COMPARATIVE ASSESSMENT OF FEED FORMULATION AMONG LIVESTOCK FARMERS IN KAKIRI SUB – COUNTY WAKISO DISTRICT

BY

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DECLARATION

I Kasima John declare that this piece of work is original and has never been submitted to any university for any award.

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APPROVAL

This is to satisfy that my approval has been given for this research proposal to be submitted to the college of Veterinary, Animal and Biosecurity (COVAB) as a requirement for the partial fulfillment for the award of a Degree of Makerere university

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DEDICATION

This work is dedicated to my parents Mr. Kasima Nelson and Ms. Nakwanga Ruth also to my beloved brothers Martin, Emma, sisters Dinah, Loyce and my colleagues. I have been with throughout the program encouraged me and supported my academic advancement through the course.

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LIST OF ACRONYMS AND ABREVIATIONS

AFSO: Animal Feed Optimization Software

EMPFT: Exotic Multipurpose Fodder Trees

FAO: Food and Agriculture Organization

GDP: Gross Domestic Product

NARO: National Agricultural Research Organization

UBOS: Uganda Bureau of Statistics

ABSTRACT

Feed formulation is based various feed standard tables that should be considered for different livestock and each feed is found to be for different categories of livestock. The study intended to make a comparative assessment of feed formulation among livestock farmers in Kakiri sub county wakiso district. The study gave a clear background of the study especially on agriculture and feed formulation. It also stated the objectives as the major objective of the study was a comparison of the different feed formulations among the livestock farmers whereas the specific objectives of the study were; (1) Understanding the levels of adoption towards feed formulation among the livestock farmers in Kakiri Sub County, (2) to examine the farmer's knowledge about feed formulation and to assess the attitude of livestock farmers towards feed formulation. (3) Further, the study addressed the gap under which the study intends to fill and also the different research questions of the study.

The result was obtained using a set of both closed and open ended questions which made the study to meet its objectives. The study presents that most of the farmers had higher level of adoption towards feed formulation practice with 76% an indicator that farmers have positively perceived it. It also presents that farmers prefer linear programming as a method of feed formulation is mostly practiced by most farmers of the respondents in Kakiri sub county with 56% knowledge about feed formulation. The majority of the respondents wish to practice feed formulation with 70% but because its costly and due to limited information they haven't practiced it. This shows a higher level of attitude among the livestock farmers

Farmers dealing in livestock production, the majority of the respondents were dealing in poultry with 58% an indicator that poultry might be favorable for most of the people in the sub county. The study indicated that most of the respondents do practice feed formulation in Kakiri sub county Wakiso district and this is evident in table. And this has been done for a good period of time especially one year as the farmers responded. Also the most common method used by the farmers was linear programming as it seemed to be the most appropriate and convenient to most of the farmers 56% (table 4.7). But in my view, the farmers have to be taught much on the feed formulation because on the interaction with most of the farmers, it seems to be more scientific and costly whereby most of the farmers are illiterate and are poor. Most of the farmers don't want to invest in their business yet when they are taught they can learn more on feed formulation.

CHAPTER ONE

INTRODUCTION

1.1 Introduction

This chapter presents the background to the study, the statement of the problem as well as the study objectives. It also included sub-sections describing the research questions, a statement on the significance and scope of the study.

1.2 Background

Agricultural production has been on the decline as a result of natural resource constraints, climate change and competing demands for land. Livestock make an important contribution to most economies. According to FAO, (2014), Livestock produce food, provide security, enhance crop production, generate cash incomes for rural and urban populations, provide fuel and transport, and produce value added goods which can have multiplier effects and create a need for services. Furthermore, livestock diversify production and income, provide year-round employment, and spread risk. Livestock also form a major capital reserve of farming households. Because of livestock's contribution to societies, human and economic pressures can direct livestock production in ways detrimental to the environment.

According to National Agricultural Research Organization (NARO), the livestock sector is one of Uganda's important growth sectors contributing about US $ 290 million to total GDP in 2008/09 up from US $ 210 million in 2007/08. It constitutes 17 percent of the agricultural GDP and is a source of livelihood to about 4.5 million people in the country. The sector is categorized into cattle, goats, pigs, sheep and poultry. The growing local and regional demand for meat and milk products has escalated the number of livestock in the country over the years to an estimated 68 million in 2008 compared with about 49 million livestock in 2002

The 2008 national livestock census estimated the number of cattle at 11.4 million whereas the sheep, goats, pigs and poultry were estimated at 3.4 million, 8.5 million, 3.2 million and about 27.5 million respectively (MAAIF, 2009)

According to MAAIF, (2009), in economic value, cattle are considered the most important livestock although other animals such as goats, sheep, pigs and poultry are equally important. Uganda's cattle corridor extends from the south western, through central to the north eastern region. 93.6 percent of Uganda's cattle herds are indigenous; - Ankole (29.6%) and Zebu/Nganda (70.4%), whereas 0.8% are beef exotic/cross breeds and; 5.6% are dairy exotic/cross breeds. In terms of distribution, the eastern region (23%), Karamoja (20%) and central region (19%) have the highest number of cattle followed by the south western (16%)

Therefore, Feed formulation is the process of quantifying the amounts of feed ingredients that need to be combined to form a single uniform mixture (diet) for poultry that supplies all of their nutrient requirements (Vishal Patil *et al.,* 2017). Since feed accounts for 65-75% of total live production costs for most types of poultry throughout the world, a simple mistake in diet formulation can be extremely expensive for a poultry producer hence Feed formulation is essentially applied nutrition. A number of terms and expressions are introduced that will be put to practical use as information is presented on the nature and qualities of various feedstuffs and the information presented on the nutrient requirements of livestock farming. Precise understanding of these terms is essential to their correct application. One must recognize that some of these terms have a built-in error that cannot be escaped. This does not eliminate their usefulness in feed formulation. However, one must appreciate the fact that some are useful approximations of the values and not true values

According to Afolayan and Afolayan 2008, each feedstuff in any diet formulation should be present for a specific reason; i.e., it is a good energy source, it is rich in a limiting amino acid, etc. In addition, each feedstuff in a particular diet formulation should be the least costly ingredient available for its particular function in the diet. This leads to another assumption in feed formulation; that is, any nutrient in a particular feedstuff, such as an amino acid, is just as valuable as the same nutrient in any other feedstuff. This allows feed formulators to interchange one feedstuff with another as cost and availability change. Thus, it is assumed that there is no "ideal Formulation", but rather an almost infinite number of possible feed formulations that met the nutritional needs of the fish equally well.

In addition, feed formulation is one of the important aspects of animal feed industry. Balancing the feed stuffs is big challenge faced by the industries when the costumers and requirement increases. Development of animal feed industry depends upon the quality of feed and quality of feed is based upon the raw material used to formulate feed (ration). Ration is the total amount of feed given to the animal on a daily basis while, ration formulation can be defined as the process by which different ingredients are combined in a proportion necessary to provide the animal with proper amount of nutrients needed at a particular stage of production, (Afolayan, Matthew Olatunde and Moji, 2008)

Furthermore, there are many conventional and non-conventional methods of feed formulation. Conventional methods are: Simultaneous equation method, trial-and-error method, two by two matrix method and square method. After this, new methods like linear programming, stochastic programming, goal programming, least-cost formulation and non-linear programming came into effect Mwenye D. (2010). Selecting appropriate method depends upon the objective for which feed is formulated for example, minimizing the cost or maximizing milk yield. For feed formulation, various feed standard tables should be considered for different livestock. It was found that there are different categories of livestock. In case of cattle or buffalo, it is categorized in three ways: Dry animals with pregnancy; Animals in milk and Milk animal with pregnancy. Similarly, other poultry and livestock animals are categorized. Depending upon the category of the animal, age and weight, the requirement of nutrients vary.

One of the major problems while formulating any mathematical model or linear model is dealing with constraints. Slight variation in the constraint makes a lot of difference in the cost of the feedstuff. Therefore, finding correct values of constraints are very important, which can be easily done by using nutrient requirement software's developed by single click (Vishal Patil *et. al.,* 2017). The major challenge faced by animal feed industry is the shortage of feed and fodder, breed improvement, animal disease, skill and quality service to the farmer in order to improve the productivity. Therefore, it's upon the scarcity of feeds that feed formulation came into play. Hence the study seeks to give a comparative assessment of feed formulation among livestock farmers in Kakiri sub county Wakiso district.

1.3 Objective

The overall objective of the study is to make comparison of the different feed formulations among the livestock farmers in Kakiri sub county Wakiso district.

1.3.1 Specific objective

- Understanding the levels of adoption towards feed formulation among the livestock farmers in Kakiri Sub County.
- To examine the farmer's knowledge about feed formulation
- To assess the attitude of livestock farmers towards feed formulation.

1.4 Statement problem

Feed formulation is based by various feed standard tables that should be considered for different livestock and each feed is found to be for different categories of livestock. In case of cattle or buff these are categorized in three ways: Dry animals with pregnancy; Animals in milk and Milk. Similarly, other poultry and livestock animals are categorized. Depending on the category of the animal, age and weight, the requirement of nutrients vary. (Vishal Patil *et. al.,* 2017)

However due to the increased population in Uganda the natural feeds have been eroded and damaged leaving the livestock farmers in misery hence it's upon this that the study will assess the comparison of feed formulation among the livestock farmers in Kakiri sub county in Wakiso district.

1.5 Research questions

- What could be the level of adoption among different farmers on feed formulation under livestock farming?

- What is the level of knowledge do farmers have about feed formulation?

- What could be the attitude livestock farmer's show on feed formulation?

1.6 Scope of the study

The study involved Comparative assessment of feed formulation among livestock farmers in Kakiri sub county Wakiso district Uganda and it involved the use of descriptive survey onto a selected population (n=50 farmers), using questionnaires designed with both open and closed ended questions, interview and more others.

1.7 Justification of the study

Farmers dealing in livestock face complex challenges as they incur a lot of expenses in getting feeds for the animals. Due to the growing population in the world, the demand for feeds has been at an increase because people have occupied the areas where the pastures could be planted.

Therefore, several scientists have come up with different methods to solve the issue of feeds by coming up with different methods hence there is need to make a comparative assessment of feed formulation in Kakiri Sub county Wakiso district.

1.8 Significance of the study

The findings of this study will be useful to farmers, researchers, and other concerned persons to understand the different knowledge, attitude and level of adoption of feed formulation among livestock farmers. The study will be significant to the government of Uganda especially to the ministry of agriculture in that the study will give a view on what form of feeds will increase on the nutrition and health of the livestock.

CHAPTER TWO

LITERATURE REVIEW

2.1 Livestock farming

Livestock farming consists a key player in the economy of a large number of countries and until recently, it was practiced in a traditional manner. Nevertheless, large scale investments have been observed in this sector and its structure has changed from nomadic to keeping animals in a lairage, characterized also by extensive mechanization in its main operations (Karelakis *et al*., 2013).

According to Victor Suresh (2016), The development of livestock farming does not only involve issues related to lairage facilities, equipment and the genetic improvement of livestock, but also concerns farmers' attitudes on better livestock treatment practices and their knowledge on farming management issues and zoo technics Hence, a potential conflict may exist between seeking profitability and concerns should be promoted through attractive scenarios, and the relevant policies and technologies that will contribute to this aim, should be defined.

Also the Livestock industry is an important and integral part of the agricultural sector in Ethiopia. Moreover, livestock farming is vital as a supply of meat and milk, being a source of additional income both for smallholder farmers and livestock owners (Ehui *et al.,* 2002). In a smallholder livestock production system, animals are dependent on a variety of feed resources that can vary both in quantity and quality.

In addition, for optimum livestock production, feed resource available should match with the number of animals in a given area. Feed resources as reported by Tolera *et al.,* (2012) can be classified as natural pasture, crop residue, improved pasture forage and agro-industrial by-products, of which the first two are the most important contributors. Animals depend mainly on natural pastures for their feed requirements. In Ethiopia, there are extensive areas where keeping of livestock on the natural vegetation is the only possible types of land use (Coppock, 1994).

Natural pastures which provide more than 90% of the livestock feed are generally very poorly managed. Nowadays, the rangelands of Ethiopia are being extensively damaged both in quantity and quality (Belaynesh, 2006). Due to the poor management and overstocking of natural

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pastures, which are highly over grazed and result in severe land degradation, loss of valuable species and dominance by unpalatable species (Alemu, 1998).

Fibrous agricultural residues are the most important contributor in livestock feed, especially in the populated countries where crop cultivation of land is prioritized. Tolera *et al.,* (2012) reported that crop residues contribute to about 50% the total livestock feed supply in Ethiopia. Livestock production constraints could vary not only among agro-ecological zones, but also among production systems. For example, different animal species are bred by the urban and peri-urban farmers which are regulated by the demand of products such as milk and availability of the supplemental feeds.

2.2 Feed formulation

According to Vishal Patil *et.al*, (2017). Feed formulation is one of the important aspects of animal feed industry. Balancing the feed stuffs is big challenge faced by the industries when the costumers and requirement increases. Development of animal feed industry depends upon the quality of feed and quality of feed is based upon the raw material used to formulate feed (ration). Ration is the total amount of feed given to the animal on a daily basis while, ration formulation can be defined as the process by which different ingredients are combined in a proportion necessary to provide the animal with proper amount of nutrients needed at a particular stage of production,

There are many conventional and non-conventional methods of feed formulation. Conventional methods are: Simultaneous equation method, trial and error method, two by two matrix method and square method. After this, new methods like linear programming, stochastic programming, goal programming, least cost formulation and nonlinear programming came into effect Selecting appropriate method depends upon the objective for which feed is formulated for example, minimizing the cost or maximizing milk yield (Victor Suresh, 2016).

For feed formulation, various feed standard tables should be considered for different livestock. It was found that there are different categories of livestock. In case of cattle or buffalo, it is categorized in three ways: Dry animals with pregnancy; Animals in milk and Milk animal with pregnancy. Similarly, other poultry and livestock animals are categorized. Depending upon the category of the animal, age and weight, the requirement of nutrients vary. One of the major

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problems while formulating any mathematical model or linear model is dealing with constraints. Slight variation in the constraint makes a lot of difference in the cost of the feedstuff. Therefore, finding correct values of constraints are very important, which can be easily done by using nutrient requirement software's developed by single click (Vishal Patil *et. al.,* 2017). The major challenge faced by animal feed industry is the shortage of feed and fodder, breed improvement, animal disease, skill and quality service to the farmer in order to improve the productivity.

There are several feed formulations developed with different purposes and bellows are some of the feed formulations.

Kasturi Feed Formulation

Feed formulation is simple and practical feed formulation software is developed by K. Chandra Shekhar in the year 2002. Itis meant for least cost feed formulation with user friendly interface. A person with basic knowledge can easily use this software. It comes with two functions, optimize: where it uses liner programming to optimize feed formulation at least cost and Analyse: If we don't want least cost formulation but only want to know the nutrient values, this will calculate the Nutrients Values and the Formula Cost on entering the ingredients quantity and rate. It is suitable for Egg Producers, Broilers, Nutritionist, Hatcheries, Feed Manufacturers, etc. Feed Formulation. (2008).

Win feed Software

WIN FEED is the cheapest least cost feed formulation software developed in the year 2012. It is equally useful for ruminants and non-ruminants such as poultry, cattle, sheep, horses, dogs, cats, fish and aqua culture etc. WinFeed works in two modes, Linear Mode: suitable for conventional feed formulation and Stochastic Mode: specifically, for probability based least cost feed formulation (Win Feed 2.8. 2012).

AFSO (Animal Feed Optimization Software)

AFOS is built using hybrid-cloud technology which allows system installation on cloud or on the user's PC as a standalone application and from mobile devices using just a browser. The standalone application is focused on users who want a traditional application with database saved locally. It is mainly developed for Nutritionist Professional, Feed Production Professionals;

Farming Professionals which helps the user develop, manage, store, analyze, collaborate and exchange animal feed formulas. It is available in English, French, Italian, etc.

AFOS. www.animalfeedsoftware.com

Feed-Mixer

Feed-Mixer is a web application which is developed to help the farmers to calculate the least possible cost of feed formulation by comparing the ingredient price between suppliers. Besides, the Feed-Mixer is able to help farmers utilize the budget by calculating the maximum amount of feeds that can be produced within the budget and maximum number of feeding days of the animals. In conclusion, the Feed Mixer is able to help farmers lower the production cost and at the same time maintain a good livestock production (Feed Formulation, 2008).

2.3 Adoption of feed formulation

Economists have defined final adoption at the farm level as the degree of use of a new technology when the farmer has full information about the new technology and its potential Adoption typically has been viewed from two perspectives. At the individual farm level, each household chooses whether or not to adopt and the intensity of adoption. Farm-level adoption studies, then, are concerned with the factors influencing the adoption decision either statically or dynamically by incorporating learning and experience. At a macro-level, diffusion studies examine how adoption evolves across a population or region (Victor Suresh, 2016)

Scanty information exists on the adoption of feeds and feed practices in general, however there is a lot that has been documented on agriculture and agro forestry adoption. Pattanayak *et al.,* (2003) for example reviewed 120 articles on adoption of agricultural and forestry technology by smallholders and concluded that the following five categories of factors explain technology adoption which may also be applicable to livestock feeds and practices: preferences, resource endowments, market incentives, biophysical factors, and risk and uncertainty. The review notes that preferences define the objectives and motivations of the economic agents choosing technologies. Resource endowments enable their technology choices. Market incentives and biophysical factors condition the extent, timing and nature of the technology choices.

2.4 The farmer's knowledge about feed formulation

Several studies have been carried out to assess availability of livestock feed resources on farms, farmer's perceptions and preferences of fodder trees. Nyaata *et al*., (2000) assessed the use and availability of livestock feed resources on smallholder dairy farms of central Kenya. Findings indicate that Napier grass was grown by all the farms visited. Other forage crops found on the farms included Nandi Setaria, sweet potato vines, desmodium and Guatemala grass. A number of pasture grasses were also observed on the contour lines in coffee fields, with ruzi grass (*Brachiaria ruziziensis*) being the most common. Crop residues such as maize stover, banana leaves and pseudostems were used as dry season supplements by all farmers. Other feeds reported by fewer farmers included weeds (from coffee fields and road sides), fodder tree leaves, and concentrates (mainly wheat and rice bran).

According to Mekoya *et al*., (2008) assessed farmer preferences of multipurpose fodder trees (MPFT) in the Ethiopian highlands. The study looked at preference criteria, compared farmer preference between exotic and local MPFT, and evaluated the relationship of farmers' knowledge of feed value assessment with laboratory indicators. The study used focus group discussions, and preference ranking and scoring in two districts. The comparison between exotic and local MPFT for their benefits and desired tree characteristics showed that farmers preferred local MPFT to exotics for biomass production, multi-functionality, life span, and compatibility to the cropping system. In another study, Mekoya *et al.,* (2008) assessed the values of multipurpose fodder trees and farmer's practices of growing fodder trees and the constraints they perceive for introducing and growing exotic multipurpose fodder trees (EMPFT) in the crop-livestock mixed farming system of the Ethiopian highlands.

Findings showed that farmers were aware of the EMPFTs with development agents and farmer-to-farmer information exchange being the major sources of information. *Sesbania sesban* and *Calliandra calothyrsus* were noted to have fast growth as they could be cut 12 months after planting. The study also found out that a majority of adopters preferred exotic multipurpose fodder trees as compared to non-adopters who preferred local multipurpose fodder trees.

2.4 The attitude of livestock farmers towards feed formulation.

The attitudes of different farmers on feed formulation vary from farmer's needs and interests but also ability to have one. According to Wagner and Stanton, (2006), Pearson's Square method has been used for livestock ration formulation for many years however, the major disadvantage with this method is that, it cannot handle inequalities and ranges and also the solutions are independent of price of the feed ingredients. Another limitation is that it can balance only one nutrient at a time and so has limited application in diet formulations as situations demand balancing many nutrients at a time

According to Zhang and Roush, (2002 since in LP no constraints violation is allowed. This over rigidity of nutritional specification and requirement will normally lead to infeasible solution (Zhang and Roush, 2002) some relaxation of the constraints imposed would not seriously affect an animal's physical and economic performance. Similarly, a small increase of minimum ration cost, may achieve a mixture of ingredients capable of yielding a superior performance that could compensate the extra expenditure on feed in the long run. This gives a negative attitude to farmers.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter presents the methodology that was adopted during the study. It describes and discusses; the research design, sample size and selection, the data collection methods used and their corresponding data collection instruments, data management and analysis procedure as well as steps that were taken to ensure validity and reliability during the study and measurement of variables.

3.2 Description of the study area

3.2.1 Location of the study area

Wakiso District lies in the Central Region of the country, bordering with Nakaseke District and Luwero District to the north, Mukono District to the east, Kalangala District in Lake Victoria to the south, Mpigi District to the southwest and Mityana District to the northwest. Wakiso, where the district headquarters are located, lies approximately 20 kilometres (12mi), by road, northwest of Kampala, the capital of Uganda and the largest city in the country. The coordinates of the district are: 00 24N, 32 29E. And Kakiri is approximately 30 kilometres (19 mi), by road, northwest of Kampala, the capital of Uganda. The town is located on the highway between Kampala and Hoima. The coordinates of Kakiri are 0°25'12.0"N, 32°23'24.0"E (Latitude:0.4200; Longitude:32.3900)

3.2.2 Population of the study area

Population can be defined as the totality of observation with which the study is concerned (Saunders et. al. 2007). In 2002, the national population census put the population of the town at about 4,200. In 2010, the Uganda Bureau of Statistics (UBOS) estimated the population at 5,800. In 2011, UBOS estimated the population at 6,000 inhabitants. In 2014; the national population census put the population at 19,449.

3.2.3 Agriculture in the study area

The agricultural sector is dominant in Uganda's economy. Whilst this sector grew at an annual average of only 3.7 percent over 1990-99 compared to the far more impressive growth of the industrial and service sectors, the importance of agriculture in Uganda (/knowledge/Agriculture in Uganda.html)'s economy outweighs all other sectors put together. The agricultural sector employs 82 percent of the workforce, accounts for 90% (percent) of export earnings, and provided 44 percent of GDP in 1999. Moreover, the farmers in Uganda's 2.5 million smallholdings and scattered large commercial farms provide the majority of their own and the rest of the country's staple food requirements. Uganda is able to rely on agriculture due to the country's excellent access to waterways, fertile soils, and, (relative to many other African nations) its regular rainfall, although it does still suffer from intermittent (/knowledge/Intermittency.html) droughts such as in 1993-94.

3.3 Study approach and design

According to Gwimbi and Dirwai (2003), a research design is a structure of the research which provides glue that holds a project together, groups or samples, observations or measures, programs or treatments and other aspects of methodology. This study used both qualitative and quantitative. Qualitative is a descriptive approach when there is documentation of what is exactly said, observing behavior or even studying written documents. According to Polit and Beck (2008), a quantitative research design is an explorative non experimental, descriptive structure which involves quantifying relationships between variables.

3.4 Sampling and sampling techniques

Sampling procedure was done based on random selection of respondents as defined by Kothari (2006) as the process of selecting a part of the aggregate of the totality based on which a judgment or inference about the aggregate or totality is made. It is a process of selecting a group of people, events, behavior or other elements with which to conduct a study.

The study used simple random method to select 50 different livestock farmers in Kakiri sub county Wakiso district**.**

3.4.1 Sample size

Kothari (2006) defines sample as a collection of some parts of the population on the basis of which judgment is made. He stressed that a sample should be small enough 31 to make data collection convenient and should be large enough to be a true representative of the population which is selected. The study used 50 respondents from the case study.

3.5 Data Collection Procedures and Tools

Based on the work of Van-Zyl, (2005) the data collection method is described as the specific approach used to gather information and the choice of methods depends on research objectives and questions to be addressed. The data collected for the study comprised of primary data. Data collected from livestock farmers was used to measure the level of their satisfaction.

Data was obtained by both open and closed ended questions

3.6 Primary Data

Primary data can be defined as the fresh information gathered for the first time and happens to be original in character. Kothari, (2006) described primary data as the original work of research or raw data without interpretation or pronouncements presented in official opinion or position. According to the nature of the study structured questionnaires were used as the tool for collecting primary data used in the study.

3.6.1 Questionnaires.

According to Kothari (2006), a questionnaire is a set of questions which are usually sent to selected respondents to answer at their own convenient time and subsequently return them to the investigator. Close and open ended questionnaires were employed in the study as they are easier and more convenient to be filled by respondent.

3.7 Validity and Reliability of the Research Instrument

3.7.1 Validity

Validity was used to determine whether research measured, what it intended to measure and to approximate the truthfulness of the results. Validity is concerned with whether the findings are

really about what they appear to be (Saunders *et al.,* 2009). The study ensured that valid questions only asked.

3.7.2 Reliability

Reliability is the consistency of measurement or the degree to which an instrument measures the same way each time it is used under the same condition with the same subjects. Reliability of the instrument according to Amin (2005) refers to the degree to which the said instrument consistently measures whatever it is measuring. To check for reliability, the questionnaire, will be given to 20 people and after a month they will be given the same questionnaire. The variance will be determined and found that the questionnaire will be reliable since the degree of variation from the earlier response will be negligible.

3.8 Statistical   Data analysis

Data collected was entered and analyzed using a Statistical Package for Social Scientists (SPSS). Descriptive statistical analysis was also used to characterize the respondents, determine the prevalence of feed forms on broiler performance on selected farms and to determine the cost burden incurred by farmers in buying feeds at the farm. Descriptive statistical analysis was employed to analyze data by use of Frequencies, means, percentages and standard deviations. Data collected was critically assessed, interpreted and presented using quantitative and qualitative methods. It was also tabulated and recorded.

3.9 Data collection procedure and considerations

Before going to the field, the researcher began with getting authorization letter from the Makerere University and then talk to the respondents and this enabled the researcher to attain adequate information from the respondents. During data collection, confirmation was given to the respondents in that the researcher assured the respondents that the reason for the research is for only academic purpose and that no information was given outside hence was kept confidential. (Skinner, 2010).

CHAPTER FOUR

RESULTS AND DISCUSSION

(A) DEMOGRAPHIC CHARACTERISTIC

Table 1: Demographic characteristics of respondents

Variable	Frequency	Percentage
sex		
male	39	78.0
Female	11	22.0
Age group		
Below 20 years	4	8.0
20-35 years	12	24.0
35-55 years	21	42.0
56 years and above	13	26.0
Education level		
None	5	10.0
primary education	15	30.0
secondary education	16	32.0
Tertiary institutions	14	28.0
Main source of income		
livestock farming	35	70.0
crop growing	15	30.0

The results from the study showed that a total number of 50 respondents who were approached as per this study (Table 1), from which sample space constituted more of 78% respondents were male and 22% were female farmers who were practicing feed formulation in Kakari sub county Wakiso district. Most of the respondents were of the age bracket of 35-55years with a percentage of 42% indicating that most of the old people are practicing and adopting to the system of feed formulation as compared to other age group. This was followed by persons 56years and above making 26%, then the age group which could be more active in the practice (20-35years) had 24% response and it was followed by those bellow 20yaers with 8%.

According to the table above, the majority of the respondents attained secondary level of education with 32% an indicator that most of the respondents had some knowledge on what they were practicing. This was followed by those with primary level of education with 30% then tertiary obtained 28% and lastly those without any education level were 10%.

Also most of the respondents indicated that their main source of income is from livestock with 30% and those whose source of income is from crop growing were 30%.

(B) ADOPTION

Table 2: Livestock production

Type	Frequency	percentage
piggery	16	32.0
poultry	29	58.0
Diary	5	10.0
Total	50	100.0

According to the study in table 2, most of the respondents were dealing in livestock production and the majority of the respondents were dealing in poultry with 58% an indicator that poultry might be favorable for most of the people in the sub county. This was followed by piggery with 32% and lastly diary. But contrary According to MAAIF, (2009), in economic value, cattle are considered the most important livestock although other animals such as goats, sheep, pigs and poultry are equally important.
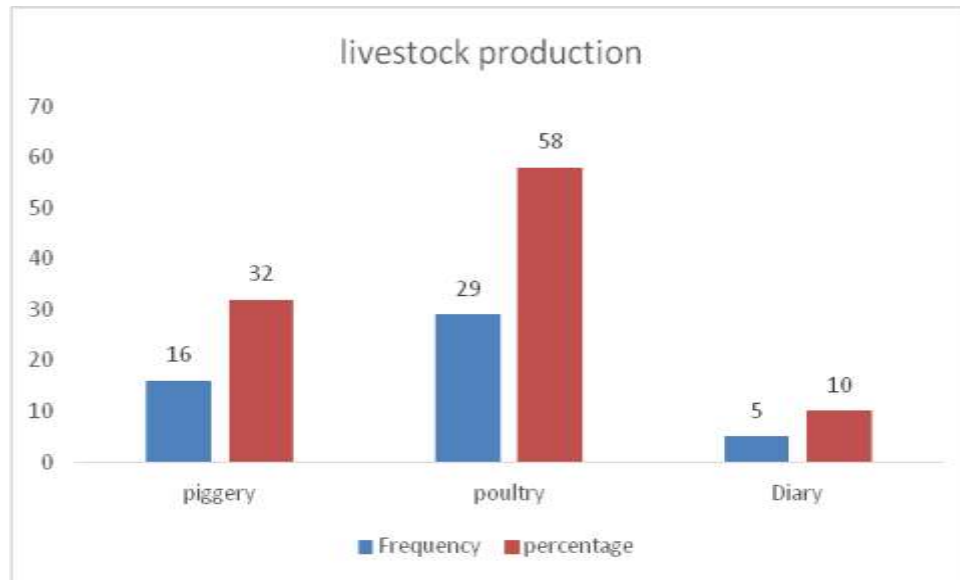
Figure 1: Livestock production

Table 3: Farmers practicing feed formulation.

	frequency	percentage
yes	38	76.0
no	12	24.0
total	50	100.0

According to the study, most of the respondents do practice feed formulation with 76% and indicator that people have positively perceived feed formulation and hence they have adopted to the methods of feed formulation. And this was followed by 24% respondents who said no in the table 3 above. But according to (Saxena 2010), Selecting appropriate method depends upon the objective for which feed is formulated for example, minimizing the cost or maximizing milk yield.
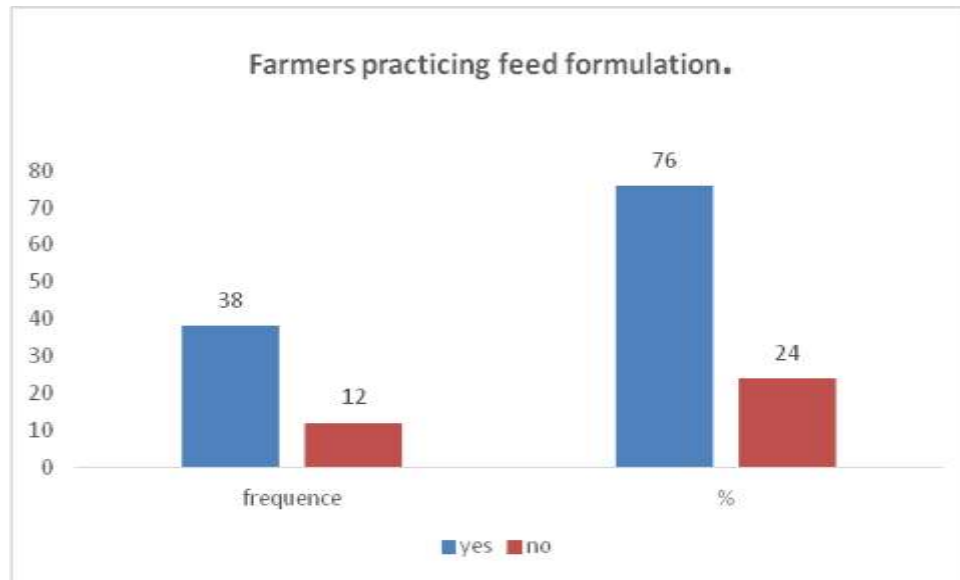
Figure 2: Farmers practicing feed formulation.

Table 4: Respondents who have you ever practiced feed formulation

	frequency	percentage
yes	23	46.0
no	27	54.0
total	50	100.0

The majority of the respondents have never practiced feed formulation since it's expensive and it has hard formulas to adopt easily by illiterate farmers and those were 54% and those who have ever practiced feed formulation were 46%. But according to literature, Feed formulation is the process of quantifying the amounts of feed ingredients that need to be combined to form a single uniform mixture (diet) for poultry that supplies all of their nutrient requirements (Vishal Patil *et. al.,* 2017). Since feed accounts for 65-75% of total live production costs for most types of poultry throughout the world, a simple mistake in diet formulation can be extremely expensive for a poultry producer hence Feed formulation is essentially applied nutrition. Hence according to the respondents, it seems they have adopted to the practice of feed formulation.
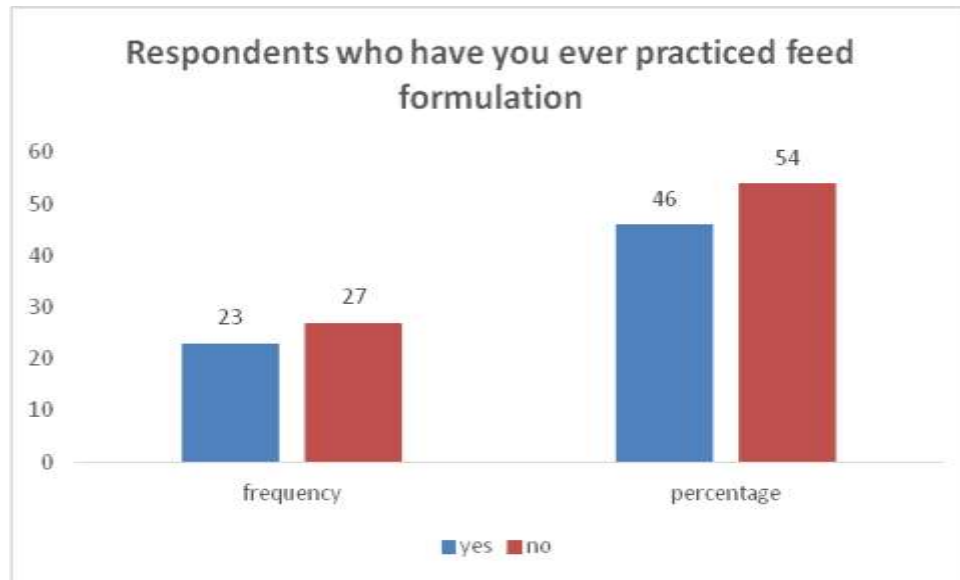
Figure 3: Respondents who have you ever practiced feed formulation

Table 5: How long have you been formulating for your animal's feeds?

	frequency	percentage
2 months	7	14.0
6 months	1	2.0
1 year	39	78.0
Others specify	3	6.0
total	50	100.0

The study cited the period under which the different farmers have been practicing feed formulation and it found out that the majority of the farmers have practiced feed formulation for a period of one-year table in the table 5 above. This was followed by those who have been practicing it for a period of 2 months, followed by 6 months and lastly those who specified were the least. But Adoption typically has been viewed from two perspectives. At the individual farm level, each household chooses whether or not to adopt and the intensity of adoption. Farm-level adoption studies, then, are concerned with the factors influencing the adoption decision either statically or dynamically by incorporating learning and experience
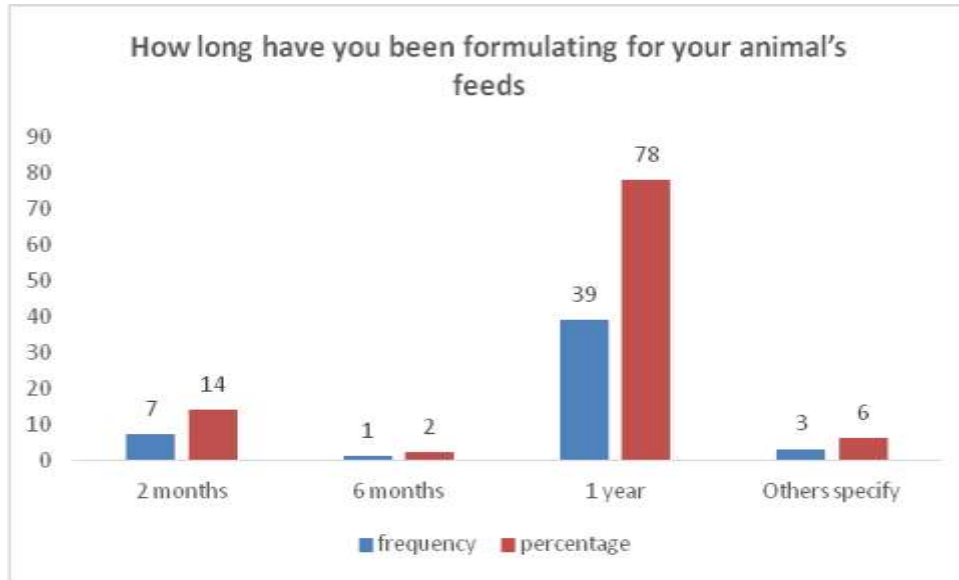
Figure 4: How long have you been formulating for your animal's feeds

 (C) Knowledge

Table 6: Method used by farmers while practicing feed formulation?

	frequency	percentage
Pearson square	5	10.0
Linear programming	28	56.0
Computer software	7	14.0
Feed calculator	10	20.0
total	50	100.0

According to the study in table 6 above, linear programming as a method of feed formulation is mostly practiced by most of the respondents in Kakiri Sub County with 56%.an indicator that most of the people have adopted to this method since it seems so easy to be adopted by people and also it is the cheapest method according to the farmers who practice feed formulation. Also, 20% of the respondents practice feed formulation using feed calculator with indicating that they have also adopted to it slowly.

Further, the use of computer software as a method of feed formulation attained 14% response which means that people have not yet adopted this method since its costly and hard to learn.

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Lastly, Pearson square as the method of feed formulation had 10% response an indicator that most of the respondents have no enough knowledge about this method (Mwenye D. 2010).
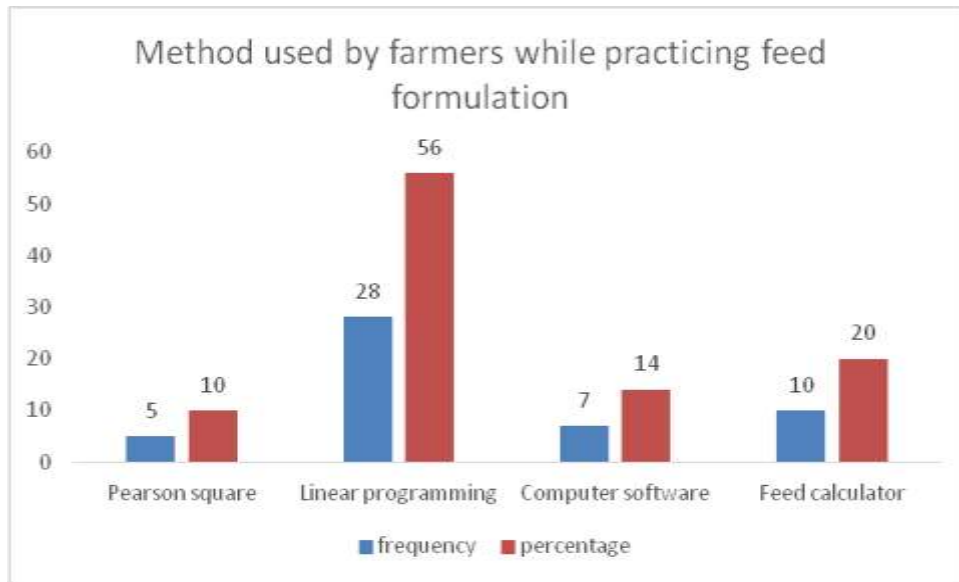
Figure 5: Method used by farmers while practicing feed formulation

Table 7: Farmer's response on different stages of livestock animals require different proportion of nutrients?

	frequency	percentage
Agree	32	64.0
Disagree	18	36.0
Total	50	100.0

According to table 7 above, agreed that different stages of livestock animals require different proportion of nutrients with 64% an indicator that each stage requires a separate nutrient to boost the growth of the animal. And this is very important because each stage in growth has its own nutritional importance. 36% of the respondents disagreed with the different stages of livestock animals require different proportion of nutrients.
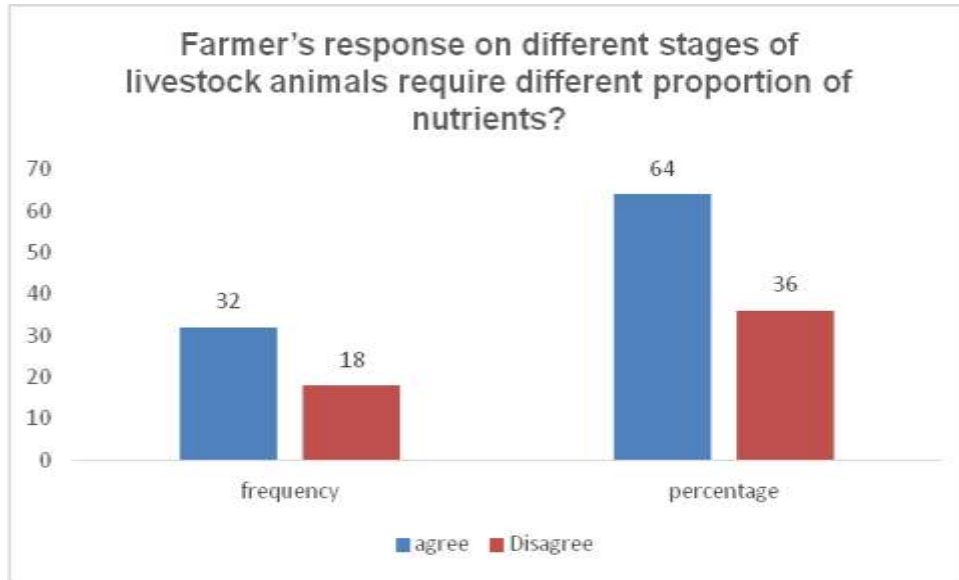
Figure 6: Farmer's response on different stages of livestock animals require different proportion of nutrients.

(D) Attitude

Table 8: Farmers who wish to practice feed formulation?

	frequency	percentage
yes	35	70.0
no	15	30.0
total	50	100.0

The majority of the respondents 70% (yes) with to practice feed formulation but because it's costly they haven't practiced it yet. But 30% of the respondents have no plan of practicing feed formulation hence they don't wish to practice feed formulation. But in literature, Adoption typically has been viewed from two perspectives. At the individual farm level, each household chooses whether or not to adopt and the intensity of adoption. Farm level adoption studies, then, are concerned with the factors influencing the adoption decision either statically or dynamically by incorporating learning and experience

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Figure 7: Farmers who wish to practice feed formulation

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

Farmers dealing in livestock production, the majority of the respondents were dealing in poultry with 58% (table 2) an indicator that poultry might be favorable for most of the people in the sub county. Th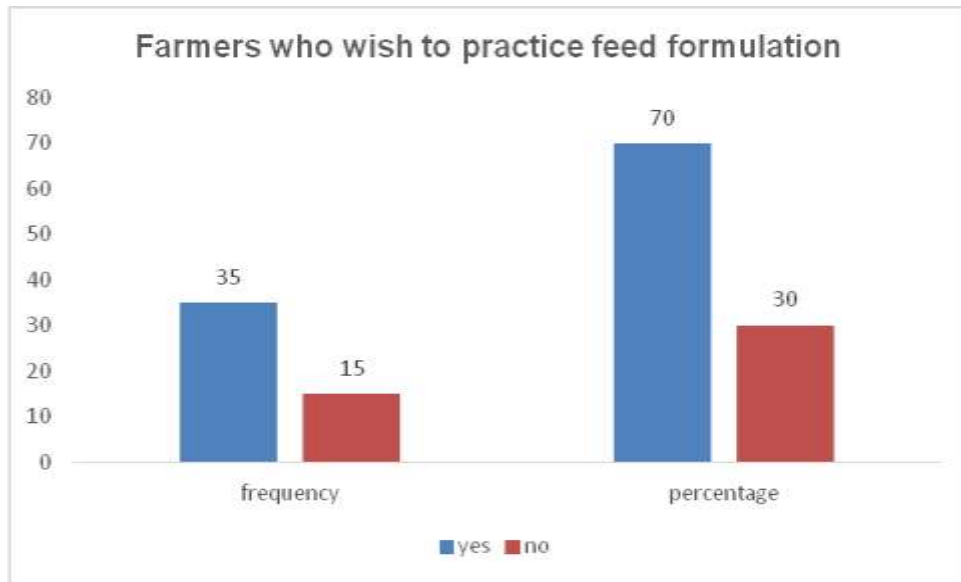e study indicated that most of the respondents do practice feed formulation in Kakiri sub county Wakiso district and this is evident in table 3 (78%). And this has been done for a good period of time especially one year as the farmers responded. Also the most common method used by the farmers was linear programming as it seemed to be the most appropriate and convenient to most of the farmers 56% (table 6). But in my view, the farmers have to be taught much on the feed formulation because on the interaction with most of the farmers, it seems to be more scientific and costly whereby most of the farmers are illiterate and are poor. Most of the farmers don't want to invest in their business yet when they are taught they can learn more on feed formulation. But in my opinion, linear programming is the best form of feed formulation and I recommend farmers to adopt that method because it's easy to learn and less costly.

5.2 Recommendations

The study recommends farmers to still practice feed formulation to give their livestock a proper nutrient to their different stages of growth.

The study also recommends farmers to start up groups so that they are facilitated with knowledge about feed formulation.

The study also recommends that government should teach people more on feed formulation so that they adopt the different methods of formulations.

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APPENDICES

Appendix 1: GEOGRAPHICAL LOCATION OF THE STUDY AREA

Appendix 2: Consent Form

MAKARERE UNIVERSITY

COLLEGE OF VETERINARY MEDICINE ANIMAL RESOURCES AND BIOSECURITY

Appendix 1: Request for information as a respondent in an academic research

I here write to humbly request for information in an academic research.

My name is **Kasima John** pursuing bachelors in **Feed industry and Business** in my final year at Makerere University. Am required to carry out an academic research as a partial fulfillment requirement for the award of the degree in industrial livestock and business.

The main purpose of this letter therefore is to request you to provide me with adequate information as a respondent in my research entitled

ASSESSING THE ADOPTION, KNOWLEDGE, ATITTUDE OF FEED FORMULATION AMONG LIVESTOCK FARMERS IN KIKIR SUBCOUNTY.

The data collected is used for exclusively academic purposes and a high level of confidentiality is guaranteed.

Looking forward for your cooperation.

Yours faithfully.

………………………………………………………

Kasima John

Appendix 3: Farmers 'respondent questionnaire.

Instructions.

Tick in the box of your choice for each question.

Tick either a "yes" or a "no" for each question.

Write a brief answer in the space provided for each question.

NB. Do not indicate your name anywhere on this questionnaire.

Part one.

RESPONDENT'S BIOGRAPHY

1. Sex   M ☐   F ☐
2. Age bracket
   Below 20 ☐   20-35 ☐   35- ☐   55-abov ☐
3. Location: village……………………………
              Parish…………………………………
              Sub county…………………………...

Education level

a) None or informal educatio ☐
b) Primary level   ☐
c) 'O' level   ☐
d) 'A' level   ☐
e) Diploma holder   ☐
f) Bachelor's degree holder   ☐
g) Others(specify)   ☐

Main source of income

a) Livestock production   ☐
b) Crop growing   ☐

Part two

Livestock production.

1. Species of the livestock you own.

   a) Piggery

   b) Poultry

   c) Dairy

2. Number of species owned.

   a) Piggery.

   b) Poultry.

   c) Dairy

3. Sources of the initial livestock animals.

   a) Piggery

   b) Poultry

   c) Dairy

4. Size of land allocated by;

   a) Piggery

   b) Poultry

   c) Dairy

Part three

FEED FORMULATION.

5. Are you practicing feed formulation?

   a) Yes

   b) No

i. If no, have ever practiced feed formulation?

…………………………………………………………………………………………………

……………………………………………………………………...

ii. If no, still would you wish to practice feed formulation?

   a) YES

   b) NO

iii. If yes, how long have you been formulating for your animal's feeds?

    a) 2 months.

    b) 6 months.

    c) 1 year.

    d) Others specify.

iv. If yes still, which method are using while practicing feed formulation?

    a) Person square.

    b) Linear programming.

    c) Computer software

    d) Feed calculator

6. Are continuously practicing feed formulation?

a) YES.

b) NO.

7. What do you know about feed formulation?

…………………………………………………………………………………………

………………………………………………………………….......................................

8. What are the challenges faced while formulating feeds for your animals?

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

9. Do you agree that different stages of livestock animals require different proportion of nutrients?

    a) Agree

    b) Disagree

i. If you agree, explain

    …………………………………………………………………………………………

    …………………………………...

ii. If you disagree; why?

    …………………………………………………………………………………………

    …………………………………………………………….......................................

10. What is the energy proportion required for?

Chicks …………………………………………………………………………………...

Piglets……………………………………………………………………………………

Dairy …………………………………………………………………………………….

11. Why do you think it is important to include proteins in your feed for livestock?

…………………………………………………………………………………………

…………………………………………………………………………………………

12. What is the importance of minerals in the livestock feeds?

…………………………………………………………………………………………

…………………………………………………………………………………………

13. Why do you formulate feeds for your livestock animals?

…………………………………………………………………………………………

…………………………………………………………………………………………

14. What are the main essentials in feed formulation?

…………………………………………………………………………………………

…………………………………………………………………………………………

15. Which feed ingredient and the proportion do you use in your formulation?

Type ………………... Stage……………….

Feed ingredient	Proportion
Total	

16. What is a balanced feed?

…………………………………………………………………………………………

……………………………………………………………..

<div align="center">END</div>