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Growth Performance Evaluation of Yearling (1 to 1.5 Years Old) F1 Male Calves of Hf Cross with Arsi Cows at Adami Tulu Agricultural Research Center

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ABSTRACT

The study was conducted at Adami Tulu agricultural research center on 18 two years F1 male calves of HF cross with Arsi cows of 112.60 kg average initial body weight during the year of 2020/2021. The objectives of the study were to investigate the effect of different dietary rations on the growth performance of crossbred male calves and to identify the most economical feeding dietary ration. hree dietary treatments rations (T1=8 hrs Grazing+20% molasses+40% wheat bran+40% Noug cake, T2=8 hrs Grazing+20% maize grain+45% wheat bran+35% Noug cake, and T3=8hrs Grazing+65% wheat bran+35% cottonseed cakes) were evaluated. Complete Randomized Block Design was used to assign six cross-bred male calves randomly to three dietary rations. All experimental calves were supplemented dietary rations based on their body weight at the rate of 2.5% of their live body weight throughout the experimental period. The results indicated that there was no significant difference in average daily weight gain and total weight gain between crossbred young bulls fed with dietary the three rations. Partial budget analysis indicated that there was no significant difference among cross-bred bulls fed with three dietary feed rations. But From the partial budget analysis, it was observed that experimental bulls fed on T3 are more feasible economically as compared to bulls fed on T1 and T2. Further investigation needed on fattening HF-crossbred bulls under different levels of ration offering was recommended to evaluate their potential for economic profitability based on their weight gain.

Keywords: Crossbred bull, Growth rate, Ration, Weight gain.

INTRODUCTION

The total cattle population for Ethiopia is estimated to be about 65.35 million. The majority (97.77%) of the total cattle in the country are local breeds. The remaining are hybrid and exotic breeds that accounted for about 1.91% and 0.22%, respectively. Regarding age groups, the majority of the cattle population (that is about 62.95%) was in 3 years to 10 years and 16.75% is 1 year to 3 years. The remaining 2.25% are 10 and above years old [1]. Cattle production plays an important role in the economies of the farmers and the country at large.

Crossbreeding work in Ethiopia was initiated in the early 1950s. Following this initiation, several governmental and non-governmental institutions have worked on the development of the dairy sector [2]. This resulted in improvement in milk production as well as surplus crossed bulls' availability in different parts of the country. However, the lack of a disposal mechanism for surplus male calves at the dairy farm level has been reported as one of the main constraints in improving the dairy farm profitability [3]. The importance of dairy beef to minimize the problem of continuous supply of young bulls to the market was reported in different studies [4-6].

By 2050, the human population will grow to over 9 billion people, and in the same time frame, global meat consumption is projected to increase by 73% [7]. In the developing world meat consumption is rapidly increased to meet the sharp demand for meat in Asian, Pacific, and African continents. More specifically, Ethiopia is one of the fastest-growing countries and registered two-digit economic growths since the last two decades in the world. To meet the meat demands of the ever-growing Ethiopian human population with an annual growth rate of 2.4% and expected to reach about 149.3 million by the year 2040 [8]. This scenario creates a better and huge market opportunity for the livestock producers in the country particularly for livestock producers such as for small-scale and commercial fattening schemes in the country.

However, fattening in Ethiopia is mainly practiced in the traditional way by smallholder farmers except for very rare commercial farms. For example, in the traditional mixed crop-livestock farming practice of the highland parts of Ethiopia demands male cattle to mainly serve as draught animals [9]. Draught oxen are normally released for beef when they retired from work. In rare cases male cattle that are considered as extra of the household farm power requirement are channeled to finishing or fattening diets at a younger age and being sold as beef [10]. Furthermore, developing an economic feeding system that enhances the existing traditional production and emerging private business is among timely interventions required to increase production and productivity of beef cattle and thereby achievement to the growing demand for meat and also to the country's plan of increasing meat export, by encouraging small scale beef fatteners based on scientific evidence [11]. Among other options improvement of fattening performance of crossbred cattle through proper feeding of the animal using concentrate, supplementation is crucial to achieve the desired yield. Supplementation with the differential proportion of agro-industrial by-products up on the animal requirement is among the alternatives to be due attention [12]. Currently, a large number of smallholder dairy farms are operating in the study areas. However, information on the growth performance of crossbred bulls in the study area and country-wise is not well documented and is relatively limited. Hence, there is a need to the periodical evaluation of the growth performance of cross bulls. The present study was therefore undertaken to investigate the effect of different feeds on the growth performance of crossbred male calves and to identify the most economical dietary ration for fattening of crossbred male calves.

METHODOLOGIES

Study area

The study trial was done at Adami Tulu Agriculture Research Center that found near Batu town and 167 km far from Addis Ababa city. The agroecological Zone of the area is semi-arid and sub-humid with acacia woodland vegetation type. The rainfall is 760 mm. Adami Tulu Agriculture Research Center temperature is 12.6°C-27°C.

Experimental animals

A total of eighteen young cross Bred HF × Arsi bulls produced by the crossing of Holstein Friesian with Arsi Cow at ATARC were selected for the experiment. The calves were injected anti parasites before starting the trial. The vaccination was given for important diseases in the area.

Dietary feeds/treatment groups used for feeding of experimental bulls

The following three different feeds option were used for the fattening of the crossing of Holstein Friesian with Arsi Cow (F1) to evaluate the growth performance of the animals.

- T1=8 hrs Grazing+20% molasses+40% wheat bran+40% Noug cake
- T2=8 hrs Grazing+20% maize grain+45% wheat bran+35% Noug cake
- T3=8 hrs Grazing+65% wheat bran+35% cottonseed cakes

The DM, total CP and TDN content of experimental feeds used for fattening of the bulls during the year 2020/21 was depicted in (Table 1) below.

Table 1: Chemical composition of experimental diets

Type of feeds	Treatment	DM%	CP%	TDN%
Molasses (5.8, 72)	T1	20	1.16	14.4
Wheat bran (13, 67)	T1	40	5.52	26.8
Noug cake (29.75, 66)	T1	40	11.9	26.4

Total		100	18.58	67.6
Maize grain (10, 85)	T2	20	2	17
Wheat bran (13, 67)	T2	45	5.85	30.15
Noug cake (29.75,66)	T2	35	10.41	23.1
Total		100	18.26	70.25
Wheat bran (13,67)	T3	65	8.45	43.55
Cotton seedcake (28, 75)	T3	35	9.8	26.25
Total		100	18.25	69.8

Feeding management

The experimental cross bulls were grazing on natural pasture for 8 hours in the daytime. Each calf was supplemented concentrate based on their body weight. The feed amounts that were given to experimental calves were adjusted based on their body gain in a fifteen-day interval. The animals were fed on individual bases. The feeding trial was stopped at 154 days.

Feeding of experimental animals

In addition to 8 hrs grazing, all the day the experimental bulls were supplemented with concentrates feeds at 2.5% of their body weight throughout the fattening periods. However, the amounts of feed offered to the bulls were gradually changed within two weeks intervals depended on the weight change of the experimental bulls during the feeding periods. All experimental animals were individually fed their respective dietary feed for 154 fattening days. Each daily allocated dietary feeds of experimental based on their body weight were divided into two equal amounts to offer the feeds twice per day; half in the morning and a half in the afternoon.

Refusal feeds from each treatment group of experimental bulls were collected and weighed every day before the daily feed allowance was provided for bulls. All data on body weight change of experimental bulls were collected every two weeks (fortnightly) starting from the commencement of the trials to the end of the fattening periods.

Measurements

The fattening bulls were weighed every two weeks (fortnightly) using a weighing scale and the Average Daily Weight Gain (ADG) of the fattening bulls were calculated using the following formula. ADG=(FWT-IWT) D

Where:

FWT=Final body weight

IWT=Initial body weight

D=Number of fattening days

Feed conversion efficiency

Feed Conversion Efficiency (FCE) was calculated for each animal as a proportion of weight gain to DM intake.

$$\mathrm{FCE} = \frac{\text{Weight gain}\left(\text{kg}\right)}{\text{DM Intake}\left(\text{kg}\right)}$$

Partial budget analysis

The variable costs incurred during the fattening period were recorded properly to analyze the financial return. The purchase price of experimental calves feed cost, labor cost and veterinary costs were included in the partial budget analysis. The purchasing and selling prices of experimental calves were estimated by the help of experienced three persons. The fixed cost was excluded from the partial budget analysis. Hence, this partial budget analysis indicates only the gross margin of fattening calves using the three different feed options.

Statistical analysis

The weight data of the experimental calves were analyzed using the General Linear Model (GLM) of Statistical Analysis System (SAS, 2002) [13]. The estimated least-squares means were separated using the LSD Test at $p<0.05$.

RESULTS AND DISCUSSION

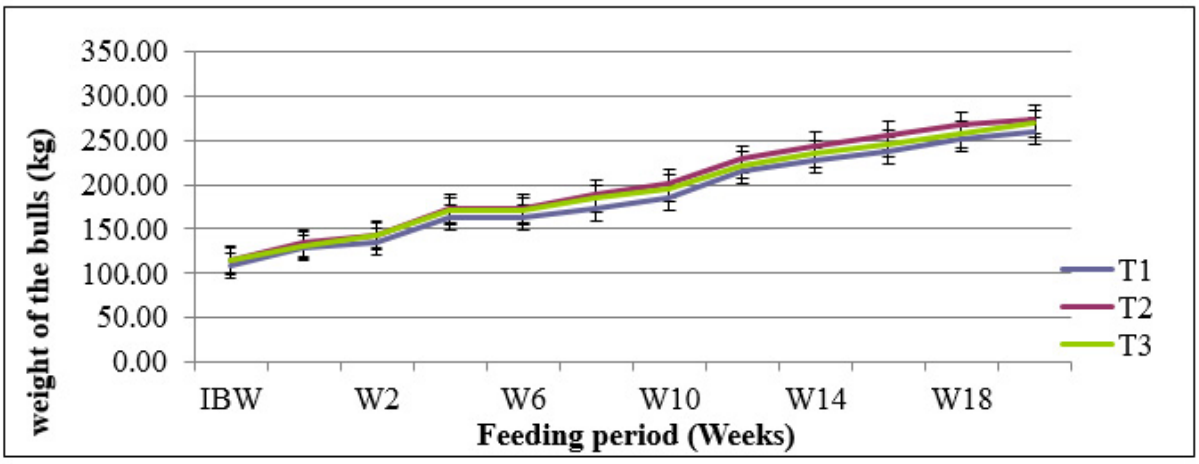
Live weight gain

Least-Square Means (LSM) of Final Body Weight (FBW), Total Weight Gain (TWG), and Average Daily Weight Gain (ADG) of young cross Bred HF × Arsi bulls fed on different feed rations are indicated in Table 2. There is no statistically significant difference in ADG, TWG, and FBW between T1, T2, and T3. Animals in a group of T2 (Grazing+20% maize grain+45% wheat bran+35% Noug cake) were higher in ADG (1.03 ± 0.04), FBW (273.00 ± 7.49) and TWG (158.00 ± 6.46) as compared to the other treatment. Whereas T1 was lower in ADG, TWG, and FBW; but it was higher in FCR.

Table 2: Bodyweight gain of young cross Bred HF × Arsi bulls fed on different dietary ration

Parameter	T1	T2	T3	Overall Mean
ADG (g)	0.99 ± 0.03	1.03 ± 0.04	1.00 ± 0.14	1.01 ± 0.05
TWG (kg)	151.80 ± 4.79	158.00 ± 6.46	154.40 ± 21.59	154.73 ± 7.14
FBW (kg)	260.20 ± 4.87	273.00 ± 7.49	268.80 ± 33.55	267.33 ± 10.81
FCR (%)	23.07	22.87	22.24	22.73

This result is similar with the previous findings of by Bassa, et al., for local oxen around Wolaita and Ahmedin, et al., who reported that feeding of F1 (Harar and HF crossbred) did not bring any significant difference among the three treatment groups [14,15]. In contrary Genet, et al., reports that there were statistically significant variations ($p<0.05$) in average daily gain and total weight gain for calves of HF × Arsi crossbred with the same feeding treatment and with different age groups. He also reported that there is no statically difference with final body weight among the treatments [16]. The average daily weight gain for the young cross Bred HF × Arsi bulls in this study was higher than reported by Merera and Galmessa which was 0.87 kg for Horro-Friesian crossbred bulls in the age from 2 to 3 years, 0.58 kg for young cross Bred HF × Arsi bulls, 0.88 kg for crosses between Borana bulls and Friesian dam as well as 0.98 kg for a cross between Barca sire with Friesian dam at Holota research center and report by O'Donovan, et al. He also reported 0.54 kg ADWG for crossbreds at Bakko research center [3,16-18]. The trend of body weight change of 1 year to 1.5 year young cross Bred HF × Arsi bulls over the whole fattening periods is showed in Figure 1.



Where: IBW=Initial body weight, W2=Week 2, etc up to W 20=Week 20

Figure 1. Bodyweight change of young cross Bred of HF × Arsi bulls over the total fattening period

This result is less than the findings of Laborde et al. (2012) who reported that the ADWG of finishing steers of Simmental (SM) and Red Angus (RA) breeds is 1.58 kg ± 0.07 kg and 1.71 kg ± 0.09 kg respectively [19]. The body weight gain of experimental bulls fed on three different feeds rations at different fattening periods as indicated in (Table 3). O'Donovan and Gerwolde, also report an average daily weight gain of 1.18 kg of Borana bull fed on 40% maize silage, 20% cane molasses, 12% cracked maize, 25% sunflower, 2% bone meal, and 1% salt [20].

Table 3: Least square mean of body weight change of young cross Bred HF × Arsi bulls fed on different dietary ration

Treatment	14 days	28 days	56 days	84 days	112 days	140 days	154 days
T1	108.40 ± 6.56	135.60 ± 8.03	163.00 ± 8.23	184.80 ± 9.58	227.00 ± 7.44	251.00 ± 6.15	260.20 ± 4.87
T2	115.00 ± 2.81	143.40 ± 3.19	172.60 ± 3.41	201.20 ± 5.67	243.40 ± 5.64	266.60 ± 5.04	273.00 ± 7.49
T3	114.40 ± 11.9	142.00 ± 16.16	170.00 ± 19.3	196.00 ± 21.8	234.40 ± 27.8	256.40 ± 30.2	268.80 ± 33.6
Overall mean	112.60 ± 4.48	140.33 ± 5.72	168.53 ± 6.65	194.00 ± 7.78	234.93 ± 9.23	258.00 ± 9.78	267.33 ± 10.8

Feed intakes and daily weight gain

The average daily feeds intake and feedlot performance of young cross Bred HF × Arsi bulls understudy from the beginning of the feeding trial to the end of the trial periods is depicted in Table 4. The average feed intake was higher in the treatment group fed Grazing+20% maize grain+45% wheat bran+35% Noug cake (T2) comparison to other groups. The same trend was found with Dry Matter Intake (DMI) in absolute weight or as a percentage of body weight.

As it is indicated in the (Table 4), the experimental animals feed intake increases as the bodyweight advanced through feeding days. The rate of daily weight gain of experimental calves was steadily increased up to the end of the fattening periods which similar to the finding of Girma, et al., for Boran bull and Genet, et al., for young cross Bred HF × Arsi bulls [16,21]. The daily dry matter intake was increased as experimental animals grown.

Table 4: Daily feed intake and daily weight gain of young cross Bred HF × Arsi bulls

Fattening Periods	T1		T2		T3	
	Feed intake (kg)	DWG (kg)	Feed intake (kg)	DWG (kg)	Feed intake (kg)	DWG (kg)
0-14 days	2.71	1.47	2.88	1.34	2.86	1.20
14-28 days	3.23	0.97	3.35	1.01	3.28	0.99
28-42 days	3.39	1.30	3.64	1.37	3.55	1.32
42-56 days	4.14	0.98	4.54	1.03	4.36	0.99
56-70 days	4.54	0.93	5.00	1.05	4.74	1.00
70-84 days	5.04	0.91	5.41	1.03	5.31	0.97
84-98 days	5.32	1.09	5.66	1.16	5.27	1.09
98-112 days	5.82	1.06	6.09	1.15	5.61	1.07
112-126 days	6.34	1.03	6.55	1.11	5.94	1.04
126-140 days	5.63	1.02	5.82	1.08	5.51	1.01
154 days	4.77	0.99	5.10	1.03	6.09	1.00

Feed intake in beef cattle is influenced by many factors, i.e energy level, protein concentration, palatability, digestibility, live weight, fatness, breed, sex, age, environmental temperature, and physiological state of animal [22]. Of these factors energy level, digestibility and physical state of the diet are the most important factors that limit intake.

Dry matter intake of the current study was higher than what was reported by ElKhidir which might be due to the effect of feed palatability and digestibility [23]. Babiker found an average daily weight gain as 1.062, 1.016, 1.068 and 1.2043 kg with an increase of feed intake when Sudan Baggara bulls were fed bagasse-based diets with differed types of supplements [24]. The trend of daily weight gain of each experimental bulls fed on three different feeds ration over the whole 154 fattening days is indicated in Figure 2.

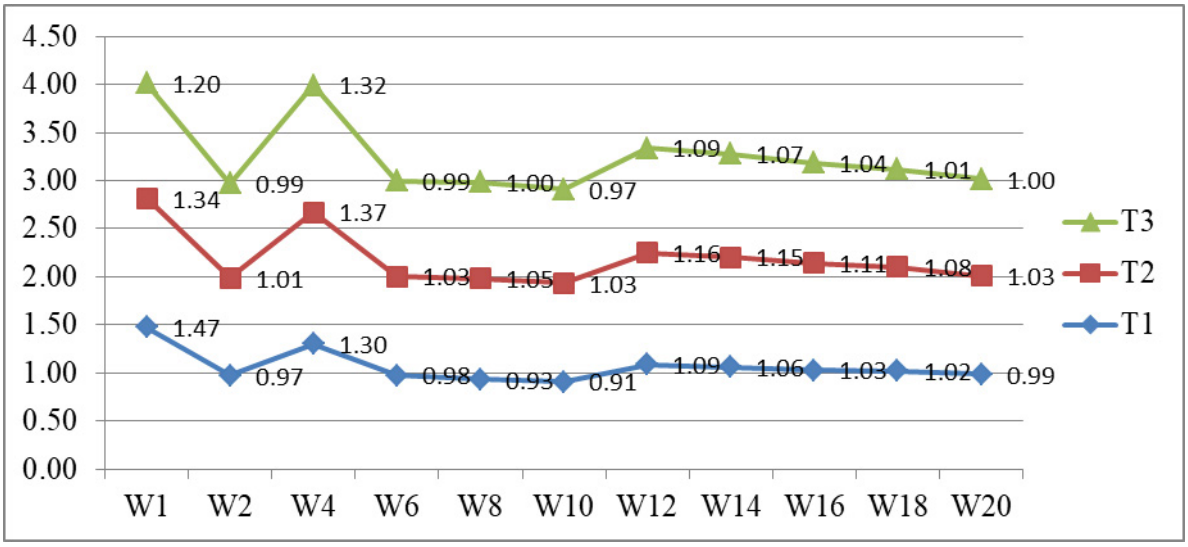


Figure 2. Indicate trend of daily weight gain of young cross Bred HF × Arsi bulls

Feed conversion ratio

Feed conversion efficiency was not significantly ($p<0.05$ different in the three feeding groups. Bulls fed T1 diet (Grazing +20% molasses+40% wheat bran+40% Noug cake) and T2 diet (Grazing+20% Maize grain+45% Wheat bran+35% Noug seed cake) had higher feed conversion ratio respectively. To the contrary bulls fed with T3 diet hand lower feed conversion ratio (Table 2). Similarly, Merera and Galmessa reported that feed conversion efficiency was higher for the lower age group but the differences were not significant ($p>0.05$) for Horro-Friesian crossbred bulls [3]. The overall mean value obtained in this study was greater than the feed conversion efficiency of Fogera (0.10) oxen reported by Adebabay, et al., the value for Adet (0.09) oxen and values were reported by Tolla, et al., for Boran (0.14) and Arsi (0.13) [25,26].

The feed conversion ratio is affected by feed intake and daily gain. Cooper, et al., stated that FCR was affected by the type of feed and improved significantly by high concentrate diet compared to high roughages diet [27]. Huque also report higher FCR a BCB-1 bull of 250 kg live weight gained 1200 g/day and showed 5.13 FCR to 6.73 FCR [28]. The lower FCR in the present study may be due to the lower body weight at mature age compared to most temperate beef breeds but still they are more promising for beef production as FCR is an important economic parameter for commercial beef production. But, to support the increasing demand of beef we need to produce fast-growing beef cattle within an economic FCR.

Economic return on fattening of young cross Bred HF × Arsi bulls

The result of partial budget analysis of fattening of young cross Bred HF × Arsi bulls fed on three different feeds ration for about 154 days for market weight gain is indicated in (Table 5).

Table 5: Partial budget analysis of fattening two years old Borana bulls

Items	T1	T2	T3
Number of bulls	6.00	6.00	6.00
Initial purchasing price of one bull	10840.00	11500.00	11440.00
Transportation cost per animal	470.00	470.00	470.00
Cost of concentrate feeds per animal	6345.88	6846.87	5919.00
Labor cost per animal	3750.00	3750.00	3750.00
Veterinary cost/animal	76.00	76.00	76.00
Total cost per animal	21481.88	22642.87	21655.00
Gross return per animal	26020.00	27300.00	26880.00
Gross margin per animal	4538.12	4657.13	5225.00

Total revenue of finished animals depends mainly on the price of one kg live weight and final weight of animals.

The result of economic return showed that experimental bulls fed with T3 had a higher gross margin per animal (5,225.00) than bulls fed on T2 (4,657.13) and T1 (4,538.12). Feeding of bulls with T1 and T2 are less profitable as compare to T3. This is because of the high cost of Noug seed cake used in T1 and T2. But the cost of molasses used in T1 and the cost of maize grain used in T2 is relatively low as compared to other feeds items used in the same treatments. Hence, fattening of young cross Bred HF × Arsi bulls for 154 days by using three different feeding rations for market weight gain is profitable for all the three feeding rations in general. As indicated that there were less variation in the purchase price of bull which was due to the similarity in the mean values of initial live weight. However, there were differences in total cost between groups. These differences were mainly due to feed cost which was affected mainly by the cost of one kg fed.

CONCLUSION AND RECOMMENDATION

The results indicated that there was no significant variation in daily weight gain and total weight gain between cross-bred bulls fed with dietary ration treatment. Partial budget analysis revealed that there was no variation among calves fed with three dietary feed rations. But crossbred young bulls fed with dietary treatment three was numerically higher in gross margin as compared to crossbred young bulls fed with dietary treatment one and treatment two rations. Therefore, the young crossbred bull can be fed on one of the three dietary feed options based on the availability and accessibility of the feeds in the area.

Generally, feeding 2.5% of body weight of concentrate ration for 154 days was economically profitable providing an overall mean of 4,806.75 ETB per head of HF × Arsi bulls. However, further investigation on fattening HF-crossbred bulls under different levels of ration offering was recommended to evaluate their potential for economic profitability based on their weight gain.

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CONFLICT OF INTEREST

The authors declared that there is no conflict of interest between authors and organizations regarding this paper.

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