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An investigation on the effects of Theileriosis/January disease drug administration on beef cattle production. A case of Shamva District, Zimbabwe.

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS OF THE BACHELOR OF SCIENCE HONOURS DEGREE IN ANIMAL HEATH AND PRODUCTION EXTENSION.

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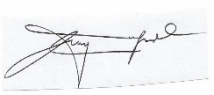
Signature 

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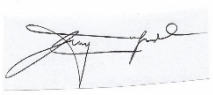
Signature: 

DEDICATION

I would like to dedicate this research project to my family, friends and everyone who contributed towards my success.

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Firstly, l would like to thank God for his sufficient grace bestowed upon me to partake in this BScHAHPE program. My sincere gratitude goes to my workmates and farmers for their continuous support throughout my research project. Special mention goes to Dr Hanyire (DVO) Shamva, who despite of being extraordinary busy with his duties, took his time to guide me. Lastly, l salute Dr P. Nyamapfeni my academic supervisor, the entre Department of Animal Science and Department of Natural Resources Management lecturers for their continuous support throughout my research project. Glory be to God.

ABSTRACT

This study examined the effects of theileriosis drug administration on beef cattle production in Shamva District, Zimbabwe focus on three aspects of production- mortality, weight and reproductive performance. A survey research design was adopted in conducting this study where eight six farmers made the sample. Semi-structured questionnaires were administered. A census method of sampling was used to select research participants. Data was presented tables and graphs. Major findings of the study show that Butachem and Paverxon-Plus were the main drugs used to treat theileriosis in Shamva, the most preferred drug is Paverxon-Plus. These drugs were administered alongside other drugs such as tetracyclines. The study found parverxon plus having a greater comparative effect on all the three components of production under investigation- reduced mortality, improved cattle weight and improved reproductive performance, though the two drugs seemed effective in treating theileriosis. Conclusion of the study highlight the importance of timely and appropriate drug treatment in reducing cattle death rates, reduction in cattle weight and improving overall productivity, strengthening the need for responsible drug use and monitoring to minimize the risk of resistance development.

KEY WORDS: ***Theileriosis, Drug administration, Beef cattle Production***

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CHAPTER 1

PROBLEM AND ITS SETTING

1.0 Introduction

Theileriosis, a tick-borne disease poses a significant threat to livestock health and production worldwide. Effective drug administration is important in managing the disease and preventing complications. This study examines Theileriosis and drug administration and its effects on cattle production. This chapter introduces the study by providing the problem and its setting from the background, the problem statement, objectives, research questions, significance of the study, delimitations and limitations.

1.1 Background of the study

Theileriosis, commonly known as January disease is a tick-borne disease that affects cattle, sheep and goats in Zimbabwe more common in the Northern regions of Zimbabwe than in the Southern regions (Mahanjane *et al.,* (2013). January disease is a notifiable disease hence a major problem for the livestock industry in Zimbabwe, causing significant economic losses. It is estimated that up to 40% of cattle in Zimbabwe are infected with the disease and losses due to Theileriosis can reach up to 10-20% the total herd in some areas. This can have a devastating impact on cattle farmers, especially those in communal sector.

The disease is caused by the parasite Theileria parva, which is transmitted by the parasite of the brown ear tick (Rhipicephalus appendiculatus). The parasite affects the white blood cells causing swelling of the lymph nodes. It is related to the organism causing East Coast Fever which was eradicated from Zimbabwe in 1954. Theileria are obligate intracellular protozoan parasites that infect both wild and domestic Bovidae throughout much of the world including cattle, goats, sheep, water buck (Kobus spp), African buffalo (Syncerus caffer) and Indian water buffalo (Bubalus bubalis) (Maphamire *et al.,* 2025). They are transmitted by ixodid ticks, and have complex life cycles in both vertebrate hosts. According to a study by Mlambo *et al.,* (2006) theileriosis was twice as common in dairy class as in the beef class. The same study

found that theileriosis was most common in first-calf heifers, followed by second calf cows. Adult stock is more susceptible to theileriosis and higher mortality occurs in exotic than indigenous breeds. Recovered animals usually develop a solid immunity but act as carriers despite drug treatment.

In Zimbabwe, Theileriosis occurs between the months of December and March, with most cases seen in January, hence the name “January Disease”. The disease is mainly restricted to the highveld with high rainfall. In the low rainfall areas, outbreaks of theileriosis are due to *Theileria parva,* which is transmitted from buffalo to cattle by ticks *R. appendiculatus and R. zambeziensis* (Pipano and Shkap 2000). The mortality rate of theileriosis varies depending on several factor, such as the age and breed of cattle, the severity of infection, and the access to veterinary care. A study by Mahanjane *et al*., (2013) found that the overall mortality rate of theileriosis in Zimbabwe was about 11%. However, the study also found that the mortality rate was much higher (around 80%) in animals that were not treated for the disease.

January disease can cause high levels of mortality in cattle herds, and this can have a devastating effect on the livelihoods of smallholder farmers who depend on cattle for their income (Lawrence *et al., 2004*). The disease can also lead to reduced milk production, which can impact the nutritional status of farmers and their families; significant financial burden due to treatment and prevention costs; reduced productivity of cattle; and loss of draft power thus negatively affecting farmer’s livelihoods, the country’s exports and other people involved in the beef and dairy industries (Lawrence and Williamson 2004).

With regards to morbidity, or the severity of the illness, study by Mpofu *et al*., (2012) found that theileriosis caused severe illness in about 30% of cattle. The same study found that even after treatment, theileriosis caused chronic illness in about 10% of cattle. The study also found that there was a high incidence of relapse, with about 40% of animals that were treated of theileriosis relapsing after initial treatment.

Current drugs used to cure theileriosis are not completely effective. Sick animals can be treated with antiparasitic drugs such as buparvaquone. Combinations of drugs have been used such as tetracyclines, anti-inflammatory drugs such as dexamethasone and diminazen dicerturate but

with limited success (Coetzer and Tustin). Ant-parasitic drugs are most effective in the early stages of theileriosis and severely affected animals may die despite intensive care (Lawrence *et al.,* 2004). Organisms can persist in animals that recovering which may impact on cattle production. This study therefore seeks to examine the impact of theileriosis drug administration on cattle production in Shamva.

1.2 Statement of the problem

In Shamva District, Zimbabwe, beef cattle quality production is being negatively affected by Theileriosis, a tick-borne disease that can cause fever, anemia, inappetence, corneal opacity, loss of condition, drooling of saliva, swelling of superficial lymph nodes and death. The current drugs available for treatment Theileriosis are not completely effective in treating all the symptoms of the disease, leading to reduced productivity and increased costs for farmers. This is a significant problem for the region, which relies heavily on cattle for food and income. A number of treatment methods were used to treat theileriosis but with little documentation as to their effectiveness hence the need for this study.

1.3 Objectives of the study

1.3.1 Main objective

The main objective is to determine the effects of Theileriosis and drug administration on beef cattle production in Shamva District, Zimbabwe.

1.3.2 Specific objectives

- To determine the effects of Theileriosis drug administration on beef cattle mortality in Shamva.
- To examine the effects of theileriosis drug administration on beef cattle weight.
- To investigate the effects of theileriosis drug administration on reproductive performance of cattle

1.4 Research Questions

- What are the effects of Theileriosis drug administration on cattle mortality in Shamva?
- What are the effects Theileriosis drug administration on beef cattle weight in Shamva?

- What are the effects of theileriosis drug administration on reproductive performance of beef cattle in Shamva?

1.5 Significance of the study

This study is significant in respect to the following:

- *Development of evidence-based treatment guidelines*

This study will inform the development of standardized treatment protocols for January disease, promoting consistency and best practices in animal care.

- *Improved treatment outcomes*

Identifying effective drug regimes and administration avenues will enhance the treatment of theileriosis, leading to better animal health and productivity

- *Economic benefits*

By reducing the economic impact of theileriosis on livestock production, the study contributes to improved food security and sustainable agriculture.

1.6 Delimitations

This study is limited to the effects of Theileriosis and drug administration on beef cattle production in Shamva District, Zimbabwe. Only farmers with cattle that have been affected by January disease from 2018 to 2023 will participate in this study.

1.7 Limitations

Despite the successful completion of this project, it was not free from limitations. The sample size used in this study is quite small that it may not accurately represent the larger population. As such, there is limited generalizability since the findings may not be applicable in other regions where conditions and cattle breeds differ. However, this study is designed to explore certain drug administration methods for further investigation. Funding constraints have restricted the study design from experimental tests to merely qualitative relying more on farmers' statements than laboratory testing which is highly costly.

1.8 **Summary**

This chapter presented the background of the study, the problem statement, objectives of the study, its significance, limitations and delimitations. The next chapter provides a review of literature related to the study.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This literature review explores the effects of Theileriosis and drug administration on beef cattle production.

2.2Epidemiology of Theileriosis

According to Norval, Brian, Perry, and Young (1992). The protozoan parasite Theileria parva, transmitted by the ixodid tick *Rhipicephalus appendiculatus,* is the cause of East coast fever (ECF) and the related syndromes of corridor disease and January disease in cattle of eastern, central and Southern Africa. Hence buffalo (Syncerus caffer) are termed to be the natural host of T. parva. Both eastern and Southern Africa, there exists buffalo adapted parasite is called corridor disease and that caused by cattle adapted parasite is termed East Coast Fever (ECF).

Theileriosis is caused by several species of Theileria hence the most important of which in Africa are Theileria annulata and Theileria parva. Their distribution in the continent varies and follow that of their main field tick vectors with the former occurring in North Africa and Nile River valley and the latter in sub-Saharan eastern, central and southern Africa. Theileria parva infection was first recognized in Southern-Africa as East Coast Fever (ECF) when it was introduced at the beginning of the century with cattle imported from eastern Africa, where disease had been endemic for centuries. It caused huge losses due high mortalities. Thereafter, it was eradicated from most Southern African countries. It has persisted in eastern Africa, despite continued and intensive control measures, hence remains the most important cattle disease in terms of economic loss and restriction of livestock development due to the high susceptibility of productive Taurine breeds of cattle.

Tick-borne diseases are a major cause of cattle losses in Zimbabwe particularly Theileriosis. Theileriosis disease is responsible for about 2000 cattle deaths each year (Muvhuringi *et al*., 2022; New Zimbabwe 2020). According to Norval *et al.*, (1985) found that antibodies to the T. parva group of parasites occurred in cattle throughout the country but the percentage of the reactors was generally low. The tick was common in over-grazed communal farming areas. Outbreak of T.p. bovis in Zimbabwe follows a seasonal pattern and occur commonly between

January and March hence coincides with the activity period of the adult stage of *R. appendiculatus.*

2.3 Impacts of Theileriosis in beef cattle production

Theileriosis is a large group of tick-borne protozoal apicomplexan parasites classified in the family *Theileridae*, order *Piroplasmida* (Levine *et al.*, 1980). The parasite is transmitted by brown ear ticks hence cause swelling of all superficial lymph nodes, corneal opacity, inappetence, lethargy, lacrimation, loss of condition, fever, abortions, drop in milk yield and high mortalities. It can also affect the quality of beef produced by infected cattle, as it can lead to a loss in muscle and fat. In the waste cases Theileriosis can be fatal. Hence the disease has a significant impact on healthy and productivity of cattle.

The severity of theileriosis affects the quality of beef production. Hence beef quality is dependent variable whereas severity of theileriosis is independent variable. A study by Upadhyay *et al.*, (2018) found that several factors, including breed, age and feed intake, can influence the degree of marbling in beef. Marbling is the amount of intramuscular fat present in beef. Beef with higher levels of marbling is generally considered to be more tender and flavorful. Tenderness refers to the texture of the meat and how easily it can be chewed or cut. For flavor, a study by Reuter *et al.*, (2012) found that a number of factors, including breed, diet and postmortem aging time, can influence the flavor of beef.

Color is another important factor as it can affect consumer perception and acceptance of beef. A study by Perigo *et al*., (2007) found that a number of factors including breed, diet and muscle type can affect color of beef. Texture, a study by Sharman *et al*., (2001) found that factors such as postmortem aging, time, breed and cooking method can influence the treatment of beef. The severity of theileriosis refers to the extent to which cattle are infected with theileriosis and can range from mild to severe. Hence the disease can affect beef quality in several ways, including reduced voluntary feed intake, lowering body weight gain, anemia and edematous visceral organs.

According to the study by Maburutse *et al.,* (2016), Theileriosis has a significant socioeconomic impact on beef cattle production in Shamva, Mashonaland Central. The study found that farmers in the area face high treatment costs, decreased milk and meat production and increased labor costs. It also found that farmers often have to sell their cattle at a loss due to the effects of the disease. According to Maburutse *et al.,* (2016), Theileriosis can cause weight loss and poor body condition in cattle. The study found that affected cattle had lower body weights and body condition scores than health cattle and that the affected cattle took longer to recover.

A study by Katunguka Rwakishaya *et al.,* (2012) found that Theileriosis can cause a significant decrease in reproductive performance in the calving interval and a decrease in the calf survival rate. Hence the management strategies that farmers use to control Theileriosis are an important part of research. According to Thomas *et al*., (2017), farmers can use a combination of control measures, including vaccination, tick control and quarantine. Farmers can also use early detection and treatment of the disease to prevent further spread. According to Ngulube *et al.* (2018), Theileriosis has significant economic impact on the beef cattle industry in Zimbabwe. The study found that the disease costs the industry an estimated $14 million USD per year, due to reduced meat and milk production and increased veterinary costs.

Economically, a decrease in beef production has a negative impact on the economy of Shamva district and nation at large, as beef cattle production is a major source income for many farmers. The decreased production can also have an impact on food security, as beef is a major source of protein as well as draft power for many people in the area. A study conducted in Tanzania found that theileriosis caused estimated economic loss of $24 million per year due to decreased productivity and increased costs of veterinary care and drug administration. A similar study in Ethiopia found theileriosis resulted in a 25% decrease in income from beef production and 27% increase in the cost of veterinary care. One study found that the annual cost of theileriosis in Zimbabwe was estimated to $2.8 billion, which is equivalent to 3.3% of the country's GDP. More so, when animals are sick, they require more feed and care, which can also increase costs for farmers. Worse off, farmers may also need to sell their animals if they are infected with theileriosis. When theileriosis causes decreased productivity, it can lead to shortage of food, which can in turn lead to increased prices and decreased access to food for the people of Zimbabwe. This can have a devastating impact on people's health and wellbeing.

2.4 Treatment and control of theileriosis

2.4.1 Vaccination

According to Thomas *et al., (*2017), vaccination is one of the most cost-effective control measures for Theileriosis. However, the cost of vaccination can vary depending on the size of the herd, availability of vaccines and the quality of vaccine. According to Thomas *et al.*, (2017), some of the challenges that farmers face includes limited access to veterinary services, lack of knowledge about control measures and lack of resources to implement control measures. These challenges can make it difficult for farmers to effectively control Theileriosis.

2.4.1 Acaricides tick control

The control of T. parva infections has relied on the use of chemical acaricide to kill the vector ticks but deemed to have become increasingly unreliable in recent years. Therefore, use of effective immunization procedure using live parasites called infection and treatment is available and believed to be a good prospect of more effective and safer vaccines in the near future. Although dipping of cattle in acaricides has not been used on a wide scale for the control of T. annulata infections, it has been the mainstay of ECF control. During pre- and post-colonial period, dipping has proved to be the most effective but relied on good logistic support. It is Zimbabwe still runs national program of regular and effective dipping of its entire cattle population.

The advent of the infection and treatment methods of immunizing cattle against T. parva brought with it hope of an alternative method of control, more appropriate for the changing livestock production systems in the ability to select individual animals to be protected. Infection and treatment work but considerable field research in areas to be immunized is required before scientists and governments are sufficiently confident to see it applied.

2.4.2 Immunization

Tick control through the use of acaricides has been an important prophylactic approach to T. parva infection in cattle, although sustainability remains questionable (Norval 1992, Pipano, Morzaria & Spooner 2008). Trigger applicators (Tick-off acaricide dip (Cypermethrin 0,4% &Permethrin 0,8%) for adult animals and manual application of Frontline (Fipronil) for

neonates were used to control tick load in animals on a property in Malelane, RSA, experiencing high incidence of theileriosis. For the prophylactic control of tropical theileriosis due to T. annulata, cattle can be vaccinated using a culture-derived schizont-infected stabilate (Pipano & Shkap 2000). The use of an infective stabilate can cause clinical disease, which is controlled by prophylactic treatment with oxytetracyclines or buparvaquone at strategic times during disease incubation (McHardy *et al.,* 1985, Norval 1992). This is known as an infection and treatment method of immunization. In the case of T. parva and T. annulata, oxytetracycline is administered at the same time as infection (day zero) or alternatively on day zero and 3or 4 days later (Radley 1981). Tetracyclines have been shown to have suppressive effect if administered during the incubation period (Neitz 1953), but were less successful when treating clinical theileriosis (Lawrence, Perry & Williamson 2004). In the case of clinical disease, the drug of choice is buparvaquone (McHardy 1989).

Early studies of *T. parva* by Lowe (1993), Wilson (1950), Barnett (1957) and Wilde (1967) led to the hypothesis that the severity of T. parva infection was dependent on the quantum of infection material introduced. The question then arose as to whether low doses of an immunizing parasite stock could be given in the absence of concurrent anti-theilerial chemotherapy. Although the quantum of infection hypothesis was supposed when tick suspensions or sporozoite stabilates were titrated in cattle by Wilder *et al.,* (1981) and Dolan *et al.,* (1984d), then was considerable variation in response in groups of cattle given doses of sporozoites that approached LD. Hence it was established that the use of stabilate on its own was not suitable for immunization.

Neitz (1993; 1957) was the first to demonstrate that T. parva infections induced by tick, the administration of tetracyclines over a prolonged period (8-12) doses administered intravenously at the rate of 10mg/kg resulted in cattle becoming effectively immunized without adverse effect. He concluded that tetracyclines were schizonticidal, but a recent study by Spooner (1990) showed that tetracyclines slowed down the division of schizonts and their host cells.

Subsequently, Brocklesby and Bailey (1962) applied T. parva infected ticks to cattle which then received oral tetracycline (15mg/kg) and recommended the use of their immunization technique in valuable exotic breeds of cattle. This method was applied further by Jezierski *et*

al., (1959) in Rwanda and Jarret *et al.,* (1969b) in Kenya. A variation on the use of oral tetracycline was to treat cattle undergoing natural tick challenge in the field. This method has to be developed with the use long-acting formulations of tetracycline as well as with other drugs such as parvaquone (Chumo *et al.*,2019; Young *et al.,* 2020). The disadvantages of the use tetracycline are threshold; the expense of using prolonged oxytetracycline treatment and possible disruptive effects it may have on gastro-intestinal flora; secondly, the need to confirm that animals have become infected by the use of pre and post infection serology; thirdly the uncertainty in T. parva infection as to whether cattle so treated will have been exposed to an adequate T. parva challenge to give broad immunity to subsequent field exposure. Young *et al.,* (1990b) investigated the possibility of using parvaquone for the treatment of cattle that became infected during the monitoring period.

A breakthrough in the technique of infection and treatment was achieved by the production of sporozoite stabilates which allowed cattle to be infected with a particular predetermined dose (Cunningham *et al.,* 2013). For example, using N-pyrolidnomethyl tetracycline, it was established that for intra-muscular doses at 5mg/kg on days 0to 3 after stabilate administration allowed excellent protection to develop with minimal clinical reaction (Brown *et al.*, 1997).

2.5 Theileriosis drug administration

Literature shows that there are a few different ways that drugs can be administered to the cattle, including oral administration, injection and pour on administration in treating theileriosis. Each route of administration has its own advantages and disadvantages. Oral method-is usually less expensive than injection and it can be easier to administer. However, oral administration can be less effective than injection and it can also be affected by factors such as the cattle's appetite and the palatability of the drug. Injection-injection is usually more effective than oral administration, but can cause stress in cattle, which can lead to an increase in cortisol levels. This can affect the taste and quality of the beef. Pour-on administration is less likely to cause stress, but it can still affect the taste of the beef and can actually increase tenderness. According to Dr Dustin Boler (2021), an associate professor at Oklahoma State University which found that injection and pour-on administration can increase tenderness in beef. This study was published in the journal of Animal Science in (2012).

A study by Dr. Joe Calkins of Texas A&M University found that injection and pour-on administration can lead to a more intense beef flavor. This study was published in the journal of Animal Science in (2002). A study by Dr Robert Shackelford of Texas A&M University found that oral administration can cause off-flavors in beef (Journal of Food Science, 2006). However, in terms of safety, studies have found that all three methods of administration – oral, injection and pour-on can be safe when used correctly. Nevertheless, incorrect use of any of these methods can lead to the presence of drug residues in beef. In terms of shelf life, studies have found that injection and pour-on administration can increase the shelf life of beef, oral administration can decrease it. In terms of colour, studies have found that oral administration can cause darker colour in beef while injection and pour-on administration can cause a more desirable color. Studies have also found that injection and pour-on administration can lead to a more intense aroma, while oral administration can cause an off-odor. Generally, injection is the most expensive method of drug administration followed by pour-on then oral. However, the cost of the drug is only one factor in the overall cost of beef production. Other factors include the cost of feed labour, facilities and equipment.

2.6 Factors affecting choice of drug

Literature shows that there are several drugs that can be used, including Imidocarb dipropionate and Diminazen aceturate. The choice of drug can affect the severity of the disease and the resulting impact on beef quality. Imidocarb is a carbamate compound that works by targeting the parasite's acetylcholinesterase enzyme (Lawrence, 2003). This drug has been shown to be effective at reducing the severity of theileriosis and has been shown to have minimal effects on beef quality.

On the other hand, Diminazen aceturate is a quinalizone compound that works by damaging the DNA of the parasite (Lawrence 2004). It is important to note that while both of these drugs are effective at treating theileriosis, they also have some potential side effects that can affect beef quality. For example, both drugs can cause mild anemia and decreased body weight gain in cattle (Young 1994). Imidocarb dipropionate has been shown to cause reduced feed intake and decreased milk production.

Timing of treatment

Another key factor that can influence the relationship between theileriosis and beef quality is the timing of treatment. Early treatment has been shown to be more effective at reducing the severity of disease and improving beef quality. As a result, early treatment can also reduce the need for other interventions, such as supplemental feeding. Padya *et al*., (2009) found that the efficacy of anti-theileriosis drugs can be affected by factors such as dosage, drug resistance and duration of treatment. A study by Vreysen *et al.,* (2011) also found that the effectiveness of anti-theileriosis drugs can be influenced by the health status of the animal, the stage of the disease and the route of administration.

Breed

Another important factor is the type of breed. Some breeds such as the Nguni and Boran are more resistant to theileriosis and may experience less severe disease. This can result in improved beef quality, as the animals are less likely to lose weight or suffer from anemia.

Age

Young cattle, especially calves are more susceptible to theileriosis as well as older ones due to poor immune system and are more likely to experience severe disease. This can negatively impact beef quality as young cattle are more likely to have decreased weight gain and impaired muscle development.

Nutritional status

Nutritional status of cattle can also affect cattle. Cattle that are malnourished are more susceptible to theileriosis and are more likely to experience severe disease. This can negatively impact beef quality as malnourished cattle are less likely to reach optimal slaughter weight and may have reduced marbling.

Environment

Environmental factors, such as temperature and humidity can influence the severity of theileriosis and the resulting impact on beef quality. High temperatures and humidity can exacerbate the effects of theileriosis leading to more disease and reduced beef quality. According to a study by Mahamba *et al.,* (2019); environmental factors such as temperature and humidity are key drivers of theileriosis incidence in cattle. Ramachandran *et al.,* (2014) found that environmental conditions can also influence the success of treatment for theileriosis.

A study by Madzima *et al.*, (2017) found that environmental conditions in Zimbabwe can have a significant impact on the incidence of theileriosis. Nyika *et al.,* (2012) found that the husbandry practices and management systems used in Zimbabwe can also affect the incidence of theileriosis.

CHAPTER 3

MATERIALS AND METHODS

3.1 Introduction

This chapter explains the methods and materials used in conducting the study. It presents the study area, the research design, sampling procedure, data collection tools, data analysis **procedure and ethical considerations.**

3.2 Brief description of study area

Shamva District is located in Mashonaland central Province, Zimbabwe. It is a rural district with an estimated population of 200 000 people. Agriculture is the main economic activity in the area and small-scale cattle farming is a major source of income for many people. Hence an estimated cattle census of 25052 and 6408 stockowners. Shamva district is located in the highveld region of Zimbabwe, which has a temperate climate with relatively high rainfall. The annual rainfall ranges from 500-700 millimeters and the region experiences four distinct seasons: summer, autumn winter and spring. The dominant veld type in the district is miombo woodland, which is characterized by Savannah grasslands with scattered trees. The altitude in the area ranges from 900 to 1800 metres above sea level.

3.3 Research Design

This research is a cross sectional epidemiological study designed to examine the effects of theileriosis drug administration in beef cattle production. A cross section of farmers in Chakonda Zone, Shamva were selected to participate in this study. The researcher sought farmers' experiences with specific drugs that they used in treating theileriosis to determine their effects on beef cattle production. The choice of this design was based on its cost effectiveness in terms of finances and time since the researcher is not well resourced and the timeline for completion of the study does not allow for designs that need time to complete.

3.4 Study population

This study targeted farmers in Chakonda Zone of Shamva District that had their cattle infected with Theileriosis and treated on either Butachem or Parvexon Plus. According reports from the Veterinary Extension Officer for Chakonda Zone, the entire population of farmers that had

cattle infected with theileriosis and had their cattle treated on the two drugs under study is 86. Since the study targeted

3.5 Sample

The researcher considered the entire population of farmers in Chakonda Zone to be small enough to not select a subset from it. Thus the researcher employed a census method of sampling also known as complete enumeration that involves collecting data from every unit in the entire target population (Cock, 2019). Thus, all the 86 farmers that had their cattle treated of theileriosis took part in the study.

Table 1: **Distribution of participating farmers and drugs administered.**

Main Drug administered	**Supporting Drug**	**Number of farmers**
Butachem	Long acting Tetracyclines Short acting tetracyclines	37
Parvexon-Plus	Long acting Tetracyclines Short acting tetracyclines	49
Total		86

Despite the resource intensity of the sampling technique the researcher conducted the study to ensure complete coverage and reduce sampling error (Cock 2019).

Data Collection Tools

Data collection was done using two data collection methods- semi-structured questionnaires. A semi-structured questionnaire is a research instrument that combines elements of both structured and unstructured questionnaires. The questionnaire used in this study has both predefined questions and open-ended responses to allow the researcher flexibility in probing additional information (Flick 2006). Semi-structured questionnaires offer balance between the structure of a survey and the depth on an interview (Johnson and Turner, 2000). The questionnaires were not self-administered to ensure that participants seek clarity on questions they would have not understood.

Data analysis

Findings of the study are presented in in two ways. Qualitative data from key informants were presented a narrative form. The researcher adopted Ritchie and Lewis' (2003) process of describing, classification and collecting. Interviews were recorded and transcribed through

identification and coding of key points. An informal analysis of findings began during interviews when recurring themes, patterns and categories emerged. Key points were summarized in tables and interpreted. Some data acquired from document analysis and observations is presented in graphs and pictures. Quantitative data was presented in graphs and tables. Statistical tools such as SPSS and Microsoft excel were used to analyze data.

Ethical considerations

The researcher protected the rights of all research participants, ensured beneficence, no maleficence and justice and protected the integrity of the university to which it will be presented through observing the principles of informed consent, privacy and confidentiality. The researcher first explained the purpose of the research in-order to make the participants understand what they were up to. He then advised them that they have a right to decide not to participate and /or withdraw from the study whenever they felt uncomfortable. The protection of privacy and confidentiality was assured by the signing of consent forms and the researcher advised the participants that they can report to the police any form of harm that may have been caused by not observing these principles. To this end Payne and Payne (2004) believe that ethical practice is a moral stance that involves conducting research to achieve not just high professional standards of technical procedures, but also respect and perfection for the people actively consenting to be studied.

3.6 Summary

This chapter explained the methodology used in conducting the study. This study used a survey research design collecting data through semi-structured questionnaires. The next chapter presents study results.

CHAPTER 4

RESULTS

4.1 Introduction

This chapter presents the study findings showing the drugs administered, their effects on cattle mortality, on cattle weight and on reproductive performance.

4.2 Drugs administered to treat theileriosis

The findings presented in this study are based on 89 cattle that received different treatment methods for theileriosis. The study found that farmers mainly administered Parvexon Plus and Butachem together with Tetracyclines in treating Theileriosis. This is as shown in Table 1.

Table 2: Drugs administered in the treatment of theileriosis

Main drug administered	Number of cattle	Percentage
Parvexon Plus	122	69
Butachem	54	31
Total	176	100

As shown in table 1 the most administered drug in the treatment of theileriosis in Shamva is Parvexon Plus. Preference to the drug was based on it having an extra component – Frusemide which is not in Butachem. This meant that farmers that administered butachem were to purchase administer frusemide separately or administer butachem in the absence of frusemide. The farmers indicated that parvexon Plus became the drug of choice because it is effective in all stages of the disease. *Frusemide caters for pulmonary oedema*- said a key informant.

Weight or body mass of an animal determined how the drugs were administered as shown in table 2.

Table 3: Treatment methods for theileriosis

Drug	Treatment method	Frequency (hours)
Parvexon Plus (main drug)	1ml / 15kg body mass	48
Long acting Tetracyclines	1ml/10kg body mass	48
Short acting tetracyclines	1ml/10kg body mass	24x3-5 times
Butachem (main drug)	1ml / 20kg body mass	48
Long acting Tetracyclines	1ml/10kg body mass	48
Short acting tetracyclines	1ml/10kg body mass	24x3-5 times

Table 3 shows that farmers administered 2 main theileriosis treatment drugs Pervexon and Butachem. These drugs were not administered in isolation but together with other drugs. Parvexon was administered along with tetracyclines- short and long acting whilst Butachem was used along with Frusemide and the tetracyclines too. The volume of drugs injected and the application frequency are shown in table 3 above.

4.2 Effects of theileriosis drug administration on cattle mortality

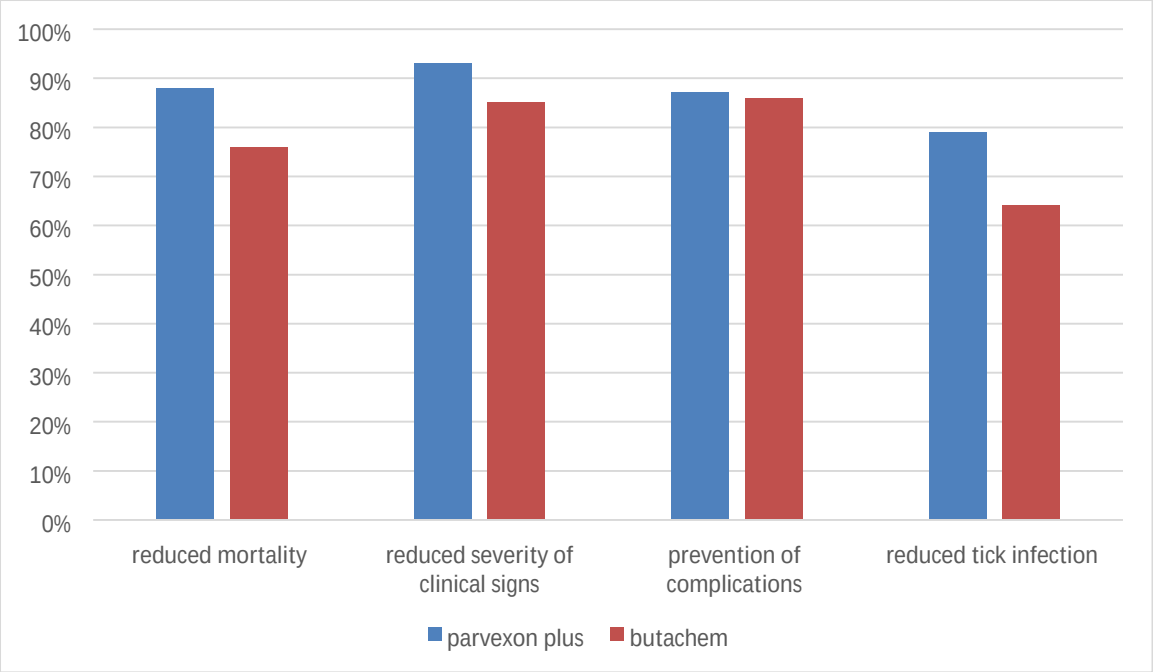

Figure 1: Effects of drug administration on cattle mortality

This study observed differences in the effects of Paverxon-Plus and Butachem on cattle mortality. In this enquiry, the researcher sought to determine the effects of drug administration on number of deaths, severity of clinical signs, prevention of complications and tick infection. Farmers presented that number of cattle that were treated of theileriosis using the two drugs under investigation to see if they have any effect on the above stated components. The observation of the study was that Paverxon-Plus had a higher reduction (88%) in mortality or cattle deaths than Butachem (below 80%); while 93 of cattle treated from Paverxon-Plus had reduced severity of clinical signs such as fever, swelling of lymph nodes and dyspnea against 85% for Butachem. On prevention of complications both drugs registered nearly equal percentage prevention but less than 90% suggesting that over 10% of cattle that had both drugs administered on them still had complications. The study further observed lower reduction in tick infection for cattle that received Butachem than in cattle that received Paverxon-Plus (64% and 79% respectively). From these findings, it can be determined that both drugs are somehow effective in reducing mortality and other related complications but efficacy is more skewed on Paverxon-Plus.

4.3 Effects of drug administration on cattle weight

The study examined the effects of drugs administered on animal weight. Farmers were asked to provide the weight of their animals when they initiated treatment upon testing for theileriosis and then after completion of treatment. After weighing and initiating treatment, the animals were then weighed 45 days afterwards to measure if there was an increase in weight gain.

Figure 2 shows the difference in weight for cattle treated on parvexon and butachem.

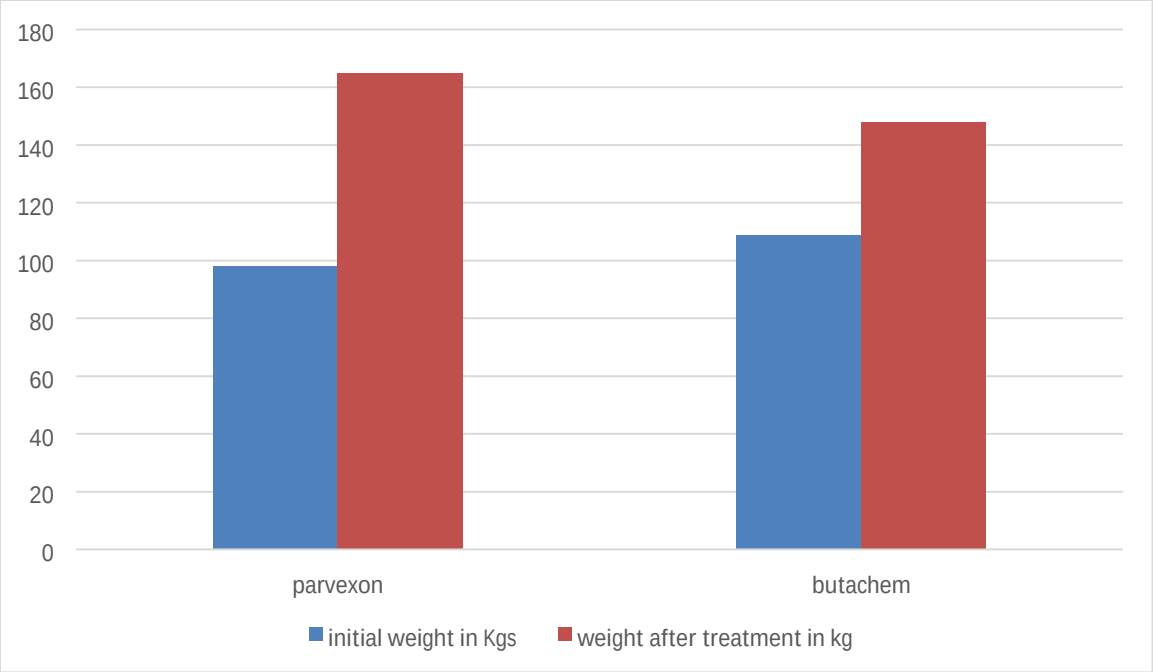

Figure 2: Average cattle weight before and after treatment

As shown in figure 2 cattle treated on Paverxon Plus had an average weight gain from below 98kg to above 165kg whilst those treated on Butachem gained weight from 109kg to 148kg showing an average weight gain of 67 kg and 39kg respectively. This shows a better improvement in weight gain for Paverxon-Plus than for Butachem .

4.4 Effects of drug administration on reproductive performance

The study also sought to determine the effects of theileriosis drug administration on reproductive performance. Five aspects of reproduction were considered – conception rate, enhance fertility, abortion rate and calving. The findings in this subsection were based on farmer's responses regarding reproduction and drug administration.

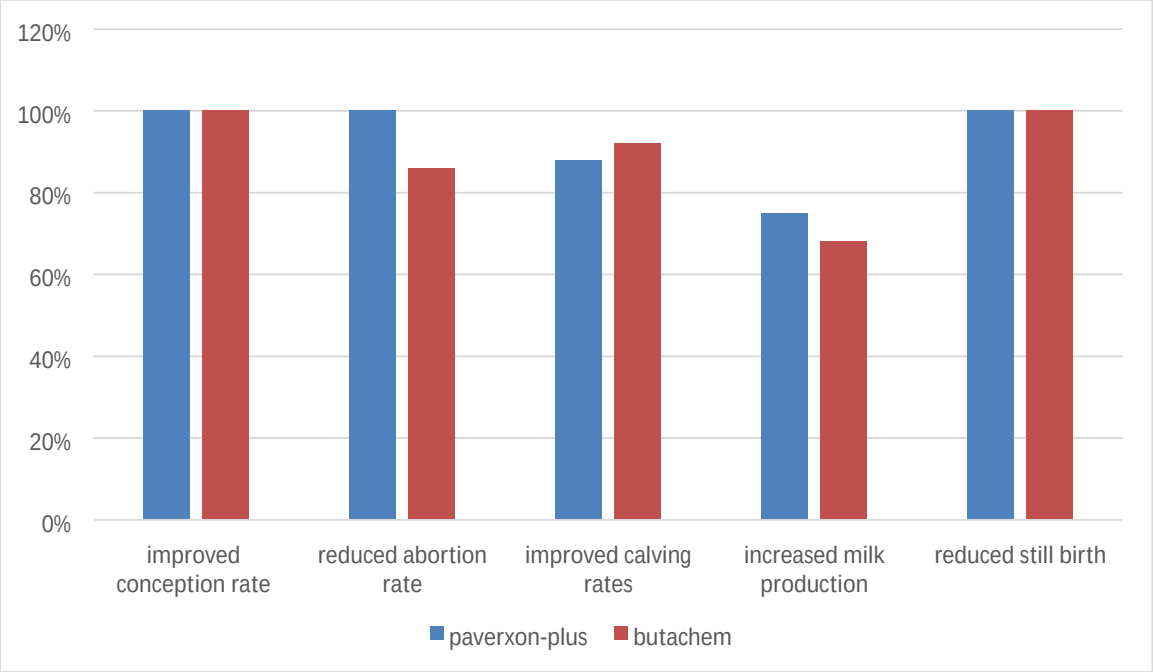

Figure 3: Effects of drug administration on reproductive performance

Participants to the study indicated that they have noticed an improvement in conception having their cattle receiving treatment. All farmers with cows treated in either of the two drugs Paverxon-Plus and Butachem equally noticed improved conception in their cows. Conception was determined by farmers' observation of heat cycles and breeding behavior and detection of pregnancy. A farmer stated that *'all my three cows treated on Paverxon fell pregnant after treatment.'* Another farmer who administered Butachem stated that, 'I am happy my cows are now on heat, January disease had affected my cattle so much. Now I can regrow my herd.' Related to conception rate is fertility were suggesting that the successes in administering the two drugs under study ensured improved fertility for the cows that were hit by theileriosis.

The study also found a 100% reduction in abortions for cows treated on Paverxon-Plus while 86% of farmers that treated their cows on Butachem registered reduction in abortions. This shows that Paverxon Plus may have a greater effect in reducing the abortions than Butachem. On calving rate, the study found a higher rate of farmers administering Butachem (92%) having improved calving rate as compared to 88% of those that administered Paverxon-Plus. This shows that despite the small percentage difference in farmers that registered improvement in calving, both treatments have a positive effect on calving.

The study also observed a higher percentage of farmers that administered Paverxon-Plus (75%) as compared to those that administered Butachem (68%) with increased milk production. On reduction in still birth both drugs had all farmers testifying that they did not experience still births on their cows after treatment.

4.5 Summary

This chapter was a presentation of results on the effects of theileriosis drugs administration on beef production. The findings were based on study objectives that sought to examine effects on cattle mortality, animal weight and reproductive performance.

CHAPTER 5

DISCUSSION OF FINDINGS

5.1 Introduction

This chapter presents a discussion of findings on theileriosis drug administration. Findings from chapter 4 are reviewed in relation to previous trends and literature.

5.2. Drugs administered in the treatment of theileriosis

This study showed that the main drugs used in the treatment of theileriosis inn Shamva were Parvexon-Plus and Butachem where the Paverxon was the most preferred by farmers for its composition of Frusemide for its usefulness in treating pulmonary oedema making it effective in treating theileriosis at all stages. The absence of Frusemide in Butachem makes it a less effective treatment if administered on its own. As such it is recommended that Butachem be used specific to a particular of stage of the disease unless used along with Frusemide which can be injected separately (Calkins 2002).

To increase drug effectiveness, Parvexon Plus and Butachem are used alongside other drugs such as tetracyclines (hitet, oxyvet, terramycin, alamycin, limoxin and diminazene diceturate) which are either long acting or short acting drugs depending on severity of the disease. Similar findings were also revealed by Padya *et al., (*2009)

Not only do Parvexon Plus and Butachem work in treating theileriosis, other findings show effectiveness of other drugs such as Buparvaquone and Long-acting oxytetracycline but resistance have been reported (Padya *et al.,* Vreysen *et al.,* 2011).

5.3 Effects of theileriosis drug administration on cattle mortality

This study found that drug treatment significantly reduces mortality rates of cattle. As such both Parvexon-Plus and Butachem are variedly effective in treating theileriosis- Parvexon-Plus being more effective. Related to reduction in mortality rate is the positive effect of drug treatment on survival rates as found in (Mahamba *et al.* 2019) where the same is noted in treatment using other drugs like buparvaquone (Ramachandra *et al.* 2014) with a survival rate in cattle of up to 90% (Madzima *et al.,* 2017). Previous studies conclude that the efficacy of drugs in reducing mortality rates is dose-dependent, with higher doses resulting in better outcomes (Mahamba *et al.,* 2019). This also relates to timeliness of treatment as Chumo et al (2019) put it that treatment delayed beyond 14 days after infection may not significantly reduce mortality rates (Young *et al.,* 2020). Thus, late provision of drugs may render drugs ineffective in reducing mortality. Despite the effectiveness of Parvexon-Plus and Butachem in treating theileriosis, concerns are abounded regarding drug resistance concerns. Overuse or misuse of drugs may lead to the development of resistance, reducing their effectiveness in reducing

mortality rates (Young *et al.,* 2020). Therefore, prompt and appropriate drug treatment is critical in reducing cattle mortality rates due to theileriosis. However, the development of resistance and the need for timely treatment highlight the importance of responsible drug use and monitoring.

5.4. Effects of theileriosis drug administration on cattle weight

In examining the effects of paverxon-plus and butachem drugs in treating theileriosis, this study revealed considerably varied positive effects of the drugs on cattle weight albeit with parverxon registering a more improved gain as compared to the other. Brown *et al.,* (1997) explains that treatment of theileriosis generally results in improved appetite, reduced fever and increased nutrient absorption leading to increased weight gain and reduction and weight loss (Chumo *et al.,* 2019).

What is missing in this study findings are the negative effects of drugs on cattle weight. Drugs such as tetracyclines, can cause weight loss side effects (Cunningham *et al.,* 2013); while certain drugs may reduce appetite e leading to reduced feed intake and weight loss (Brown *et al.,* 1997). The other drug-related side effect is delayed growth and weight gain due to prolonged treatment or high doses in especially young cattle.

This suggests the need to monitor cattle weight and adjust treatment strategies accordingly in order to minimise negative effects and optimise weight gain. Consultation with veterinarians help determine the appropriate treatment approach.

5.5 Effects of theileriosis drug administration on reproductive performance

Findings on the effects of theileriosis drug administration on reproductive performance in cattle show that that both Parvexon-Plus and Butachem are equally effective in improving conception rates and reducing still birth as all participants agreed so as abortion rate is fully reduced in the Parvexon-Plus treatment while lower in Butachem treatment. Differences are also reported in calving and milk production where there are better calving rates in Butachem than in the other drug. Other findings on the same drugs and other drugs as drugs like buparvaquone has been shown to improve fertility in cattle infected with theileriosis (Boler, 2021) while there is reduced abortion rate in pregnant cattle (Calkins, 2017); increased conception rates and improving milk production for lactating cattle (Vreysen *et al.*, 2011). Additional findings show

that generally drug treatment of theileriosis restores normal estrous cycles and reduces the duration of anestrus or sexual inactivity in affected cattle (Padya *et al.*, 2009).

This study however, fell short in identifying the side effects of the drugs under study on reproductive performance. Other studies revealed that some drugs may have negative effects on reproductive performance, such as reduced fertility or abortion (Madzima *et al.*, 2017); and the timing and dosage of drug administration can impact reproductive performance (Nyika *et al.*, 2012). Such that possible side effects of drug administration must cannot be ignored.

Overall, effective drug treatment of theileriosis can improve reproductive performance in cattle, but careful consideration of drug selection and administration is crucial to minimize potential negative effects.

5.6 Summary

Findings on the overall effects of theileriosis drug administration on cattle production show improved productivity reduced mortality, improved weight gain and increased reproductive performance. The next chapter summarises and concludes the study providing recommendations

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary

This study focused on the effects of theileriosis drug administration of beef cattle production among farmers in Shamva. The objectives of the study were limited to cattle mortality, cattle

weight and reproductive performance of cattle treated mainly on either parverxon-plus or butachem albeit alongside other drugs such as tetracyclines.

The study found parverxon Plus having a greater comparative effect on all the three components of production under investigation- reduced mortality, improved cattle weight and improved reproductive performance.

6.2 Conclusions

Based on the findings, the following conclusions are made:

- Paverxon-Plus is a more effective drug in treating theileriosis as compared to butachem.
- Theileriosis drug administration generally reduces cattle mortality rates.
- Treatment of theileriosis using drugs parverxon plus or butachem along with some short or long-acting drugs results in overall cattle weight gain
- Theileriosis drug administration improves fertility, conception rates, calving rate, improves milk production, reduces still birth and abortion leading to enhanced reproductive performance.
- Overall, drug administration has a positive effect on beef cattle production.

These conclusions highlight the importance of timely and appropriate drug treatment in reducing cattle death rates, reduction in cattle weight and improving overall productivity, strengthening the need for responsible drug use and monitoring to minimize the risk of resistance development

6.3 Recommendations

Based on this study, the following recommendations can be made:

- Farmers should treat infected cattle early to maximize drug efficacy,
- Paverxon-plus drug can be used at any stage of theileriosis disease,
- Farmers or stockmen and extension officers must regularly monitor and cattle for signs of theileriosis and follow-up with additional treatment as needed,
- There is a need to consult with veterinarians to determine the appropriate treatment specific to cattle production systems
- Regular weight monitoring is essential in detecting weight loss or gain,

- Training is essential for stockmen and veterinarians to increase knowledge and understanding animal diseases.
- More experimental studies need to be conducted to allow generalizability of the effects of different drugs administered on production.

CHAPTER 7

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APPENDICES

QUESTIONNAIRE

DEMOGRAPHIC INFORMATION

1. Participant code / name …….
2. Age ……
3. Gender ……...
4. Educational level……

5. Years of experience in beef cattle farming ……

DRUG ADMINISTRATION

6. **Which drugs have you administered in treating theileriosis?**

Drug administered	**Quantity**	**Frequency**	**Administration method (e.g. injecting)**

7. **Explain why you use administer the drugs you have stated**

……

……

…….

EFFECTS OF DRUG ADMINISTRATION ON CATTLE MORTALITY

8. How many cattle have you treated of theileriosis? ……

9. How many cattle fully recovered or survived due to treatment? ……..

10. How many cattle died after receiving treatment?.....

11. What changes did you notice in the treated cattle? *(tick where appropriate)*

Effects of treatment on cattle mortality	**Yes**	**No**
Reduced mortality		
Reduced severity of clinical signs		
Prevention of clinical signs		
Reduced tick infection		

EFFECTS OF DRUG ADMINISTRATION ON BEEF CATTLE WEIGHT

12. Did you regularly weigh your cattle during the treatment period?

Yes …… No ……

13. What was the initial weight and the weight at completion of treatment?

Animal number	**Initial weight**	**Weight after treatment**	**Weight gained or lost**

EFFECTS OF DRUGS ADMINISTERED ON REPRODUCTIVE

PERFORMANCE OF CATTLE

14. **What are the effects of drug administration on the following:**

Effects	**Response**
Improved conception rate	
Reduced abortion rate	
Improved calving rate	
Increased milk production	
Reduced still birth	