness of the
services to the entire Kikatsi community” (Chairman Kayonza cell, 06/03/2024).*

Increased number of inseminators

It is revealed that most (22.5%) farmers demand the service providers to increase on the number of inseminators. This implies that while farmers would be willing to adopt the services provided under NAGRIC community-based breeding program, most of them are limited number of inseminators. This implies that if the number is increased, then most farmers will embrace the services. During interviews, the local leaders and cooperative leaders confirmed that there is more training being undertaken at Ruhengyere field station as narrated below;

*“Training of more inseminators is taking place in Ruhengyere field station” (K.J.,
member Kikoona Coop., 2/3/2024)*

*“There is training of more technicians at Ruhengyere Field Station” (A.G Youth Councilor,
Kayonza, 05/03/2023)*

Need for heifers

Farmers (12.5%) also require service providers under NAGRIC community-based breeding program to bring semen that breeds heifers only. This is geared by the high demand for improved milk production which is the main source of income in the study area. This means that farmers can easily utilize community-based breeding services if they are sure that they will breed heifers instead of bulls.

Tick resistant breeds

There is also dire need for breeds that are tick resistant as reported by 7.5% of the farmers. Most farmers fear the improved breeds because of their high mortality rate due to ticks compared to the local breeds. This implies that if farmers can be sure of the breeds provided under communitybased breeding services are tick resistant, then they can utilize these services. One farmer actually demanded that government should look for better acaricides for ticks which are main causes of mortality among improved breeds. During interviews with veterinary officers, it was revealed that most animal breeds provided under NAGRIC community-based breeding program are subject to tick infestation.

Tick borne diseases like Theleriosis (ECF) have contributed to reluctance of farmers to adopt the services due to intolerance to the diseases (T.C Vet Officer, Kikatsi 03/03/2024)

4.6 Information and Communication

This section highlights the methods and means through which farmers in Kikatsi Sub County, Kiruhura district receive information about community-based breeding services, their belief about the need for improved communication and information dissemination of community-based breeding services and their overall satisfaction with the current availability and quality of community-based breeding services. The results are shown in table 4.7 below;

Table 4.7: Means through which farmers in Kikatsi sub county, Kiruhura district receive information about community-based breeding services

Information and Communication		Frequency	Percent
Word-of-mouth		27	67.5
Means of receiving information about community-based breeding services	Farmer groups/associations	7	17.5
	Radio/TV	5	12.5
	Social media	1	2.5
	Total	40	100.0

	Yes	30	75.0
	No	10	25.0
The farmer believes there is a need for improved communication and information dissemination on CBBS	Total	40	100.0

Source: Field data, 2024

Majority (67.5%) of the farmers reported that they received information about community-based breeding services through word of mouth while 17.5% received this information through farmer groups/associations. Only 12.5% of the farmers received information about community-based breeding services from radio or television while 2.5% received information from social media. Generally, most (75%) of the farmers believed there is need for improved communication and information dissemination on community-based breeding services. During interviews with key informants, it was revealed that face to face meetings was indeed the most common form of information dissemination about NAGRIC community-based breeding services. These were held at the village level and at the cooperative level. However, some interview participants reporting incidences where they would engage with the local community and farmers on social media, radios, televisions and direct phone calls to promote the use of community-based breeding services but on a small scale.

CHAPTER FIVE

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Discussion of findings

The results indicate that while over 90% of the farmers in Kikatsi Sub County, Kiruhura District are aware that NAGRIC Community based animal breeding services are readily available and used by some farmers in the study area, about 62.5% of the farmers have personally never utilized community-based breeding services for the livestock. This implies that the level of farmer engagement and participation in NAGRIC Community-Based Animal Breeding Program is low. Most (72.5%) of the farmers are still reliant on natural breeding methods with limited farmer engagement and participation in modern breeding methods such as artificial insemination. Only 27.5% of the farming population use artificial insemination yet 86.7% reported that these improved or high-quality semen are available and accessible in the study area.

The study found out that the following factors affects performance of community based animal breeding programmes; cost-effectiveness, quality and availability of semen, accessibility and convenience, trust and reputation of the service providers, expertise and knowledge of service providers and provision of follow-up support and guidance. Nearly 80% of the farmers reported their dissatisfaction with community-based breeding services due to lack of trust (35%), poor results (17.5%), lack of awareness (15%), cost (15.0%), lack of information (10%), and long distance (7.5%). Addressing these challenges can therefore improve farmer engagement and participation in NAGRIC Community-Based Animal Breeding Programs as well as their utilization.

Also the results indicate that farmers in Kikatsi Sub County perceived Community-Based Breeding Initiatives to be highly beneficial in terms of genetic improvement (17.5%) and increased availability of quality and improved semen (15.0%). The results however indicate that majority of the farmers reported having a lower number of herds that are products of community based animal breeding services which was less than 10 heads which makes milk production limited. The study findings are in agreement with *Omer et al (2022)* who demonstrated how widely indigenous breeds and exotic breeds have been crossed for genetic improvement, but that this practice has mostly failed under low-input traditional production circumstances since the crossbred animals cannot survive in

severe climates and are poorly managed. The same results are in line with *Omer et al., (2022)* who simulated alternative breeding plans for genetic improvement of Butana cattle under smallholder production conditions. The study findings are also in agreement with *Galukande et al., (2013)* who reported that although crossbreeding has been practiced in Sub Saharan Africa for more than a century, the majority of dairy farmers in the smallholder dairy sector have been unable to reap the benefits. Lack of clear breeding techniques, environmental and genotype mismatches, low conception rates and lack of farmer involvement in breeding program design are the main limitations. The above findings justify need for the stakeholders in the Community-Based Breeding Program such as NARO and MAAIF to support farmers and empower them to improve on the cattle breeds. Suggestions by farmers indicate dire need for stakeholders to sensitize farmers about artificial insemination, better feeding, reduce on the price of semen and more inseminators, bring semen that breeds heifers only, introduce breeds that are tick resistant and look for better acaricides for ticks in order to enable farmers realize the benefits of community-based animal breeding program.

Similarly; the results indicate that amongst the farmers who had benefited from NAGRIC Animal Breeding Programs, half of them (50%) produced 30-50 litres of milk from milking NAGRIC breeds while 25% were producing above 50 litres of milk. This is evidence that NAGRIC community-based animal breeding program has a significant influence on milk production in Kikatsi Sub County, Kiruhura District. These findings are in agreement with Kabunga (2017) who discovered that enhanced dairy cows raised milk output of adopters by over 200% at the company level. Further, the findings are in agreement with *Omer et al., (2022)* who asserted that milk production increased significantly between 2001 and 2010, rising from 1209 kg/lactation between 1961 and 1970 to 1689 kg. Between 2001 and 2010, the age at first calving considerably dropped from 55.6 months to 45.9 months. The study further agree with *Omer et al., (2022)* who revealed that milk yield was ranked as the most crucial attribute for future improvement by farmers, followed by growth efficiency and lactation duration.

There was however a common query among farmers who demanded service providers to sensitize farmers about the most effective animal breeds for high milk production. A section of farmers (12.5%) also required service providers under NAGRIC community-based breeding program to bring semen that breeds heifers only in order to improve milk production which is the main source of income in the study area. This means that farmers can easily utilize community-based breeding

services if they are sure that they will breed heifers instead of bulls. This is also in line with *Kabunga (2017)* who revealed that while there have been significant increases in milk production, they are still below the genetic potential of the region's and Uganda's known improved breeds. In addition, the results are in line with *Birhanie et al., (2018)* who revealed that improvements in milk yield under the sire line selective breeding scheme fell far short of expectations. The study further agree with *Omer et al., (2022)* who revealed that the high cost of concentrate feed, a lack of financial support, a lack of genetic improvement services, and a high incidence of illnesses were all obstacles to cattle productivity in the research locations.

The study revealed that most dairy communities have not sustainably benefitted from NAGRIC Community-Based Animal Breeding Programs. While services are readily available in the area, their utilization by dairy farming communities is largely limited by low success rate of conception, limited number of trained inseminators, lack of semen that breeds more heifers and low resistance to ticks among improved breeds compared to local breeds. While most dairy farmers (57.5%) prioritized dairy breeds that are highly productive in terms of milk yield and disease resistance, breeds with high adaptability to local conditions, high growth rate and high fertility and reproductive performance, these breeds were largely lacking in the area. Unless these challenges are addressed, the sustainability of NAGRIC Community-Based Animal Breeding Programs among dairy farming communities will be at stake since they will not be utilized by the dairy farmers. Therefore, NAGRIC Community-Based Animal Breeding Programs can be sustainable if dairy farmers can be sensitized about advantages of artificial insemination and the most productive and tick resistant breeds for improved dairy production and if the price of semen is reduced to a level that every dairy farmer can afford.

The study findings are in agreement with *Neef et al., (2011)* who noted that the effectiveness and long-term sustainability of development programs are dependent on farmers' input in the decisionmaking processes. Experiences from other studies (*Iniguez 1998; Kosgey., 2007; Wurzinger et al., 2011; Iniguez et al., 2013*) show that complete independence and self-sustained CBBPs are nearly impossible in smallholder systems and that technical support and external funding will always be required to improve its sustainability. In the light of the above, sustained support from government and other stakeholders is important for scaling up NAGRIC Community-Based Animal Breeding Programs.

5.2 Conclusions

There is low level of farmer engagement and participation in NAGRIC Community-Based Animal Breeding Program. Addressing the key issues associated with limited farmer engagement and participation such as cost-effectiveness, quality and availability of semen accessibility and convenience, trust and reputation of the service providers, best feeding, expertise and knowledge of service providers and provision of follow-up support and guidance is key to improving farmer engagement and participation in NAGRIC Community-Based Animal Breeding Programs as well as their utilization.

Community-Based Animal Breeding Program has had a positive influence on cattle-breed improvement in Kikatsi Sub County since they are perceived by most farmers to be highly beneficial in terms of genetic improvement, increased availability of quality and improved breeds. However, most farmers still have a lower number of cows that are products of community based animal breeding services which justify need for more sensitization and support to farmers to empower them to improve on the cattle breeds.

NAGRIC Animal Breeding Programs had a positive influence on milk production in Kikatsi Sub County since over half of the farmers who had benefited from NAGRIC Animal Breeding Programs produced over 30 litres of milk from milking NAGRIC breeds. There is however concern among most farmers who urged service providers to sensitize them about the most effective animal breeds and feeding for high milk production and to bring semen that breeds heifers only in order to improve milk production.

Most dairy communities in Kikatsi Sub County have not sustainably benefitted from NAGRIC Community-Based Animal Breeding Programs since utilization of services provided under this program is still low. This is attributed to lack of knowledge about artificial insemination, low conception rates, poor feeding, lack of semen that breeds more heifers and low resistance to ticks among improved breeds compared to local breeds. Sustainability in this case can be ensured by supplying breeds with high adaptability to local conditions, high conception rates, high tick and disease resistance, high growth rate and high fertility and reproductive performance and ensuring that the price of semen is reduced to a level that every dairy farmer can afford.

5.3 Recommendations

Based on the findings, the following recommendations have been made;

- The government through the NARO, NAGRIC and MAAIF should provide good /high quality dairy breeds to farmers.
- The government through the NARO, NAGRIC and MAAIF should supply high quality semen from proven tested breeds.
- The study therefore recommended Government through the NARO and MAAIF to make thorough research into the breeds of dairy cattle that are highly productive and resistant to ticks and diseases as well as the most effective acaricides and drugs for ticks and diseases respectively.
- The Government should also provide subsidy on the cost of semen used in artificial insemination and train and employ more agriculture extension officers to scale up sensitization.
- Improve on extension services to reduce incidence of diseases and employ veterinary professionals to treat sick animals.

5.4 Areas of further study

1. The study was limited to a single study area-Kikatsi sub county, Kiruhura district, therefore a similar study can be conducted in other different districts in Uganda.
2. There is need for a similar study to be conducted in all sub counties in the entire district.

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APPENDICES

Appendix i: Questionnaire to farmers

I am **Brian Ahimbisa**, a student at Bishop Stuart University, currently conducting research on community based cattle breeding programs.

Your valuable experience in this field are crucial for the success of this study. The purpose of this questionnaire is to gather information and understand the current practices, challenges, and potential areas of improvement in cattle breeding programs. Your participation will contribute to the advancement of knowledge in this important area and help inform future strategies and policies.

Thank you in advance for your time and willingness to share your experiences.

How long have you been involved in the livestock farming community?

Awareness and Knowledge of Breeding Programs:

Breeding Practices:

1. Do you use NAGRIC Community based animal breeding services in your area?

Yes		No	
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2. What breeding methods do you currently use in your livestock farming activities?

	Natural
	Artificial Insemination
	Both

3. What is the size of your livestock herd?

Less than 10		10-30		30-50		Above 50	
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4. Do you maintain records of breeding activities, such as mating and pedigrees?

Yes		No	
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5. How many of your herd are products of community based animal breeding services

Less than 10		10-15		15-20		Above 20	
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Access to Breeding Services and Resources:

6. Are there any challenges you face in accessing breeding services or resources?

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.....

7. Do you have access to improved or high-quality semen?

Yes		No	
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Perceptions and Benefits of Community-Based Breeding Initiatives:

8. What benefits do you associate with community-based breeding initiatives?

	Genetic Improvement
	Increased production and Income Generation
	Increased availability of quality animal products
	Improved community participation

9. Which of the following characteristics do you prioritize when selecting semen?

	Milk production
	Disease resistance
	Fertility and reproductive performance
	Growth rate
	Adaptability to local conditions

Section A. Awareness and Knowledge of Community-Based Breeding Services

(Please, tick only one box that is appropriate for you)

10. How many years have you been involved in livestock farming?

Less than 1 year		1-5 years		6-10 years		More than 10 years	
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11. Are you aware of any community-based breeding services available in your area?

Yes		No	
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12. Have you ever utilized community-based breeding services for your livestock?

Yes		No	
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13. If yes, how would you rate your overall satisfaction with the community-based breeding services you have used? (scale: *Very Satisfied, Satisfied, Neutral, Dissatisfied, Very Dissatisfied*)

Very Satisfied		Satisfied		Neutral		Dissatisfied		Very Dissatisfied	
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14. If no, what are the reasons you have not utilized community-based breeding services? (Multiple-choice options: *(you can tick more than one reason)*)

	Lack of awareness
	Lack of trust
	Lack of information
	Cost
	Distance
	Poor results
	Other (please specify)

Section B: Factors Influencing the Use of Community-Based Breeding Services

15. How important are the following factors in your decision to use community-based breeding services? (Scale: Not important, Somewhat important, Important, Very important)

Factors	Not important	Somewhat important	Important	Very important
Cost-effectiveness				
Quality and availability of semen				

Accessible location and convenience				
Trust and reputation of the service providers				
Expertise and knowledge of service providers				
Provision of follow-up support and guidance				

Section C: Community Engagement and Support

16. Have you received any support or training from community-based breeding service providers?

Yes		No	
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17. How frequently do you participate in community meetings or workshops related to livestock breeding in a year?

None		Once		Twice		More than twice	
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18. How effective do you perceive the community-based breeding services in meeting the specific needs of livestock farmers in your study area? (Scale: Not effective, Somewhat effective, Effective, Very effective)

Not important		Somewhat important		Important		Very important	
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19. What improvements or additional support would you like to see in community-based breeding services?

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Section D: Information and Communication

20. How do you usually receive information about community-based breeding services? (Multiplechoice options)

	Word-of-mouth
	Farmer groups/associations
	Flyers/brochures
	Radio/TV
	Social media

	Other (please specify)
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21. Do you believe there is a need for improved communication and information dissemination regarding community-based breeding services? (Yes/No)

Yes		No	
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22. If yes, what communication methods or channels would you prefer for receiving information about community-based breeding services? (Open-ended)

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Section E: Recommendations

23. Overall, how satisfied are you with the current availability and quality of community-based breeding services in your study area? (Scale: Very Satisfied, Satisfied, Neutral, Dissatisfied, Very Dissatisfied)

Very Satisfied		Satisfied		Neutral		Dissatisfied		Very Dissatisfied	
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24. Do you have any recommendations for policymakers or organizations involved in communitybased breeding initiatives?

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Appendix II: Interview Guide to technical persons and leaders

Introduction

I am **Brian Ahimbisa**, a student at Bishop Stuart University, currently conducting research on community based cattle breeding programs.

Your valuable experience in this field are crucial for the success of this study. The purpose of this interview is to gather information and understand the current practices, challenges, and potential

areas of improvement in cattle breeding programs. Your participation will contribute to the advancement of knowledge in this important area and help inform future strategies and policies.

Thank you in advance for your time and willingness to share your experiences.

Section 1: Background Information

1. Please provide an overview of your role and responsibilities in relation to community-based breeding services.
2. How long have you been involved in working with community-based breeding programs?
3. Can you describe the community-based breeding services that are currently available in the study area?

Section 2: Awareness and Perception

1. Are you aware of the level of awareness among farmers regarding community-based breeding services?
2. What is your perception of the farmers' knowledge and understanding of the benefits of community-based breeding programs?
3. In your opinion, what factors contribute to the acceptance or reluctance of farmers to use community-based breeding services?

Section 3: Implementation and Service Delivery

1. How would you assess the effectiveness of the current delivery of community-based breeding services?
2. Are there any challenges or barriers that hinder the successful implementation of these services?
3. What support mechanisms or resources are available to facilitate the provision of community-based breeding services?

Section 4: Community Engagement and Collaboration

1. How do you engage with the local community and farmers to promote the use of community-based breeding services?
2. Have you observed any successful community engagement strategies that have positively impacted the adoption of these services?
3. Are there any community-led initiatives or collaborations that have been established to support community-based breeding programs?

Section 5: Technical Assistance and Capacity Building

1. What types of technical assistance and capacity-building initiatives are offered to farmers in relation to community-based breeding services?