

# **Past, Present and Future Perspectives of Animal Sciences Graduate Thesis Research: The Case of Alemaya University**

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## **Abstract**

This study was initiated based on the author's experience both as a student and instructor in the Animal Science graduate program of Alemaya University (AU). Masters theses published by graduates of the Department of Animal Sciences of AU from 1981 to 2005 were analyzed in terms of subject area, livestock species, subject area within livestock species, and gender of graduates to assess the type and nature of M.Sc. theses published by Animal Science graduates of AU in the last 25 years and to highlight scope for future livestock research. The number of M.Sc. graduates from the department has increased three-fold from 6 students in 1981 to 19 in 2005. Male and female graduates accounted for 95.6% and 4.4%, respectively of the total graduates. The most studied livestock species was cattle (31%) followed by poultry (17.6%), sheep (13.2%) and goats (9.6%). Camels (4.4%) appeared to be the least studied species indicating that many aspects of camels remain to be investigated. The most researched discipline was animal nutrition (33.1%) followed by animal breeding (19.9%), and characterization of livestock production systems (14%). Processing and preservation of animal products (5.1%), animal health (4.4%), draft animal power (2.2%) and animal physiology (0.74%) were given little attention and hence deserve detailed research in the future. The difference observed in the number of researches conducted in each subject area could be attributed to lack of subject matter specialists and laboratory facilities to conduct specific experiments in some fields of study and also due to inadequate financial resource to conduct theses research in the areas which are not well addressed. Thus, the Department of Animal Sciences needs to revise its human resource development and capacity building plans and strengthen its relationship with different national and international institutions to broaden its research programs through multidisciplinary and multi-institutional collaboration.

**Keywords:** Alemaya University; Department of Animal Sciences; Ethiopia; Livestock species; M.Sc. thesis research

## **Introduction**

Ethiopia possesses 34.5, 22.5, 17, 55.8, 8.6 and 1 million heads of cattle, sheep, goats, chicken, equines and camels, respectively (ILRI, 2000). Despite the huge livestock resources, the contribution of the livestock sector to the national economy is limited. The livestock sector contributes about 18.8% to the total Gross Domestic Product (FAO, 2003) and about 40% to the Agricultural Gross Domestic Product (Getachew Feleke, 2003) of the country while it contributes about 31% of total employment (Getachew Feleke, 2003). The total annual production of meat, milk and eggs in the country was estimated at 653.6, 1197.5 and 75.6 thousand metric tones, respectively in the year 2000 and the annual growth rate of these products was estimated to be 1.3, 2.1 and 0.3%, respectively (FAO, 2003).

Various factors contributed to the under development of the livestock sector in the country one of which is shortage of well-trained professionals in the area of animal sciences. Successful development of the livestock sector in the country calls for highly trained professionals in modern animal husbandry and management techniques. It is, therefore, essential that in countries where the livestock sector is to be developed, manpower requirements need to be assessed at the early stages of development planning and steps should be taken to establish appropriate training facilities. Thus, intensive training programs in animal sciences aimed at producing high caliber, capable and dedicated professionals are of paramount importance in countries with developing animal agriculture.

It was to meet this demand for trained manpower in the livestock sector that the graduate program in Animal Sciences was launched in the then Alemaya College of Agriculture as part of the Addis Ababa University graduate program in 1979 (Tilahun Jiffar, 1987; AU, 2004). Until 2004, the Department of Animal Sciences of Alemaya University (AU) was the only higher learning institution in the country that offers M.Sc. training in Animal Sciences (AU, 2004). The M.Sc. program consists of both course work and research based thesis. Till recently, the Animal Science graduate program has been offered in two fields of study viz., animal production and animal breeding. However, currently with the initiation of two additional programs, animal nutrition and range ecology and management, the M.Sc. programs in the department increased to four (AU, 2004).

Every year increasing number of students join the Animal Sciences graduate program. The author's experience as a student, instructor and member of the Departmental Graduate Council (DGC) shows that graduate students are often confronted with problem of identifying research areas for their M.Sc. thesis work. This is mainly attributed to the absence of systematically organized and well-documented information retrieval systems either in the AU library (Belay Kassa, 2004) or in the Department of Animal Sciences. As a result, students often come up with a topic very similar to an earlier work done by their predecessors. Moreover, because of lack of reference materials, the DGC usually faces problem while approving M.Sc. thesis titles submitted by graduate students.

Assessing and analyzing the nature of M.Sc. theses research published so far by Animal Science graduates of AU would be of paramount importance in examining the type and nature of masters thesis research that has been undertaken, understanding the trends in the direction of research in the various aspects of animal production and helping to develop strategies for future livestock research. It will help students and researchers identify research areas that have been thoroughly studied and those that have been given little attention and it will also highlight future animal science research direction. This in turn will avoid repetition of experiments and will save time wasted in search of new research areas.

Analysis of M.Sc. theses published so far in the livestock sector could also contribute to the documentation system of the AU library in particular and to the livestock research directory of the country in general. Besides, it will facilitate the decision making process of the DGC of the department during thesis proposal approval. This study will also provide feedback information that would help the department to strengthen its graduate program. Other sister institutions which currently launched graduate programs in animal sciences would also benefit in identifying research areas. Moreover, the information generated would be useful in the design of appropriate curriculum for the Animal Science graduate program. The objectives of this study were, therefore, to assess and analyze the type and nature of M.Sc. theses published by Animal Science graduates of AU in the last 25 years and to highlight scope for future livestock research.

## **Methodology**

List of M.Sc. theses published by Animal Science graduates of AU over the last 25 years (1981-2005) was used for this study. In addition, to determine theses published on socio-economic and marketing aspects of the livestock sector, M.Sc. theses published by graduates of Agricultural Economics from 1981-2005 were examined. The data was obtained from the School of Graduate Studies of AU and the M.Sc. theses reserved in the library were referred to verify the specific field of study to which each thesis belongs. To avoid overlap of field of study for some theses, only the major themes of such theses were considered in categorizing these theses by subject areas. Descriptive statistics was used to analyze the data.

## **Results and Discussions**

### **Masters graduates of the Department of Animal Sciences**

Figure 1 presents the number of M.Sc. students graduated from the Department of Animal Sciences from 1981 to 2005. Over the 25 years period, the number of graduates from the department has increased three-fold, from 6 students in 1981 to 19 in 2005 (Appendix 1). The increase in the number of graduates in recent years could be attributed to the change in the education policy of the country. Recently, the minimum grade point average required to join the graduate programs of AU decreased from 2.5 to 2.0. The increased number of graduate students in recent years could also be attributed to the increase in the number of B.Sc. graduates in the field of animal sciences in the country and fierce competition for jobs among the graduates which in turn necessitated graduates to upgrade their qualifications. The initiation of different fields of specializations at a graduate level by the department might also have partly contributed to the increased enrollment of graduate students in the department.

Although the department has played a significant role by training highly qualified livestock professionals for the various stakeholders in the country during the last 25 years, the country's need for trained manpower in the livestock sector is not yet fulfilled. The country's demand for well-trained agricultural professionals is still very high and supply has continuously fallen short of demand (Belay Kassa, 2004). The national demand for M.Sc. degree holders in agricultural sciences was estimated at 445 per year (Belay Kassa, 2004); however, currently the country produces less than 100 graduates per year. In the 2004/2005 academic year, the total number of

students graduated with M.Sc. degree in agricultural sciences from AU was 75 (AU, 2005) and until 2004 AU was the only higher learning institution in the country that offers M.Sc. training in agricultural sciences (AU, 2004). This high demand offers a great opportunity to the department and hence the department needs to strengthen and further diversify its graduate program.

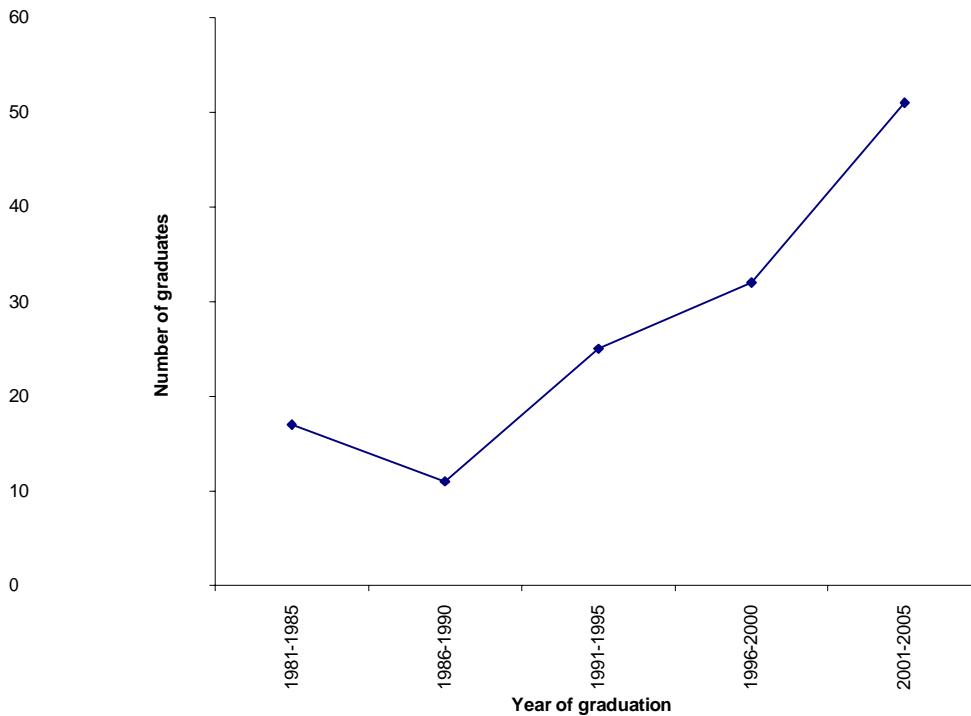


Figure 1. Trends in the number of M.Sc. graduates from the Department of Animal Sciences (AU) from 1981-2005 (N = 136) (AU = Alemaya University)

### **Distribution of thesis research by livestock species**

Figure 2 illustrates distribution of M.Sc. theses published by Animal Science graduates over the last 25 years by livestock species. Among the major livestock species, cattle were the most studied species. This finding is inline with that reported by Azage Tegegne (1998) in which he analyzed the type and nature of research articles published during 1987-1997 in the proceedings of the Ethiopian Society of Animal Production and found that cattle were the most studied (36%) species. Given their large number and high contribution in

the country, the relatively large number of studies on cattle is expected. Although more studies have been conducted on cattle relative to other livestock species, the research done so far is not exhaustive and it hasn't significantly increased the productivity of cattle in the country (Knips, 2004). Thus, more demand-driven and applied research needs to be conducted on cattle in the future.

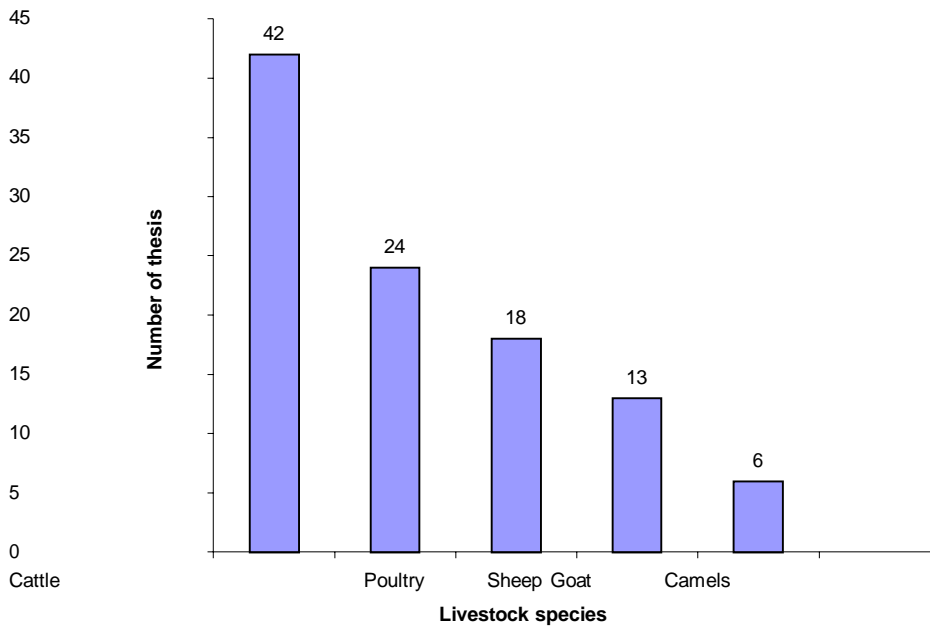


Figure 2. Distribution of M.Sc. theses published by Animal Science graduates over the last 25 years by livestock species

Poultry were the second most studied species after cattle (Fig. 2). In view of their large number and potential contributions especially to the resource-poor farmers, the studies conducted so far on poultry are not exhaustive. Thus, there are still many unstudied aspects that could potentially be addressed by AU graduate students.

For many of the rural poor farmers in the country, small ruminants provide a number of advantages over other livestock species. Although a number of researches have been conducted on small ruminants in the country, in view of the large number and contribution of goats and sheep, still much remains

to be studied. Thus, more and detailed scientific research needs to be conducted on small ruminants and their products in order to exploit their full potential.

Despite the huge potential of the camel in human food production in the arid and semi-arid lowlands of the country, camels are the least explored species and until recently little research and academic attention has been given to this important domestic animal. This calls for an urgent attention to the camel and conduct an in-depth research so as to increase the productivity of camels and to scale-up their contribution towards food self-sufficiency in the country.

#### **Distribution of thesis research by subject areas**

Figure 3 presents livestock thesis researches published by AU graduates during the period 1981-2005 by major subject areas. Of the total Animal Science M.Sc. theses published over the last 25 years, 33.1% were on animal nutrition while 20% were on animal breeding and reproduction. The higher number of theses published in the area of animal nutrition in relation to other subject areas is not because animal nutrition is the most pressing problem of the country as compared to other subject areas. A possible reason could probably be the availability of subject matter specialists in the department who could guide and advise graduate students and the relative convenience to conduct nutrition research with the available facilities in the department as compared to other disciplines. The Department of Animal Sciences had PhD holders in animal nutrition since the inception of the graduate program. Currently too, the number of PhD holders in the department in animal nutrition is greater than those with similar qualifications in the other disciplines. In the 2004/2005 academic year, the department had eight PhD holders (AU, 2004) of which 3 (37.5%) were in animal nutrition. On the other hand, the department currently faces a critical shortage of staff in poultry science and animal breeding and genetics (Tessema *et al.*, 2004). The foregoing indicates the importance of having qualified academic staff in the various fields of study. Thus, the department needs to make strategic human resource development plan to increase the number of qualified staff in the various fields of study.

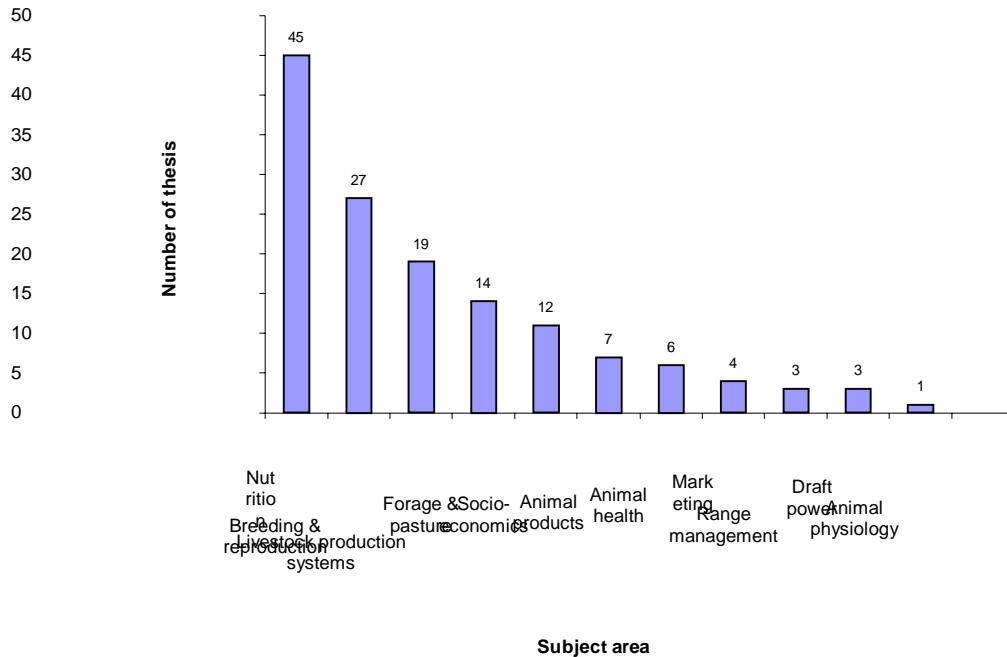


Figure 3. Distribution of livestock theses published by AU graduates over the last 25 years by major subject areas (Theses on socio-economics and marketing were by graduates of the Department of Agricultural Economics)

Following nutrition, breeding was the second most studied area in the department (Fig. 3). Postgraduate program in animal breeding was launched in the 1989/90 academic year (Belay Kassa, 2004) and most of the breeding theses were published since 1992. Expatriate staff mainly from Sweden, were in charge of this program. The theses published so far focused on breed characterization and analysis of secondary data collected over the years in various state farms across the country. No thesis was published in the area of molecular genetics and biotechnology. This could partly be attributed to the lack of trained staff and facilities in the department. Thus, it is high time for the department to seriously think about this and devise a means so as to provide graduate students an opportunity to do their thesis research in this direction.

Mere increase of production of meat, milk and other animal products could hardly bring the desired development in the livestock sector. To bring about a significant progress in the livestock sector, much attention needs to be



given to the production, collection, handling, transportation, preservation and distribution of animal products in the country. Post-harvest losses of animal products are generally high in most African countries. Considering milk alone, 20 to 80% of the milk produced in East and Central Africa is wasted through post-harvest losses (ILRI, 2005). Appropriate processing and preservation techniques could significantly reduce post-harvest losses of animal products. So far, however, little work has been done in the area of animal products processing and preservation by AU graduates (Fig 3). Among the theses published in the area of animal products, four were on dairy products, two were on meat and one was on eggs. In Ethiopia, the export of hides and skins is the second most important source of foreign exchange earnings after coffee (Knips, 2004). However, no research was done on hides and skins by graduate students of the department and so was the case with poultry meat, wools and hairs. The opening of the Department of Food Science and Postharvest Technology in the University (AU, 2004) is a good opportunity to graduate students to conduct their thesis research in the area of animal products processing and preservation because they will get subject matter specialists who will guide them while conducting their thesis research.

Except one work on dairy cattle physiology, no research was done on the physiology of goats, sheep, poultry and camels by Animal Science graduate students (Fig. 3). Although such studies might have been done elsewhere in the country, given the diverse climatic and agro-ecological zones of the country, much remains to be done by AU graduate students.

Among others, disease is an important factor which hinders the productivity of the livestock sector in the country. However, over the last 25 years only five theses were published in the area of animal health (Fig. 3). In fact, one may argue that animal health research is the duty and responsibility of graduates of veterinary science and the mandate of animal science graduates is mainly on the production aspects of domestic animals. In a way this might be true but animal health research should not be left only to veterinary graduates. There is a wide scope for animal science graduates to do research on animal health in relation to various production parameters and this aspect could probably be better handled by animal science graduates than veterinary graduates. Hence, more research needs to be carried out in this direction.

The most common farming system in Ethiopia is smallholder mixed crop-livestock farming (Knips, 2004). Animal traction is the major source of power used for crop cultivation by millions of smallholder farmers in the country and cattle are kept for ploughing (Knips, 2004). However, only three studies have been conducted on draft animals by AU graduate students so far (Fig. 3) indicating that draft power is one of the neglected areas of research and certainly deserves due attention. Similarly, only three studies have been conducted on range management by AU graduates to date (Fig. 3). Since the department launched M.Sc. training on range ecology and management (AU, 2004), more studies on range management are expected to be conducted by AU graduate students in the future.

Studies on socio-economic and marketing aspects of livestock and their products have not been done by Animal Science graduates probably because graduates of the Department of Agricultural Economics do their thesis research on these aspects of the livestock sector and probably because Animal Science graduates lack a strong background to conduct such studies. Examination of M.Sc. theses published by graduates of the Department of Agricultural Economics has shown that very few studies (a total of 16 theses) have been conducted on socio-economic and marketing aspects of livestock and livestock products (Fig. 3). The development of effective and efficient livestock marketing systems is essential to improve and sustain the livelihood of poor livestock producers in the Horn of Africa (Knips, 2004). Thus, there is a pressing need for more and detailed scientific research on socio-economic and marketing aspects of the various livestock species and their products.

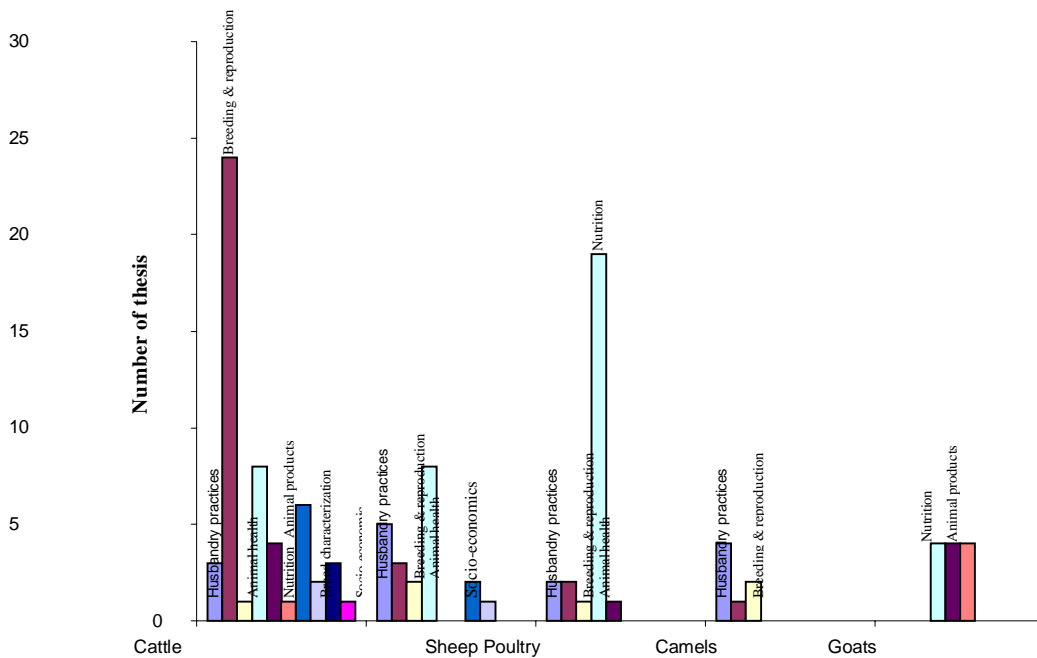
#### **Distribution of thesis research by subject area within livestock species**

**Cattle:** Figure 4 shows the distribution of M.Sc. theses by subject area for the major livestock species. In the case of cattle, the most studied field was breeding followed by nutrition. On the contrary, breeding was the least studied area in goats, poultry and camels. The possible reason for more study on cattle breeding could be the availability of breeding data collected over the years in the various state farms across the country.

Though prevalence of disease is one of the major factors affecting the productivity of cattle in the country, it is not given due attention. This is evidenced by the fact that only a single thesis was published in this aspect to

date (Fig. 4). The opening of Faculty of Veterinary Medicine in the University (AU, 2004) is a good opportunity for our graduate students to conduct their thesis research in the area of animal health because they can get subject matter specialists to guide them during their thesis research. Hence, more research needs to be conducted in the area of animal health in the future.

Most of the studies conducted on cattle so far focused mainly on dairy traits and very few on beef. Although meat and milk are the major food products obtained from cattle, only few studies have been conducted on these products. To date, only three studies were conducted on cow milk while no research has been done on quality aspects of cattle meat by AU graduates. Thus, research on milk and meat from cattle need to be given due attention.



**Subject areas within livestock species**

Figure 4. Distribution of M.Sc. theses published by Animal Science graduates over the last 25 years by subject area for the major livestock species (Theses on socio-economics & marketing aspects were published by Agricultural Economics graduates)

**Goats and sheep:** Except for the few breed characterization studies, no research has been done on goat breeding (Fig. 4). Similarly, no study has

been conducted on goat health problems. Thus, these aspects are potential areas for research. So far, only two studies each were done on goat milk and goat meat. Hence, further and detailed investigations need to be conducted on the processing and preservation of goat products.

To date, few studies have been conducted on sheep breeding and reproduction by AU graduates (Fig. 4). Moreover, very few studies have been conducted on sheep products such as milk, meat and wool in the country. Hence, there is an urgent need to conduct detailed research on quality parameters of products from sheep.

Trends of the last 25 years of thesis in AU indicated that the main research interest so far has been increasing the productivity of small ruminants, while research on marketing and product improvement is lagging behind. The contributions of goat and sheep milk to human nutrition and health have received little research attention. Therefore, research is needed to identify and promote marketing of the unique values of dairy products from goat and sheep milk.

**Poultry (Chicken):** Nutrition appeared to be the most researched field of study in the case of poultry (Fig. 4) whereas no research has been conducted on poultry breeding and characterization of the indigenous breeds of chicken by AU graduates. Moreover, only one study was conducted each on poultry health and egg quality so far. On the contrary, no study has been conducted on quality parameters of poultry meat indicating that these areas very much deserve detailed investigation.

**Camels:** By virtue of their unique anatomical and physiological adaptation to the arid and semi- arid environments, camels are the most important domestic animals that determine the survival of millions of pastoralists in the arid and semi-arid lowlands of the country. However, camels are the least explored species. Until recently, no research and development attention has been given to the camel along with development programs of other livestock species in the country. Many aspects of camels remain to be investigated. Very little, if any, research has been done on camel nutrition so far by AU graduates. Similarly, no study has been conducted on processing and preservation of camel milk and milk products and on quality parameters of camel meat and meat products. Even the few studies conducted on husbandry practices, health and breeding (Fig. 4) of camels are far from

adequate. In general, much remains to be done about the camel in the country.

### **Distribution of thesis research by gender of graduates**

Of the total graduates of the department, 95.5% were male, and female graduates accounted for only 4.5% of the total graduates. Due to the current policy reform on gender equity by the Ethiopian Government, the number of female students joining the Animal Science graduate program is increasing in recent years. In the 2004/2005 academic year alone, nine female students joined the Animal Science graduate program. This is a tremendous increment as compared to only six students during the last 25 years. The recent trend of the University to sponsor female graduate students (Belay Kassa, 2004) will encourage more female students to join the graduate program of the department.

### **Conclusion**

Among others, lack of facilities and inadequate financial resource to conduct thesis research are reasons for the less involvement of our graduate students in the areas which are not well addressed. Thus, the University in general and the Department of Animal Sciences in particular need to linkup and strengthen their collaboration with different national and international institutions and scientists to give their graduate students an opportunity to broaden their thesis research area through multidisciplinary and multi-institutional collaboration.

Although almost all of the AU Animal Science MSc theses contain important and publishable results, the information contained in most of these theses has not been published and thus not accessible for use by the scientific community. Hence, the Department of Animal Sciences and the University in general should devise a means and encourage graduate students to publish the results of their thesis research work.

Areas such as processing and preservation of animal products, animal health, draft animal power and animal physiology and animals such as camels were given relatively little attention by our graduate students. Thus, attention should be given to and detailed research needs to be conducted in order to address problems associated with the relatively neglected animal species and/or subject areas.

Some of the students joining our graduate programs are self-sponsored and do not have fund to undertake their thesis research work. As a result, they desperately pickup any topic when they find a potential sponsor. Thus, in an effort to give more emphasis to research areas which have not been given attention, the Government or non-government organizations involved in development work should devise a strategy to provide financial support to graduate students planning to conduct their thesis research in the areas that are not well addressed.

Given the significant role of women in livestock production and management in the country, efforts should be made to increase the enrollment of female students in our graduate programs.

### **Acknowledgements**

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## **Appendix 1. List of M.Sc. theses published by Animal Science graduates of AU from 1981 to 2005\***

### **1981**

- 1. Alemu Yami.** 1981. Laboratory Evaluation of Nutritive Value of Some Feedstuffs in the Alemaya Woreda. 81 pp.
- 2. Azage Tegegne.** 1981. Reproductive Performance of Pure Zebu Cattle and their Crosses with Temperate Breeds in Ethiopia. 98 pp.
- 3. Gebrekiros Asegede.** 1981. The Study of Ovine Helimenthiasis in Awassa and the Effect of Control with Nilzan. 65 pp.
- 4. Maaza Sahle.** 1981. Comparative Laboratory and Animal Evaluation and Estimation of Protein Supplementation Value of Noug (*Guzotia abyssinica*) and Peanut (*Arachis hypogea*) Seed Cake. 71 pp.
- 5. Mekonnen Lemma.** 1981. Evaluation of Noug Meal Versus Groundnut Meal as Protein Source in Calf Starter Rations. 46 pp.

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\* Arranged alphabetically within a year.

6. **Tsegaw Belay.** 1981. Comparative Laboratory and Animal Evaluation and Estimation of Calcium Supplementation Value of Bone Meal, Egg Shell Meal and Lime Stone. 115 pp.

**1982**

7. **Amanuel Tuku.** 1982. The Feeding Value of Sisal Waste for Fattening Borena Steers. 93 pp.
8. **Tilahun Jiffar.** 1982. Pathophysiological Studies on the Infectability of Coccidian Parasite (*Eimeria tenella*) to the Water Strain of Domestic Ethiopian Chicken (*Gallus domesticus*). 56 pp.

**1983**

9. **Tesfaye Ayelew.** 1983. The Performance of Black Head Ogaden Sheep Fed Poultry Litter and Monensin. 144 pp.

**1984**

10. **Girma Abebe.** 1984. Laboratory Evaluation of Lime Treated Maize Cobs and Feeding Value of Lime Treated Maize Cob Based Diets. 88 pp.
11. **Negussie Bussa.** 1984. The Use of Tritiated Water to Estimate the Kinetics of Body Water in Lactating Borena Cows Under Ranch Condition. 86 pp.
12. **Solomon Demeke.** 1984. Comparative Laboratory and Animal Evaluation of the Protein Quality of Atella and Noug Seed Cake and their Supplementary Interrelationship. 80 pp.
13. **Solomon Mogus.** 1984. The Nutritive Value to Sheep of Post Harvest Sorghum Panicles Sprayed with 4% Urea, or Ensiled with either 2% Slaked Lime or 4% Fertilizer Grade Urea. 69 pp.
14. **Tegene Negese.** 1984. Digestibility of Poultry Litter and its Influence on the Performance of Beef Cattle. 122 pp.
15. **Woldu T/Debessai.** 1984. The Mineral Content of Some Herbage Found in Jijiga. 178 pp.

**1985**

16. **Ali Beker.** 1985. Laboratory and Animal Evaluation of the Nutritive Values of Atella and Brewers' Dried Grains Supplemented to Grower-Chicks Rations. 75 pp.



17. **Zinash Seleshi.** 1985. Protein Quality Evaluation of Dagussa (*Eleusine coracans*) and Gibto (*Lupinus albus*) and the Supplementary Value of Gibto when Added to Dagussa. 102 pp.

**1987**

18. **Fekadu Beyene.** 1987. Composition and Quality of Milk Delivered to Addis Abeba Milk Plant and the Effect of Transportation on Quality. 94 pp.
19. **Getachew Gebru.** 1987. Laboratory Evaluation of the Effects of Processing Method and Treatment on Chemical Composition and *In vitro* Digestibility of Coffee Pulp. 79 pp.
20. **Mekonnen H/Mariam.** 1987. Evaluation of Growth and Reproductive Performance of Borana Cattle and Their Crosses with Friesian at Abernossa. 151 pp.
21. **Teshome Shenkoru.** 1987. Nutritive Value, Dry Matter Yield and *In-Vitro* Dry Matter Digestibility as Affected by Cutting Interval and Fertilizer Application on Native Natural Pasture Growing on Three Soil Types at Alemaya University of Agriculture Campus. 184 pp.

**1988**

22. **Adnan Beker.** 1988. Evaluation of the Nutritive and Supplementary Values of Brewer's Dried Grains in Layer Poultry Ration. 87 pp.
23. **Yalemshet W/Amanuel.** 1988. Evaluation of Protein Quality and Supplementary Value of Brewers Dried Yeast and Noug Seed Cake in Chick- Starter Ration. 69 pp.

**1989**

24. **Eyob Haile.** 1989. The Nutritive and Supplementary Value of Malt Barley By-Products in Chick-Starter Diet. 73 pp.
25. **Sisay Asres.** 1989. Survey of the Tick Fauna and its Control on Crossbred Dairy Heifers Using Permethrin Impregnated Cattle Ear Tags at Abernossa, Ethiopia.

**1990**

26. **Amha Kassahun.** 1990. Evaluation of the Nutritive and Supplementary Values of Noug Seed Meal (*Guizotia abyssinica*) in Commercial Broiler Chicks Ration. 165 pp.

27. **Fikre Abera.** 1990. The Mineral Composition and Effect of Bole Local Natural Lick Supplementation on Feed Intake, Digestibility and Weight Gain of Black-Head Ogaden Sheep. 195 pp.
28. **Niftalem Dibissa.** 1990. On-Farm Study of the Reproductive and Growth Performance of the Menz Sheep in Debre Brehan, Ethiopia. 103 pp.

**1991**

29. **Diriba Dabar.** 1991. The Study of Nutritive and Supplementary Value of Different Levels of Brewers Dried Grains in Starter Chicks Rations. 76 pp.
30. **Zewdu Sisay.** 1991. Effects of Watering Frequency on Water Budget, Feed Intake, Nutrient Utilization, Body Weight Change and Subsequent Survival of Black Head Ogaden Sheep. 226 pp.

**1992**

31. **Abdinasir Ibrahim.** 1992. Growth Performance of Crossbred Dairy Cattle at Asella Livestock Farm, Arsi, Ethiopia. 103 pp.
32. **Aschalew Tsegahun.** 1992. Effects of Frequency of Clipping and Nitrogen Fertilization on Dry Matter Yield, Nutrient Composition and *In Vitro* Digestibility of Four Improved Grasses Under Irrigated Condition. 76 pp.
33. **Asheber Sewalem.** 1992. Evaluation of the Reproductive and Prewaning Growth Performance of Fogera Cattle and their F<sub>1</sub> Friesian Crosses at Andassa Cattle Breeding Station, Ethiopia. 100 pp.
34. **Beniam Akalu.** 1992. Productive Performances of Adal and Blackhead Somali Sheep under Irrigated Conditions at Melka Werer. 93 pp.
35. **Enyew Negussie.** 1992. Reproductive Performance of Local and Crossbred Dairy Cattle at the Asella Livestock Farm, Arsi, Ethiopia. 140 pp.
36. **Gashaw Geda.** 1992. Assessment of Feed Resource Base and Performance of Crossbred Dairy Cows Distributed to Smallholder in The Selale Dairy Development Project Areas. 171 pp.

**1993**

37. **Alemayehu Reda.** 1993. Characterization (Phenotypic) of Indigenous Goats and Goat Husbandry Practices in East and South –Eastern Ethiopia. 149 pp.
38. **Kidane Gebremeskel.** 1993. Effect of Cutting Date on Botanical Composition and Nutritive Value of Native Pasture in the Central Ethiopian Highlands. 117 pp.

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