
Variations and Profitability of Bishoftu Cattle Milk Production

African Dairy Genetic Gains (ADGG)

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Personal Background

Growing up, almost my entire life has been spent in rural small towns and agriculture. As a youth and still today my life has revolved around a show ring. I showed pigs, horses, and of course my favorite; cattle. My summers were spent traveling around the state of Iowa and showing cattle. We spent the non-summer months preparing for even more shows. A few years ago, my family and I began to show nationally at various shows such as the American Royal in Kansas City, MO and the National Western Stock Show in Denver, CO. My passion truly lies within cattle and I am so thankful to have been given a life with an abundance of calves.

Throughout high school, I was rigorously involved in several activities. FFA and basketball turned into my main extracurricular activities. But, after two serious knee injuries in basketball, I turned to the National FFA Organization. It is in this organization where my love for agriculture fully blossomed. In the Spring of 2016, my FFA advisor presented me with a new opportunity, the Iowa Youth Institute. He told me to write a paper on world hunger, go to this institute, and receive a scholarship sponsored by Iowa State University. So, I did and I absolutely loved it. Everyone was so intelligent and working diligently towards the end of hunger. It was like a new path, that God wanted me to go on. One thing that really stuck out to me was the opportunity to be a Borlaug-Ruan International Intern. That became my new goal.

In the Fall of 2016, I was selected to attend the Global Youth Institute. There my understanding of the world and my deepest want to make a difference was sparked. Listening to scientists, World Food Prize Laureates, and my own peers really showed me that we can all make a difference. As the time drew near to apply for the Borlaug-Ruan Internship, I knew that I had to take that leap of faith. Though I was not fully sure what I would be getting myself into, I just had to trust in God that this was what was right for me. When I found out that I was selected to be a 2017 intern at the International Livestock Research Institute in Addis Ababa, Ethiopia, I knew that God was planning something great.

With my background in cattle and utter love for the species, I was so blessed to be given a project on African Dairy Genetic Gains (ADGG). I worked with Dr. Olivier Hanotte on the variations of cattle milk production in the Bishoftu (Debre Zeit) area. My focus was on the environmental factors that are key effects on milk production for the farmers and their families in this area. I also worked with Dr. Jean Hanson focusing on the economic profitability and nutrition of these same dairy farms.

I am so glad that I took that leap of faith to become a Borlaug-Ruan Intern. I was very intent on going to Iowa State University into the fall to major in animal science and focus on livestock reproduction. But, because of my time spent at ILRI and in Ethiopia, my eyes were opened to so many more opportunities that I did not know were possible. I have a new found passion for genetics and nutrition in livestock. I do not know what my future holds, but I know that all I have to do is take that leap of faith.

About ILRI

The International Livestock Research Institute (ILRI) is a CGIAR research center headquartered in Nairobi, Kenya and co-hosted by the Government of Ethiopia in Addis Ababa. ILRI offices stretch from East, South, and Southeast Asia, All parts of Africa, and Central America. ILRI works with programs from all over the world to increase food security and alleviate poverty, mainly in Africa and Asia.

ILRI's mission is to improve food and nutritional security and to reduce poverty in developing countries through research for efficient, safe, and sustainable use of livestock - ensuring better lives through livestock. [Vision]

ILRI envisions a world where all people have access to enough food and livelihood options to fulfill their potential. [Vision]



African Dairy Genetic Gains (ADGG) is a project funded by the Bill and Melinda Gates Foundation initiated in 2015 by the International Livestock Research Institute. The main goal of the project is to bring more milk productivity to dairy cattle in Africa. The importance of milk as a commodity throughout Africa along with the population increase supports the need for more productive dairy cattle. The economic standpoint of dairy production holds that a large majority of the cost comes from feed and forage. A questionnaire was created to survey Bishoftu area farmers on their management practices as well as their inputs and outputs. By looking at the management practices in place and the individual costs, key factors affecting dairy milk production as well as the profitability associated with the dairy production has been identified. Data was collected on genetics, environment, management practices, and economic inputs and outputs. The collected data were analyzed to compare the differences between the cattle, management practices and the individual profitability of the dairy production. The results from the questionnaire have helped support the hypothesis that better management practices will lead to better milk yield. As a follow-up, blood samples will be taken to assess the genome of the various cattle throughout the ADGG project areas. Combining genetic and environmental data, ILRI scientists should be able to identify the genotype for the best local dairy production.

Milk Production in Ethiopia

Cattle are the main source of milk production in Ethiopia. In areas around the country, camels and goats also add to milk production. However, cattle are the main source of milk production for the country. Milk yields have gone up substantially, tripling, within the last fifteen years. Even the government is playing a role and planning to double milk yields by the year 2020 for domestic export. [Opportunities]. Ethiopia is increasing yields yet the country still needs more education and knowledge to be able to attain the highest yields possible.

Key Factors Affecting Milk Production

There are several factors that affect milk yields. Some of the biggest effects being daily management, feed and genetics. Some farmers have been able to receive guidance and follow models on how to create the best system for their cattle and themselves whereas the majority has lacked in that assistance. The main reason behind these factors that affect the milk production is due to the lack of knowledge.

Feed

Feed contributes for 70% of a farms inputs [Hanson, Jean]. Since the inputs of feed is relatively high, it is important for farmers to make appropriate choices for their cattle. In Ethiopia, there are many agro-industrial byproducts available thus making them popular choices for feed. Noug cake is a popular choice for feeding dairy cattle due to the high protein that is left over after the extraction of the oil from the *Guizotia abyssinica* seed [Little, 1987]. Wheat bran is another protein-rich feed ingredient. Because of the lower cost of the bran, there has been slightly increased net returns compared to other ingredients in place of it. Corn silage is another well-liked feed ingredient for dairy cattle. For the cows, it offers a high starch content and a large amount digestible energy although it lacks in protein. Bone meal is also an added feed ingredient because of the calcium and phosphorus it offers especially for dairy cattle [V., Heuzé]. It is very important for the correct amount and type of feed to be given to the cattle for the best possible yields.

Roughages are necessary for all ruminant animal diets, including dairy cattle. The rumen within the stomach of the cows needs a coarse fiber, e.g. roughage, to rub the walls of this stomach compartment. This action encourages the microorganisms in the rumen to full break down the feed consumed [Roughages]. It can be concluded from the questionnaire that elephant grass, varieties of straw, and grass hay are all widely used for roughage in cattle diets within the Bishoftu area.

Management

In dairy operations, good management is imperative and it is a term that encompasses several aspects. A major factor that requires substantial management is feed. Dairy cows need feed for maintenance and/or growth as well as production [Irshad, 2015]. It is also very important to know the signs and indications of when female cattle are in heat, particularly when artificial insemination is being used. The sooner the cow's heat cycle is noticed, the earlier that cow can be bred, thus a sooner calf and lactation period [Signs]. There must also be consistency with the timing of feed. Especially with the timing of calving, cattle respond depending on they are fed

[Selk, 2011]. A cow milked at equal intervals, will yield more milk compared to those not milking at equal intervals [Irshad, 2015]. A common disease that disrupts milk production is mastitis. This disease spreads by bacteria through the teats of the cow's udders [Mastitis]. Proper prevention in the cows is obligatory to defend against such diseases.

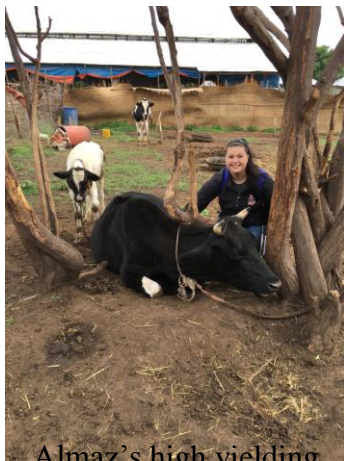
Genetics

In Europe and the United States, the Holstein breed has become well known as one of the highest milk producing dairy cattle breeds. In Europe, prior to the Holstein breed, the breeds of cattle were predominantly a Friesian type [Oltenu, 2010]. Through cross-breeding over the years, the Holstein Friesian is one of the most popular breeds that has spread throughout Europe and other developing countries, including Ethiopia. The local Ethiopian indigenous breed, e.g. Boran breed, are known for disease resistance and are better adapted to Ethiopia's climate. The one major issue with the local breeds is the very low milk production, averaging 1.69 liters of milk each day [Gates, 2017]. With the Holstein Friesian crossbred breed that was brought to this country, milk production yields have boosted. There has been a genetic improvement with the crossbreed between the Holstein Friesian and indigenous breeds. This has allowed farmers to reach higher milk yields. However, these exotic breeds require more management and feed in order to keep them high-producing [Chebo, 2012]. The exotic breeds have allowed Ethiopia to begin increasing their milk yields yet, there is still a need for increased knowledge on how to properly manage these crossbreds.

Bishoftu Area Dairy Farms

The following farms were categorized into different size levels. Small farms owning 1-5 head of cattle, medium farms owning 6-19 head of cattle, and large farms owning more than 20 head of cattle. One quintal of feed is equivalent to 100 kg and 23 birr is equal to 1 USD. The data responses were collected from a questionnaire to be analyzed on profitability and the factors that affect the milk yields. The profitability aspect is estimated using daily milk yield averages and other dairy operation related costs.

Almaz Dairy Farm



Almaz's high yielding cow.

A small dairy herd with only three head of cattle, Almaz dairy farm is averaging 20 liters of milk a day from only one Holstein Friesian crossbred milking cow. Almaz, the owner, owes her feed ingredients to the high production. Four kilograms of wheat short, wheat bran, noug cake, and a mixed roughage of elephant grass and cabbage residue are being fed every day to the milking cow. Along with selling the milk, she also sells eggs, and cabbage at the market. From the cattle, she has been able to use the manure as fertilizer for her vegetable crop. She would like to expand her dairy herd with the two heifer calves she currently owns and start a vaccination program to combat sickness.

For a small dairy farm, an average of 20 liters a day is exceptional. Though dairy is not Almaz's main source of income, it is definitely a good start for a secondary source. From selling the milk at 14 birr per liter she would make around 280 birr a day, given an everyday average of 20 liters. For feed, she spends an average of 794 birr per quintal. From one quintal, she is able to feed the cattle for 20 days. This would result in purchasing feed every 3.5 weeks. The cost of veterinary services and any medication average 250 birr per month. With the cost of veterinary service and feed, the expenses for the cattle per month equal out to be 1, 838 birr. With average sales of 8,400 birr per month from milk sales, the profit is 6,562 birr. In the future, Almaz will end up purchasing more feed to support the growth of the calves as well as increasing the use of veterinary services for a vaccination program. As the calves begin to start milking, the profit will heighten for Almaz and her dairy production.

Alfa Fodder

Alfa Fodder Dairy Farm is one of the largest in all of Ethiopia. The 433 head of cattle are of purebred Holstein Friesian bloodlines that were imported from Holland. With a large amount of livestock there comes a need for higher technology and efficiency. Currently, the cows are being milked three times daily, essentially every eight hours, by a machine operated system. The average milk yield is 24 liters from each cow, each day. The milk is sold privately as well as to a milk processor, Holland Dairy. Manure from the cattle is used for fertilizing the corn fields which are used to make corn silage as feed for the cows. The total mixture of feed is made of brewery by-product, corn silage, minerals imported from Holland, and salt. A roughage of straw and hay is also fed. The ingredients were chosen because it is natural as well creates a high-

quality milk. The farm primarily uses sexed heifer semen to continue growing the progeny of high milk producers, however, when bulls are born on the farm, the best bulls are sold to the National Artificial Insemination Center (NAIC) to have semen collected and distributed throughout the country. The rest of the bulls are sold for meat purposes. In 2015, Alfa Fodder actually lost almost half the herd of cattle to foot and mouth disease. After the loss of so many cows, the biosecurity on the farm tightened and more precise safe keeping was placed on the dairy farm. Since the outbreak, no cattle have died from a disease.

The profitability of the farm is very high due to some of the best milk producing genetics as well as an updated precise farm management. There is also extra income from selling manure for fuel and the bulls for semen collection as well as for market. Per week, the farm is spending 200,000 birr on feed. That's about 462 birr for each cow for the week. The veterinarian costs were worked out in Holland before coming to Ethiopia and the labor costs vary per job. Currently, they are selling the milk produced for 14 birr per liter to Holland Dairy and 19 birr per liter privately. The money made from milk sales cover the cost of machine upkeep, labor, veterinary services, feed, and shelter costs. Any profit goes into expendable income to improve the farm either with new technology or adding to the herd.

Aster Worku

The second largest dairy farm is Aster Worku with 93 head of dairy cattle. All of the cattle are of the Holstein Friesian cross bloodlines. Every day, two times a day, the 32 milking cows are milked by hand. The average amount of milk produced daily per cow is about 16 liters. The head manager at Aster Worku has chosen to use feed ingredients of wheat bran, wheat short, brewery by-product, noug cake, bone meal, and vitamins for high milk production. The feed mixture is also very available all year long. The farm also grows alfalfa and elephant grass as roughage for the cattle. As a disease preventative, a vaccination program is in place and there have been few problems with sickness. The manure is also being utilized as fertilizer for the forages grown.

Profitability of the farm can be inspected from various points. The milking cows are receiving 10 kg of the mixed concentrate which costs 581 birr per quintal. The farm roughly feeds about 5 quintals of feed per day, for the cows and calves, and feeds 150 quintals of feed per month. The cost of feed per week is 87,150 birr. Veterinary services are also administered by the supervisor. The only veterinary costs that occur are the vaccinations at 1,300 birr for all the cattle. The cost per month for the cattle is 88,450 birr. There are also added costs for labor and shelter costs. Nonetheless, with selling the milk at 13 birr per liter, the farm can expect to earn around 199,680 birr per month and making a profit of around 111,230 birr which covers labor and other possible costs. The farm is currently performing quite well and is actually increasing the average of milk yield throughout time.

Azu Dairy Farm

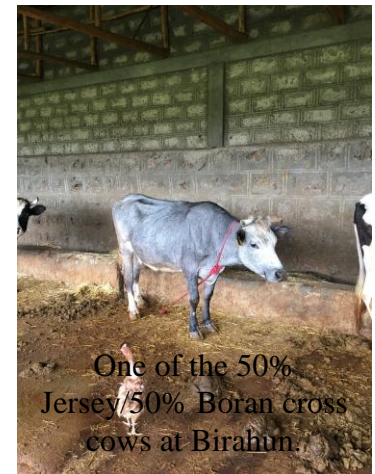
Azu Dairy is another large farm with 22 head of Holstein Friesian cross cattle. The 17 milking cows are milked all by hand, two times a day. All of the milk collected is sold for 13 birr per liter. The cattle are receiving a pre-mixed feed of soybean, corn, wheat short, wheat bran, and vitamins. This feed mix is only seasonally available so it is bought in mass amounts when available. The cattle also receive a roughage mixture of straw and hay grown on the farm. The amount of feed given is based on the production, approximately a half kg for every liter. The

feed was chosen due to the high quality of the feed and the boost in milk production. Azu Dairy wishes to grow their own ingredients but with a lack of land and equipment, buying is next best option for the farm. Any bulls born on the farm are used for bull replacement or mainly for the market. Veterinary services are also permanent to administer vaccines regularly and maintain health.

Per month, the cost of a veterinary visit is 3,000 birr and the vaccines costing 500 birr. The cost of feed is 650 birr per purchase. Being that the feeding amount is based on the production, it can be assumed that 9 kg of concentrate is fed for the average milk yield of 18 liters a day. The farm would need 4,590 kg a month based on the average milk yield and feeding amount. The milk is currently being sold for 13 birr per liter. Based off of the average milk yield, the average money earned per month is about 119,340 birr. After the costs of veterinary services, feed, and labor the profit is used for the benefit of improving the farm.

Birahun

Birahun, a medium sized farm with seven total head of cattle, is comprised of five Holstein Friesian and two Jersey/Boran crosses. The owner of the farm lives in the United States and has entrusted his main farmhand to run the operation. Currently, the cows are being milked two times a day by hand. The 7 cows are only averaging 10 liters of milk a day. The feed is made up of wheat short, wheat bran and noug cake as well as a roughage of grass hay and wheat straw. The cattle are being fed based off of their production. If the cow averages 10 liters, they also receive 10 kg of feed during the day. The farm is starting to face several problems. There has been sickness, such as mastitis, spread through the cattle. The veterinarian when needed does not always show up and any medicine administered is not of a high-quality import. The cattle are staying sick rather than getting better. Another way the sickness has spread is through poor biosecurity. There is no disinfectant for shoes as well as a lack of regular cleanliness in the cattle stalls. There is also a loss of a valuable source of the manure. The farmhand is choosing to simply throw it out rather than you using it for fuel or fertilizer. The farmhand admitted to his lack of knowledge in the dairy field.



It was suggested to acquire a new, consistent veterinarian with trusted medication as well as initiating proper biosecurity practices to maintain the cow's health. As for the feed, the farmhand is currently spending 275 birr per quintal of feed. If each of the seven cows is regularly producing 10 liters a day, that's 70 kg of feed per day. That's around 2,100 kg of feed per month with a bill of 5,775 birr. Another recommendation for the farm would be to give the cattle half the amount of what they are producing. If they produce ten liters of milk, they will receive 5 kg of feed concentrate. For current profitability, the cost of the veterinarian services and medication is 650 birr per month and with the added cost of feed, the farm is spending around 6,425 birr. The milk is sold at 12 birr per liter and if only five cows are currently producing 10 liters daily, the money earned is 18,000 birr. The profit for the farm is 11,575 birr. If the recommendations were put in the place, there would be an increase in milk productivity, healthier cattle, and a more steady flow of income.

Birhanie

With fifteen head of Holstein Friesian crossbred cows, this medium sized farm is averaging 7 liters of milk per cow, per day. Currently, there are 9 cows and 6 heifers with any bull calves being sold at market. Currently, the milk is being sold to be processed for sale. With the money earned from selling the bull calves and selling the milk, a feed mixture is bought made of wheat short, wheat bran, and noug cake. The cattle are also receiving a roughage made up of teff straw. With a shortage of land, the farmer is faced with having to buy the feed ingredients rather than growing their own. The ingredients were chosen based on the availability of the markets all year-round. The farmhand was unsure of the prices for each ingredient but the cows are being fed the concentrate two times a day and the roughage four times a day with the amount based on the first weight of when the calf was born.

From the feeding and management practices, it is presumed that the concentrate for the cows is not enough nutrients for the cows to maintain a high milk yield. From a profitability standpoint, the average price the farm sells the milk for is 13 birr per liter. That would be 819 birr for one day worth of milk. But, with the cost of feed based on the prices from various markets around the area, the average price for the feed is around 900 birr per quintal. It can be concluded that a higher nutritional value of feed mix will lead to higher milk yields. With more productive yields, the owner can see more return on the cattle and thus a better ability to purchase high-quality feed and even expand the herd size for even more profit.

Charnet

This medium sized farm consists of 19 Holstein Friesian cattle with 9 milking cows that average 13 liters of milk each day. The feed was chosen because of its availability as the only option. The mix consists of wheat bran, wheat short, noug cake, bone meal, and vitamins. The owner wishes to grow all their own feed ingredients but because of a shortage of land and lack of processing facilities, the ingredients must be bought. The cattle are receiving 5 kg of the mix each day. The manure from the cattle is used as a fertilizer for the cattle's straw roughage and also as fuel for the home. Any bulls born on the farm go directly to the market after 7 days. During the rainy season, the cattle face sickness but a reliable veterinarian is accessible for treatment.

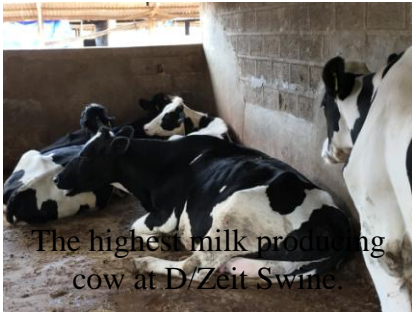
From the profitability aspect, the feed is costing around 25,080 birr each month at 880 birr per quintal. With the monthly cost of feed and veterinary service at 400 birr per cow, the monthly cost is 32,680 birr. The farm is currently selling their milk at 14 birr per liter. With 9 milking cows producing around 13 liters a day would equal out to an income of 45,630 birr. The total profit after expenses is 12,950 birr. In the future, it would be recommended to look at other available feed ingredients or mixtures that could boost the milk productivity for an increase in overall profitability.



Surveying the owner of Charnet on his management practices and inputs/outputs.

D/Zeit Swine

Debra Zeit Swine farm focuses primarily on the market of swine but also owns 44 head of Holstein Friesian dairy cattle as well as a large number of broiler chickens. The current set of 36 milking cows is milked three times a day, either by hand or machine, and average 14 liters of milk. The feed ingredients are bought at the market and mixed on the farm. The concentrate is made up of wheat bran, wheat short, molasses, salt, yeast as well as the byproduct of barely. The cows receive 8 kg of the concentrate and 10 kg of barley byproduct each day. On farm there is corn being grown for silage in addition to elephant grass and alfalfa. The farm also utilizes natural breeding and artificial insemination (AI). If the cow does



The highest milk producing cow at D/Zeit Swine.

not conceive through AI, a clean-up bull is used impregnate the cow thus leading to higher conception rates.

With a large, diverse farm there are several different sectors that lead to high profitability. The dairy operation is currently spending 6,000 birr a month on a veterinarian for all three animal species. That can estimat to 2,000 birr being spent on the dairy cattle. The feed ingredients vary in price but average 450 birr per quintal. With 18 kg of feed being fed each day, the monthly cost is 106,920 birr. From selling the milk at 14 birr per liter, if each cow were to produce 14 liters daily, the money earned would be 258,720 birr. The overall profit equals out to be 149,800 birr. There is also the cost of labor, electricity, and machine upkeep which is compensated through the profit from veterinary and feed costs.

Elvera Farm

Elvera Farm, a large scale dairy producer, owns 68 head of cattle of the Holstein Friesian breed and 4 head of cattle of a Jersey and Boran cross. Currently, this farm is completing their own experiment of cattle management with four milking cows. The cows have a special area that is half cement and half stalling with bedding. These cows are free to walk around the pen and have access to tthrough for feeding. The owner wants to compare the milk yields of these penned cows to the milk production of his cows currently on cement throughout the day and released into a pen at night. If the cattle involved in this experiment increase their milk yields, the farm will completely switch to the half stall and half cement pen. Currently, the 34 milking cows average 11.5 liters of milk a day. The present yields are what elicited the on-farm experiment. The owner also explained that he chose the feed mix of wheat short, wheat bran, noun cake, brewery byproduct, corn, and salt for better milk production. The cattle are fed up to 10 kg of feed depending on their yields and as low as 4 kg for the lowest producing cows. There is also alfalfa and elephant grass being fed as roughage to cattle that are grown on the farm along with corn. The manure from the cattle is used as fertilizer for the crops. The farm also has a permanent veterinarian that visits at least once a day every week to ensure herd health.



How the workers at Elvera Farm milk, two times a

The costs of the farm vary but the average feed costs were unknown. As for the veterinary costs, every month is 2,000 birr for the service and 80 birr per vaccination shot. The farm has been able

to be highly profitable with proper management and establishing good cattle health. After the on-farm experiment, the farm will be able to be even more profitable with higher milk yields and the best conditions for the cattle.

Engida Ashenafi

At the Engida Ashenafi farm, there is 29 head of Holstein Friesian cattle. Twenty of those are milking cows that are milked by hand, two times daily producing an average of 8.5 liters of milk. The cattle are being fed 16 kg of concentrate made up of brewery byproduct and a roughage mixture of teff, barley, and wheat straws. The farmer chose the ingredients because it had claimed to boost the milk production. But, he was disappointed with the results. There is also a precise vaccination program in place that keep the cattle healthy. The manure produced from the cattle is also sold as a fuel source. A recommendation for the farm is to find a higher quality of feed that will actually boost the milk production. For example, noug cake, wheat bran, and wheat short along with vitamins and minerals is quality feed mix that aid in the boosting of milk production.

The farm is performing well in terms of herd health nevertheless, the farm would like to have higher milk yields that provide more profit. The milk is sold at 13 birr per liter and with the cattle producing an average of 8.5 liters a day, the monthly income from the milk is 66,300 birr. The cost of veterinary services and vaccinations is 2,600 birr for two rounds or 217 birr monthly. The cost of feed is 500 birr per quintal and with 16 kg fed to the cows daily, it is 63,750 birr for feed a month. The farm is barely above breaking even in terms of cost. If a higher quality feed was taken advantage of, the milk yields would increase allowing the farm to see a larger profit.

Genesis Farm

Another high producing farm with 66 head of cattle is Genesis Farm. Sixty-four of the cattle are Holstein Friesian and two are 50% Holstein Friesian and 50% Boran. The Boran breed is an indigenous breed known for the dual purpose of meat and milk production. The feed mixture being fed is made up of corn, wheat bran, wheat short, noug cake, brewery byproduct, salt, limestone, and molasses. The roughage diets include alfalfa, elephant grass, hay, straw, and vegetable residues. The farm is able to grow almost all of the roughage with alfalfa, elephant grass, and the vegetable residues. The cattle manure is also used as fertilizer for these forages. Currently, the milking cows are being fed 1 kg of feed for every 3 liters of milk they produce. With the half Holstein Friesian, half Boran the cattle are receiving 1 kg of feed for every 5 liters of milk produced. The higher percentage of Boran cattle means less feed and less management is needed because of their climate adaptability and disease resistance.

Genesis farms focus on laying hens, vegetables, and plants as well as dairy cattle. The profitability of the dairy cattle can be analyzed from the milk sales at 15 birr per liter. If the 43 milking cows produce an average of 17 liters a day, the income from the milk is 328,950 birr a month. The price of the feed was unknown but the price of the veterinarian each month was 2,000 birr. Without the complete data on the costs at Genesis Farms, it can still be noted that this farm is largely profitable. The cattle are kept healthy to the best of their ability, producing high amounts of milk on average, and the milk is sold quickly and locally.

GGK Farm

GGK Farm, run solely by a woman, owns 75 of Holstein Friesian head of cattle. Thirty-three of the cattle is milking cows that average 8.5 liters of milk a day. These cows are being fed according to their production. The amount of feed they receive is half of however many liters of milk they produce. The feed mixture is made up of soybean, wheat bran, corn, noug cake, salt, and limestone. The cattle also receive elephant grass grown on the farm as a roughage which also utilizes the manure as fertilizer. The ingredients are bought in the market and mixed on the farm. This concentrate was chosen because of the boost in milk production. GGK also uses a veterinarian monthly to ensure proper herd health. In the past, the farm faced problems with poor quality vaccines and medications. Now, the farm has chosen to use vaccines from America and Europe as well as vaccines from the National Veterinary Institute in Bishoftu. The farm would like to see more milk production within the cattle but because of the lack of knowledge, there is an uncertainty of how to boost the production.



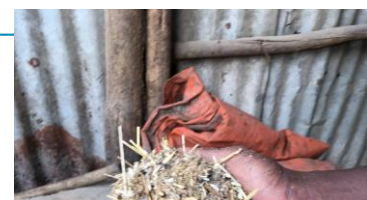
Between the individual price of ingredients, veterinary costs, and labor, GGK is dependent on the profit made from the dairy cows as well as the chickens she owns. If the thirty-three dairy cows were producing 8.5 liters every day and the milk is being sold for 14 birr per liter, the monthly income would be 117,810 birr. Costs of veterinary services are 3,500 birr a month and the cost of feed at an average of 644 birr per quintal. The cattle would eat 58 quintals of feed each month, at an average cost of 36,756 birr. The monthly profit excluding labor costs is 77,554 birr. When the cost of labor is accounted for, the profit just above breaking even for the dairy operation. Thus, the need for overall, higher milk yields.

Hana Dairy Farm

A medium sized farm with nineteen head of Holstein Friesian cattle averages 15.5 liters of milk every day from the five milking cows. The cattle receive 9 kg of concentrate made up of wheat bran, wheat short, noug cake, bone meal, and vitamins. The cattle also receive a straw and grass hay mixture for roughage. The owner wishes to grow alfalfa for the cattle but because there is a lack of excess water, none is able to be grown. The manure currently is serving no purpose for the farm whereas there is the possibility for profit if sold as fuel in the markets. In the past, there were problems with foot and mouth disease but now there is a vaccination program in place with a reliable veterinarian.

Hana Dairy Farm is currently the selling the milk produced at 13 birr per liter. With five cows averaging 15.5 liters of a milk each day, the monthly earnings are 30,225 birr. However, the cost of veterinary services are 1,400 birr each month and the cost of feed is 750 birr per quintal. The farm would use 33 quintals of feed each month at a monthly cost of 24,750 birr. The profit for a month would be 4,075 birr. This profit will increase in the future as the six heifers currently owned, reach their first lactation.

Tilahun Kopessa



Twenty-eight of Holstein Friesian cattle is currently owned at Tilahun Kopessa. Ten of those are milking cows that average 13.5 liters every day. The cattle are fed a mixture of wheat bran, wheat short, noug cake, brewery byproduct, and roughage. The higher producing cattle receive up to 50 kg of the mix whereas the lower producing cattle receive 20 kg. The farm is able to use the manure as fuel for the home and fertilizer for the hay fields. There is currently expansion taking place, soon the farm will add their own milk processing equipment. They hope to be able to sell the products to the public directly.

The prices of the feed and veterinary services were unknown to the head farmer. Yet, it can be estimated that there is enough expendable income from the dairy cattle due to the adding of the farm's own processing equipment. There is a plan to sell milk, butter, yogurt and cheese in shops as well as directly to the consumer.

The feed mixture that the cows at Tilahun Kopessa receive.

Emany Dairy Farm

Just above the small dairy size level, Emany has six total head of Holstein Friesian cattle. The two milking cows average 8.5 liters per day. The concentrate that cows are fed was chosen due to its availability in the market. It is made up of wheat short, wheat bran, noug cake, and salt. A roughage of teff and wheat straw is also fed. The cows are eating 5 kg of this concentrate each day. The cattle receive treatment only when there is a sickness. Currently, there is no vaccination program in place. As for the manure, it is used as fertilizer and fuel for the home. The farm also has a more successful conception rate of the cows when the heat detection is caught right away. This was based on the length of time to the cow's first lactation. The average for the farm is about 25 months but with a timely heat detection, the length of time decreases.

On average, the farm goes through nine quintals of feed every month. The rounded cost for the feed each month is 4,700 birr. Veterinary services cost 1,200 birr each visit or roughly once a month. If both of the milking cows produce 8.5 liters each day and the milk is sold for 14 birr per liter, the revenue would be 7,140 birr. Profit after the stated expenses would be 1,240 birr. It is recommended to have the farm initiate a vaccination program. With a vaccination program, there is a probability of not needing the veterinarian as often. Also, with the cattle being prevented of disease, there is the chance for higher milk production overall.

Etenash Dairy Farm

This small dairy farm of just three Holstein Friesian cattle sells the milk as well as consumes a small portion. The two milking cows average 12 liters a day. The concentrate the cattle eat was chosen because of the boost in milk yields. Wheat short, wheat bran, and oats are fed to the cattle based on production. Essentially the cattle receive half of how much milk they produce. If one cow produces 12 liters a day, they are fed 6 kg of concentrate. The cattle also receive a mixed roughage of teff, barley, and wheat straw. A lack of capital has disabled Etenash from growing their own feed and forage.

The family keeps 1 liter of milk to drink every other day. Fifteen liters of milk each month is kept for home consumption while 705 liters are sold each month. The milk is sold for 13 birr per liter and the earnings are 9,165 birr each month. With feed costing 260 birr per quintal, 1,404

birr is spent on feed each month. For vaccinations and any medication for sickness, it is 10 birr for each shot. Roughly, 30 birr is spent on the veterinary services and medications each month. The monthly profit can be expected to be 7,731 birr. Etenash plans to expand the cattle herd to gain even more profit for an expendable income.

Mulegata Farm

This successful medium sized farm owns twelve Holstein Friesian cattle with five milking cows that average 18 liters a day. A high quality feed from local feed processing plant is fed to the cows. The milking cows are fed 8 kg of concentrate and the calves are fed 4 kg. A roughage is also fed made of teff and barley straw. This farm also is currently processing and selling different products directly through their two owned shops in Bishoftu. The milk is sold for 28 birr per liter as well as 14 birr for 1/2 kg of cheese and 1/2 kg of butter.

For this farm, there are added costs for electricity for the processing equipment and storage. The cost of feed is 800 birr per quintal. The owner specifically chose the feed due to the high-quality factor. This has allowed the cows to boost their yields. The farm also utilizes a vaccination program for the herd that works to avert sickness. This farm's profitability cannot be estimated due to the lack of information on the total sales for the products processed on the farm.

Mestwat Farm

Mestwat Farm, a small level farm, owns five Holstein Friesian cattle with two milking cows that average 10 liters of milk a day. According to the owner, the ingredients of noug cake, wheat short, and wheat bran boost milk production. All the ingredients are mixed on the farm. The cattle are receiving 6 kg of feed every day plus a roughage mix of teff, wheat, and barley straw. The cattle are currently on a vaccination program to keep healthy. The milk is sold for 14 birr per liter. Besides selling the milk, the farm also earns money from selling the cattle manure as fuel. With a small amount of land, 400 square meters, the farm relies on the income from the dairy cattle to support the farm.

Currently, the price of the individual ingredients is 260 birr for wheat short and wheat bran per quintal and 1,400 birr per quintal. With all five head of cattle receiving 6 kg of feed each day, the farm would go through 9 quintals of feed each month. The current monthly cost of feed is 5,760 birr. The cost of the vaccinations is 50 birr for each cow, costing 250 birr each month. It can be estimated that the cattle produce around 600 liters of milk a month generating a monthly revenue of 8,400 birr. With the stated costs of feed and veterinary service, the total profit for the farm is 2,390 birr a month. With three heifers soon to be milking age, the income will increase slightly but the main focus of the farm is to increase the milk yields of the cattle.

Norobi

A medium-sized farm owned by a father and his four sons own this micro-enterprise of nine Holstein Friesian cattle. Seven milking cows average 15.5 liters every day. The farm is able to use the cattle manure for fuel in the home as well as marketing the product. Every day, the cows are receiving 14 kg of a mixture of concentrate and roughage. The concentrate includes what bran, wheat short, noug cake, corn, and brewery byproduct. The roughage is a teff and wheat

straw mix. The ingredients for the feed was chosen based on how accessible it is. The farm is selling the milk as well as consuming about 5% of it.

The farm is going through roughly thirty quintals of feed that cost 485 birr each. The monthly cost of the feed is 14,550 birr. The veterinary costs were unknown by the head farmer. Although, the milk is sold for 15 birr per liter. With the seven cows averaging 15.5 liters a day, around 3,255 liters are collected monthly. The family consumes 163 liters a year or 13.5 liters a month. The monthly income from milk sales is 48,623 birr. It can be estimated that the farm is relatively profitable overall given the revenue of the milk sales. Through artificial insemination, the cattle herd is growing steadily as will the profit and the milk yields through high-quality bull semen.

W/ro Zelalem

W/ro Zelalem is a small dairy farm with four head of cattle and only one milking cow that averages 4.5 liters of milk a day. Any bulls born on the farm are kept for meat purposes. The manure from the cattle is sold as fuel in the market. The cattle are currently receiving a mixture of wheat bran and wheat short and a roughage of wheat straw. The ingredients were chosen simply because it is cheap. The milking cow is being fed 3 kg of feed each day and the three heifers receive 1 kg of feed each day. There is also no disease prevention within the cattle through vaccinations. The owner claims the veterinarian is very inconsistent and is the reason she chooses to not enact a vaccination program.

From the given responses to the questionnaire, it is estimated that the cattle are not receiving enough, nutritious feed. In order to boost milk production, the cattle need to be fed a higher nutritive feed. For example, added ingredients of noug cake and corn will allow the cattle to keep a proper body condition and even boost milk yields. If a vaccination program were also put in place, the cattle would also stay healthier meaning more reliable milk collected and more. In terms of profitability, the feed is costing 560 birr per quintal and 896 birr each month. With the milking cow producing around 135 liters a month and selling the milk for 13 birr per liter, the monthly earnings are 1,755 birr. For the farm with the cost of feed and the revenue from the milk, the profit is 859 birr. If milk production was increased through more nutritive feed as well as a larger amount of feed the farm could see a larger profit especially with three heifers soon to be milking age.

Farm Name	Farm Size	No. of Cattle	Avg. Milk Yield (L)	Known Inputs (birr)	Known Outputs (birr)	Estimated Profitability (birr)
Almaz Dairy Farm	Small	3	20	1,838	8,400	6,652
Etenash	Small	3	12	1,434	9,165	7,731
Mestwat Farm	Small	5	10	6,010	8,400	2,390
W/ro Zelalem	Small	4	4.5	896	1,755	859
Birahun	Medium	7	10	6,425	18,000	11,575
Birhanie	Medium	15	7	N/A	24,570	N/A
Charnet	Medium	19	12-14	32,680	45,630	12,950
Emany Dairy Farm	Medium	6	8-9	5,900	7,140	1,240
Hana Dairy Farm	Medium	19	15-16	24,750	30,225	4,075
Mulegata Farm	Medium	12	24	N/A	N/A	N/A
Norobi	Medium	9	15-16	14,550	48,623	34,073
Tilahun Kopessa	Medium	28	15-16	N/A	N/A	N/A
Alfa Fodder	Large	433	24	857,340	N/A	N/A
Aster Worku	Large	93	15	88,450	199,680	111,230
Azu Dairy Farm	Large	30	18	N/A	119,340	N/A
D/Zeit Swine	Large	44	24	108,920	258,720	149,800
Elvera Farm	Large	72	11-12	N/A	N/A	N/A
Engida Ashenafi	Large	32	8-9	63,967	66,300	2,333
Genesis Farm	Large	66	15-18	N/A	328,950	N/A
GGK Farm	Large	75	20	40,256	117,810	77,554

Farm Overview

Farm to Market

In Bishoftu, the first ever private dairy cooperative in Ethiopia, Ada'a Dairy Cooperative, was created to aid smallholder dairy farmers. Currently, there are 400 members with sixty-five percent being female smallholder dairy operation owners. Almost all of the members are in the Bishoftu area but anyone can be a member.

Two times a day at fifteen different collection sites, milk is brought to be tested for milk acidity and milk fat content, using a lactometer. Once the milk cleared, it is then brought to the main processing plant in the city of Bishoftu. Once the milk arrives on site at the plant, it is tested once again for milk acidity and milk fat content. There is a possibility of milk being rejected through these tests. If the milk does not hold up to the standards it cannot be accepted. For example, if there is more than 10% of water in the milk, the milk can be traced back to the collection site and then back to the farmer.

After the milk is cleared for the second time, it is filtered and moved to a chiller. The milk is kept cold to deter bacteria from growing. After about a day in the chiller, the milk is moved to another container to be boiled, pasteurized, and separate the fat. In another container, the milk is homogenized and either sent straight to be packaged or to be churned into butter. Yogurt is another product made at the cooperative. The milk is packaged in a container and then set in a special temperature where the cultures can create the yogurt. Cheese is another popular product for the cooperative, the milk is 'dehydrated' to create the cheese.

The prices for the products reduce during the fasting season. In the Ethiopian Orthodox calendar, there are 232 days of fasting. Because of this, it has a big effect on the livestock producers throughout the country because no animal products are to be eaten during this time. Despite this, the cooperative is processing milk every day according to the order. The products are distributed to markets, shops, and government organizations. The cooperative also offers feed services for its members but, during the rainy season, the feed processing production is frozen.

When it is not during fasting season, milk is sold for 18 birr per liter, yogurt for 8 birr for 250 mL, butter for 190 birr per kg, and cheese for 50 birr per kg. The main idea of the dairy cooperative is to support the farms, especially the smallholder farmers in any way they can. Now, there are several other dairy cooperatives around Ethiopia, modeled after Ada'a Dairy. It is a very successful cooperative meant to support farmers as well as providing a quality product to consumers.

Conclusion

From the collected responses of the twenty Bishoftu area farmers, the hypothesis that ‘Better Management will lead to higher milk yields’, was supported. The farms that were implementing accurate feed amounts compared the cow’s milk yields, maintained keen herd health and were utilizing the best herd genetics through either artificial insemination or natural breeding had the highest milk yields. Several hours of work, as well as money, is placed into dairy operations and when those resources are properly used, a farm should be able to acquire the best milk yields for themselves.

Through this research of various farmers in the Bishoftu area, there is a better understanding of what really affects a cow’s individual milk production. There is also a better understanding about the profitability factors in milk production. Feed is one of the largest inputs that goes into production costs, making it another reason why it is very important for farmers to be attentive to feed ingredients. For almost all of the Bishoftu area farmers, profit was a conscience idea on their minds for their dairy operations.

In conclusion, small and few medium-sized farms lack the knowledge of proper management and feeding whereas large farms had a better grasp on how to maintain cattle well. In order for the small and medium farms to better their production systems, there must be knowledge provided and learned by the farmers to increase the milk yields thus increasing the profit. Programs like the NAIC and projects like ADGG have been able to assist farmers in the improvement of the cattle and milk production.

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Appendix

Questionnaire

Genetics

1. Breed of cattle?
2. Do you prefer crossbred or indigenous breed?
3. How many cows do you have? (How many heifers, how many cows?)

Management

4. Milk by hand or machine?
5. How often do you milk?
6. What do you do with the milk? (Sell or consume) How much do you sell the milk for?
7. AI or Natural Breeding?
8. Age of calf at weaning?
9. How long from calving to first lactation?
10. What do you do with bulls?
11. What do you do with manure? (Fuel, fertilizer, sell)

Feed & Water

12. Water availability?
13. What are they being fed?
14. How much for each cow, each day?
15. Why have you chosen the ingredients?
16. Which crops do you grow/Have residues to feed?
17. How much land do you have? (How much for crop, how much for livestock?)
18. Are the feed ingredients available all year or only seasonal?
19. How much does the feed ration cost you?
20. Why are you buying feed rather than growing feed?

Health

21. Is a vet available to you? What issues do you call the vet for?
22. How much does medication cost typically?
23. How much does it cost for the vet to come out?

Yield

24. What is the max yield for your farm?
25. What is the average yield for your farm?