بسم الله الرحمن الرحيم

Sudan University of Science and Technology
College of Graduate Studies

Afield Study on the Extent of Applying the Bio security Measure at Dairy Farms - Khartoum State

دراسة ميدانية عن مدي تطبيق مقياس الأمن الحيوي في مزارع الألبان - ولاية الخرطوم

By:

Sara Kamal El Deen Mohamed Suliman
B.Sc. Agriculture Animal Production
Sudan University
(2008)

A Thesis submitted in partial fulfillment of the requirements of Sudan University of Science and Technology for the degree of Master Science in Animal Production

Supervisor:

Prof. Dr. Mohamed Hassan Musa Tabidi

Department of Animal Production. Collage of Agriculture Studies.
Sudan University of Science and Technology

June2018

الآية

بسم الله الرحمن الرحيم

(وَإِنَّ لَكُمْ فِي الْأَنْعَامِ لَعِبْرَةً ۖ نُّسْقِيكُم
مِّمَّا فِي بُطُونِهِ مِن بَيْنِ فَرْثٍ وَدَمٍ لَّبَنًا
خَالِصًا سَائِغًا لِّلشَّارِبِينَ)

صدق الله العظيم

سورة النحل – الأية (66)

DEDICATION

MOST ALL LOVE … OF DEDICATE MY RESERCH :

MY FATHER KAMAL ALDEEN MOHAMED

MY MOTHER (HBOBA)SAFWA & ZMZEM

MY SISTERS: SOMIA ,ELHAME ,EMTITHAL, MARWA, SELMA, ALAA

MY BRETHERS: Mahadi Elhbeeb YASSIR, ABUBAKR, MOHAMED, ABUALGASIM, SULIMAN

MY TEACHERs

MY COLLEGES ENTER MENSTRY OF AGRUCLCHER AND EXIT MENSTRY OF AGRUCLCHER

MY FRINDS

ACKNOWLEDGEMENTS

I wish To Acknowledge That This Research Has Been Possible Through The Advice, Co – Operation And Help I Received From My Supervisor Prof. Dr. Mohamed Hassan Musa Tabidi To Whom Iam Very Grateful.

I Am Also Profoundly Professors, Lecturers of Department Of Animal Production And Also Profoundly Ministry Of Agriculture and Animal Wealth & Fishes. Khartoum State

List of Contents

List of Tables

List of Figures

Abstract

In a study to evaluate the Biosecurity system in dairy farms in Khartoum state, three located sites Kuku , Eastern Nile and Selete dairy farms were chosen to examine three majors indicators health, nutrition and farm buildings, in addition to blood and water analysis.

In health indicators the high percentage in disinfectant indicator take place in Kuku farms 63.2% and the lowest percentage in Selete farm 15.8 % while the Eastern Nile farms 21.1%. Also in the Vaccination Kuku and Selete farms accrued 36.2 % as a high level flowed by Eastern Nile farms 27.7 %. All farms in three locate on affected by diseases 100%.

The transfer of diseases take a high percentage in Kuku farms 42.5% then in Eastern Nile farms 28.9%, then the lowest one Selete farms 28.5%.

All farm use tick control in a same level percentage 33.33 %. In preventive indicator Kuku farms have the highest percentage 44.4 % flowed by Eastern Nile farms 33.3 % and 22.2% in Selete farms.

In nutrition indicator feeding system in Kuku farms accrued the high level percentage 36.7% followed by Selete farms 34.7% and then Eastern Nile farms 28.6%.

In the indicator of building in the three location animal All farms were full fenced, and the suitable area for animal as indicator were 60% in Kuku farms, 30% in Eastern Nile farms 15% in Selete farms respectively.

The optimum shedding area in Pens a high level 60% in Kuku farms, and 30% in Eastern Nile farms, where the lowest percentage 15% in Selete farms.

78.6% of the farms in Kuku location have storages as a high level percentage, where the lowest percentage 7.1% in Eastern Nile farms, where the Selete farms 14.3% percentage from the total number.

39.1% of the Kuku farms have a labors housing and services, flowed by Selete farms 32.6% then the lowest percentage in Eastern Nile farms 28.3%.

Farm records were used 52.4% in Kuku farms, while it used in both Eastern Nile and Selete farms 23.8%.

Blood samples analysis indicate the tick parasite disease KUKU project and Eastern Nile Found in KUKU project high Risk level Disease.

Water chemical analysis indicate that all the water samples are valid as drinking water, with increase of Sodium (Na) cautions in two locations *Selete and Kuku*, but this level of sodium have no effect in the validity of water but it effect in the water test.

The same analysis, appearance that the water sample is not valid as drink water in *Selete* because of the equality (PH) of acidity and alkaline and the cautions of (Ca, Mg ,Na and K).

in dairy cows ticks represent in a big hazard about 60% of animal resources problems . and appearing The ticks in dairy cows for blood Parasitic diseases (Theilleria ‘ Babasia) ‘ which consist a major hazard in dairy cows.

ملخص الدراسة

في دراسة لتقيم الامن الحيوي لمزارع الالبان بولاية الخرطوم تم اختيار ثلاثة مواقع لمزارع بحلة كوكو، شرق النيل و السليت لاختبار ثلاثة مؤشرات الصحة و التغذية و المباني اضافة الي تحليل الدم و المياه.

عند اختبار مؤشر نظام الصحة الخاص بالتعقيم بالمزارع اظهر موقع حلة كوكو اعلي معدل بنسبة 63.2% بينما كان أقل معدل 15.8 % في السليت و 21.2% بمزارع شرق النيل. اما نظام اللقاحات التطعيم كان اعلي معدل 36.2% بحلة كوكو و السليت ، و نسبة 27.7% بمزارع شرق النيل، عموما توجد اصابات بجميع المزارع قيد الدراسة.

في مؤشر انتقال الامراض اظهرت مزارع حلة كوكو اعلي معدل للانتقال 42.5% ثم 28.5% بشرق النيل و اقل معدل انتقال 28.5% بمزارع السليت.

تستخدم كل المزرع قيد الدراسة نظم الوقاية من القراد بنسب متفاوتة 44.4% بحلة كوكو 33.3 شرق النيل و 22.2% بمزارع السليت.

فيما يختص بمؤشر التغذية اعلي معدل لاتباع نظام للتغذية 36.7% بمزارع حلة كوكو ثم السليت 34.7% و مزارع شرق النيل 28.6% كاقل معدل.

في مؤشر نظم المباني اظهرت النتائج ان كل المزارع قيد الدرسة مسورة، و اظهرت ايضا" أن توزيع الحيوانات كان أفضل في مزارع حلة كوكو 60% ثم شرق النيل 30% و السليت 15%.

فيما يلي نسبة توزيع الظل بالحظائر اظهرت مزارع حلة كوكو اعلي معدل في الالتزام بنسب الظل الي الحظيرة 60% تليها شرق النيل 30% واخيرا" 15% بالسليت.

اظهرت الدراسة ان تخصيص نظم للمخازن كان اعلي 78.6% بمزارع حل ة كوكو و اقل معدل 7.1% بشرق النيل فيما كانت النسبة بمزارع السليت 14.3%.

كما ان تخصيص منازل وخدمات للعاملين كان بنسبة 39.1% بمنطة حلة كوكو و 32.6% بالسليت و 28.3% بشرق النيل.

اوضحت الدراسة ايضا ان اتباع نظام السجلات بالمزارع كان بمعدل 52.4% و 23.8% في كل من السليت و شرق النيل.

في تحليل عينات الدم اظهرت كل العينات اصابات متفاوتة بامراض الطفليات و القراد بكل المزارع خاصة بمزارع حلة كوكو.

اظهرت تحليل المياه بالمناطق قيد الدراسة ارتفاع في نسبة عنصر الصوديوم في مياه شرب الحيوان بمستوي لايؤثر علي نوعية المياه لبعض العينات لكل من مزارع حلة كوكو و شرق النيل، فيما اظهرت نتائج تحليل لبعض العينات بمنطقة السليت ارتفاع القاعدية بالمياه لاحتوائها علي نسب مرتفعة من عناصر الكلسيوم و المنجنيز و الصوديوم و البوتاسيوم مما يجعل المياه غير صالحة لشرب الحيوان.

من خلا ل الإستبيان ضعف إجراءات الأمن الحيوي في معظم المزارع المستهدفة مما أدي إلي ظهور الأمراض الطفيلية بوجود القراد في معظم المزارع مما يشكل مخاطر في الأبقار وقلة الإنتاج في الألبان .

Chapter One
Introduction

Livestock is the largest subsector of the Sudanese domestic economy and is a growing contributor to exports. The great bulk of all livestock production – possibly 90% of the total, though no one really knows the actual figure – comes from small holders and migratory producers. To a remarkable extent, the Sudanese economy is based on a combination of mobile and sedentary pastoral and agro-pastoral production by farming and herding households in almost every region and state. It is essential that Sudanese policy makers recognize the centrality of pastoralist to their economy and take practical steps to support the livestock sector. The most commonly quoted measure of the importance of an economic sector or industry is the size of its contribution to national gross domestic product (GDP). From this perspective, Sudan's official national accounts reveal the very significant contribution made by livestock to the country's domestic economy. Sudan's agricultural sector GDP includes crop, livestock, fisheries and forest production. (Roy Behnke, 2012).

Definition of Biosecurity The broad meaning of biosecurity literally means the "safety of living things or the freedom of concern for sickness or disease". A second definition is "the management of risks posed by organisms to the economy, environment and people's health through exclusion, mitigation, adaptation, control, and eradication Another definition of biosecurity is "security from transmission of infectious diseases, parasites and pests to a production unit .

Biosecurity is in practical terms a "mindset" or "philosophy" that must be developed by the producers in order to prevent the entry of disease to the flock. It is an approach to animal husbandry that has a focus on maintaining or improving

the health status of their animals and preventing the introduction of new disease pathogens by assessing all possible risks to animal health. Additionally, biosecurity is a tool to help minimize the effect of infections and decrease the impact of disease. (FAO, 2007).

The tenets of biosecurity have been long recognized by veterinarians. However, throughout the past decades, interest in Biosecurity as a scientific discipline has surged because of; 1) disease outbreaks that have threatened to devastate agricultural economies, and 2) bioterrorism. In fact, the meaning of the term biosecurity and the structure and focus of biosecurity programs have evolved throughout time to more accurately reflect the scientific community's evolving perception of disease as well as the needs of the consumer, the veterinary profession, and producers and owners.(Stephen *et al*, 2018).

The dairy cow is, however, a very valuable animal and owning one entails a number of risks. The biggest risk is losing the animal. Low productivity due to poor management will also lead to losses cow better management can increase overall health, milk yield, and productive life because of enhanced animal welfare.

Housing systems for dairy cows vary from housing cows throughout the year to housing cows in the winter months only. Outdoors grazing is allowed throughout the year in regions with the appropriate climate. Systems in which cows are housed throughout the year are used in areas where grazing the cattle is not the most efficient or cost-effective use of the land. Cows can be fed high levels of concentrate feed more easily when they are housed, so extended or continuous housing systems are more common in farms having cows with a high genetic potential for milk yield. It is hypothesized that the increased length of the housing period may have adverse effects on cow lameness and leg injury. Provision of adequate shading is the easiest and most effective way in controlling cows' heat

stress. Direct sunlight adds a tremendous heat load to the cow, but heat energy that is reflected from areas exposed to the sun such as concrete floors. barn walls and other exposed surfaces also add to the cow's heat stress. Shading reduces the black globe environmental temperature (a measure of temperature and radiant energy) and lowers the rectal temperature and respiration rate of cows, increasing feed intake and milk yield. Gains in milk production of 10 to 20 percent occurred where shaded and un shaded cows were compared. (Saeed, 2015).

Diseases affect the quality and the quantity of livestock products and the extent to which diseases are controlled therefore affects the incomes of producers. For the same level of inputs, a disease-free herd of dairy cattle will produce higher levels of output compared to the output from a herd in which animal health problems are present. Both of the above factors will affect producer incomes, not only in the country in which the disease outbreak occurred but also elsewhere. (Ramsa *et al, 1999*).

This study aimed to evaluate the bio-security system in the dairy cow farms in Khartoum state, focused in the northern areas in the traditional farms. The study also focused on the ticks and ticks born disease affected the animal health and the production as an economic factor.

Chapter Two

Literature Review

2.1 Livestock in Sudan

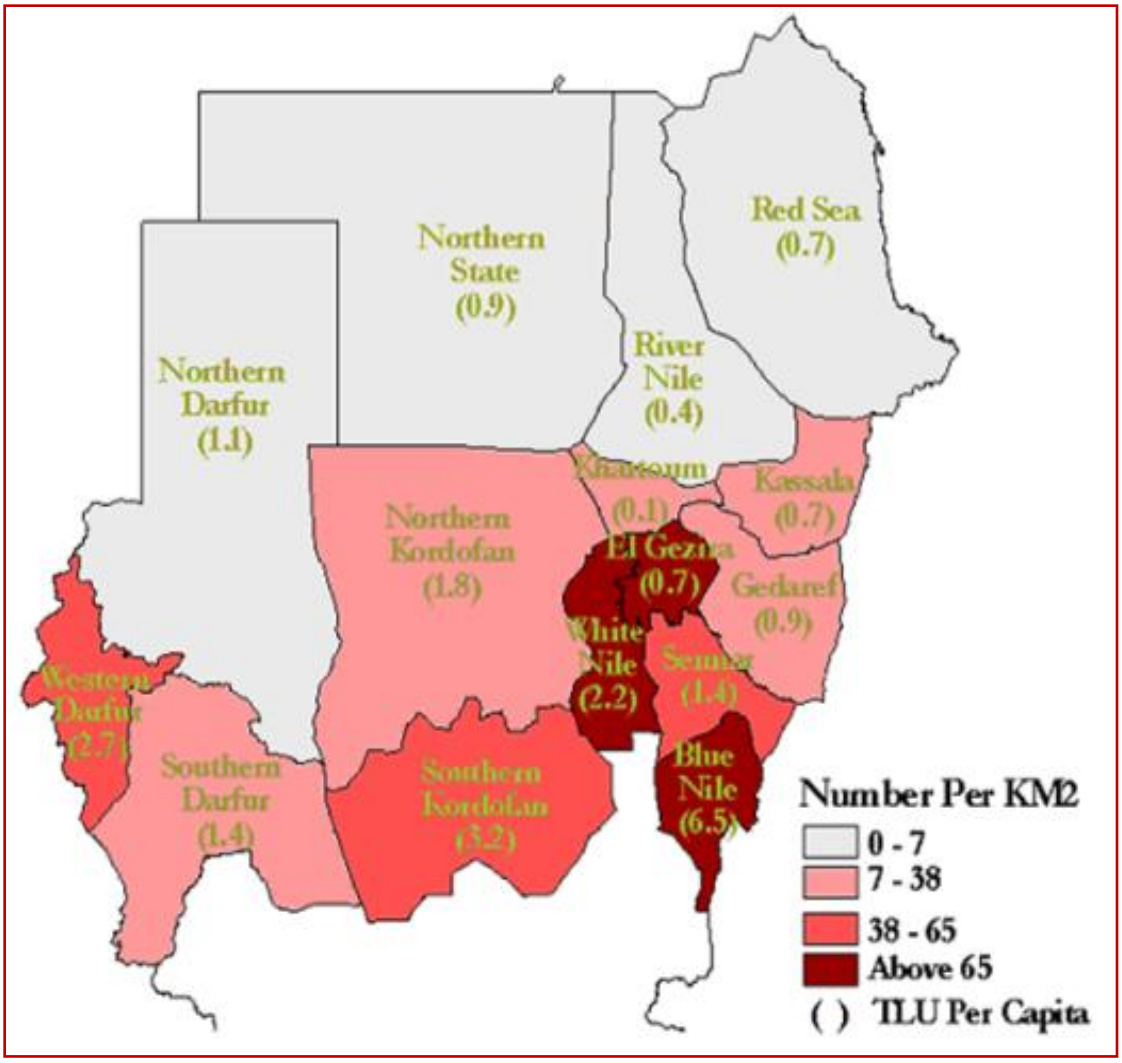
Sudan is endowed with large and diverse wealth of domesticated livestock species, which include cattle, sheep, goats and camels. There are different types and breeds of livestock, the majority of which is raised by tribal groups and often carries the names of the tribe or locality. Other domesticated local types of animals include horses, donkeys, and poultry. Various species also have different production attributes and uses, with camels providing transport in addition to milk and meat, goats providing rapid rates of post-drought herd recovery, sheep providing seasonal income opportunities related to Islamic festivals and camels and cattle providing prestige and social status in some areas (HCENR 2013). According to Ministry of Livestock Fisheries and Rangelands, 2012(MoLFR) that livestock exports earned around US$480 mn by the end of November 2012, which was an increase on the estimated US$333 mn earned in 2011. It represents 60% of Sudan's agricultural GDP, about 50% of recorded agricultural exports and, by value, the largest sub-sector of the domestic economy. According to MoLFR 2013.

Table 2.1 Estimated livestock population (000)2013

Cattle	Sheep	Goats	Camels	Total
30010	39568	30984	4773	105335

Source: Information Centre MoLFR 2013

Figures 2-1: Sudan livestock density



(Sudan tropical livestock unit (TLU)[1])

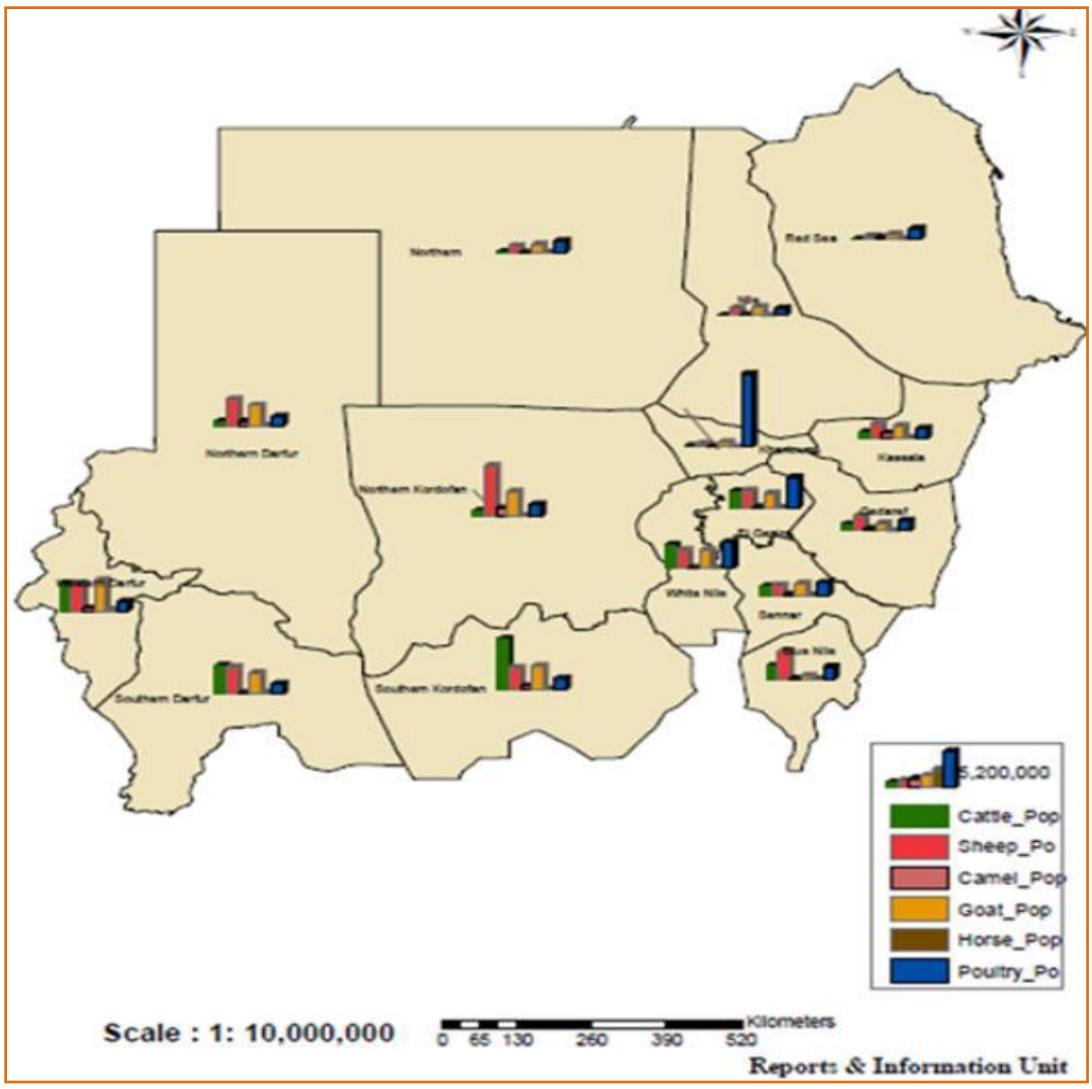


Figure 2.2: Livestock distribution

Source: SIFSIA-FAO-Sudan 2012

2.2 Livestock production system

In the Sudan livestock are raised mainly by pastoral and agro-pastoral groups, with the former dependent on livestock and the latter on both livestock and cultivation.

Pastoral herds are mainly semi-nomadic, as is the case in western Sudan and Southern Blue Nile where traditional movements occur between wet and dry season grazing areas. The wet season range is an alternative grazing area during the rainy season due to the availability of both pastures and water and because of the unfavourable conditions (mud and biting insects) in the dry season grazing areas.

2.3 Extensive production systems/or traditional mobile system

Animals raised under these systems satisfy their nutritional needs through grazing the existing vegetation, with a regular year round movement of herders their families and herds. This movement is mainly due to environmental factors such as lack of water and pasture in the north during the dry season, mud, flies and insects in the south during the rainy season.

Through their movement, the nomadic pastoralists follow traditional inherited migration routes that are used in the movement between wet and dry season grazing areas. The movements of each pastoral group take the following pattern:

2.3.1 Mixed extensive systems/or sedentary pattern or agro-pastoralists, transhumance

Livestock largely utilize with some supplementation. There cultivation is practiced alongside with animal rising. Limited animal movement is practiced between the domain and surrounding grazing areas. While in Semi-nomadic (Transhumance) system part of the family moves with the herd while the other stay in the Dar (homestead) to practice cultivation.

2.3.2 Mixed crop-livestock production systems/or Improved modernized systems

Integrated intensive livestock/crop production systems typically involve small herd sizes, with animals either confined in limited spaces or free-roaming. Animals under these systems are fed on different feeds, largely available on-farm and primarily consisting of crops and crop residues produced and as they become available throughout the year.

In this system, intensive dairy production is practiced using irrigated fodder, mixed feed and concentrates with exotic breeds or indigenous local ones. This system is seen as the promising system for the future supply of milk and meat for the increasing demand of the communities in the country due to sustainable feed balance.

2.3.3 Intensive production systems/or commercial production system

Such systems are, in general, professionalized, using high levels of resources but also yielding high volumes of meat and milk. They comprise: Milk cooperatives; specialized large dairy enterprises; and individuals owning high-producing milking cows. Feedlots for fattening cattle and sheep trekked for long distances from the western regions of the country to urban areas and markets are also established. Fattening and dairy production are also practiced in big privately owned rain fed semi mechanized agricultural schemes on crop residues; and poultry commercial production business around big towns.

2.3.4. Integrated crop-livestock production systems

Pastoralist and agriculture of complementary relationships to earn a livelihood and economic systems since the 19th century under Turco -Egyptian rule. Recently this relationship changed dramatically, becoming the competitive due to different factors such as scarcity of resources, droughts and population growth *etc.…,* these

create challenges for the balance of traditional management systems and environmental governance.

Zaroug 2006 indicated that traditionally most farmers, whether in irrigated or dry land farming areas, keep some of livestock; the animals benefit from crop residues, weeds and in a few cases grown fodder crops. At present the problems that hinder larger scale integration are twofold: firstly, there is the inherent divorce between crops and animal production in the crop rotations of the mechanized farming areas and in the major irrigated schemes of Gezira, Rahad and New Halfa and secondly, integration of livestock into farming systems is not always viewed as a complete package of socio-economic and technical factors and supporting services that should be designed and implemented in close collaboration with the target producers. Introduction of livestock into the crop rotations of the Gezira, the largest irrigated agriculture scheme in Sudan, has been attempted with the objective to ensure a source of good quality feed on an annual basis.

2.4 Livestock feeding systems

2.4.1. Rangelands

With reference to Sudan Land Cover Classes (FAO, 2012), rangelands covered an estimated area of more than 48,214,047 hectare[2] (25.7% of total country area). Most of the country's forests are open or semi-open habitat, with 4% of Sudan's land area mandated as forest reserves that receive a special level of protection and management, those provide contribute significantly to browse (Badri, 2012).

The rangelands of importance to traditional livestock rising are confined to the Semi–Desert, Low Rainfall woodland Savannah, and the northern fringes of the Rainfall woodland Savannah areas. In the Semi- Desert the plant cover is a mixture of grasses and herbaceous plants intermingled with *Acacia spp*, and shrubs

representing the main grazing areas for camel and sheep. Two areas of pure grassland form a distinct feature of this rangeland type namely, the Butana plains (grassland on clay) and Baja area (grassland on sand). The Rainfall woodland Savannah on clay and sand have a plant cover of a mixture of *Acacias spp*, and other trees such as *Balanites aegyptiaca* and *Ziziphus spina-christi* in addition to shrubs and a number of herbaceous plants.

Grasslands (grazing) are most important feed source, in term of area and production. They provide feed during wet season (August to December). During the short wet season grasses grow and mature rapidly producing abundant biomass where herbs and grass characterized by succulence with a high crude protein content, low fiber in the beginning of the wet season.

Rangelands are affected by amount of rainfall and its distribution. The nutritional inadequacy of the dry season grazing imposes a major constraint on sustainable livestock production under traditional systems where grazing constitutes the only source of feed for livestock (RPGD, 2012).

Browse species (fodder trees and shrubs) are important components of the natural rangelands national for herd at different ecological zones under traditional pastoral production system depends mainly on grazing and browsing. In the drier areas where *Acacias* are predominant, fruits (seed pods), twigs, flowers and leaves are main browse materials. In the wetter areas to the south where broad-leafed plants are dominant, livestock depend heavily on tree foliage. The most important feature of the browse species is availability during dry season when all types of grasses are already exhausted or of low nutritive value. They are particularly valuable in the Semi-Desert and Low Rainfall woodland Savannah zones. Utilization of forage depends on different factors such as availability, security of countryside, availability and accessibility of water sources, general resource degradation *etc*….

2.4.2. Crops residues

These are utilized by landowners, or sold in the field (standing hay) to nomads (value differs according to type of by-products quality and site). Crop residues are a strategic source of feed for livestock during the dry season, with a part grazed in situ and part transported and stored for subsequent use (RPGD 2009).

2.4.3. Irrigated fodder

Area under irrigated fodder it comprises a very small proportion of the total area under cultivation it estimated as 0.1 million hectares on annual basis. The area depends on farmer's decision as part of the crop rotation, however annual production estimated as 0.97 million tons /year (Khair, 2011).

2.4.4. Agro-industrial by–products

Include sugar molasses, baggase, oil seed cakes (cotton, groundnuts, sesame, and sunflower), grains and by-products of cereal milling (bran), which are of high nutritive value and are, used as supplementary feed as well raw input for producing pelleted feed.

2.4.5 Concentrates

Agro-industrial by–products, grains and feed additives are main raw materials for pelleted feed. Utilization is determined by the pattern of animal production; availability and accessibility of raw materials.

2.4.6. Cereals

Mainly sorghum, millet and maize constitute the main grains for mixed or pelleted feed**.** Cereals in particular sorghum form one of the main components of livestock feed especially for sedentary livestock production system (some pastoralist of South Kordofan (Savannah) feed sheep with sorghum during the summer season).

Amount of the cereals available for animal feed consumption is estimated as 5 % (sorghum, maize and millet) of the total annual production based on the estimates of the food security situation studies (Ministry of Agriculture and Forestry, 2009).

Table 2.2 Available animal feed (million tons) 2012

Region/ecological zone	**Agro-industrial by-products**	**Cereals**	**Irrigated fodder**	**Crop residues**	**Rangelands**	**Total**
Eastern (Semi-Desert Zone)	0.05	0.34	0.029	5.16	4.38	9.619
Northern(Semi-Desert Zone)	0.02		0.335	0.33	0.77	1.4559
Central (Low Rainfall Woodland Savannah Zone)	0.05		0.05	4.67	2.65	7.42
Western(Low Rainfall Woodland Savannah Zone)	0.06		0.131	3.1	13.36	16.651
Darfur (Low Rainfall Woodland Savannah Zone)	0.02		0.006	0.887	13.61	14.5234
Total	0.2	0.34	0.551	14.147	34.77	49.6693

Source: Range and Pasture General Directorate 2012

2.4.7 Characteristic features of traditional livestock movement

Longstanding system of stock routes facilitates the movement of livestock through agricultural and forest areas in the central zone. Most of these routes were demarcated during the colonial period, their size depending on the intensity of agriculture, the presence of villages and the natural contours of the land. Routes accommodate pastoralists' complete social life, (trade, ceremonies and family commitments, utilization of resources characterized as:

1. Communal grazing is the prevailing use of the rangelands each tribe or clan moving along the route that links between wet and dry season grazing areas.
2. Regulation of pastoral activity concerned the limitation of tribal intermingling in the grazing areas.
3. To relieve pressure on both water and grazing around the watering centers, pastoralists tend to move away and disperse widely among the different regions during Kharif (rainy season) to make use of the water pools formed by the rain as well as the extensive grazing area.

2.4.8 Legal frameworks of range resource

Land in pastoral communities is considered as: means of livelihood, source of wealth, identity, and social peace and source of conflict. Accessing pastoral land was governed by the system of communal rights. Although, this system has some shortcomings such as lack of transparency and democracy besides being gender bias as woman can access land only through their fathers and husbands, it has proven its efficiency in securing livelihood and reducing conflicts in the country (Elhadary, 2010).

The Civil Transaction Act: provides regulating access to grazing land. The Act (Section, 565) specifies that: All fallow land is grazing lands; it stipulates the right of government to impose temporal or spatial restrictions on grazing in these areas

or to allocate land for grazing for the benefit of an entire community or for the protection of wildlife (De Wit, 2001).

Many attempts to issue Acts to regulate range resources utilization were made by Range and Pasture Administration (1996, 2002, and 2012). The proposed 1996 Act defined rangelands, proposed measures for participatory natural resource management that empower communities to manage pastoral reserves under the overall supervision of the State Range and Pasture Departments. However due to lack of political endorsement, the proposed Act was not ratified at that time, which has been updated 2002 and 2012 and the process by 2013 was submitted to the Council of Ministers for ratification.

The Government passed a Forest and Renewable Natural Resources Act in 2002. The Act recognized the access rights of pastoralists for grazing and clear passage. Unfortunately, due to provisions that gave a discretionary power to the FNC in some cases, limit access rights, the Act was perceived as being biased in favor of sedentary communities. Although these provisions were put in place with the given intent of giving the FNC oversight over land use for environmental protection, this perception limited the acceptability and practical effectiveness of the Law (IFPRI 2006).

At state level Local Orders and Local Acts were issued in different states ordering the utilization and protection of the grazing resources. In the past colonial government strictly enforced these regulations, mainly through the native administration that protectively guarded the domain of pastoral activity. Several political and social factors worked to undermine the effectiveness of native administration, the most important of which are social and politicization of the native administration. In certain parts of the country where societal changes happened, native administration has become outdated. As people acquire education and wealth or become exposed to mass media, they begin to lose faith in the

sanctity of traditions and customs, the backbone of a successful native administration (Tayeb, 2006).

The Interim National Constitution of Sudan 2005 provided specific articles for the ownership of land and the management of natural resources, thereby giving impetus to socially informed land tenure policy and legislation.

2.5 Biosecurity

Biosecurity practices designed to minimize the transmission of infection diseases between and within farms are an important component of modern flock health programs (Dorea *et al*, 20100). Bio security is simply described to consist of three fundamental principles: segregation cleaning and Disinfection (FAO, 2008) Dairy cows represent an important sector in animal production. The movement of farm personnel was positively associated with the probability of farm infection as highlighted by Mc Quiston *et al*, 2008.

It was reported that bio security implementation requires training awareness, resources and the perception of higher risk and loss of profit (conan *et al*, 2012) and that the use of untreated poultry manure as fertilizer poses a serious risk of infection spread 9cristalli and(Capua, 2007) .water and feed .

2.5.1 Bio security and bio containment

Disease prevention protocols on dairies, either aimed at keeping disease out (biosecurity) or preventing spread of disease on the farm (biocontainment) have always been a concern. However, the first dairy specific biosecurity publication, the USDA-APHIS National Animal Health Monitoring System (NAHMS) report, “Biosecurity Measures in Dairy Herds” did not appear until 1993.(USDA, 1993) The 1996, 2002 and 2007 NAHMS Dairy studies each include a specific section about biosecurity; specifically physical contact between animal groups and

biosecurity for new arrivals.(USDA, 1996; USDA, 2002; USDA, 2007a) A wide variety of dairy biosecurity resources have been published in lay journals and on the Internet. Some are focused on disease control for specific diseases (Johne's, mastitis, bovine viral diarrhea, foot warts, and foot and mouth disease). (Rauff et al., 1996; Sischo et al., 1997; Pfizer Animal Health, 2000; BAMN, 2001; Schoonmaker, 2002; Quakenbush, 2003; Collins, 2004; Naugle et al., 2004) Other resources are more general in their recommendations or are focused on specific threats, such as visitors to the farm, expansion herds, or exhibiting animals. (Hill, 2003; DEFRA, 2003; GVMA, 2004; Kirk, 2004; Siebert et al., 2004) Those that addressed the risks from introducing new animals to the herd varied in their recommended times for quarantine or isolation or failed to provide the details for practically implementing the change on dairies. (Wallace, 1996; NYSCHAP, 2001; Kirk, 2003; Wisdairy, 2004).

One national source for dairy biosecurity information, the Dairy Quality Assurance Center, Inc. (DQA) developed a pamphlet, "Biosecurity – Profit for the Taking" in 1998 as an educational instrument for producers and veterinarians.(Dairy Quality Assurance Inc., 1998) The content was also presented in an online training. In 2008, DQA published a peer reviewed document, "Biosecurity – Foundation for Food Security and Food Safety" which was designed as a 'risk assessment'.(Milk & Dairy Beef Quality Assurance Center Inc, 2008).

2.5.2 Dairy bio security

has been the subject of numerous reviews and continues to be discussed at veterinary and producer meetings, in dairy industry publications, as well as through cooperative extension service and state departments of agriculture. (Thomson, 1997; Garry, 1998; Godkin et al., 1999; NYSCHAP, 2001; Dargatz et al., 2002; Kirk, 2003; Mass Dept Food Ag, 2003; PSU, 2004; Bickett-Weddle, 2004; Bickett-

Weddle, 2005a; Lombard et al., 2008) Topics ranged from general recommendations to specific disease management topics. A report published by Moore, et al. in 2008 described an extensive list of bio security recommendations for dairy and other agricultural animal species that were available on the World Wide Web.(Moore et al., 2008) There was no shortage of information regarding dairy biosecurity recommendations, but overall there was a lack of consistency, depth of information and evidence for the cost-benefit of many of the recommendations. (Moore et al., 2008; Lombard et al., 2008) A detailed, comprehensive list of instructions for implementing various biosecurity recommendations for all life stages on dairy operations did not exist, although many sources reported that risk assessment, or assessing the farm was an important biosecurity management practice. Despite the fact that many different recommendations exist, the reality is that each dairy operation is different and there is not a one-size-fits-all answer. Risks must first be identified before they can be managed.

2.6 Biological risk management

The term bio security is widely used but its application varies among countries and can present translation problems in certain languages. The Food and Agriculture Organization of the United Nations (FAO) Expert Consultation discussed its use in communication documents. This group defined bio security in the broadest of terms as the concept, process and objective of managing biological risks associated with food and agriculture.(FAO, 2002b) It was concluded that as long as it is italicized and capitalized, the term Bio security could be retained. (FAO, 2002b) This same group generated the document, "Biological Risk Management in Food and Agriculture: Scope and Relevance" that provided some guiding principles that can be applied internationally to protect animal and public

health and at the farm level. One notable item was the recognition of using hazard identification and principles of risk analysis as part of a "whole-cycle" approach to managing disease at farm or country level. The authors reported that a holistic approach has benefits and that a "toolbox" with proven practices in regards to risk management at the local, national and international levels is needed for synergism.(FAO, 2002a).

In response to the need for a holistic approach, consistent recommendations, and the ability to customize disease risk management for a variety of livestock operations, a set of tools was developed by a group of veterinarians at the Center for Food Security and Public Health (CFSPH) at Iowa State University. The phrase 'biological risk management' from the FAO document was used to describe this project as opposed to the term bio security. Biological risk management (BRM) and the concepts it entailed encapsulated the approach of educating livestock producers and veterinarians about identifying disease risk and preventing disease entry and spread to the animals in their care. Biological risk management (BRM) also fit with the Center's mission of 'increasing national and international preparedness for accidental or intentional introduction of disease agents that threaten food production or public health". (Roth, 2002).

2.7 Scope of the biological risk management

(BRM) toolbox Biological risk management (BRM) accounted for the fact that disease risk cannot be completely eliminated, but it can be managed through effective control measures. The concepts of the epidemiology triad, host – agent – environment, were applied.(Pfeiffer, 2002; LeBlanc et al., 2006) These concepts were essential in the selection of the first audiences for BRM. The swine and poultry industries tended to focus their efforts on disease exclusion. For the most part, modern swine and poultry production facilities have systems in place to

accomplish that task. This was not the case for the majority of cattle operations; they are fundamentally different in husbandry, production cycles, and nutritional needs. Complete exclusion of all diseases was not deemed a practical approach for the majority of cattle operations. Developing a method to assess an operation for what disease prevention.

Risk management assessment tools were also developed. Open-ended assessment questions gathered information about milk production and quality parameters, herd demographics, on-farm protocols for visitors, new animal introductions, and vaccinations. Closed-ended questions identified various strengths and weaknesses of disease introduction and spread on a dairy operation. Reports and educational handouts were also developed to educate dairy producers about disease risk and specific details to manage it.

2.8 Risk perception

The first phase of risk analysis is to identify an individual's perception of risk. Risk perception is often influenced by previous experience, the media, and locale.(Slovic, 1987) A dairy producer's perceived risk, right or wrong by another's standards, ultimately affects 7 how, or if, change is carried out. By identifying what is viewed as a threat to an operation, management protocols can be tailored to address these concerns. Risk means different things to different people and acceptable risks also vary between individuals. For example, two dairy producers may perceive Johne's disease as a risk to their cattle. One producer may put numerous control mechanisms in place to prevent disease entry or spread. Another producer accepts the risk and instead of preventing it, tolerates production losses. The producers may have the same perception of risk but different tolerance. Scientific advancements such as vaccines and antibiotics have also influenced the perception of infectious diseases and how they are managed.(Garry, 1998) With

these tools, some dairy producers may choose to vaccinate or treat their way out of disease situations rather than prevent their entry. The choice to vaccinate, extrapolated from what is known in human medicine, often depends on the likelihood of disease occurring, susceptibility to the disease of concern, and severity if disease were to occur.(Brewer et al., 2007) Producers may make herd vaccination decisions based on the same three concepts. Aside from risk perception and tolerance, some individuals may have negative perceptions associated with risk management. These are often based around ideas of disbelief, "that practice will not work to stop disease entry" or economic concerns, "vaccination is too expensive".(Rauff et al., 1996; Vaillancourt and Carver, 1998) While it is difficult to prove and measure the benefit of things that do not happen, counter-arguments tend to fall into three categories: there is a risk, it is economically worthwhile to prepare, and the overall impact must be considered. Vaccines are not 100% effective, carrier animals can perpetuate disease in a herd, and increasing concern with antibiotic resistance are all realities of dairy production in the 21st century.(Kelly, 2005) Awareness and understanding of disease management practices are crucial for their ultimate implementation.(FAO, 2002a).

2. 9 Routes of disease transmission

The approach taken in the development of the CFSPH biological risk management tools was to look at diseases, not based on the agent or clinical signs produced, but rather on the route of transmission to the animal or human (in the case of zoonotic diseases). An advantage of this approach is that it will also help protect against new or unanticipated infectious agents. While disease agents and the infections they produce vary depending on if they are a bacterium, virus, parasite or prion, they all have one thing in common: the animal must be exposed to them to develop disease. It is important that animal caretakers understand that certain pathogens can

be acquired orally and others are acquired by aerosol transmission. Those are visual things that people can grasp and better yet, gain control over. From a disease management standpoint, hazards must first be identified and then protocols designed to minimize exposure. This disease control approach was used as far back as 1892 when contagious bovine pleuropneumonia was eradicated from the United States. At the time, the etiologic agent Mycoplasma mycoides subspecies mycoides was not yet identified but control methods were put in place based on what was known about the epidemiology of the disease.(Schwabe, 1984) Designing prevention protocols with specific applications, such as minimizing fecal contamination of feedstuffs by using separate loader buckets for feed and manure handling, provides action steps that producers can implement to control disease spread. Producers do not necessarily need details about a disease agent's etiology, only the critical control point. Based on the recommendations of the NRC in 2003, this approach will provide a broader prevention strategy. (NRC, 2003).

2. 10 Domestic and foreign animal diseases

Management protocols based on the route of transmission approach can reduce the infectious burden for diseases already present in the herd. For instance, if the adult cattle are carriers of an endemic disease agent, management protocols can be put in place to limit their contact with young stock. Preventing direct contact, shared air space or equipment between these groups are all management techniques that can be implemented to decrease exposure. Decreased herd prevalence or environmental contamination has the potential to reduce the economic impact of existing diseases.

2.11 Risk management practices Disease management

Practices should focus on minimizing identified risks. One approach to disease prevention is to focus on the critical control points for a dairy operation.(Villarroel

et al., 2007; Noordhuizen, 2008; Boersema *et al*., 2008) Numerous authors have described five management areas that have the potential to introduce or spread disease: introduction of animals, people, nutrients (feed, water), equipment, wildlife/rodents/vectors.(BAMN, 2001; van Schaik et al., 2002; England, 2002; Kirk, 2003; PSU, 2004; Villarroel et al., 2007; Maunsell and Donovan, 2008; Milk & Dairy Beef Quality Assurance Center Inc, 2008).

2. 12 Khartoum state

The estimation of livestock number in Khartoum state between 2012 to 2016 are indicated in table below according to the ministry of Animal Resource Khartoum state (2016) with gross rate Cattle 3%, Sheep 5.25 %, goat 3 % and Camel 0.5%.

Tabl 2-3 The estimation of livestock number in Khartoum state between 2012 to 2016

Animal	**م2016**	**م2015**	**م2014**	**م2013**	**م2012**
Cattle	304,029	295,174	286,576	278,230	270,126
Sheep	624,985	609,742	594,870	580,361	566,206
Goat	821,900	794,107	767,253	741,307	716,239
Camel	6,906	6,872	6,838	6,804	6,770

Table 2-4 The number of population (2012 - 2016) indicated in the table below:

م2016	**م2015**	**م2014**	**م2013**	**م2012**
6.721.995	6.531.162	6.345.748	6.165.597	5.990.560

2.13 Milk Production

Milk production in Khartoum state estimated 640,224 / day with a total year production 2,134,080 ton. This produced from 142,272 head as average.

The gross of production throw last three years are also indicated in table blow

Table 2-5 Milk production in Khartoum state (2014-2016)

Years / Numbers	2016	2015	2014
Number of heards	304,000	295,146	286,573
Number of large	197,600	185,942	1,719,432.80
Average of milking cows	142,272	130,159	116,921.78
Yield / Day	2,134,080	1,952,391	1,753,827
Yield / Year	640,224	585,717	526,148

Chapter Three

Materials and Methods

3. 1 Location

The city is located in the heart of Sudan at the confluence of the White Nile and the Blue Nile, where the two rivers unite to form the River Nile. The confluence of the two rivers creates a unique effect. As they join, each river retains its own color: the White Nile with its bright whiteness and the Blue Nile with its alluvial brown color. These colors are more visible in the flood season.

The state lies between longitudes 31.5 to 34 °E and latitudes 15 to 16 °N. It is surrounded by River Nile State in the north-east, in the north-west by the Northern State, in the east and southeast by the states of Kassala, Gedaref, Gezira and White Nile State, and in the west by North Kurdufan.

3.2 The Experiments

Fifty (50) dairy cows farms in Khartoum state Bahry localities are selected randomly as flowing:

- Elsilate Agriculture Project seventeen (17) farms.
- Saba Agriculture Project sixteen (16) farms.
- Kuku Milk project seventeen (17) farms.

3.2.1. The Experiments 1.

The experiment farms were evaluated the bio security system using a questionnaire including:

A- Health

Hygiene, Defragment, Vaccination, diseases, Ticks control and preventive and west control.

B- Nutrition and production

Feeding systems, drinking water system, and manage of milk farm production.

C- Buildings

The fences, pens area /shedding area also including type of housing and storages. Farm labors housing services.

3-2-2. The Experiments 2

3-2-2-1 Laboratory blood samples analysis

Fifteen (15) blood samples were taken randomly from the cows analyze in *(The laboratory of the KUKU Milk Project) the* tick parasite disease (Babasia and Theilliria).

3-2-2-1-1 Collection of blood samples

Blood smears were prepared from blood samples, 3 ml from each sample, collected from jugular vein in EDTA coated vacutainer tubes (Soulsby, 1982).

3-2-2-1-2 Blood smears examination

Blood smears were stained with 10% Giemsa's stain and examined under 100× oil immersion objective using light microscope for the presence of *Theileria* spp. piroplasms. At least 50 microscopic fields were examined, and the presence of one or more piroplasm was considered positive (FAO, 1984).

Table 3-1 Result of blood Analysis for Babasia and Theilliria

NO	Location / Indicator	Result
1	KUKU	Three positive +Two Negative
2	Eastern Nile	One positive +Four Negative
3	Selete	Four positive +One Negative

3-2-2-2 Laboratory analysis of drinking water

Seven (7) drink water samples were also taken and analyze in *(The Central Laboratory of Soil, Water and Plant Ministry of Agriculture)* to indentify as a suitable water for drinking animals.

3-2-2-2-1 Collection of water samples

Water samples were collected in pre-cleaned, sterilized, polyethylene bottles of one litre capacity (APHA, 2003).

3-2-2-2-2 Analytical method of drinking water

The water samples were analyzed for pH, electrical conductivity (EC), dissolved solids (TDS), total calcium (Ca 2+), magnesium (Mg 2+), total hardness (TH), sodium (Na +), potassium (K +), total alkalinity (TA), chloride (Cl), fluoride (F) and Sulphate (SO4 2). All the precautions were taken as given for sampling and analysis (APHA, 2003).

Table 3.2 Result of water analysis

No	Lacation Sample	EC	pH	Ca Meq/l	Mg Meq/	Na Meq/a	K Meq/	Cl Meq/	Co3 Meq/	HCO3 Meq/	SAR
1	Selete A	0.1	7.0	3.5	4.5	20	0.5	6.0	Nill	6.5	10
2	Selete B	0.1	7.0	1.0	3.5	6.5	1.3	2.0	Nill	2.5	4.3
3	KUKJU A	0.1	6.03	1.5	5.0	21	1.3	2.7	Nill	8.0	11.7
4	KUKJU B	-	5.6	1.0	2.0	5	1.0	1.5	Nill	3.0	4.2
5	Eastern Nile A	0.8	7.0	2.0	5.0	4	0.75	3.5	Nill	4.0	2.1
6	Eastern Nile B	0.2	7.6	1.0	6.6	2.5	0.25	0.8	Nill	2.5	1.3
7	Eastern Nile C	0.2	8.3	1.8	6.5	2.0	0.6	3.0	Nill	3.8	1.0

- SAR = Sodium Adsorption Ratio
- Meq =Magnesium Adsorption Ratio

3-3 The statistic analysis

The statistic analysis used in this study were comparing between averages and percentages.

Table 3.3. The result percentage of ticks presence in Target Farms

Questionnaire	Chooses	Number Of Target Farms
Types of cows Breeds	Local Cross Foreign	- 13 -
Production Purpose	Milk Meet	- 13
Farm System	Closed Opened	- 13
Types of Ticks	Yes No	12 1
Control Program	Weekly Monthly Yearly Needs	3 3 - 7
Infection of trans Ticks disease	Yes No	6 7
Most of Spread disease	Theilliria Mastitis Other	3 8 3
Treatment of trans Ticks disease	Betotax Other	3 10
Time of spread of ticks	Summer Autumn Winter	4 6 3
Method of Control	Spry Injection Sowing	13 - -

Table 3.4 Ticks control result

Area	ticks Control			
	Yes		No	
	Fre.	%	Fre.	%
KUKU	13	33.3	6	54.5
Eastern Nile	13	33.3	1	9.1
Selete	13	33.3	4	36.4
Total	39	100.0	11	100.0

Table 3.5 Preventive result

Area	/Preventive Disease			
	Yes		No	
	Fre.	%	Fre.	%
KUKU	2	50.0	17	37.0
Eastern Nile	1	25.0	13	28.3
Selete	1	25.0	16	34.8
Total	4	100.0	46	100.0

Table 3.6 Time of Vaccination result

Area	Time of Vaccination			
	Yes		No	
	Fre.	%	Fre.	%
KUKU	17	36.2	2	66.7
Eastern Nile	13	27.7	1	33.3
Selete	17	36.2	0	0.0
Total	100.0%	100.0%	100.0%	100.0%

Table 3.7 Feeding System result

Area	Feeding System			
	Yes		No	
	Fre.	%	Fre.	%
KUKU	1	100.0	18	36.7
Eastern Nile	0	0.0	14	28.6
Selete	0	0.0	17	34.7
Total	1	100.0	49	100.0

Table 3.8 Source of drinking water system result

Area	Source water drinking System			
	Yes		No	
	Fre.	%	Fre.	%
KUKU	16	57.1	3	13.6
Eastern Nile	4	14.3	45.5	10
Selete	8	28.6	9	40.9
Total	28	100.0	22	100.0

Chapter Four
The Result

4.1 Experiment 1. Biosecurity Indicators
4.1.1 The Health indicators

In the health indicators it can seen from table (4.1) in Kuku Eastern Nile or Selete location, in health indicators the high percentage in disinfectant indicator take place in Kuku farms 63.2% and the lowest percentage in Selete farm 15.8 % while the Eastern Nile farms 21.1%. Also in the vaccination Kuku and Selete farms accrued 36.2 % as a high level flowed by Eastern Nile farms 27.7 %. All farms in three locate on affected by diseases 100%.

The transfer of diseases take a high percentage in Kuku farms 42.5% then in Eastern Nile farms 28.5%, then the lowest one Selete farms 28.9%.

All farm use tick control in a same level percentage 33.33 %. In preventive indicator Kuku farms have the highest percentage 44.4 % flowed by Eastern Nile farms 33.3 % and 22.2%.

In the west control indicators the high level were 50% in Kuku farms then Selete farms 26.3% and Eastern Nile farms 23.7%.

Table 4.1. The Health indicators percentage

Location / Indicator	Defragment	Vaccination	Disease*	Transform Disease	Tick Control	Preventive	West
KUKU	63.2	36.2	100	42.5	33.3	44.4	50.0
Eastern Nile	21.1	27.7	100	28.5	33.3	33.3	23.7
Selete	15.8	36.2	100	28.9	33.3	22.2	26.3

*Type of Diseases

4.1.2. Nutrition indicators

The nutrition indicator in the farms under study can be show in table 4.2, systems applied in the farms as management system; in the feeding system indicators Kuku farms accrued the high level percentage 36.7% followed by Selete farms 34.7% and then Eastern Nile farms 28.6%.

Water drinking system indicator, a high level percentage 57.1% in Kuku farms, Selete farms 28.6% as a second level and the lowest level 14.3% in Eastern Nile farms.

The management of milk production in Selete farms 58.3% was a high level flowed by Kuku farms with a 53.7% and the lowest percentage 46% in Eastern Nile farms.

Table 4.2. The Nutrition indicators,

Location / Indicator	Feeding System	Source water drinking System	Manage of milk Production
KUKU	36.7	57.1	53.7
Eastern Nile	28.6	14.3	46.0
Selete	34.7	28.6	58.3

4.1.3. Buildings indicators

The indicator of building in the three location indicated in table 4.3. All farms were full fenced, and the suitable area for animal as indicator were 60% in Kuku farms, 30% in Eastern Nile farms 15% in Selete farms respectively.

The optimum shedding area in Pens a high level 60% in Kuku farms, and 30% in Eastern Nile farms, where the lowest percentage 15% in Selete farms.

78.6% of the farms in Kuku location have storages as a high level percentage, where the lowest percentage 7.1% in Eastern Nile farms, where the Selete farms reported 14.3% percentage from the total number.

39.1% of the Kuku farms have a labors housing and services, flowed by Selete farms 32.6% then the lowest percentage in Eastern Nile farms 28.3%.

Farm records were used 52.4% in Kuku farms, while it used in both Eastern Nile and Selete farms 23.8%.

Table 4.3. The Buildings indicators

Location / Indicator	fences	Pens area	Pens Shedding	Storages	labors housing services	Records
KUKU	100	60	60	78.6	39.1	52.4
Eastern Nile	100	30	30	7.1	28.3	23.8
Selete	100	15	15	14.3	32.6	23.8

4.2 Experiment 2. Chemical Analysis

4.2.1 Blood Analysis

It can be seen from table 4-4 Found in Selete project a high Risk level Disease Four Sample positive (Two Babasia + (Two Theilliria) + One Sample Negative

Than KUKU project and Eastern Nile project Further Found in KUKU project high Risk level Disease

Three Samples positive (Babasia) +Two Sample Negative a high Risk level Disease than Eastern Nile project

Table 4.4 Blood Analysis

NO	Location / Indicator	Result
1	KUKU project	Three blood Samples positive (Babasia) +Two blood Sample negative for test of Babasia.
2	Eastern Nile project	One Sample positive (Theilliria) +Four Sample blood Negative
3	Selete project	Four Sample positive (Two Babasia + (Two Theilliria) + One Sample blood negative

4.2.2. Water analysis

According to table 4 -4, the chemical analysis indicate that all the water samples are valid as drinking water, with increase of Sodium (Na) cautions in two locations *Selete A and Kuku A*, but this level of sodium have no effect in the validity of water but it effect in the water test.

The same analysis, appearance that the water sample is not valid as drink water in *Selete A* because of the equality (PH) of acidity and alkaline and the cautions of (Ca, Mg ,Na and K).

Table 4. 5. Water Analysis

No	Sample Location	EC	pH	Ca Meq/l	Mg Meq/	Na Meq/a	K Meq/	Cl Meq/	Co3 Meq/	HCO3 Meq/	SAR
1	Selete A	0.1	7.0	3.5	4.5	20	0.5	6.0	Nill	6.5	10
2	Selete B	0.1	7.0	1.0	3.5	6.5	1.3	2.0	Nill	2.5	4.3
3	Kuku A	0.1	6.03	1.5	5.0	21	1.3	2.7	Nill	8.0	11.7
4	Kuku B	-	5.6	1.0	2.0	5	1.0	1.5	Nill	3.0	4.2
5	Eastern Nile A	0.8	7.0	2.0	5.0	4	0.75	3.5	Nill	4.0	2.1
6	Eastern Nile B	0.2	7.6	1.0	6.6	2.5	0.25	0.8	Nill	2.5	1.3
7	Eastern Nile C	0.2	8.3	1.8	6.5	2.0	0.6	3.0	Nill	3.8	1.0

Table 4. 6. Questionnaire indicate Ticks percentage in target dairy cows farms

questionnaire	Chooses	Number Of Target Farms	Percentage%
Types of cows Breeds	Local	-	-
	Cross	13	100%
	Foreign	-	-
Production Purpose	Milk	-	-
	Meet	13	100%
Farm System	Closed	-	-
	Opened	13	100%
Types of Ticks	Yes	12	93%
	No	1	8%
Control Program	Weekly	3	23%
	Monthly	3	13%
	Yearly	-	-
	Needs	7	54%
Infection of trans Ticks disease	Yes	6	46%
	No	7	54%
Most of Spread disease	Theilliria	3	15%
	Mastitis	8	62%
	Other	3	23%
Treatment of trans Ticks disease	Betotax	3	23%
	Other	10	77%
Time of spread of ticks	Summer	4	31%
	autumn	6	46%
	Winter	3	23%
Method of Control	Spry	13	100%
	Injection	-	-
	Sowing	-	-

4.2.3 Result questionnaire:

It was found that all farms have 100% cross-breeds dairy cows. This may be due to the low milk production of local breed, and the high cost of foreign breed, and cross breed has a higher milk production than local breed and more adaptation to environmental condition than foreign breed.

Ticks Percentage in the farm was 92%. It is due to lack of bio-security and hygiene measures.

All farms are Open System. Most farms prefer open system from the economical point of view.

Ticks born diseases in targeted farms were 46%. It is due to lack of bio-security and hygiene measures. 54% of those farms were found free from ticks born diseases. That is due to good management efforts and good applying of bio-security measures.

23% of targeted farms following ticks control prevention weekly, 13% monthly, 54% when needed. It is a big problem happening when bad management is in charge, all of this may be due to ignorance, negligence or lack of attention to apply bio-security and hygiene measures.

Most common Diseases were mastitis 62%, Theilleria 15% and others Disease 23%. Poor management and control efforts on milking technique and hygiene, dirty and wet bedding, dirty and wet udders at the time of milking, lack of concern about teat-end lesions and not culling the severely infected cow that can transmit mastitis, all of that may increase mastitis infection

Treatment for Theileria by Butalex 23% while 77% Other Treatment s. Butalex is one of the most effective commercial antiparasitic drug product, but unfortunately many of farm owners do not know about it.

Farms ticks control program treated clinically affected animals with spry antiparasitic drug. Due to financial problems, it is one of the cheapest effective methods from the economical point of view.

Table 4.7 **Farms Infected by Ticks in Khartoum State:**

Code	Name Farm	Ticks Percentage
A	Ibrahim Capo	14%
B	Mohamed ahmed	11.6 %
C	Kuku	11.6%
D	Mohamed Ali	10%
E	Khalid Ahmed	7.2%
F	Elshazli Ali	18.2%
G	Ibrahim Sbahee	3.6%
H	Ahmed Hashim	5.8%
I	Hassan Mohamed	3.6%
J	Oad Allel	5.8%
K	Mohamed Mahadi	08%

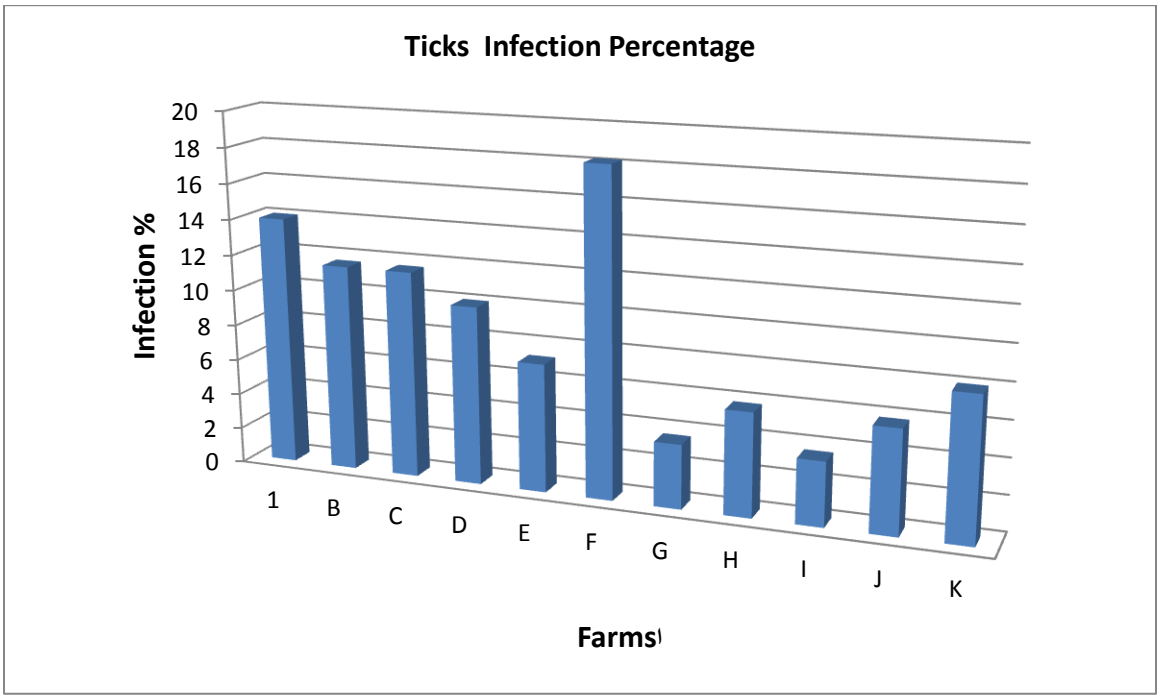


Figure 4.1 Show that Farms Infected by Ticks in Khartoum State

Table 4. 8 Ticks Genes Types

Name Farm	Genes Type	Percentage Meal For Female
Ibrahim Capo	Boophilus Annulatus	7:12
Mohamed ahmed	Boophilus Annulatus	2:14
Kuku	Boophilus Annulatus	4:12
Mohamed Ali	Boophilus Annulatus	10:4
Khalid Ahmed	Amblyomma Variegatum Boophilus Annulatus	3:0 0:7
Elshazli Ali	Amblyomma Variegatum	8:17
Ibrahim Sbahee	Amblyomma Variegatum	4:1
Ahmed Hashim	Amblyomma Variegatum	6:2
Hassan Mohamed	Amblyomma Variegatum	0:5
Oad Allel	Boophilus Annulatus	4:4
Mohamed Mahadi	Amblyomma Variegatum	1:10

The present study show that more spared gene type of ticks was Boophilus Annulatus in Khartoum state.

Chapter Five
Discussion

The present study indicate the low care of bio security in the three area under studies (KUKU, Eastern Nile or Selete farms) when use the health indicators lead to a high risk and spread of diseases.

Cook, 2013; Anon., 2014 reported that, farm-level Biosecurity is a series of management practices designed to minimize or prevent and control: the introduction of infectious disease agents onto a farm, spread within a farm production operation, and export of these disease agents beyond the farm that may have an adverse effect on the economy, environment and human health. It is an essential aspect of on farm food safety programs. Keeping food products wholesome and of highest quality is important for the health and welfare of consumers.

Another study of Stanković *et al*., 2010 show that, Biosecurity planning for livestock farms have to be analyzed as part of a larger context, Rapid Response to Animal Disease Disasters. These are both components of what is now being called All-Hazard Preparation. Farm level Biosecurity planning is the only thing that we can control in a disaster. Many of the other disaster components are things to which we can only react, but planning is something over which we can have certain control.

The quality of livestock feed and forage and their potential impact on human health begin with the growing and harvest of feedstuffs in the farmer's field and/or the grazing of the animals.

The present study show that there are low applied system in the three study KUKU, Eastern Nile or Selete farms areas either in animal feeding , animal water drink or milk production management.

The report of FAO 1997 indicate that, Feedstuff quality is affected all along the, sometimes, lengthy market route to the consumer of animal products. It is wise for the feedstuff (commodity) user to know that the ingredients being purchased for feed, or the area being grazed, is free from contamination which would not ordinarily be removed by processing, and/or that pastures and ponds are free from pollution or other contamination.

The same report of FAO consultant 1997, added that; animal feed or forage may be the source of a limited number of infections for farm animals that could in theory lead to human illness. These include Salmonella enteric and Toxoplasma gondii, Trichinella spiralis and possibly the agent of bovine spongiform encephalopathy (BSE). The risks to human health from several other infectious agents, which may contaminate either feed or forage, appear to be either negligible or non-existent. These include Bacillus anthraces, Clostridium botulinum toxin, Listeria monocytogenes and Mycobacterium bovis.

The present study indicates a variation in applied safety system in buildings or services in the three study area Kuku, Eastern Nile or Selete farms.

A study of FAO, 2009 reported that the safety physical part in the farm should include many points like:

- Ensure that all animals destined for slaughter are clean, healthy and fit to travel and have not had recent contact with diseased stock or infectious material.
- Apply short duration feeding regimes aimed at reducing the shedding of harmful bacteria by animals destined for slaughter.
- Ensure that contamination of animal products from animal and environmental sources during primary production and storage are minimized
- Ensure that storage conditions maintain the quality of the products

- Keep records of animals and animal products leaving the farm as well as their destination and date of dispatch.
- Ensure that mustering or catching and handling of animals prior to loading is carried out in a safe and humane manner.
- Ensure that loading facilities are appropriately constructed.
-Take the necessary care during animal loading so as to minimize injury.
- Handle products in such a way as to prevent damage.

Another study FAO 1997 present, animal and human waste may be incorporated in animal feed or can be used to fertilise forage crops. The use of untreated human wastes in fish farming may be associated with serious human health problems. For example, liver fluke infestation (clonorchiasis and opisthorchiasis) in Southeast Asia.

The present study indicate that there is an infection of blood Parasitic daisies (tick born) *Brucella.* A study of Paul Nicolette *et al* ,2018 The disease in cattle, water buffalo, and bison is caused almost exclusively by *Brucella abortus*; however, *B suis* occasionally is isolated from seropositive cows but does not appear to cause clinical signs and is not contagious from cow to cow. In some countries, the disease in cattle is caused by *B melitensis*. The syndrome is similar to that caused by *B abortus, B melitensis* is not present in the USA.
Infection spreads rapidly and causes many abortions in unvaccinated cattle. In a herd in which disease is endemic, an infected cow typically aborts only once after exposure; subsequent gestations and lactations appear normal.

The present study indicates the different types and quality variation of water supply in the three study areas Kuku, Eastern Nile and Selete farms. The laboratory analysis resulted as suitable water for animal.

A study of Murphy, M.R., C.L. Davis and G.C. McCoy. 1983 indicate that, factors affecting water consumption by Holstein cows in early lactation. Drinking or free water intake satisfies 80 percent to 90 percent of the dairy cows' total water needs. The amount of water a cow will drink depends on her size and milk yield, quantity of dry matter consumed, temperature and relative humidity of the environment, temperature of the water, quality and availability of the water, and amount of moisture in her feed. Water is an especially important nutrient during periods of heat stress.

McFarland, D.F. 2000 reported that, Water quality is an important issue in the production and health of dairy cattle. The five properties most often considered in assessing water quality for both human and livestock use are organoleptic properties (odor and taste), physiochemical properties (pH, total dissolved solids, total dissolved oxygen and hardness), presence of toxic compounds (heavy metals, toxic minerals, organophosphates and hydrocarbons), presence of excess minerals or compounds (nitrates, sodium sulfates and iron) and presence of bacteria. Research on water contaminants and their effects on cattle performance are sparse. The following attempts to define some common water quality problems in relation to cattle performance.

Beede, D.K. 1992. Show that, Salinity, total dissolved solids (TDS) and total soluble salts **(TSS)** are measures of constituents soluble in water. Sodium chloride is the first consideration in this category. Other components associated with salinity, TDS or TSS is bicarbonate, sulfate, calcium, magnesium and silica.

The Most Important of Biosecurity in dairy cows ticks represent in a big hazard about 60% of animal resources problems . and appearing The ticks in dairy cows for blood Parasitic diseases (Theilliria ‘ Babasia) ‘ which consist a major hazard in dairy cows.

The floor of most farms was (sandy and clay) which suitable conditions for parasite growth in especial way ticks . Theilliria disease the most ticks blood parasitic disease which transited by ticks, causes especially for cross breeds and newborn animals, which causes economic loss in dairy farms. According to (Camilla *et al,* 2015) economic losses in dairy farms which infected by ticks.

The limited use of Biosecurity practices by many in the farming community is likely to be due to a range of factors; further understanding of this issue is required, attitudes and behaviors of producers relating to selected Biosecurity practices in the farming (Marin *et al*, 2013).

Conclusion & Recommendations

Conclusion

1- The ticks caused high hazards in dairy cow farms.

2- There is a weakness of Bio security in dairy cow's farm especially in building, hygiene, water and feed.

3- The record system was not effective in the most of dairy cows farms mainly in Hygiene, production and health.

Recommendations

1. Establishment of strong bio security system in the dairy cows farms for prevent from contagious diseases, fellow by vaccination program for bacteria or virus diseases.
2. Establishment of ticks control programs in dairy cow farms in Sudan because of its high infection percentage (60 %).
3. A good nutrition system for dairy cows.
4. Foundations pens and buildings according recommended trails.

References

- APHA, AWWA, WPCF, (2003), "Standard Methods for Examination of Water and Wastewater", 20th Edition, American Public Health Association, Washington, DC.

- Агрознање, вол. 2015. Sustainability and Efficiency of Dairy Farms Biosecurity Plans. 16, бр. 4, 437-453. UDK: 636.2.034:637.1 DOI: 10.7251/AGREN1504437S.

- Authors Anders Permin and Ann Detmer DHI. Release date: 1 February 2007. Improvement of Management and Biosecurity Practices in smallholder poultry producers. Centre for Environment and Toxicology, Denmark Edition No.: 1. Copy No.: 1 Sponsor: Food and Agriculture Organisation of the United Nations Animal Production and Health.

- Beede, D.K. 1992.Water for Dairy Cattle. Large Dairy Herd Management. Ed. H.H. Van horn and C.J. Wilcox. Amer. Dairy Sci. Assoc. Champaign, Ill.

- Branislav Stanković, Slavča Hristov, Zvonko Zlatanović, Jovan Bojkovski , Nevena Maksimović. [accessed May 22 2018]. Sustainibility and Efficiency of Dairy. (PDF Download Available). Available from: https://www.researchgate.net/publication/303356240_Sustainibility_ahd_Efficiency_of_Dairy_Farms_Biosecurity_Plans.

- Camila Eckstein , Rafrael Romero Nicolino , Luciano Lopose ,Joao Paulo Ameral Haddad . (2015) Economic impacts of parasitic diseases in cattle. Agriculture Veterinary Science, Nutrition and Natural Resource. 10(51

- Dairy Practices Council. 1990. Guidelines for Potable Water on Dairy Farms, 3rd rev. ed. Barre, Vt.

- El Hussein AM, Mohammed SA, Osman AK, Osman OM (1991) A preliminary survey of blood parasites and brucellosis in dairy cattle in northern state. Sud J Vet Res 10:51–56

- FAO. (1984) Ticks and Tick-borne Diseases Control. A Practical Field Manual. Vol. 1, 2, 11. Food and Agricultural Organization of the United Nations, Rome. p621.

- Food Agriculture Organization FAO, 1997. International ReportConsultance.

- J.W. Schroeder. Water Needs and Quality Guidelines for Dairy Cattle (AS1369).Water availability and quality are important to animal health and productivity. Water is supplied by drinking, the feed consumed and metabolic water produced by the oxidation of organic nutrients.

- http://www.cabi.org/cabreviews.

- Marin louie Bernnan + Rob Chresctly Article (PDF Available) in BMC Veterinary Research 9(1):71 · April 2013 with 110 Reads.

- Marnie Louise Brennan, Rob Christley. Tackling Histoplasmosis - a neglected disease with welfare and socio-economic impact. University of Nottingham.98 PUBLICATIONS 397 CITATIONS. University of Liverpool.195 PUBLICATIONS 2,712 CITATIONS.

- McFarland, D.F. 2000. Feed Area and Water Space Design. Dairy Housing and Equipment Systems. NRAES-129. Ithaca, N.Y.

- Merck Sharp & Dohme Corp. 2018. Vetnariay manual Overview of Biosecurity. By Stephen R. Collett, BSc, BVSc, MMedVet.

- Paul Nicoletti, DVM, MS, DACVPM (Deceased), Professor Emeritus. 2018. Brucellosis in Cattle (Contagious abortion, Bang's disease). College of Veterinary Medicine, University of Florida.

- Rev. sci. tech. Off. int. Epiz., 1999, 18 (2), 343-356 The economic implications of animal diseases and disease control at the national level G.C. Ramsay(1) . Philip(2) & P. Riethmuller(3) (1) Secretariat of the Pacific Community, Private Mail Bag, Suva, Fiji (formerly: Animal and Plant Health Service, Queensland Department of Primary Industries, Brisbane, OLD 4000, Australia) (2) P.O. Box 466, Jamison Centre, ACT 2617, Australia (3) Department of

Economics, 6th Floor, Colin Clark Building, University of Queensland, QLD 4072, Australia.

- Roy Behnke Odessa Centre. 2012. The Economics of Pastoral Livestock Production in Sudan. Roy Behnke Odessa Centre The contribution of livestock and pastoralism to the national economy.

- Salma Yassin SAEED1* and Abdelnasir Mohammed Ahmed FADEL ELSEED2. Email: salmaeltelib@gmail.com. management practices of dairy farms; case study: khartoum north and eastern nile local Khartoum, Sudan.

- University, Khartoum North 13311, Sudan. 2Department of Animal Nutrition, Faculty of Animal Production, University of Khartoum, Shambat 13314, Sudan. Journal of Animal Feed Research.

- www.researchgate.net/publication/236191312. April 2013. “Discussions, stats, and author profiles for this publication at Cattle producers’ perceptions of biosecurity”. Article in BMC Veterinary Research, PubMed

Appendix

بسم الله الرحمن الرحيم

جامعة السودان للعلوم والتكنولوجيا

كلية الدراسات الزراعية /قسم الإنتاج الحيواني

إستبيان عن الأمن الحيوي في مزارع الأبقار

التاريخ : .....

- س (1) موقع المزرعة : .....
- س(2) عدد القطيع أقل من 15 ( ) 15- 30 ( ) 31 - 45 ( ) أكثر من 45 ( )
- س(3) نوع القطيع : تسمين ( ) ألبان ( )
- س(4) نوع الحظائر : مغلق ( ) مفتوح ( )
- س(5) هل يتم تربية أنواع مختلفة من الحيوانات ؟ نعم ( ) لا ( )
- س(6) نوع الحيوان : ماعز ضأن إبل
- س(7) الصحة العامة للقطيع : ممتازة ( ) جيدة ( ) ضعيفة ( )
- س(8) هل توجد أمراض مستوطنة .؟ نعم ( ) لا ( )
- س(9) وجود مرض أبولسان :(نعم) لا ( )
- س (10) وجود مرض أبوقنيت :(نعم) لا ( )
- س (11) وجود مرض إسهلات العجول الصغيرة ( ) أخري ( )
- س(12) هل حدث أي مرض في مزرعة أخري وتم نقله إلي مزرعتكم ؟ نعم ( ) لا ( )
- س(13) في حالة الإجابة بنعم
  أبولسان ( ) أبوقنيت ( ) إسهالات العجول الصغيرة ( ) أخري ( )
- س(14) انتقل المرض عبر العمال نعم ( ) لا ( )
- س(15) ينتقل المرض عبر العربات نعم ( ) لا ( )
- س(16) ينتقل المرض عبر الحيوانات نعم ( ) لا ( )
- س(17) ماهي الأمراض التي يتم التحصين ضدها ؟

أبولسان ( ) ابوقنيت ( ) الحمي الفحمية ( ) FMD( ) الساق الأسود( ) تحصين ضد كل الأمراض الخماسية ( )

- ***برنامج مكافحة القراد :-***
- س (18) هل يوجد قراد ؟ نعم ( ) لا ( )
- س(19) مصدر العلف : مصانع ( ) أسواق ( ) المزرعة ( )
- س(20) مصدر المياه : مياه النيل ( ) آبار جوفية ( )

*س(21) نظام النشاط : تقليدي ( ) حديث ( ) شبه حديث ( ) أخري ( )

* س(22) المساحة الكلية للحظائر .....

* س(23) التخلص من الفضلات : مطابق ( ) غير مطابق ( )

*س (24) للحظيرة السور خارجي نعم ( ) لا ( )

* س(25) لمدخل الحظيرة مغطس نعم ( ) لا ( )

*س(26) للحظيرة احواض التطهير نعم ( ) لا ( )

*س(27) المحرقة : بلدية ( ) حفرة ( ) متنقلة ( ) حديثة ( ) لاتوجد ( )

* س(28) المخلفات : سائلة ( ) جافة ( ) أخري ( )

* س(29) للحظيرة مخازن العلف نعم ( ) لا ( )

* س(30) للحظيرة مخازن المنتجات نعم ( ) لا ( )

* س(31) للحظيرة سكن عمال نعم ( ) لا ( )

* س(32) دورة المياه : بلدية ( ) حديثة ( )

* س(33) للحظيرة إمداد كهرباء ( )

* س(34) للحظيرة سجلات ( )

- س(35) هل يتم إعطاء اللقاحات في مواعيدها؟ نعم ( ) لا ( )
- س(36) ماهو مصداللقاح ؟

الوزارة صحة حيوان ( ) السوق ( )

- س(37) هل توجد حالات فشل اللقاح ؟ نعم ( ) لا ( )
- س(38) هل يتم إعطاء اللقاح بواسطة شخص مؤهل ؟ نعم ( ) لا ( )
- س(39) كيف يتم التخلص من الأنبولات الفارغة بعد الإستعمال ؟

حرق ( ) دفن ( ) أخري ( )

- س(40) بعد الحظائرعن بعضها البعض : بعيدة ( ) قريبة ( )
- س(41) كيف يتم التخلص من الحيوانات النافقة ؟

رمي ( ) حرق ( ) دفن ( ) أخري ( )

- س(42) هل توجد حيوانات وطيور برية حول المزرعة ؟ نعم ( ) لا ( )
- س(43) هل يأتي زوار للمزرعة ؟ نعم ( ) لا ( )
- س(44)هل العمالة مدربة ؟ نعم ( ) لا ( )
- س(45) مؤشر الإنتاجية يدل علي إن الإنتاجية: عالية ( ) متوسطة ( ) منخفضة ( )

Appendix Plate

Appendix Plate 1. Ticks in cows

Appendix Plate 2. Feeding cows

Appendix Plate 3. Pens

Appendix Plate 4. Drinking Cows

Appendix Plate 5. Traditional Farms

Appendix Plate 6. Rubbish

Appendix Plate 7. Polluted Drink Water