American Journal of Cell and Animal Biology
Vol. 1, No. 1, August 2013, PP: 01 -09
Available online at http://acascipub.com/Journals.php

**Research article**

# Evaluation of different feeding options on yearling Borana bulls to attain export market weight at Adami Tulu agricultural research center

**Mieso Guru, Girma Debele, Tesfaye Alemu Tucho, Frihiwot Messele and Tesfaye Alemu Aredo.**

**Correspondence author**: miesoguru@yahoo.com

---

## Abstract

The study was conducted at Adami Tulu agricultural research center for about 224 days on 27 yearling Borana bulls of 128.69±4.16kg of initial body weight to evaluate different feeding options on yearling Borana bulls to attain the required export market weight of 300kg and to identify the most economical feeding options for yearling bulls.by using three dietary treatment groups T1=Grazing, molasses 20%, wheat bran 35% and linseed cake 45%, T2= Grazing, maize grain 20%, wheat bran 45% and Noug cake 35%, T3= Grazing, wheat bran 65% and cotton seed cake 35% to attain the required export market weight of 300kg. For each three dietary treatments groups (T1, T2 and T3) 9 yearling Borana bulls were randomly assigned throughout the experimental period until the animals were attained an average export market weight of 300kg. The result of the feeding trial showed that there is no statistically significance difference among the three dietary treatment groups in body weight gain at the end of the experimental periods. In this trial all experimental bulls assigned under each treatment groups gained the lowest ADWG at 224 days of fattening periods as compare to 84 days and 112 days of fattening periods. The result of carcass parameters/traits evaluation showed that there is no significance difference among the three treatments groups. In This trial animal fed with T2 is very feasible both biological and economical as compare toT1 and T3. Hence, any beef cattle fatteners can be used one of the three treatments groups based on the availability of the feeds in his locality and the price of the dietary feeds to fatten yearling Borana bulls for export market weight gain of 300kg. 

**Key word:** Carcass traits, weight gain, experimental animals and concentrate feeds

---

## Introduction

The livestock sub sectors play vital roles as sources of food, income and foreign exchange to Ethiopia economy and contribute about 12% and 33% of the total and agricultural GDP respectively. Ethiopia holds the largest livestock population in Africa estimated about 63.1million head of cattle, 23.6 million of sheep, 16 Millions goats (CSA, 2008). Livestock and their products are estimated to compose a third of total value of agricultural gross output in developing countries and this share is rising from time to time (CSA, 2008). Ethiopia provided about 45% of all domestic meat consumption with small surplus which generates export income mainly from the sell of live animals. However, the earing from export of live animals from sell of live animals and processed meat is very small as compared to the potential of the country. Ethiopia has the lowest levels of beef production per animals. Only 8kg of beef is produced annually per head of cattle and the national per capita meat yield from cattle is 108 kg (FAO, 2004). To improve this scenario various research activities have been under taken in different part of the country. The recent study on evaluation feedlot performance of Borana and kereyu breeds at different age at Adami Tulu agricultural research center (unpublished data) indicate that Borana breed has a

better potential to attain a certain body weight gain at an earlier age than the kereyu breed. Looking for different feeding options for Borana breeds to attain the desired market weight and carcass quality at an earlier age was recommended.

The endeavors so far made regarding beef cattle research were either fragmented or less targeted the actual domestic and international market. Cognizant of this, national project was prepared to generate feasible technologies to meet the required international market weight for beef cattle of different ages and breed of beef cattle. The fattening practices being under taken so far especially by smallholder fatteners were mainly traditional in the sense that the feeding system did not target for export market but they only focus for local marketing.

Managing beef cattle to meet consumer demands is essential to maintain a profitable and sustainable beef fattening technologies for export market potential to increase foreign currency which the country obtain from live animal export. Hence, the current study conducted on yearling ages of Borana bulls targeted to export market of 300kg was under taken to cover the following objectives.

**The objectives of the study are:**

- To evaluate different feeding options for yearling ages of Borana bulls to attain the required export market weight of 300kg.
- To identify the most economical feeding options for yearling ages of Borana bulls to attain the target weight.
- To evaluate the carcass characteristics of Borana bulls under different feeding options.

## MATERIAL AND METHODS

### Description of the study area

The experimental trial was conducted at Adami Tulu agricultural research center, which is located at 167 km from the capital city of Ethiopia at an altitude of 1650 m above sea level in mid rift valley. The agro ecological zone of the area is semi-arid and sub humid with acacia woodland vegetation type. The mean annual rain falls is 760 mm. The mean minimum and maximum temperature are 12.6 and 27$^{o}$C, respectively. The soil type is fine, sandy loam with sand: silt: clay in the ratio of 34: 38: 18 respectively.

### Experimental animals and feeds

A total of twenty seven yearling ages of Borana bulls were purchased from Nagele Borana Zone of Oromia regional state (the place where pure Borana breed were reared). After the purchased bulls were reached at Adami Tulu agricultural research center, each experimental animal were kept in quarantine for about 3 weeks and treated for internal and external parasites by using Albendazole and accarcide respectively. All experimental bulls were randomly assigned to one of the three dietary treatments groups. For each three dietary treatments groups (T1, T2 and T3) 9 yearling ages of Borana bulls were assigned throughout the experimental period until the animals were attained on average an export market weight of 300kg. However, due to health problems one bull was died from treatment two after 21 days of adaption periods. All experimental animals were individually fed with their corresponding rations for 21 days of adaptation periods followed by a 224 days of experimental period.

The dietary feeds offered for experimental bulls during the whole experimental periods were T1=Grazing, molasses 20%, wheat bran 35% and linseed cake 45%, T2= Grazing, maize grain20%, wheat bran 45% and Noug seed cake 35%, T3= Grazing, wheat bran 65% and cotton seed cake 35%. The chemical composition of each dietary treatment groups were indicated in table 1.

**Table 1:** Chemical composition of experimental diets

| Feed types | Treatment | DM% | CP% | TDN% |
|---|---|---|---|---|
| Molasses (5.8, 72) | 1 | 20 | 1.16 | 14.40 |
| Wheat bran(13, 67) | 1 | 35 | 4.55 | 23.45 |
| Linseed cake(27, 72) | 1 | 45 | 12.60 | 32.40 |
| Maize grain(10, 85) | 2 | 20 | 2.00 | 17.00 |
| Wheat bran(13, 67) | 2 | 45 | 5.85 | 30.15 |
| Noug cake(29.75,66) | 2 | 35 | 10.41 | 23.10 |
| Wheat bran(13, 67) | 3 | 65 | 8.45 | 43.55 |
| Cottonseed cake(28, 75) | 3 | 35 | 9.80 | 26.25 |

**Feeding of experimental animals**

All 27 yearling experimental bulls were randomly assigned for three dietary rations. After 21 days of adaption periods the amount of feeds provided for the experimental bulls were slightly increased based the weight change of the bulls. On average 3.56kg, 3.84kg and 3.76kg of mixed feeds were offered for animals kept under T1, T2 and T3 respectively. Each dietary treatment was offered twice daily for the respective groups of animals half in the morning and half in the afternoon after 8hours grazing. Refusals feeds from each treatment group were collected and weighed every in the morning before the daily feed allowance was provided for the bulls. Each animal assigned for three treatment groups were kept under treatment groups and supplemented with the respective dietary rations for a maximum of 224 days and then feeding of bulls were stopped as the experimental bulls were attained the required 300kg of export market weight. All data on weight gain/ change of each fattening bulls were collected every two weeks (fortnightly) up to the end of the fattening periods.

**Carcass parameter evaluation**

At the end of the experimental period two fattened Borana bulls were randomly selected from each treatment group and slaughtered at export ELFORA abattoir at Debrezeit town. After the animals were slaughtered and skinned, all important internal organs of each bulls such as kidney, heart, liver, lung, spleen, empty gut, heart fat, kidney fat, mesenteric and omental fat were eviscerated and measured. The rest hot carcass of the slaughtered bulls were dissected equally into right and left parts with the help of modern carcass cutting machine and weight of each right and left parts of entire carcass were taken before putting in to cold chill room at $-4^{o}$c for about 24 hours. After this the cold carcass of the bulls were taken out and weighted again to see the difference in weight between the hot and cold carcass of each treatment group. To evaluate the chilled carcass characteristics of bulls, the right parts of entire animals' carcass were cut between $12^{th}$ and $13^{th}$ ribs. Then the chilled carcass was cut into five major carcass parameters such as rib eye roll, Chuck roll, Chuck Tender and two ribs and brisket. Then to evaluate the difference in primal carcass cut all the parameters were separately measured. From each primal carcass cut muscle and fat were manually trimmed from the bone using knife. Finally all the carcass traits/ parameters of trimmed muscle and fat were separately measured.

**Financial analysis of different feeding trials**

All financial data used to calculate the profitability of fattening of yearling ages of Borana bulls by using of different feeding options was collected. Accordingly all cost items used to conduct this experimental trial during the whole 224 days of fattening periods were collected. All variable costs such as animals cost, transportation cost purchased of experimental animals, feeds cost, labor and veterinary cost incurred to conduct this fattening trial for the above mentioned fattening periods were calculated. The gross output/ revenues of fattened of bulls using three different treatment groups were estimated at the end of the fattening periods by the help of three professional people who had enough knowledge on marketing of fattened bulls.

In this cost items calculation only gross margin of fattened yearling Borana bulls using different dietary treatment groups were calculated. Because of fixed cost did not include in this cost benefit analysis, the profit calculated here does not indicate net profit/ net loss. It only indicate gross margin of each fattened bulls using different feed trials. However, the opportunity costs of fattening these bulls were considered.

### Statistical analysis

All live weight and carcass parameters of each fattened and slaughtered of bulls data was analyzed using general linear model (GLM) of Statistical Analysis System (SAS 1999-2000). The estimated least squares means were separated by the Duncan's Multiple Range Test at P< 0.05.

## RESULT AND DISCUSSION

### Growth performance

An experimental trial on yearling age of Borana bulls fed with different feeding trials to attain 300kg of export market weight for a maximum of 224 days of fattening periods was conducted at ATARC. The weight change or gain of bulls during this period was recorded and its results were explained as flow. Growth performance or weight change of experimental bulls categorized under each three treatment groups and fed with different feeding trial for period of 12 weeks (84days), 16weeks (112days) and 32weeks (224 day) of fattening period was determined. Final body weight, average daily weight gain, total weight gain of experimental bulls for 84 days, 112days and 224 days periods of was indicated in table 2.

**Table 2:** Growth performance experimental bulls at different fattening periods

| Treatment groups | Growth performance | Experimental period | | |
|---|---|---|---|---|
| | | **84 days** | **112 days** | **224 days** |
| T1 | Final body weight | 205.44[a] ±5.17 | 226.00[a] ±4.89 | 300.22[a] ±6.25 |
| " | ADG | 0.919[a] | 0.873[a] | 0.768[a] |
| " | TWG | 77.22 | 97.78 | 172.00 |
| T2 | Final body weight | 215.50[a] ±5.45 | 233.75[a] ±5.18 | 303.00[a] ±6.83 |
| " | ADG | 1.020[a] | 0.929[a] | 0.774[a] |
| " | TWG | 85.75 | 104.00 | 173.25 |
| T3 | Final body weight | 211.11[a] ±5.17 | 230.55[a] ±4.89 | 302.77[a] ±6.25 |
| " | ADG | 0.988[a] | 0.915[a] | 0.780[a] |
| " | TWG | 83.00 | 102.44 | 174.66 |

The result of the feeding trial shows that there is no statistically significance difference among the three dietary treatment groups (T1, T2 & T3) in final weight gain, ADG, TWG of fattened bulls at 84day, 112 days and 224 days of experimental periods. This implies that the dietary treatment offered for all experimental bulls have similarity in nutritional value and had played the same roles to bring the animals to attain the required 300kg of export market weight. On top this breed and ages of the fattened animals are also the same. Since the breed and the age of the bulls on which the fattening trials was conducted were the same, these might be leads to the same weight gain of bulls during the fattening periods.

Even if almost all experimental bulls had attained similar weight gain during the above listed fattening periods, animals fed with T2 (Grazing + maize grain + wheat bran + Noug cake) were slightly attained more average daily weight gain than animals fed with T1 (Grazing + molasses + wheat bran + linseed cake) and T3 (Grazing + wheat bran + cotton seed cake). Animals fed with treatment 3 also gain higher average daily weight gain than animals fed with treatment 1. This shows that the feed conversion efficiency of animals categorized under treatment 2 is higher than the rest of the two treatment groups (T1 and T3).

In this experiment all animals fed with three dietary treatment groups had attained highest average daily weight gain at 84 days of fattening periods than 112 and 224 days of fattening period respectively. The average daily weight gain at 84 days of fattening periods for three treatments groups of experimental animals were 1.02, 0.988 and 0.919 for T2, T3 and T1 respectively. However, at this fattening period (84 days) the animal could not attain the required 300kg of export market weight. Similar to this finding ( P. B O'Donovan and Gerwolde, 1983) find average daily weight gain of 1.18kg of Borana bull fed on 40% maize silage, 20% can molasses, 12% cracked maize, 25% sunflower, 2% bone meal and 1% salt.

Animal fed with T2 had highest (1.02± 5.45 kg) of ADWG than the rest of the two treatment groups. This result had similarity with the finding of (F. L. Laborde, et al, 2012) which obtained an ADWG of 1.58 ± 0.07 kg and 1.71 ± 0.09 kg for finishing steers of Simmental (SM) and Red Angus (RA) breeds respectively. However, the

final body weight of the two breeds had comparable higher than this local or tropical yearling age of Borana bulls. This final body weight at slaughtering for the three breeds were 659.3 ± 20.4 kg, 505.2 ± 25.6kg and 303± kg 6.83 for Simmental, Red Angus and Borana bulls respectively.

Even though, the daily dietary feeds offered for experimental bulls in all treatment group is increased based on the weight change of the bulls over the fattening periods, the ADWG of the bulls were steadily decreased started from 84 days of fattening periods up to the end of the fattening periods (224 days). For easily comparison of ADWG of experimental animals fed different dietary feeds their corresponding of ADG of fattened animals under each feeding groups were depicted in figure 1.

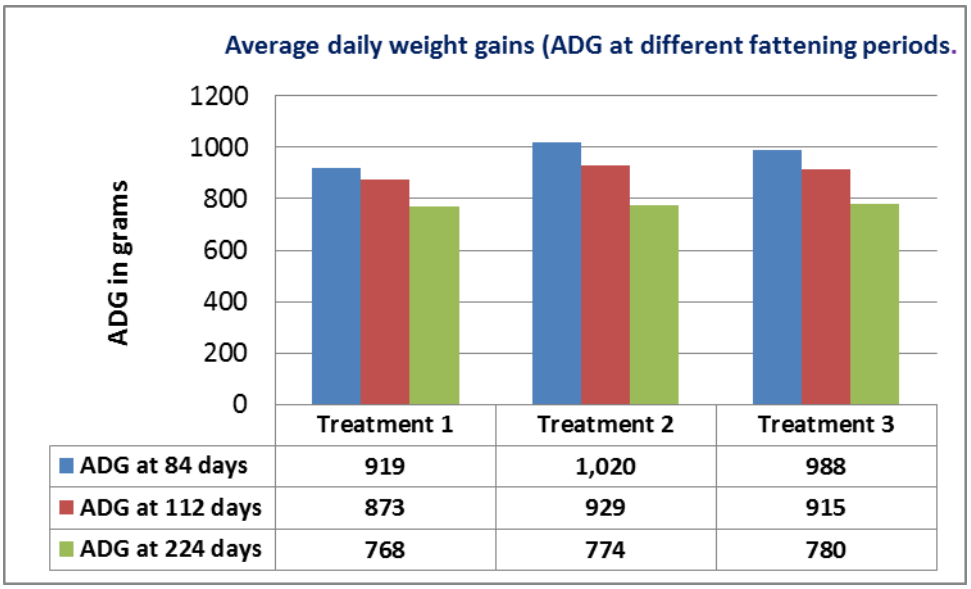


**Figure 1:** Indicate steady decrease of ADG of fattened bulls fed with different feeds

In this trial all experimental bulls assigned under each treatment groups gain the lowest ADWG at 224 days of fattening periods. The above figure 1 is indicated the maximum ADG of animal fed with treatment 2 and their ADG is gradually decreased up to a maximum of 224 days fattening periods. This is might be because of all the experimental animal finished their high growth rate and started accumulation of body fats.

Followed the ADG, the total weight gain of each experimental animals fed three dietary treatment groups were calculated at different fattening periods. The following figure 2 is indicated the total weight gains (TWG) of each experimental animal after 84 days of fattening periods up to the end of feeding periods (224 days).

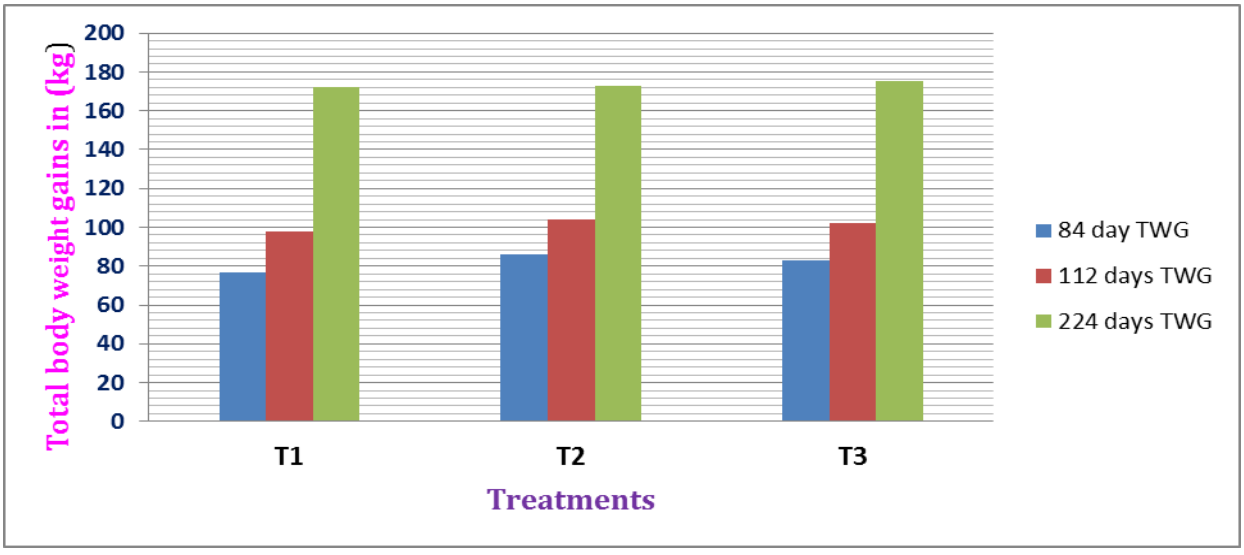


**Figure 2:** Indicate total weight gain (TWG) of fattened bull at different fattening periods.

American Journal of Cell and Animal Biology
Vol. 1, No. 1, August 2013, PP: 01 -09
Available online at http://acascipub.com/Journals.php

The weight changes of yearling Borana bulls from an initial body weight (IBW) of 128kg to final body weight (FBW) of 302kg of experimental bulls after different feeding period were depicted in figure 3 below.

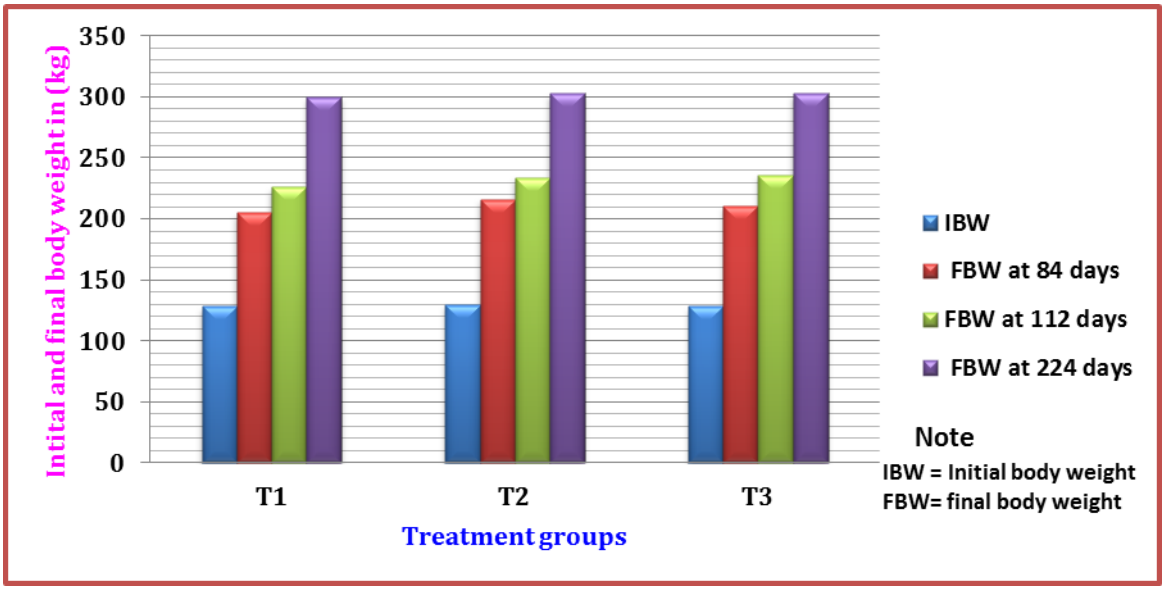


**Figure 3:** Indicate final body weight of experimental bulls at different feeding periods.

After the end of each fattening periods, almost all the experimental bulls have gained similar weight due to similar nutrient contents had offered to experimental animals.

**Carcass parameters/ measurement**

Mean carcass trait of yearling ages of Borana bulls fed with three dietary treatment groups were indicated in the following table 2. In this trial there is no significance difference in hot carcass and hot dressing percentage among the three treatment groups fed with difference type of concentrate feeds. However, bulls received T3 had slightly higher dressing percentage (61.38[a]) than animals fed with T1 (61.16[a]) and T2 (60.41[a]). Compare to other dietary feeds animals receiving T1 had the highest live weight, hot carcass weight, Cold carcass weight, Chuck roll than bulls fed T2 and T3.

The following figure 4 indicated that live weight and carcass weight of each slaughtered animals from each treatment groups at export abattoir.

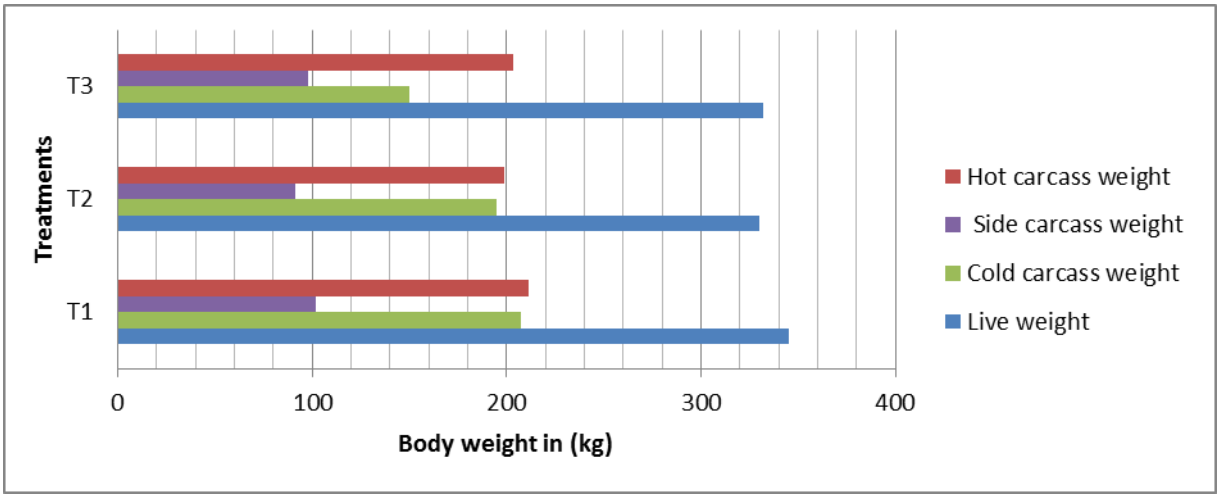


**Figure 4:** Indicate carcass weight of each slaughtered bulls

Mean carcass traits of Borana bulls fed with different proportion of concentrate feed was presented in the following table

**Table 4:** Mean of carcass trait of yearling age of Borana bull slaughter at 224days.

| Carcass parameters/traits | T1 | T 2 | T3 |
|---|---|---|---|
| Chuck roll | 19.75 ±1.54 | 11.60 ±1.54 | 16.65 ±1.54 |
| Rib Eye roll | 5.80 ±0.50 | 5.85 ±0.50 | 5.90 ±0.50 |
| Chuck Tender | 0.75 ±0.07 | 0.90 ±0.07 | 0.85 ±0.07 |
| Brisket | 5..50 ±0.55 | 5.90 ±0.45 | 5.85 ±0.26 |
| Hump | 2.60 ± 0.26 | 2.40 ±0.26 | 2.05 ±0.26 |
| Fore Shank | 3.80 ±0.17 | 3.25 ±0.17 | 3.60 ±0.17 |
| Pelate | 4.95 ±0.56 | 6.10 ±0.56 | 5.00 ±0.56 |
| Rib | 3.20 ±0.46 | 2.15 ±0.46 | 2.50 ±0.46 |
| Flank | 0.75±0.06 | 0.70±0.06 | 0.72 ±0.06 |
| Tender lion | 1.65 ±0.10 | 1.45 ±0.10 | 1.60 ±0.10 |
| Flank Steak | 1.10 ±0.11 | 1.10 ±0.11 | 1.00 ±0.11 |
| Rump | 2.25 ±0.54 | 1.90 ±0.54 | 1.95 ±0.54 |
| Ball Tip | 1.10 ±0.15 | 1.05 ±0.15 | 1.00 ±0.15 |
| Tri Tip | 1.05 ±0.13 | 0.60 ±0.13 | 0.80 ±0.13 |
| Strip Loin | 4.25 ±0.47 | 3.90 ±0.47 | 3.42 ±0.47 |
| Topside | 6.60 ±0,31 | 5.15 ±0,31 | 6.20 ±0,31 |
| Silverside | 6.25 ±0.82 | 6.00 ±0.82 | 6.00 ±0.82 |
| Thick Flank | 4.10 ±0.26 | 3.20 ±0.26 | 3.60 ±0.26 |
| Soft Shin | 1.40 ±0.11 | 1.10 ±0.11 | 1.15 ±0.11 |
| Hard shin | 1.35 ±0.09 | 1.05 ±0.09 | 1.50 ±0.09 |
| Fat Trimming | 4.20 ±0.18 | 7.25 ±0.18 | 5.50 ±0.18 |
| Lean Trimming | 3.90 ±0.77 | 2.20 ±0.77 | 2.45 ±0.77 |
| Kidney fat | 3.75 ±1.23 | 3.50 ±1.23 | 2.50 ±1.23 |
| Oxtail | 0.85 ±0.09 | 0.65 ±0.09 | 0.85 ±0.09 |

**Primal cut measurement**

Primal carcass cuts of yearling age of Borana bulls fed with different feeds options were presented in table 4 above. Bulls fed with treatment 1 had higher chuck roll, strip loin, topside, silverside and thick flank than other two groups of animals fed with T2 and T3. This indicated that large amount of muscle were found on these primal carcass cuts. Even though there is no significance difference in rib eye roll among the three treatment groups, animal fed with treatment 3 had highest rib eye roll than animal fed with T2.In this finding rib eye roll and muscle amount is varied from 5.8 to5.9 and 2.2 to 3.9 respectively. This shows that there is positive relationship between rib eye area and amount of muscle in carcass. The study conducted by (Tesfaye Lemma, etal, 2007) Borana bulls also aligned with this finding as he indicated in his finding feeding rations were not found to significantly affect carcass characteristics of Borana bulls.

There is significance difference in Chuck roll, hardship, topside and fat trimming in all treatment groups ($P< 0.05$). Animal fed with T2 had highest fat trimming (7.25) followed by bulls fed treatment T3 (5.5) and T1 (4.2). This implies that animals grouped under treatment T2 accumulate more fat than the animals grouped under treatment T1 and T3. Because of animals in T2 received more high energy feeds than animals fed with treatment T3.

**Cost- benefit analysis of fattened of yearling Borana bulls**

Simple economic analysis made to evaluate the three dietary treatments for fattening of yearling Borana bulls showed that the gross margin per animal was higher for animal fed on treatment 2 followed by the gross margin of animal fed on Treatment 3. This is because of the cost of maize grain fed by animals under T1 is very low as compare to the cost of linseed cake which is by bulls under group 3. In addition to its high price the proportion of linseed cake (45%) used in treatment 1 is very high as compare to the proportion of Nough cake (35%) mixed in treatment 2. In this experiment, fattening of yearling Borana bull for export market weight gain of 300k by using treatment 2 is very feasible both biological and economical as compare to Treatment 1 and treatment 3.

Fattening of yearling Borana bull for 84 days and 112days with three dietary treatment 1 and treatment 2 to obtain an average final body of 210kg and 230 is more profitable than fattening for 224 days to gain 300kg final body weight . Even if using the above mentioned three different feeds option are more profitable to gain the required final body weights, using dietary treatment 2 to fed yearling Borana bull is make more profit than treatment 1 and treatment 3 for end user. Fattening yearling Borana bull for 224days by using different feeding option for export market weight gain of 300k is profitable. But using treatment 2 for fattening this bull make more profit for the end user at 224 days fattening periods to obtain the required export market weight of 300kg because the low price of maize grain. See table 5 below.

**Table 5:** Partial budget analysis of finishing yearling Borana bulls fed for different periods with three dietary feeds in (ETB).

| **Items** | **T1** | | | **T2** | | | **T 3** | | |
|---|---|---|---|---|---|---|---|---|---|
| Fattening periods | 84 | 112 | 224 | 84 | 112 | 224 | 84 | 112 | 224 |
| Number of bulls | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| Initial purchasing price of one bull | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| Transportation cost per animal | 122 | 122 | 122 | 122 | 122 | 122 | 122 | 122 | 122 |
| Feed cost per animal | 1637 | 2330 | 4249 | 1017 | 1446 | 3135 | 1102 | 1559 | 3364 |
| Labor cost per animal | 102 | 136 | 271 | 102 | 136 | 271 | 102 | 136 | 271 |
| Veterinary cost/animal | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| Variable costs per animal | 3378 | 4105 | 6159 | 2758 | 3221 | 5045 | 2843 | 3334 | 5274 |
| Interest cost (opportunity cost) | 202 | 246 | 369 | 165 | 193 | 302 | 170 | 200 | 316 |
| Total cost per animal | 3580 | 4351 | 6528 | 2923 | 3414 | 5347 | 3013 | 3534 | 5590 |
| Gross return per animal | 6547 | 7009 | 8000 | 6547 | 7009 | 8000 | 6547 | 7009 | 8000 |
| Gross margin per animal | **2967** | **2658** | **1472** | **3624** | **3595** | **2653** | **3534** | **3475** | **2410** |
| Total gross output | 58923 | 63081 | 72000 | 58923 | 63081 | 72000 | 58923 | 63081 | 72000 |
| Total costs | 32220 | 39159 | 58752 | 26307 | 30726 | 48123 | 27117 | 31806 | 50310 |
| Total gross margin | **26703** | **23922** | **13248** | **32616** | **32355** | **23877** | **31806** | **31275** | **21690** |

## Conclusion and recommendation

From this trial it was concluded that there is no significance difference among T1, T2 and T3 in final body weight (FBW), total weight gain (TWG), and average daily weight gain (ADWG). There is also no significance difference in all treatment groups in hot carcass weight, cold carcass weight, dressing percentage and in primal cuts and carcass traits such as rib eye roll, chuck tender, brisket, fore shank, rib, tender lion, flank, flank steak, rump trip tip, strip loin, silverside, thick flank, soft shin, lean trimming, kidney fat and Oxtail. This implies that all the three dietary treatment groups had same effect on yearling Borana bulls to gain 300kg of export market weight at 224 days of fattening periods. This dietary feeds also had same effect on carcass traits at this time of fattening periods. The economic analysis of different dietary treatment groups showed that all the three treatment are profitable for fattening yearling Borana bulls to obtain the required export market weight of 300k at 224 days of fattening periods. Hence any fatteners (commercial farmers, private investors) can use one of the three treatments groups based on the availability of feeds for fattening of yearling Borana bulls for export market weight gain of 300kg. But for better economic return any beef cattle fatteners can use dietary treatment 2 for export market weight gain of 300kg.

**REFERENCE**

[1] Baur H, Sissoko K and Debrah S (1989). The economics of peasant cattle fattening in Mali. African

[2] Central stastically agency (CSA), 2008. Ethiopia Sample survey Enumeration. Addis Ababa. Ethiopia.

[3] F. L. Laborde, I. B. Mandell2, J. J. Tosh, J. W. Wilton, and J. G. Buchanan-Smith, 2012. Breed effects on growth performance, carcass characteristics, fatty acid composition, and palatability attributes in finishing steers1.Department of Animal and Poultry Science, University of Guelph, Guelph, Ontario N1G 2W1, Journal of animal science, Canada.

[4] P. B O'Donovan and Gerwolde, 1983. Fattening of Zebu and crossbred on maize residues and concentrate. Tropical animal production, Institute of agricultural research P.O.Box 2003, Addis Ababa,

[5] Research Network for Agricultural By-products (ARNAB).1989. Overcoming constraints to the effective utilization of agricultural by-products as animal feed. Proceeding of the fourth annual workshop held at the institutes of animal research, Mankon station, Bameeda, Cameroon, 20-27 October 1989.ARNAB, Addis Ababa, Ethiopia, PP. 49-60.

[6] Tesfaye Lemma, Tesfa Geleta, Amsalu Sisay and Tekle Abebe, 2007. Effects of four different basal diets on the carcass composition of finishing Borana bulls, Journal of Cell and Animal Biology Vol. 1 (2), pp. 015-018.