ON FARM EVALUATION OF BOVAN BROWN AND KOEKOEK LAYER BREEDS ON ADAPTIVE AND PRODUCTIVE PERFORMANCE IN OMO NADA AND SEKA CHEKORSA DISTRICTS OF JIMMA ZONE

M.Sc. THESIS

BY

JIMMAWORK TADESSE

NOVEMBER, 2018

JIMMA,ETHIOPIA

On Farm Evaluation of Bovan Brown and Koekoek Layer Breeds on Adaptive and productive performance in Omo Nada and Seka Chekorsa Districts of Jimma Zone.

BY

Jimmawork Tadesse Abera

MSc Thesis

Submitted to School of Graduate Studies, Jimma University, College of Agriculture and Veterinary Medicine In Partial Fulfillment of the Requirements for the Degree of Masters of Science in Animal Production

Major Advisor: Solomon Demeke (Prof.)

Co-Advisor: Mohammed Aliye (Ass. Prof.)

November, 2018

JimmaUniversity

DEDICATION

I dedicate this piece of work to my baby Sinmone Gadisa.

STATEMENT OF THE AUTHOR

First, I declare that this thesis is my own work and that all the source of materials used have been dully acknowledge. This thesis has been submitted in partial fulfillment of the requirement for M.Sc. Degree in Animal production at Jimma University College of Agriculture and Veterinary Medicine and is deposited at the University Library to be made available to borrowers under the rules of the Library. I declare that this thesis is not submitted to any other institution by me or others for the award of any academic degree, diploma or certificate. I concede copyright of the thesis in favor of Jimma University, College of Agriculture and Veterinary Medicine.

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Signature _____

Place: Jimma University, College of Agriculture and Veterinary Medicine.

Date of Submission: ……

BIOGRAPHICAL SKETCH

The author, Jimmawork Tadesse was born in October 1989 from her father Tadesse Abera and her mother Almaz Zaga in Jimma town of Oromia Regional State. She attended her elementary education at Jiren Elementary School from 1997 to 2004 and her secondary school at Jiren high school from 2005 to 2006. She joined Jimma Preparatory School in 2007. Jimmawork joined Ambo University and awarded B.Sc. Degree in Animal Science in 2011. Soon after graduation, she was employed by Jimma Zone Shabe Sombo Woreda Livestock Development and Health Care Bureau. Finally Jimmawork joined Jimma University, School of Graduate Studies to pursue the Degree of Master of Science in Animal Production in 2015.

ACKNOWLEDGMENT

First of all, I would like to give my special thanks to the Almighty God for all the blessings in my life. I earnestly express my sincere thanks to my Major advisor Professor Solomon Demeke and Co-advisor Mr. Mohammed Aliye for their encouragement and guidance. . I would like to express my gratitude and appreciation to Shabe Sombo Woreda Administration Office, Livestock Development and Health Care Office for sponsoring my study. I would like to acknowledge the farmers who participated in my research undertakings. I would also like to acknowledge Seka Chekorsa Livestock Development and Health Care Office staff and Development Agents for their support in data collection. My sincere gratitude and appreciation goes to Jimma University College of Agriculture and Veterinary Medicine for covering part of the financial and material requirement of my research undertaking.

My special thanks goes to my beloved husband, Ato Gadisa Dafissa for his love, advice, passion, care and encouragement throughout the study period. . Lastly I would like to express my heartfelt thanks to my Parents: Tadesse Abera and Almaz Zaga for their moral support and caring my baby.

LIST OF ABBREVIATIONS

BB	Bovan Brown
CSA	Central Statistics Agency
FAO	Food and Agriculture Organization of the United Nations
FSRE	Food Security and Rural Livelihood Enhancement
IB	Isa Brown
JUCAVM	Jimma University college of Agriculture and Veterinary Medicine
NCD	Newcastle Disease
PK	Potchefstroom Koekoek
RIR	Rhode Island Red
SPSS	Statistical Package for Social Science

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ABSTRACT

Survey of retrospective memory data of layers distributed from 2015-2016 and on-farm evaluation of bovan brown and Koekoek breedswere studied with the objective of evaluatingadaptive and productive potential of Bovan Brown and Koekoeke exotic breeds of chickens distributed in Omo Nada and Seka Chekorsa Woredas of Jimma Zone. A total of 60 households among 120 that were involved in the project FSRE have participated in the surveying study. Parallel with it, 23 bovan brown and 10 Koekoek were distributed in Seka Chekorsa for each farmer for on farm study and monitored for six months by feeding commercial feed for four months and homemade feed for two months.All data collected were analyzed using statistical package for social science (SPSS Version20). Theresults obtained revealed that the Bovan Brown and koekoek layers placed on commercial ration produced at the mean daily rate of 0.54 egg/day /bird and 0.42 egg/day /bird during the 4 months of feeding period respectively. Thus the results obtained indicated that the rate of production of Bovan Brown placed on commercial layers ration was higher ($P<0.05$) than that of Koekoek breed of chicken during the entire study of 4months.The Bovan Brown placed on homemade ration produced daily rate of 0.65 egg/day /bird, while the Koekoek placed on homemade ration produced daily rate of 0.60 egg/day /bird during the 2 months of feeding period.The results of the economic feasibility study reveals that there was net profit difference of 128.2 ETB/ month between the use of commercial and homemade ration at household level. Internal and External egg quality trait indicates there were significance difference ($p<0.05$) on egg weight, albumin weight and shell thickness. With suppermass of Bovan Brown Breed. In Summary as indicated in economic feasibility farmers got better income when they fed homemade feed for their chicken. So, preparing homemade feed by using vitamin premixes should be practiced for future.

Key words:*Commercial feed, homemade feed and egg quality.*

1. INTRODUCTION

In Ethiopia chickens are the most widespread domestic animals and almost every rural family owns chickens, which provide animal protein and family income Tadelle et al.(2003). The total Ethiopian chicken population is estimated to be 60.51 million of which 94.33, 3.21 and 2.47% is Indigenous, hybrid and exotic breeds of chickens respectively (CSA, 2016). This indicates that the most dominant chicken types reared in Ethiopia are local ecotypes, characterized by a large variation in body conformation, plumage color, comb type and productivity Nigussie et al. (2010). However, the economic contribution of the poultry sub-sector to the country's economy and export earnings is disproportionately small, attributed to the presence of many productions, reproduction and infrastructural constraints (Aberra, 2000; Halima, 2007).

The Ethiopia indigenous chickens, kept under village condition is rarely the sole means of livelihood for the household but is one of a number of integrated and complementary farming activities contributing to the overall well-being of the household. The country's indigenous chicken based local poultry by its own provides a major income-generating activity from the sale of birds and eggs. Eggs can provide a regular, albeit small, income while the sale of live birds provides a more flexible source of cash as required. Village poultry is a source of self-reliance for women, since the sale of live birds and eggs are decided by women (Aklilu et al., 2007), both of which provide women with an immediate income to meet household expenses such as food. Annual income from sale of eggs and live birds is estimated to be about ETB 322/ household in the Tigray Regional States, indicating that village poultry in extremely poor areas of the country play important economic, nutritional and socio-cultural roles in the livelihoods of the rural households. For poor families, poultry are often one of their few sources of petty cash. Thus birds are kept for sale at rural household level rather than for home consumption.The low productivity of the indigenous stock could partially be attributed to the low genetic potential of the flock. It has been reported that the main problems of the indigenous chickens are poor productivity of egg and meat (Yami, 1995 ; Tadelle et al., 2000).

The egg production potential of local chicken is 30-60 eggs/year/hen with an average egg weight of 38 g under village management conditions, as compared to exotic breeds producing around 250 eggs/year/hen with mean egg weight of 60 g (Alganesh et al., 2003) under the Ethiopia condition. The productivity of Traditional chicken production systems

in general and the free-range system in particular is low (Kondombo 2005). This is due to low egg production and high mortality rate (Nigussie et al. 2003). But, they are well adapted to the tropical, poor management and feed shortages with some degree of tolerance to some of the most common diseases and parasites. On the contrary, improved exotic breeds of chickens are challenged by tropical climate but produce higher number of eggs and more meat than the indigenous chicken. Attempts have been made to introduce different exotic poultry breeds to smallholder farming systems of Ethiopia aimed at either upgrading the production performance of indigenous chicken through cross breeding or to keep them as exotic chicken based, small scale modern poultry. Higher learning institutions, research organizations, the Ministry of Agriculture and some Non-Governmental Organizations (NGO's) disseminated many exotic breeds of chicken to rural farmers and to urban-based small-scale poultry producers. Donors, NGOs and the Ethiopian government are involved in promotion of small scale modern poultry in support of poverty alleviation and food security initiatives (Solomon, 2008**).**

Recently Jimma University College of Agriculture and Veterinary Medicine (JUCAVM) Department of Animal Science with the help of FSRE project started the distribution of Bovan Brown and Koekoek breeds of chickens to Omo Nada and Seka Chekorsa Woredas (districts) of Jimma Zone. Thus, it seems to be reasonable to evaluate the economic, financial and sustainability of such an interventions (investment). Therefore, the major objective of this research was to study the adaptive and productive potential of Bovan Brown and Koekoek exotic breeds of chickens distributed in Omo Nada and Seka Chekorsa Woredas of Jimma Zone, with the following specific objectives.

- To study the adaptive & productive potential of Bovan Brown and Koekoek breeds of exotic chickens distributed in Omo Nada & Seka Chekorsa Woredas of Jimma Zone.
- To study the comparative economic feasibility of keeping Bovan Brown and Koekoek breeds of exotic layers on homemade and commercial ration.
- To evaluate external and internal egg quality traits of Bovan Brown and Koekoek breed

2. LITERATURE REVIEW

2.1 Poultry Production Systems in Ethiopia

The word poultry production is synonymous with chicken production under the present Ethiopian conditions (Solomon, 2007). The poultry production systems of Ethiopia show a clear distinction between the traditional, low input system on the one hand and modern production system using relatively advanced technology on the other hand (Yami, 1995). All the available evidences tend to indicate that the poultry sector in Ethiopia could be characterized into three major production systems based on some selected parameters such as breed, flock size, housing, feeding, health care and bio-security (Alemu & Tadelle, 1997; Bush, 2006; Goutard & Magalhaes, 2006). These are traditional production (village or backyard) poultry production system, small scale intensive poultry production system and large scale commercial poultry production system (Nzietcheung 2008).

2.1.1 Traditional Production System

Throughout Ethiopia poultry keeping has been practiced by village communities for many generations. The Ethiopian traditional poultry, currently make up more than 95% of the country's flock. Rural family poultry are a valuable asset to local populations as they contribute significantly to food security, poverty alleviation and the promotion of gender equality, especially in disadvantaged groups and less favoured rural areas (Guèye, 2000).

The Ethiopian traditional poultry production system comprises of the indigenous chickens, characterized by small flock sizes and low input and output. There is no separate poultry house and the chickens live in family dwellings together with human population and scavenging is almost the only source of diet. There is no planned breeding. A broody hen hatching, rearing and protecting few number of chicks (6-8)ceases egg laying during the entire incubation and brooding periods of 81 days. Yet the successes of the hatching and brooding process depends on the maternal instinct of the broody hen and prevalence of predators in the area, such as birds of prey, pets and some wild animals, all of which are listed as the major causes of premature death of chicks (Solomon, 2007).

The indigenous chicken's production system is practiced in rural areas of the country as a source of food for household consumption and as source of family income. The production system is characterized by small flock size (5-20) per household.

2.1.2 Small Scale Intensive Production System

According to Solomon (2008) small scale intensive system of production is newly emerging system in urban and peri-urban areas, where small number of exotic breeds of chickens (50-1000) is produced along commercial lines using relatively modern management methods. This activity is being undertaken as a source of income in and around major cities and towns. Most of these farms obtain their feeds and foundation stocks from Genesis and Alema commercial poultry farms and occasionally from nearby government owned breeding and multiplication centers. The small scale modern poultry production system is involved in the production and supply of table eggs to various supermarkets, kiosks and small roadside restaurants through middlemen. The small scale modern poultry farms located in Debre Zeit and Addis Ababa enjoy the privilege of being advised and assisted by health professionals and Faculty of Veterinary Medicine. They are also at the reach of information, vaccination and treatment drugs. The small scale modern poultry production systems located outside of these locations has limited access to such service. There is no adequate information on diseases affecting poultry in this production system. Kinung'hi *et al*. (2004) mentioned coccidiosis as a cause of mortality, reduced weight gain and egg production and market value of affected birds.

2.1.3 Large-Scale Commercial Production System

The large-scale commercial production system is highly intensive production system involving an average of greater or equal to 10,000 birds kept under indoor conditions. This system heavily depends on imported exotic breeds that require intensive inputs such as feed, housing, health, and modern management systems. In Ethiopia the large scale commercial poultry production system is estimated to be accountable for about 2% of the total national poultry population. This system is characterized by higher level of productivity where poultry production is entirely market oriented to meet the large poultry demand in major cities (Bush, 2006).

There are several private large scale commercial poultry farms in and around Addis Ababa, the majority of which are located in Debre Zeit. ELFORA, Alema and Genesis are the top 3 largest commercial poultry farms with modern production and processing facilities. ELFORA annually delivers around 420,000 chickens and over 34 million eggs to the market of Addis Ababa (www.ethiomarket.comelfora). Alema poultry farms is the

2nd largest commercial poultry farms in the country delivering nearly half a million broilers to Addis Ababa market each year. Formal marketing operations exist within the large scale commercial poultry farms of the country.

The large scale commercial poultry provide fertile eggs, table eggs, day old chicks, broiler meat and adult breeding stocks to the small scale modern poultry farms. They are kept as full time business and highly dependent on market for inputs. The general indications are that the intensive poultry industry plays a key role in supplying poultry meat and eggs to urban markets at a competitive price. The industry also provides employment for a range of workers from poultry attendants to truck drivers to professional managers. The larger commercial poultry units have agreements with clients such as Ethiopian Airlines for using in the plane during transportation and the larger hotels to supply poultry meat and eggs. Most poultry meat is sold frozen. The majority of the products sold within the formal sector come from the commercial industry but a small number of frozen indigenous chickens are supplied through supermarkets in Addis Ababa (Solomon, 2007).

2.2. Productive Performance of the Ethiopia Poultry

2. 2.1Productive Performance of the Indigenous Chickens

The productive performance of indigenous scavenging chickens of Ethiopia is low because of their low genetic potential, high chicken mortality and longer reproductive cycle (slow growth rate, late sexual maturity and broodiness for extended period (Besbes, 2009). The low productivity of the indigenous stock could also partially be attributed to the low management standard of the traditional household poultry production system.Pullets and cockerels reached sexual maturity at an average age of 6.4 months and 5.7 months, respectively.Even though the productivity of local chicken is very poor, they are very important to withstand certain harsh environmental conditions, and can perform better under poor management than cross and exotic breeds, they are also well known to possess desirable characters such as ideal mother, good sister, hatch their own eggs, excellent foragers, resistance to common poultry disease and special meat and egg quality (flavor), hard egg shells (Abdelqader et al., 2007). It have been seen that the provision of vaccination, improved feeding, clean water and night time enclosure improve the performance of the indigenous chickens (Abebe, 1992 and Solomon 2007).

Local chicks weigh about 28 g at hatching, 185 g at eight weeks and 1.035 kg at 6.5months which is point-of-lay (Dessie and Ogle, 2001). Mature body weights range from1.0-1.2 kg for hens to 1.3-1.7 kg for cocks with carcass weights being around 800 g. Annual egg production is 55-80 eggs per yearin 5-6 clutches of 10-15 eggs with an average egg weight of 30 g (Dessie and Ogle,2001). A study at Asela Livestock Farm showed that the average production of localbirds was 34 eggs/hen/year with an average egg weight of 38 g (Brannang and Persson, 1990). In five areas of the highlands a further study showed somewhat higher productionof 17 eggs in the first clutch, 21 in the second and 25 for third and all other clutches with2.6 clutches being laid per year (Tadelle et al., 2003b). Within a clutch, eggs are not laid every day and a 10-egg clutch may be laid in 15-18days whereas a 15-egg clutch may take 25 days (WBISPP, 2003). Egg fertility under broody hens is only about 55% and hatchability about 75% so that total eggs hatched isonly about 40% of the potential (Table 3). Other sources put eggs set as 13.5 per clutchand eggs hatched as 70-81% of those set in the overall range of 44-100% (Dessie andOgle, 2001; Tadelle et al., 2003b. In summary, local chickens are appropriate under the traditional production system with low input levels, that makes the best use of locally available resources and hatch their eggs and brood chicks which are important traits under the present Ethiopian conditions (Yami and Dessie, 1997 ; Solomon,2007). The total national annual poultry meat and eggs production were estimated at 72, 300 and 78, 000 metric tons, respectively, resulting in per capita consumption of 57 eggs and 2.85 kg of poultry meat.

2 2.2 Productive Performance of exotic Chickens

In Ethiopia, the importation of exotic breeds of chicken goes back to the early 1950s. According to Alamargot (1987), about 99% of the Ethiopian poultry population consists of indigenous chickens, while the remaining 1% consists of imported exotic breeds of chickens during the 1970s and 1980s.

At present it is estimated that the exotic breeds of chickens consists of about 2.47% of the national poultry population (CSA, 2016) and all the available evidence indicates that all the imported breeds of chickens performed well under the intensive management system (Alemu and Tadelle, 1997).

According to Bell and Weaver (2002) Poultry production is affected by factors such as breed and strain of chicken used, environmental conditions in poultry house, management

practices and feed and feeding management. Egg production of exotic breeds under the Ethiopian condition begins at an age of 145-150 days depending on breed and season. Flock production rises sharply and mean annual egg production/hen reaches about 200-230 with mean egg weight of 56g. There are many factors that adversely affect egg production. Unraveling the cause of a sudden drop in egg production requires a thorough investigation into the history of the flock. Egg production can be affected by feed consumption (quality and quantity), water intake, intensity and duration of light received, parasite infestation, diseases, management and environmental factors (Jacob *et. al*., 1998).

Production performance of exotic birds under the Ethiopian condition needs to be monitored regularly to provide guidelines for policy makers. Lack of recorded data on the productive performance of exotic breeds of chicken makes it difficult to assess the importance and contributions of the exotic breeds of chickens in the past (Fissehaet *al*., 2010). In Ethiopia, the initial idea of distributing exotic chickens particularly that of Rhode Island Red (RIR) was aimed at improving the productivity of local birds through crossbreeding. According to Permin (2008), this scheme usually failed to work due to the fact that the introduced breeds could not adapt to the hot climate, low feeding and extensive management. Result obtained from Ada'a and lume districts illustrated that mean annual egg production of Bovan Brown and Koekoek breeds of chickens was 266 and 187 eggs/year respectively (Desalew, 2012).

2.3 Poultry Management Practices

2.3.1Feed resources and feeding practice

There is no purposeful feeding of rural household chickens in Ethiopia and the scavenging feed resource is almost the only source of feed. The results of the study in Gomma Woreda by meseret, (2010) reported almost all of the respondents (97.8 %) reported to practice scavenging system with supplementary feeding.

Similarly, Asefa (2007) and Mekonnen (2007) reported 95 -98% of the small scale household poultry producers in Awassa Zuria and Dale offer supplementary feeding to their chickens. The study in Gomma woreda confirmed that scavenging feed resource consists of insect, grass, enset (*Ensete ventricosum*), kitchen wastes, and harvest leftovers indicating that the village chicken production system is friendly with the environment. Unfortunately, all the available evidences tend to indicate that scavenging feed resource

base for local birds are inadequate and variable depending on season (Hoyle, 1992 and Alemu and Tadelle 1997).

Similarly, Desalew 2012,in lume and ada'a districts, 97.8% of the respondents using scavenging with additional supplements and 2.2% used only scavenging with no additional feed supplements for chicken. From 88 (97.8%) respondents who practiced scavenging with additional supplement, 3(3.4%) respondents in Ada'a and 2 (2.3%) respondents in Lume district were using purchased commercial feeds.

Scavenging materials like food left overs and small amount of grain given by house wife (Tadelle and Ogle, 2001; Tesfu, 2006). The birds are scavenging from morning to evening, except around mid-day in hot sunny condition and on very rainy days. However, the diet composition varied according to the housing density and the flock biomass in the village and neighbourhood (Tadelle, 1996; Tadelle and Ogle, 2001). According to Tadelle and Ogle (2001) in a few cases, house wife provided a preferential feed supply for chicks. This might be boiled teff grains or water socked enjera (pancake made of fermented teff flour), which was given in a conveniently placed container until they started to scavenge with the mother hen.

2.3.2 Housing

The study in Nole Kabba woreda showed that, there are no separate houses for poultry and village chickens spent most of their time scavenging in the vicinity of human dwellings. About 70, 54.5 and 44.8% of the respective respondents, categorized as poor, medium and rich households keep poultry in the same room with human being during night time. On the other side 20, 33 and 41% of the respective respondents categorized as poor, medium and rich household reported to have separate partition as night time enclosure for poultry within family dwellings. The remaining respondents reported to have separate poultry houses. The general indication is that about 57% of all the respondents share family dwellings with poultry, attributed to the small flock size, low priority given to chicken and relatively high cost of poultry house construction.

Sharing family dwellings particularly during night times might also be associated with protection from predators (Matiwos, 2012). The separate poultry houses constructed in kabba nole area lack internal facilities like egg laying nest, roosts and feeder.

Similarly, the results of study of Meseret (2010) who reported that about 94.4% of the farming population of Gomma Wereda has no separate poultry house. Such a situation might be attributed to the fact that women own and manage rural household poultry whereas construction of poultry house is the job of husbands in the Gomma Wereda. Birds without separate poultry houses perch in the kitchen, cattle yard and even on trees during night time. Housing facilities in the Gomma Woreda include the use of baskets and cartoons placed on the bare floor of the family house. In fogera the majority of the respondents clean their chicken house/shelter daily, while the remaining (20.8%) clean weekly. The situation in the other study areas is similar. Lack of frequent cleaning of poultry shelter can easily cause diseases and increase morbidity and mortality rates of chicken. Thus, raising awareness of farmers on the need for cleaning shelters is important that all development practitioners should take seriously (Fisseha et al.,2010). As the chicken farmers replied, chickens were confined only during the night and they move freely during the day, thus 65.6 % of the households clean the chickens' house once per day, while as 12.2 % and 21.1% of the owners cleaned it twice and one times per week, respectively. This result is in agreement with the survey undertaken by Halima et al. (2007) in northern Ethiopia who reported 74.02 % of the households cleaned their chickens' house once per day, while 11.66 % of the owners cleaned it twice per day.

According to Matiwos 2012, there is no well recognized design for the construction of poultry house in the study area and most of the available poultry houses are constructed from sorghum stalk and bamboo trees. Similarly, the result of Meseret (2010) who reported that Bamboos and sticks are occasionally used for construction of perches within the family houses in Gomma Woreda. The construction of poultry house is targeted towards protecting of chicken from predators without giving consideration to the negative-impact of harsh environmental factors on productivity. Mekonnen (2007) reported that there are no specific separate poultry houses in Dale Wereda. About 54% of the respondents reported to have constructed poultry house to control free movements of birds mainly for the reasons of preventing losses by predation and theft. About 22% of the respondents reported to construct poultry house to control bird's movement for the main reason of protecting the birds from disease transmission.

2.3.3 Disease Control

In nole kabba woreda both vaccination and treatment of chickens are not common (Matiwos2012). Exceptions to this condition are exotic breed of chickens that are immunized against Newcastle disease before distribution. Tadelle (2003) reported the wide occurrence of Newcastle disease all over Ethiopia. Locally known as Fengle the disease is characterized by recurrent outbreaks and higher mortality. Newcastle disease is economically important disease all over developing countries and its severity is subjected to seasonal variation. Newcastle disease outbreaks commonly start at the beginning of the rainy season (Sonaiya *et al*., 1998). According to Meseret(2010) about 85.6% of the respondents confirmed that occasional and serious disease outbreak results in complete devastation of the flock when accrued. About 34.4, 27.9, 26 and 11.7% of the respondents reported Newcastle disease, infectious bronchitis, infectious bronchitis and external parasites, and coccidiocis to be disease of economic importance respectively.

According to *Nebiyu et al. ,2013,* Farmers indicated that the major causes of losses in the study area were predation by hawks, fox and wild cats (51.1%), disease (45%) and thieves (3.9%) Among the classes of chickens, chicks and growers were severely attacked by predators during both dry and rainy seasons. Diseases accounted for 45% of the death of chickens in which Newcastle disease played the major cause of death. The severity of the disease was higher during rainy season (75.4%) than during dry season (24.6%). The most common type of traditional medicines used for treating sick birds was tobacco leaf, lemon juice and table oil, which were administrated with drinking water. The measures taken by farmers when sick birds were observed in the flock was medication (90%), selling (6.8%) and isolation of birds (3.2%). Dead birds were disposed through pet animals (86.8%) and burying.

2.4 Egg Quality

2.4.1 Internal Egg Quality

Internal quality of the egg begins to decline as soon as the egg is laid. Thus although factors associated with the management and nutrition of the hen do play a role in internal egg quality, egg handling and storage practices do have a significant impact on the quality of the egg reaching the consumer.

Egg weight influences the weight of components of eggs especially egg albumen and yolk (Zhang *et al.,* 2005; Aygun and Yetisir, 2010). Danilov (2000) reported the proportion of yolk, albumen and shell that contribute to the egg weight increases with hen's age, reaching a plateau by the end of the laying cycle. Thus, egg weight is one of the important phenotypic traits that influence egg quality and reproductive fitness of the chicken parents (Islam *et al*., 2001; Farooq *et al*., 2001). Anderson (2002) provided detailed information on the differences in egg production and quality between different white and brown egg strains and reported the egg weight from brown hens (61.1g) was more than that of white hens (58.3g). Tixier-Boichard *et al.,* (2006) recorded weight of 42.8 g for Fayoumi eggs and 58.8 g for IB eggs. Higher weight of egg from commercial strains is not a surprise since such strains submitted to important breeding pressure for egg weight improvement (Hocking *et al*., 2003). Further, under smallholder farmers condition in northern Ethiopia, egg weight was recorded as 52.5g, 52.1g and 43 g for Rohde island Red, White leghorn and Fayoumi, respectively (Lemlem and Tesfaye, 2010). Hen age has also been shown to increase yolk weight (Van den Brand *et al.,* 2004) albumen weight (Suk and Park, 2001).

Yolk color is a key factor in any consumer survey relating to egg quality (Okeudo *et al.,* 2003). Consumer preference for yolk colour are highly subjective and vary widely from country to country. The determinant of yolk colour is the xanthophyl (plant pigment) content of the diet consumed (Silverside *et al.,* 2006). Green grass during scavenging might be responsible for carotenoid deposits in the yolk, which improves the yolk color. Among feed ingredients, only supplemented maize contributes to improved color intensity of the yolk. Thus, if a hen has access to green grass or supplemented feed ingredients containing carotenoids/xanthophylls, it will be enough to give the yolk the colour preferred by consumer (Zaman *et al*., 2004). Ethiopian consumers have a strong preference for eggs with deep yellow yolk colour. Very small sized eggs from the scavenging local chicken with deep yellow yolk colour fetch much higher prices compared to larger eggs of improved strains with pale yolk (Tadelle *et al.,* 2003a).

The Haugh Unit (HU) proposed by Haugh (1937), is calculated from the height of the inner thick albumen and the weight of an egg and it is considered to be a typical measure of albumen quality. It is generally accepted that the higher the Haugh unit value, the better the quality of the egg. It is also important that all eggs being evaluated at the same internal temperature. Age of the hen and season of the year can also affect Haugh unit values.

Rajkumar *et al*. (2009) reported that brown egg layers produced eggs with higher HU. Some of the large supermarkets chains in the UK set minimum acceptable level of 70 HU on regular documented tests (TSS, 1999).

2.4.2 External Egg Quality

The eggshell thickness is an important trait for hatchability. For best result of hatchability egg shell thickness should be between 0.33 and 0.35 mm and few eggs with a shell thickness less than 0.27mm will hatch (Khan *et al*., 2004). One of the main concerns is a decrease in eggshell quality as the hen ages, due to an increase in egg weight without an increase in the amount of calcium carbonate deposited in the shells. For this reason, the incidence of cracked eggs could even exceed 20% at the end of the laying period (Nys, 2001).The egg shell quality is given throw the weight and the percentage of shell, thickness and the strength. The differences in eggshell quality depend on the environmental conditions and the feed quality and also of strain of layers (Zita *et al.*, 2009). On the other hand, Khan *et al.* (2004) reported no significant effect of breed on eggshell thickness under semi scavenging condition.

In comparison, strains used for production of white and brown eggs, Silversides and Scott (2001) reported that eggs from IB hens had better percentage of shell than those from Isa-White hens. Several authors reported variable results about the influence of the rearing systems on shell thickness. Leyendecker *et al.*, (2001, 2005) reported thicker shells in free range eggs when compared to conventional cage and aviary systems (Leyendecker *et al.*, 2001), and to conventional and furnished cages (Leyendecker *et al.*, 2005). On the other hand, Tumova and Ebeid (2003) noticed thicker shells in battery cage compared to barn system, while Van de Brand *et al.* (2004) did not find differences between free range and battery cage.

2.4 Socio-economic role of poultry

The Ethiopian chickens' population accounts for about 60 % of the total chicken population of East Africa (Mekonnen *et al.*, 1991). The contribution of these birds to household food security and income source is highly significant (Halima, 2007). It is widely accepted that village chickens are important in breaking the vicious cycle of poverty, malnutrition and disease (Roberts and Gunaratne, 1992).

This is true in northern Ethiopia particularly in Tigray, Amhara and northern Oromia Regional States which collectively own about 43% of the total national poultry population. The average numberof chickens per household (flock size) is estimated at 7.2 and 4.4 in Tigray and Amhara Regional State respectively, the values of which are above that of the national average of4.1. Annual poultry meat and egg consumption per household is estimated to be 2.19 and1.72 kg respectively in the Tigray Regional State as compared to the national average of0.12 and 0.14 kg respectively. Similarly annual live bird and egg sale per household is estimated at 6 chicken and 100 eggs respectively in the Tigray Regional State. At a current market price these figures tend to indicate annual income of Birr 322 from household poultry, indicating that village poultry in extremely poor areas of these parts of the country play important economic, nutritional and socio-cultural roles in the livelihoods of the rural households (Aklilu,2007).

The market demand and price of live chickens and eggs experienced during the last 5 years are very much rewarding compared to the previous times indicating that for poor families, poultry are often one of their few sources of petty cash (Bush, 2006). Yearly income from rural household poultry ranges from ETB 50 to over ETB 300 and is largely under the control of women. This income is significant for poor families with ETB 300 a year representing 25% of the typical annual income of poor families in SNNPR (Bush,2006).

3. MATERIALS AND METHODS

3.1 Description of the Study Area

This study was conducted in Omo Nada and Seka Chekorsa Woredas (districts) of Jimma Zone. Seka Chekorsa Woreda is located between 360 33' East and 7020' to 70 45' North. The Woreda covers an estimated area of 455km^2 and comprises of 36rural and 1 urban Kebeles. The elevation of the Woreda ranges between 1560 and 3000 masl and mainly falls within Ghibe watershed area. It is divided in to two agro- ecological zones i.e Dega and Woinadga, accounting for about 19% and 81% of the total area of the Woreda respectively. The annual rainfall is reported to be between 900 mm and 1400 mm. The maximum and minimum temperature recorded for the area varies between18 and 28 ^{o}c and 7and 11^{o}C respectively. There are 31, 563 households in the Woreda of which 4,036 are female headed and the Woreda is among the most densely populated area in Oromia Region. The farming system of Seka Chekorsa Woreda is mixed farming, with considerable size of livestock (WARDO, 2010).

Omo-Nada is the second Woreda of JimmaZone considered for this study. The altitude of this Woreda ranges between 1000 and 3340 meters above sea level. A survey of Omo-Nada Woreda land showed that 56.8% is arable, 36.3% is under annual crops, 25.2% is pasture, 6.3% is forest, and the remaining 11.7% is considered to be swampy, degraded or otherwise unusable. Coffee, teff and wheat are the major cash crops (GOR, 2006). Total population of the Woreda is 248,173, of whom 50% is male. About 4.92% of its population are urban dwellers.

3.2 Selection of the Study Districts

The two districts being purposively selected for the project are high cereal crop producing districts of the zone assumed capable of supplying the exoticbreeds with required feed resources per house hold from the locally available feed resources. The PA(Peasant Association) used in the study were also purposively selected on the basis of kebeles involved in FSRE project; to evaluate the performance of the birds.

3.3 Selections of the Participating Households

Households who received Bovan Brown and Koekoeke breeds of chickens distributed by JUCAVM were identified in both Seka Chekorsa and Omo-Nada Weredas of Jimma Zone. A total of 30 households each of which received Bovan Brown and Koekoek breeds of chickens were randomly selected from each of the two districts. Thus, 60 households were randomly selected from the total households who received the two breeds of exotic chickens were used to study the adaptive and productive potential of Bovan Brown and Koekoek exotic breeds of chickens distributed within Omo-Nada and Seka Chekorsa districts under FSRE project.

3.4 Data Collection

A structured questionnaire was used to collect data on adaptive and productive potential of Bovan Brown and Koekoek exotic chickens distributed. The primary data collected included characteristics of the households, adaptive potential (mortality or rate of survival), and production performance of the two distributed exotic breeds of chickens. The primary data collected also included information on the contribution of the chickens distributed to the household nutritional status, family income and other related benefits. The secondary data were collected from the review of the FSRE project document and discussion with the Woreda Agricultural offices and the participating development agents. For on farm evaluation egg production and mortality were daily recorded.

3.5 On Farm Evaluation Study

On-farm evaluation of the productive performance of two exotic breeds of chickens (Bovan Brown and Koekoek) placed on homemade and commercial poultry rations was conducted at two different Keble's. The two Kebeles of Seka Woreda used for the on-farm evaluation were Sakela and Alaga Purposively selected on the basis of road accessibility to the woreda for proper follow up, number of chickens and competent farmers were found in the kebeles. Eight households (farmers) were also purposively selected from each of the two Kebeles based on number of chickens they owned and also competent farmers were included. Thus a total of 16 farmers who attended the training and constructed their own separate poultry house were purposively selected on the basis of their own choice and participated in the evaluation for a total duration of 6 months. A total of 368 Bovan Brown and 160 Koekoek breed pullets(at an age of 12 weeks Bovan Brown and 16 weeks Koekoek) were randomly divided into two groups of 184 Bovan Brown and 80 Koekoek breeds of chickens each.

Eachof these were further sub-divided randomly in to 8 groups of 23 Bovan Brown and 8 groups of 10 Koekoek breeds of chickens. Finally each groups of 23 Bovan Brown (20F plus 3M) and 10Koekoek (8F+2M) were randomly distributed to the 8 participating households in completely randomized block design in both kebeles as shown in Table 1. All the groups were placed on commercial growers ration purchased from Kaliti. The study starts at an age of 6 months Bovan Brown and 7 Months Koekoek breeds. At an age of 9 months Bovan Brown and 10 months koekoek all the groups were switch over to homemade ration (shown in Table 2) for additional study period of two months. Egg production and mortality rate were used as evaluation parameters.

Table 1. Treatment allocation to the experimental units in completely randomized block design

		Bovan Breed	Koekoek Breed		Bovan Breed	Koekoek Breed
Kebele1	F1	23	10	Kebele2	23	10
	F2	23	10		23	10
	F3	23	10		23	10
	F4	23	10		23	10
	F5	23	10		23	10
	F6	23	10		23	10
	F7	23	10		23	10
	F8	23	10		23	10

F= farmer

3.6 Laboratory Analysis of the Commercial Layer Ration

The feed has about 2650kcal per kg while the requirement is about 2750 kcal per kg.The Measurement Ca level in the feed is low about 2.8% and the requirement for layers is 3.7% to 4%.

Table 2 Laboratory Analysis of Kality Layer Feed

Feed ingredients	Amount
Moisture	10.08 %
Crude Protein	15.68 %
Crude fat	3.99 %
Ash	10.55 %
Crude fiber	6.51 %
Starch	38.27 %
Manganese	126.91 ppm
Copper	14.45 ppm
Zinc	114.34 ppm
Calcium	2.78%
Phosphorus	0.74 %

3.7 Formulation of Homemade Ration

Table 3. Formulation of Homemade ration in the experiment

No	Feed ingredients	Amount
1	Maize	85.5kg
2	Soya bean	10kg
3	Limestone	3kg
4	salt	0.5kg
5	Grass and leaves	1kg
total		100kg

In Homemade ration farmers bought maize and soya bean as energy and Protein Source. The price of the ingredients were Maize 5 birr/kg, Soya bean 40 birr/kg, limestone 3.40 birr/kg and salt 10 birr /kg and green plants were given from surrounding**.**

3.8 Partial Budget Analysis

Partial Budget Analysis in this study expressed as, in commercial feeding feed used for four months were calculated and divided by four were taken as one month data and calculated its cost. And Also Eggs collected during four months from both breeds added and divided by four i.e. average were taken. Also the same way taken for homemade partial budget analysis.

Net Profit = Total net Income – Total Variable Cost

3.9 Internal and external egg quality

A total of 72 (40 Bovan Brown and 32 Koekoek) Fresh eggs were purchased from the participating household (Farmers) and transported to JUCAVM nutrition laboratory. Soon after arrival at JUCAVM nutrition laboratory, egg weight was measured using digital balance. Egg shell thickness was measured at the middle, broad and narrow sides of an egg and the average value was taken. To determine the internal egg quality traits, eggs were broken onto a flat surface. The thick albumen height was measured at its widest part at a position half way between the yolk and the outer margin. The yolk and albumen were carefully separated and weighed separately using digital balance.

The shell weight was also weighed using sensitive balance. Yolk color was measured using roach color fun. Haugh unit was calculated using the following formula adopted from **(**Haugh, 1937**).**

$HU = 100 \log (H + 7.57 - 1.7 W^{0.37})$

Where, HU= Haugh unit

H= Albumen height (mm).

W = Egg weight (g).

3.10 Data Management and statistical model of analysis

All data gathered during the study period were analyzed using statistical package for social science (SPSS) version 20.0 for windows. Numerical survey data, differences in productive performances and egg quality traits were compared using means generated from one-way ANOVA. For qualitative factors descriptive statistics was used. The following model was used in the experiment data analysis

$y_{ijk} = \mu + B_{ri} + F_j + e_{ijk}$ –model 1 (Experimental Data)

Where:

Y_{ijk}=the observation taken at the i^{th} breed and j^{th}feed types

μ = overall mean

Br_i=the effect due to the i breed (kokoke and Bovan Brown)

F_j = the effect due to j feed type (homemade, commercial)

e_{ijk} = random residual error

The following Model was used for the survey study-model 2 (Survey)

$Y_{ijk} = \mu + I^{th} + J^{th} + Є_{jk}$

Where:

Y_{ijk}= The value of the respective variable

μ = overall mean of the respective variable

I^{th}=the effect of i^{th}*District*

J^{th} = the j^{th} production performance

$Є_{jk}$= random error term

4. RESULTS AND DISCSSION

4.1. Result of the Survey

4.1.1 Household Characteristics

The sex, marital status and religion of the participating households are shown in Table 4.The result of the study revealed that male headed household respondents accounted for about 66.7 and 90% in Omo Nada and Seka Chekorsa district respectively. This results indicated that the proportion of female household respondents recorded from Omo-Nada district (33.3%) was higher than that of Seka Chekorsa district (10%). This was due to the bias by the project participant sampling. About 93 and 97% of the household respondents of Omo-Nada and Seka Chekorsa Woreda was reported to be married respectively, indicating that the household respondents of both Woreda were on comparable marital status. About 86.7% of the respondents of Seka Chekorsa district was Muslim and the remaining 13.3 % was OrthodoxChristian, whereas all of the respondents of Omo Nada district were Muslim. The average age of the household respondents was 38.43 years in Omo Nada and 42.5 years in Seka Chekorsa districts showing that the mean age of the household respondents of Omo-Nada district is slightly lower than that of Seka Chekorsa woreda. However the household respondents of both Districts were within the economically productive age group.

Table 4. Sex, age, marital status and religious characteristics of the householdrespondents in Omo Nada and Seka Chekorsa districts**.**

Districts	Sex		Marital status		Religion		Age
	Male	Female	Married	Single	Muslim	Orthodox	
Omo Nada	66.7%	33.3%	93.3%	6.7%	100%	None	38.43
Seka Chekorsa	90.0%	10.0%	96.7%	3.3%	86.7%	13.3%	42.5
Total	78.3%	21.7%	95.0%	5.0%	93.3%	6.7%	40.4

The results of the educational status of the household respondents are presented in Table 5. The analysis of the educational status of the household respondents indicated that 43.3 and 23.3% of the household respondents of Omo-Nada and Seka Chekorsa was reported to be illiterate respectively.

About 46.7% of the household respondents of Omo-Nada Woreda is reported to have completed elementary school education. The results obtained showed that about 57% of the household respondents of Omo-Nada district is capable of understanding written materialsand manualson the basic principle of poultry production. The percentage (23.3%) of illiterate household respondents reported from Seka Chekorsa Woreda was lower than that reported from Omo-Nada Woreda. About 60% of the household respondents of Seka Chekorsa is capable of understanding written materials and manuals on the basic principle of poultry production.

Table5. Educational Status of the household respondents in the study area

Education level of household	Omo Nada	Seka Chekorsa	Total
Illiterate	43.3%	23.3%	33.3%
Read and Write	0.0%	16.7%	8.3%
Elementary	46.7%	26.7%	36.7%
High school	6.7%	30.0%	18.3%
College	3.3%	3.3%	3.3%

The mean family size and the average livestock and land holding of the household respondents of the study area are presented in Table 6. The average family size was 5.3 and 5.9 persons/household for Omo Nada and Seka Chekorsa Woreda respectively. The mean family size of the household respondents of both study Woredas (5.6 persons/household) is comparable to Oromia Regional average, the value of which was 5.6 persons/household as reported byCSA, (2016). The average household livestock holding comprises of 3 oxen and 2.9 cows /household in Omo Nada Woreda and 2.7 oxen and 2 cows/ household in Seka Chekorsa District. The landholding of the study area was about 2.47 and 1.75 hectare/household in Omo Nada and Seka Chekorsa of which 2.01 hectare is arable and 0.46 is grazing land in Omo Nada and 1.49 hectar is arable and 0.26 grazing land in in Seka Chekorsa District respectively.The result of this study revealed that there are about mean of 1.4 and 1.3 Fish ponds in the study area of Omo Nada and Seka Chekorsa Woreda respectively.

Table6. Average family size and livestock and land holding in the study area

Variable	Omo Nada N=30	Seka Chekorsa N=30	Total
family size (persons/household)	5.3	5.9	5.6
Owned livestock/house hold			
number of oxen/household	3	2.7	2.8
number of cows/household	2.9	2	2.4
number of fish ponds	1.4	1.3	1.3
landholding (hectare/household)	2.47	1.75	
arable land (hectare/household)	2.01 ± 0.75	1.49 ± 0.97	
grazing land(hectare/household)	0.46 ± 0.23	0.26±0.21	

The results of the mean chicken holding of the household respondents of the study area is presented in Table 7. Theoverall mean chicken holdingof 21.6 and 31.3 chickens/ household was recorded from Omo Nada and Seka Chekorsa Woreda respectively. The mean total chicken holding (31.3 chickens/ household) recorded from Omo-Nada Woreda was significantly higher ($P<0.05$) than that of Seka Chekorsa.The mean total chicken holding of the two Weredas was 26.18 chickens/household. The mean total chicken holding per household obtained from the current study was significantly higher than that of Meseret (2010), who reported mean chicken holding of 6.23chicken/household from Gomma Woreda of Jimma Zone and that of Matiwos (2012) who reported mean holding of 5.84 chickens/ household from Nole Kaba Woreda of Western Wollega. The mean total chicken holding per household obtained from the current study was also higher than the total chicken holding reported for both Oromia Regional State (3.6 chickens/household) and national average of Ethiopia (4.1chickens/household) as reported by CACC (,2003) and cited by Meseret in (2010).

The relatively higher total chicken holding/ household reported from the current study could be attributed to the outreach and research activity of Jimma University College of Agriculture and Veterinary Medicine in collaboration with FSRE project.

Recently Jimma University College of Agriculture and Veterinary Medicine (JUCAVM) Department of Animal Science with the help of FSRE project distributed large number of Bovan Brown and Koekoek breeds of chickens to Omo Nada and Seka Chekorsa districts of Jimma Zone. The farmers involved in the FSRE project were purposively selected and included in the current study. The indigenous chickens of 6.5and 7.1 /household was recorded for Omo Nada and Seka Chekorsa Woreda respectively. As indicated in Table 7, the exotic chickens holding of 15.1 and 23.9chickens/household was recorded for Omo Nada and Seka Chekorsa Woreda respectively.

Table 7. Average chicken holding and flock structure in the study area

Variable	Omo Nada N=30	Seka Chekorsa N=30	Total
Total chicken holding /household	21.6 ±15.4	31.3±10.6	26.4 ± 14.1
Total indigenous chickens /household	6.5± 7.6	7.1 ± 5.2	6.8 ± 6.3
Total exotic chickens /household	15.1 ± 12.6	23.9± 8.6	19.7 ± 11.5
Bovan Brown breed of chickens / household	5.3 ± 4	15.7 ± 5.5	10.5 ± 7.1
Koekoek breed of chickens / household	3.6 ± 5.3	4.2 ± 3.1	3.9 ± 4.4
total growers holding /household	2.6 ± 2.6	2.5 ± 1.1	2.5 ± 1.8
Total layers holding /household	13.4± 11.8	23.5 ± 8.5	19.86 ± 11.28
Total chicks holding /household	3.8 ± 3.7	3.2 ±2.4	5.4± 2.9
Total cocks holding /household	1.8 ± 2.1	2.1 ± 1.25	3.4 ± 1.7

4.1.2 Survival and Production Performance of the Exotic Breeds

The results of the survival rate of Bovan Brown and Koekoek exotic breeds of chickens rated against the educational levels of the household respondents of both districts are shown in Table 8.There was statistically significant difference ($P<0.05$) in rate of survival of Bovan Brown and Koekoek breeds of chickens attributed to the educational status of the household respondents. The result of this study indicated that illiterate's household respondents reported about 43.1 and 24% survival rate of Bovan Brown and Koekoek breeds of chicken respectively.

As indicated in the study illiterates and medium level educated farmers(read and write and high school) had better bovan and koekoek layer breeds survival rate .This might be because of this farmers take more time devoted on farming than college level farmers. As the study indicates there was no statistically significant difference (P>0.05) in rate of survival of Bovan Brown and Koekoek breeds of chickens attributed to the sex of the household respondents.

Table 8. The effect of Education level and sex on survival of Bovan Brown and Koekoek Breeds

Variable **Education level**	Survival of B. Brown to the age of 2 years	Significance Pr > |t|	Survival of Koekoek to the age of 2 year	Significance Pr > |t|
Illiterate	43.1±2.94	**	24.4±5.4	**
Read and Write	48.3±5.54	**	12.5±10.1	Ns
Elementary	41.7±2.63	**	20.8±4.8	**
High school	37.3±4.0	**	39.2±7.3	**
College	42.3±8.12	**	30.5±14.9	**
Sex				
Male	42.6±2.2	Ns	25.9±4	Ns
Female	42.5±3.8		25±7	

** Significantly different at P< 0.05

The survival rate and egg production performance of Bovan Brown and Koekoek breed of chicken as reported by the household respondents are shown in Table 9. There was significant difference (P<0.05) between Bovan Brown and Koekoek breeds of chickens kept under Seka Chekorsa and Omo-Nada condition in survival rate to the age of two years. Percent of mortality recorded from Koekoek breeds of chickens to an age of two years kept under Seka Chekorsa condition (85.7%) was reported to be higher than that recorded from Koekoek breeds of chickens (63..3%) to an age of two years kept under Omo-Nada condition. According to the household respondents Bovan Brown breed of chickens were distributed in Omo-Nada district during the big rainy season, which might have been contributed to the higher recorded mortality.

The result of this study was in contrary to that of Msami, (2002) who reported that mean flock mortality was higher during the dry season than during wet season.

The egg production performance of Bovan Brown and Koekoek breed of chicken as reported by the household respondents are shown in Table 9. About 96.7% of the household respondents of Seka Chekorsa district reported to have preference for Bovan Brown breed of chickens distributed within the farming community by the project based on their egg productivity. On the contrary about 93.3% of the household respondents of Omo-Nada district reported to have preference for Koekoek breed of chickens distributed within the farming community by the project based on their egg productivity. According to the results recorded from the respondents Bovan Brown and Koekoek breed of chickens performed better under Seka Chekorsa and Omo-Nada local condition respectively.

This result in agreement with that of Solomon, et al (2018) who, reported that household respondent of Dessei selected Bovan Brown breed of chickens over the other improved breeds of chickens in terms of growth rate, number of daily egg production , yolk color, age at first egg and adaptability to the local environment. According to the respondents mean egg production of about 220 per household per month was attained from the production of both Bovan Brown and Koekoek breeds of chickens in Omo-Nada district. Similarly mean egg production of about 247 per household per month was attained from the production of both Bovan Brown and Koekoek breeds of chickens in Seka Chekorsa district.

Table 9. Respondents Preference on Egg production performance, survival rate and Mean egg production/month in the study area.

Districts	Survival rate				Respon. Prefer. On Egg prod. perfor		Mean egg product.
	Breed				Breed		
	Bov.	Significance	Koek.	Significance	Bova.	Koek.	
Omo Nada	28%	**	36. 7%	**	6.7%	96.7%	220 ±23
Seka Chekorsa	56 %	**	14. 3%	**	93.3%	3.3%	247 ±23.3
Total							234±16.3

** Significantly different at P< 0.05

The results obtained in (Table 10) revealed that about 53.3 and 63.3% of the household respondents of Omo Nada and Seka Chekorsa Woreda prefer eggs of local chickens for home consumption respectively. The preference for local eggs over exotic eggs was attributed to the better taste of local eggs than eggs of improved breed of chickens. This result was in agreement with that of Nigussie*et al.* (2010) who reported that the main reason for preference of local chicken meat and eggs over that of the exotic chickens was its perceived good taste. About 21.7 and 20 % of the household respondents reported to have equal preference for both egg of local and improved breeds of chickens respectively. The yellow yolk color of an egg is a function of feed type rather than a function of breed. The color of the two exotic breeds kept under homemade feed in Seka Chekorsa was reported to be fairly yellow in yolk color. Thus the preference for eggs of local chickens might be attributed to psychological makeup and need to be changed in the future.There was no difference in market price between the local and exotic eggs in the study area.

Table 10 Egg preference of consumers and Average egg consumption /hh/month in Seka chekorsa and Omo nada Districts.

Districts	Egg preference of consumers			Ave. Egg consum./hh/month
	Improved	Local	Equally	
Omo Nada	20.0%	53.3%	26.7%	32.9±2.37
Seka Chekorsa	20.0%	63.3%	16.7%	36.6±2.29
Total	20.0%	58.3%	21.7%	34.7±1.6

All the respondents (100%) reported to have used about on average 32.9and 36.6of their total egg production for home consumption in Omo Nada and Seka Chekorsa Woreda respectively(Table 10). The result of consumption per household member against educational level of the household respondents indicates that as the education level increases the mean consumption of Egg also increases. As this study the mean egg consumption at college level was low. This might be because of the number of respondents at college level was very small. The mean egg consumption among the woreda was 8.9 and 9.4 in Omo Nada and Seka Chekorsa respectively. There was no significant difference among the woreda on consumption of Egg per household member. And also there was no significant difference among the sex on consumption of egg per household member.

Even if there was no significant difference among them female leaded household got good egg consumption per household member. The respondents indicated that children's consumption of egg changed after set up of the project and distributions of the exotic breeds of chickens. This result agrees with that of Muchenje *et al., (*2000), who reported that exotic chicken provides relatively fast and major opportunities for increased animal protein consumption and family income of smallholder farmers because of their short generation interval and high rate of productivity.

Table11 The effect of Woreda,Education level and sex on egg consumption per H/M

Variable	consumption of household member mean +SE	Significance
Woreda		
Omo nada	8.9±1.5	Ns
Seka Chekorsa	9.4±1.5	
Education Level		
Illiterate	5.9 ± 1.45	**
Read and Write	10.74 ± 2.7	**
Elementary	8.3 ± 1.3	**
High school	13.4 ± 1.9	**
College	7.5 ± 4	Ns
Sex		
Male	8.7 ± 1.09267928	Ns
Female	9.61 ± 1.88336297	
OVERALL	20.15 ± 2.57	

** Significantly different at P< 0.05

PHM = per household member

4.1.3 Market access of the household respondents

The results of analysis made for market access of the household respondents are presented in Table 12. The results of analysis made for market access to buy production inputs and sale poultry product indicated that all (100%) the respondents of both districts reported to have good access to sell eggs but had poor market access in buying poultry production inputs at woreda level. The majority of the participating household respondents were purposely selected from the nearest Keble's with road accessibility in the woreda, which made them accessible to the available market for the sale of eggs. All the basic inputs required were provided by the JUCAVM and FSRE project during the period of the project.

However, the household respondents lack market access in purchasing the required poultry production inputs including commercial feed. There were no private dealers or cooperatives providing inputs in the vicinity of the study area, thus the result of this study showed poor market access for poultry production inputs in both Omo Nada and Seka Chekorsa districts.

The practice of selling of eggs (Table 12) indicated that about 93.3 and 26.75% of the household respondents reported to sell their eggs to retailers in Omo Nada and Seka Chekorsa district respectively.. The result of this study was in agreement with that of Dasalew (2010), who reported that about 34 and 50% of the household respondents of Ada'á and Lume districts sell their eggs to local shop keepers. The others sell eggs at village market and about 6.7% of the household respondents of Seka Chekorsa sell to local shop keepers. The study indicates that as total 60% of respondents sell eggs for retailers. This might be because of road accessibility of kebeles involved in the project. All the household respondents reported to sell their eggs at a time they are in need of money in both districts.

Table12. Market accessof the household respondents in the study area

Variable	Omo nada	Seka Chekorsa	Total
Practice of selling Eggs			
Village market	6.7%	66.6%	36.7%
local shopkeepers	0.0%	6.7%	3.3%
Retailer	93.3%	26.7%	60%
Market Access			
To buy inputs	0%	0%	0%
To sell eggs	100%	100%	100%

4.1.4 Extension and Credit service in the study area

The results of the status of extension and credit service in the study area are presented in table 13. The results of this study indicated that all of the household respondents (100%) in both districts were got extension service and training on poultry production. This might be because of that all the selected household respondents were given orientation and training on poultry production and proper follow up of the project. On the contrary, there has not been credit service for poultry production in both study woreda. If the farmers got the access of credit it is better for continuity of this work for future.

Table13 Extension and credit service in the study area

Districts	N	Extension service	Training	Credit Service
Omo Nada	30	100%	100%	0%
Seka Chekorsa	30	100%	100%	0%

4.2 Comparative performance of Bovan Brown and Koekoeke Layers on Homemade and Commercial ration

4.2.1 Egg Production

The mean daily egg production of Bovan Brown and Koekoek breeds of chickens fed on commercial ration (during the first 4 months) and homemade ration (during the last 2 months) is shown in Table 15.The study indicated that 0.34 and 0.23 eggs per hen per day was recorded from Bovan Brown and Koekoek breed of chickens fed on commercial ration during the first month of feeding respectively. The results obtained showed that the daily egg production recorded from the group of Bovan Brown fed on commercial ration was higher ($P>0.05$) than that of Koekoek breed of chickens during the first month of feeding. The daily egg production of Bovan Brown fed on commercial ration showed an increase gradually over time and attained production of 0.70 eggs/hen/day on the 4^{th} month of the study period. Similarly mean daily egg production of Koekoek breed of chickens fed commercial ration showed increase in production gradually with time and attained production of 0.63 eggs/day on the 4^{th} month of the study period. The Bovan Brown fed on commercial ration produced at the mean daily rate of 0.54 egg/day /bird during the 4 months of feeding period, while the Koekoek placed on commercial ration produced at the mean daily rate of 0.42 egg/day /bird during the 4 months of feeding period.

Thus the results obtained indicated that the egg production of Bovan Brown fed on commercial layers ration was higher ($P<0.05$) than that of Koekoek breed of chicken during the entire study of 4months.This might be because of difference in genetic potential of the breeds.

Both of the two exotic breed of chickens were switched over to homemade ration at the end of the 4-months of the study period. Mean daily egg production of 0.66 and 0.60 eggs was recorded from Bovan Brown and Koekoek breed of chickens fed on homemade ration during the first month of feeding respectively. The Bovan Brown placed on homemade ration produced 0.65 egg/day /bird during the 2 months of feeding period, while the Koekoek placed on homemade ration produced 0.60 egg/day /bird during the 2 months of feeding period. The results of this study showed that there was increase in productivity of both breeds up to four months of the study period. During the next two months, during which the chickens were fed on homemade ration, there was slight decrease in the number of eggs laid/hen/months. This slight decrease might be because of vitamins. This result was higher than that of Solomon, et al (2018), who reported mean annual egg production of 189.2eggs/hen/year `which means 0.51/hen/day from Bovan Brown kept under semi intensive management condition.

Table14. Egg production performance of Bovan Brown and Koekoek chickens fed on commercial and homemade ration in Seka Chekorsa District.

Feed	month	Breed	Age of bird in days	Number of eggs laid/ hen/month	Mean of Egg laid/ day	Significance
				Mean		
Commercial Feed	march	Bovan brown	26	10.2	0.34	**
		Koekoek	30	6.9	0.23	
	April	Bovan brown	30	13.6	0.45	**
		Koekoek	34	9.7	0.32	
	May	Bovan brown	34	20	0.66	**
		Koekoek	39	15	0.5	
	June	Bovan brown	39	21	0.7	Ns
		Koekoek	43	19	0.63	
Homemade feed	July	Bovan brown	43	20	0.66	**
		Koekoek	47	18	0.6	
	August	Bovan brown	47	19	0.63	Ns
		Koekoek	51	18	0.6	

** Significantly different at P< 0.05

The study result indicates that there was significant difference among the kebeles.As indicated in Table 16 the mean eggs laid /month in Alaga was 190 and in Sakela the mean eggs laid/ month was 212. This different might be because of difference in management among the farmers.

Table 15 Mean of Eggs laid per month in Alaga and Sakela Kebeles.

Kebele	eggs laid/month		Significance
	Mean	SE	
Alaga	190.53	6.74	**
Sakela	212.76	6.74	

4.2.3 Survival Rate (Mortality)

The mean mortality recorded from Bovan Brown and Koekoek breeds of chickens placed on commercial and homemade rations over the feeding period of 6 months are shown in Table 17. The results obtained showed about 2.43 and 1.4% of mortality was recorded for Bovan Brown and Koekoek breeds of chickens placed on commercial ration respectively. The result obtained also revealed that 2.3 and 1.3% of mortality was recorded from Bovan Brown and Koekoek breeds of chickens fed on homemade ration respectively. The results of this study showed no feed effect on the mortality recorded. During the study period when disease outbreak occurred sicked birds were isolated and treated, the action of which saved the experimental birds from complete devastation. Coccidiosis was the major disease that affected the birds. Disease sign that was manifested during the study period included poor appetite, fall down head, bloody dihaerria and coughing. This result of this study was in agreement with that of Kinung'hi *et al*. (2004), who mentioned coccidiosis as cause of death in small scale intensive poultry production.

Table16 Mortality rate of Bovan Brown and Koekoek fed on commercial and homemade ration.

Breed	Commercial Feed	Homemade feed
Bovan brown	2.43	2.3
Koekoek	1.4	1.3

4.2.4 Egg Quality Characteristics

The internal and external egg quality characteristics of the Bovan Brown and Koekoek breeds of chickens is shown in Table18.The result showed that egg weight of 57.2 and 49 g was recorded for Bovan Brown and Koekoek breeds of chickens respectively. The results obtained revealed that the mean egg weight recorded for Bovan Brownwas ($P<0.05$) higher than that of Koekoek. There was no statistically significant difference between the two breeds studied in yolk height and yolk weight.

The albumin height of Bovan Brown 7.5 mmwas higher than that of Koekoek 6.9mm without showing statistically significant difference among each other's.

Yolk color score value of 9.1and 9.2 was recorded from eggs of Bovan Brown and Koekoek respectively. This result was in line with that of Demeke (2004) who reported that yolk color is a function of feed but not the function of breeds. The mean albumin weights of eggs of Bovan Brown breed of chicken was higher than that of Koekoek ($P<0.05$). The observed significant difference might be due to breed difference and hence low egg weight of Koekoek breed of chickens, since egg weight influences the weight of its components, especially that of egg albumen and yolk. The result of this study was in agreement with that of Zhang*et al.* (2005); Aygun, and Yetisir (2010). The mean Haugh units of 87.3and 86was reported for Bovan Brown and Koekoek respectively The average eggshell thickness measured for Bovan Brown and Koekoek chickens were 0.34and 0.3respectively.

The eggshell thickness of Bovan Brown was significantly higher than that of Koekoek breed of chickens ($p<0.05$).This result was in agreement with that of Desalew (2012)who reported that the average egg shell thickness of Koekoek chicken was significantly lower than that of Bovan Brown.

Table17: Egg quality traits of Bovan Brown and Koekoek in Seka Chekorsa district.

No	*Traits*	Bova Brown N=40 Mean ±SE	KoekoekN=32 Mean ±SE	Significance
1	Egg weight (g)	57.2± 0.8	49±0.5	**
2	Yolk height, (mm)	16.6± 0.2	15.7±0.3	Ns
3	Albumin height (mm)	7.5± 0.2	6.9± 0.2	Ns
4	Yolk weight (g)	15.7±0.3	15.6± 0 .17	Ns
5	Yolk color	9.1± 0.04	9.2 ± 0.07	Ns
6	Albumin weight (g)	34.5±0.8	27.2 ± 0.4	**
7	Haugh Unit	87.3±1.3	86 ±1.3	Ns
8	Shell thickness (mm)	0.34 ±0.7	0.30 ± 0.5	**

4.3 Cost Benefit analysis in running poultry business in Seka CheKorsa at farm level

The results of partial budget analysis of Bovan Brown and Koekoek breeds of chickens place on commercial ration (during the first 4 months) and homemade ration (during the last 2 months) is shown in Table19.The market price of commercial ration during the study period was 730 ETB/ quintal and on average 76.16kg worse 555.96 ETB is required for a duration of one month.

Similarly the market price of homemade ration was estimated to be 842.1ETB/quintal and on average 68.41kg worse581.89 ETB is required for a duration of one month. The result of partial budget analysis of this study indicates that about192.5ETB/ month could be obtained as net profit upon feeding commercial ration at household level. On the other side 320.7 ETB / month could be obtained as net profit upon feeding homemade ration at household level. The results of the economic feasibility study reveals that there was net profit difference of birr 128.2 ETB/ month between the use of commercial and homemade ration at household level.

Table 18. Partial budget Analysis of Commercial and Homemade poultry rations

Commercial Feed		TVC	Income items	TNI	Net proit	Homemade feed			TVC	Income items	TNI	Net proit
Cost items						Cost items						
Feed+tran.	Labor		Egg			Feed(Soyabean=40birr/kg, maiz=5/kg, Limestono=3.2/kg salt=10/kg	Trans.	Labor		Egg		
555.96	400	955.96	382.85	1148.5	192.5	581.89	30	400	1011.89	444.2	1332.6	320.7

tran=transport cost, TVC= total variable cost and TNI=total net income.

5. CONCLUSION AND RECOMMENDATIONS

A Survey study conducted in Omo Nada and Seka Chekorsa woreda and On Farm study was done in Seka Chekorsa Woreda of Jimma Zone. The study was conducted with the following objectives evaluating adaptive and productive potential of Bovan Brown and Koekoek exotic breeds of chickens distributed these two Woredas of Jimma Zone, A total of 60 Households who received Bovan Brown and koekoek breeds of chickens distributed by JUCAVM were purposively identified in both Seka Chekorsa and Omo Nada Weredas of Jimma Zone. In parallel, a total of 16 farmers were purposively selected for On Farm monitoring study and Bovan Brown and Koekoek exotic breeds were distributed to each farmer. Before starting the study all farmers and development agents were trained how to manage the chicken properly and make homemade feed for the chicken and also development agents were trained how to record data.

The results obtained revealed that percent of mortality recorded from Koekoek breeds of chickens to an age of two years kept under Seka Chekorsa and Omo Nada were 85.7% and 63..3% respectively. According to the household respondents Bovan Brown breed of chickens were distributed in Omo-Nada district during the big rainy season, which might have been contributed to the higher recorded mortality. There was statistically significant difference ($P<0.05$) in rate of survival of Bovan Brown and Koekoek breeds of chickens attributed to the educational status of the household respondents. As indicated in the study illiterates and medium level educated farmers (read and write and high school) had better bovan and koekoek layer breeds survival rate than college level farmers. About 96.7% of the household respondents of Seka Chekorsa district and 93.3% of the household respondents of Omo-Nada district reported to have preference for Bovan Brown and koekoek breeds respectively based on their egg productivity.

The respondents reported to have used about on average 32.9±2.37and 36.6±2.29 of their total egg production for home consumption in Omo Nada and Seka Chekorsa Woreda respectively. The mean Egg Consumption among the woreda was 8.9 and 9.4 in Omo Nada and Seka Chekorsa respectively. There was no significant difference among the woreda on consumption of Egg per household member.

The experimental result indicates that Bovan Brown at the mean daily rate of 0.54 egg/day /bird and the Koekoek produced at the mean daily rate of 0.42 egg/day /bird during the 4 months of feeding commercial ration. Thus the results obtained indicated that the rate of production of Bovan Brown placed on commercial layers ration was significantly higher ($P<0.05$) than that of Koekoek breed of chicken during the entire study of 4months.This might be because of difference in genetic potential of the breeds. The next two months Bovan Brown produced mean daily rate of 0.65 egg/day /bird and koekoek produced mean daily rate of 0.60 egg/day /bird when they placed on homemade ration. The slight decrease during homemade feed might be because of vitamins.Internal and External egg quality trait indicates there were significance difference ($p<0.05$) on egg weight, albumin weight and shell thickness. With suppermass of Bovan Brown.The results of the economic feasibility study reveals that there was net profit difference of birr 128.2 ETB/ month between the use of commercial and homemade ration at household level. There seems to be an additional profit of 128.2 ETB/month upon feeding homemade ration.

Since the economic feasibility study indicates homemade ration had better profit for farmers, practicing by using Vitamin pre-mixes is necessary for future to overcome the slight decrease in egg production during homemade feed in this study.The results of this study tends to suggest the following recommendations.

- Development Agents and extension staffs should give focus for the continuity of this work .
- Since there are no cooperatives done on commercial feed farmers should practice on homemade feed for poultry feeding by using Vitamins Pre-mixes.

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7. APPENDICIES

7.A Appendix tables

Appendix Table 1

Table1. Survival rate of koekoek

R-Square	Coeff Var	Root MSE	KOKsurvival2Year Mean
0.614682	80.49790	20.39280	25.33333

Source	DF	Type III SS	Mean Square	F Value	Pr > F
woreda	1	4141.70323	4141.70323	9.96	0.0027
EducH	4	2692.39960	673.09990	1.62	0.1839
sex	1	7.17159	7.17159	0.02	0.8960
HHN	1	294.41196	294.41196	0.71	0.4041
NTBIRDLE	1	20840.58160	20840.58160	50.11	<.0001

Table2 Survival rate of Bovan Brown

R-Square	Coeff Var	Root MSE	BOVsurvival2Year Mean
0.898708	26.45093	11.11083	42.00543

Source	DF	Type III SS	Mean Square	F Value	Pr > F
woreda	1	6462.76451	6462.76451	52.35	<.0001
EducH	4	409.77260	102.44315	0.83	0.5124
sex	1	0.04887	0.04887	0.00	0.9842
HHN	1	4.32628	4.32628	0.04	0.8522
NTBIRDLE	1	11570.52987	11570.52987	93.73	<.0001

Table3 Consumption rate per household

R-Square	Coeff Var	Root MSE	RateconsPHM Mean
0.521898	65.25896	5.486036	8.406563

Source	DF	Type III SS	Mean Square	F Value	Pr > F
woreda	1	2.6275181	2.6275181	0.09	0.7688
EducH	4	294.9250587	73.7312647	2.45	0.0578
sex	1	6.1076549	6.1076549	0.20	0.6543
HHN	1	829.7997821	829.7997821	27.57	<.0001
NTBIRDLE	1	31.8252342	31.8252342	1.06	0.3087

Table4 Daily Egg Production Record for Bovan Brown.

Date	March		April		may		June		July		August	
	Eggs collect	Ave ggs/day	Eggs collect	Av.per day	Eggs collect	Av.per day	Eggs collect	Av.per day	Eggs collect	Av.per day	Eggs collect	Av.per day
1												
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25												
26												
27												
28												
29												
30												
Total of Eggs												
Total of Birds												

Table5 Daily Egg Production Record for Koekoek.

Date	March		April		may		June		July		August	
	Eggs collect	Ave ggs/day	Eggs collect	Av.per day	Eggs collect	Av.per day	Eggs collect	Av.per day	Eggs collect	Av.per day	Eggs collect	Av.per day
1												
2												
3												
4												
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26												
27												
28												
29												
30												
Total of Eggs												
Total of Birds												

7.2 Disease (Symptom) and Mortality Record Format

Table5 Mortality Record Format

Date	March		April		may		June		July		August	
	Bovan Br.	Koekoek	Bovan Br.	Koekoek	Bovan Br.	Koekoek	Bovan Brown	Koekoek	Bovan Brown	Koekoek	Bovan Br.	Koekoek
1												
2												
3												
4												
5												
6												
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30												

Disease(Symptom)

Disease	Symptom	breed		Date
		Bovan Br.	Koekoek	

7.3. **Questionnaire Format**

Remainder to enumerators

1. Make brief introduction to each farmer before starting any question, get introduced to the farmers (greet them the local way) get his/her name and tell yours, the institution you are working for, and make clear the purpose and objectives of your question.

2. Please ask each question so clearly and patiently until the farmer understands.

3. Please fill up the questionnaire according to the farmers replay (do not put your opinion).

4. Please try not to use technical terms while discussing with farmers and do not forget the local unit.

Enumerator's Name_____Date _____

A. Demographic Characteristics of the Households in the Study Area

1. Name of Village/Peasant Association

_____

2. Name of household head_____Sex:_____Age_____

3. Marital status of the respondent 1= single 2= married

4. Family size? 1. Male_____2. Female_____3. Total_____

5. How many members of the household are?

A. below age 15 B. 16-29 C. 30 -50 D. Above 51

6. Level of education of the household head? 1. Illiterate 2. Read and write 3.Elementary School 4. High School 5. College /University education

7. Ethnicity A.Amhara B.oromo C.Tigre D.Other_____

8. Religion A. Muslim B. Protestant C. Orthodox D. Other_____

9. Land size? Please indicate the available land in the following table.

No	**Land type**	Land Unit	
		Hectare (ha)	Local measurement
1	Arable land		
2	Grazing land		
3	Unutilized land		
	Total		

11. Does the household have any of the following animal (circle) Yes No How many?

1. Oxen 2.cows 3. Horse/ mule 4.Goat/ sheep 5. Chickens

6. Donkey 7. Fish

B. Breeds Adopted

1. How many birds do you have?
1.1. All _____

1.2. Indigenous (cocks____ hens _____ pullet _____chicks ___)

1.3. Exotics (cocks _____ hens _____ pullet _____chicks _____)

1.4. Crossbreds (cocks _____hens ____pullet _____chicks _____)
2. Which exotic breeds did you own
A.Koekoek A. cocks_____ B.hens_____
B.Bovan Brown A. cocks_____ B.hens_____
3. Which type of exotic breeds
A) Layer B) Dual purpose

C. Source of breed:

1. Purchased from Govt./Pvt. Hatchery 2. Provided from agriculture research center
3.Provided from NGO's 4. Hatching of eggs naturally at home

2. For what purpose they are distributed ?
A) For breeding

B) Laying to increase egg production

C) For meat yield
3.Would you compare the performance exotics vs. local? a. yes b. No.
4. If yes, which one is good? a. exotics b. Indigenous
5.Which breed is more adaptive? A. Koekoek B. Bovan Brown
6. Preference of people toward exotic breeds egg and meat
A) High B) medium C) low
6.1Why?
A) _____
B)_____
C)_____

D. Egg Production Performance

1.Approximate age of sexual maturity age at first lay for local ----------months
2. Approximate age of sexual maturity age at first lay for exotic breeds

A. Bovan Brown_____ Months B.Koekoek_____ Months

3. Total number of eggs laid/bird/year (months/ weekly based info too)

a. Koekoek _____b. Bovan Brown _____

4. Which breed is more productive A. Koekoek_____ B. BovanBrown_____

E. Marketing (Products and production input)

1. Do you have market access to buy poultry production inputs? 1. Yes 2. No

2. Where do you buy poultry production inputs? 1. NGO 2. Government 3. Private companies 4. If others (Specify) _____

3. Do you have market access for your poultry products? 1. Yes 2. No

4. When do you sell your poultry products? (Time of selling) 1. Personal money requirement 2. During holydays and festivals

3. If others (specify) _____

5. To whom are you selling your poultry products? 1. Village market 2. Local shop keepers

3. Selling at own doorstep 4. Retailer 5. Whole sellers

6. If others (specify) _____

6. How many Eggs do you sale per month?

7. Which breed type egg is most preferred by consumers? 1. Eggs from improved breeds

2. Eggs from local chicken 3. Equally preferred

8. Write your reasons for Q.6 responses?_____

9. Is there price difference

A. Yes B. No

F. Extension service

1. Do you have access to the extension service? 1. Yes 2. No

2. If you say No for Q.1, state the reasons? 1. Have no heard of them 2. Cannot easily reach them 3. There is no need 4. If others (specify) _____

3. How frequently do you see the extension agent? 1. Once in a week 2. Once in two weeks 3. Once in a month 4. Not Seen

4. Do you discuss your production problems with extension agents? 1. Yes 2. No

5. Have you ever got any training on poultry production? 1. Yes 2. No

6. If yes, for Q. 5. When? 1. Before starting the business 2. After the business started

7. Did you get credit service in poultry business? 1. Yes 2. No

8. If yes, for what purpose did use the credit? 1. Day old chicks 2. Poultry feed 3. Poultry equipment 4. If others (specify) _____

G. Adaptation and survival statistics

1. How many birds did you get from the project?
   A.Koekoek_____ Bovine Brown_____
2. How many birds do you have now?
   A.Koekoek_____ Bovine Brown_____
3. Is there birds mortality? How many birds?
4. Which breed is your preference based on there adaptation and survival?
   A.Koekoek_____ Bovine Brown_____

H. Role of Project

1. When do you get poultry from project? _____

2. Which breed did you get? A. Koekoek B. Bovan Brown C. Both

3. Are there productive for egg or meat production? _____

4. Did you get enough production from them? A. yes B. no

5. Which Breed is more productive? A. Koekoek B.Bovan Brown

6. Is there productive difference when compare to other exotic breeds?

A. Yes B. No if yes how much in months/ weeks/years etc

7. Are there adaptable to the environment? A. yes B. no

8. If Q.7 is yes which breed is more adaptable? **A**. Koekoek B. Bovan Brown

9. After getting these breed from the project is any change in consumption of poultry product among family? A. yes B. no

10. How many eggs for home consumption per month?

11. Is there difference in children consumption of poultry products before and after project set up? A. Yes B. No

12. If yes in what way_____

13. Is there any difference in income?_____benefit

In what way_____

14. Are women have got benefit from the project? A. yes B. no

15. If Q. 12 is yes in what way_____