Journal of Natural Sciences Research www.iiste.org
ISSN 2224-3186 (Paper) ISSN 2225-0921 (Online)
Vol.15, No.1, 2024

On-farm Evaluation and Demonstration of Different Feeding Technological Options for Beef Cattle Fattening in Adami Tulu Jidokombolcha District, East Shoa Zone

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Abstract
Evaluation and demonstration study was conducted at Gerbi kebele of Adami Tulu Jidokombolcha district on young Borana bulls with the objectives of evaluation and demonstration of bulls fattening technologies at on-farm level. One farmer's research extension group (FREG) was formed for fattening the bulls. Twenty bulls were purchased from Borana zone by farmers for the fattening trials. Two feeding treatments (T_1= Grazing + 20% crushed maize grain + 45% wheat bran + 35% Noug cake and T_2 = Grazing + 65% wheat bran + 35% cotton seed cakes) were evaluated. The animals were randomly assigned for dietary rations and data on live weight change of the animals were taken using weight chart tape (developed by JICA project). Final body weights, total weight gain and average daily weight gain of the bulls were not significant (P>0.05) among the treatments. Bulls fed on treatment one attained an average daily weight gain of 0.83kg; while bulls fed on treatment two gained 0.76 kg per day. Total gross margin of treatment one (53,154.5 ETB) was higher than treatment two (49,467.75 ETB). Cost-benefit analysis indicated that feeding option number one (T_1) is more economical as compared to bulls fed on T_2. However, fatteners can use any of the feeding options depending on availability of the ingredients in their area.
Keywords: Borana bulls, Cattle fattening, Export market weight, technology demonstration
DOI: 10.7176/JNSR/15-1-04
Publication date: January 31st 2024

1. Background and Justification

Ethiopia holds the largest livestock population in Africa, which is estimated at 59.5 million heads of cattle, 30.7 million heads of sheep and 30.2 million heads of goats (CSA, 2017). The livestock sector contributes about 15% of the total export earnings and 30% of agricultural employment (source). Despite the importance of cattle among the farming communities and to the national economy at large, this sector has remained underdeveloped and in many cases underutilized (Mezgebe *et al.,* 2017). Ethiopia's beef productivity per head/annual is 108.4 kg which is far less than 119 kg for Sudan, 146 for Kenya and 205 kg for whole world (Negassa *et al.,* 2011; Mummed *et al.,* 2015; Zekarias, 2016). The current percapita consumption of meat is13.9kg/year, being lower than the African and the world averages, which are 27 kg/year and100kg/year, respectively (Tsigereda *et al.,* 2016).

The meat currently produced from livestock production in the country could not satisfy the high increasing demand of people. On the other hand, the traditional livestock practices are not mostly market oriented (Belay and Menale, 2017). Cattle fattening practices by farmers are mostly dependents on natural pasture and crop residues with few or no supplements. The practices did not also account for the nutrient requirement of animals, the level of feeding being either above or below the animal requirements.

The government of Ethiopia is trying to expand the sector to meet the increased demand from both export and domestic markets. Inline to this, some fattening feed technological options are generated in Adami Tulu Agriculture Center. Recent reports indicated that growth performance of two years old Borana bulls evaluate during different dietary rations managed to attain 300 kg within 154 days of fattening period (Girma *et al.,* 2015). Evaluation and demonstration of such technology is a way to promote to farmers and users. Hence, the study was designed to evaluate and demonstrate the growth performance of young Borana bulls at on-farm level.

Objectives

- To evaluate and demonstrate different feeding options for Borana bulls to attain export market weight demand at on-farm level
- To identify most economical feeding options for Borana bulls at farmers conditions

2. Materials and Methods

2.1. Experimental sites Selection

The study was conducted in selected district of East Shoa Zone. East Shoa Zone is one administrative zones of oromia regional state, Ethiopia. The zone has an area of 10421 km2. There are 10 districts within East zone. Adami Tulu JidoKombolcha (ATJK) is one East Shoa zone district where the demonstration took place. ATJK is

located in mid-rift valley at 167 km from Addis Ababa city, Ethiopia at an altitude of 1650 meter above sea level, along the main road to Hawassa town. The district is geographically located at latitude of 70 50' North and longitude of 380 42' East (Shiberu E *et al.,* 2019). Kemo Gerbi kebele was purposely selected with livestock expert of ATJK district. Farmers' cattle fattening history, access to road, market and water availability for cattle are some criteria used during site selection.

2.2. Farmers' selection and capacity building

The activity was conducted using the farmers' research group (FRG) approaches. One farmer research group was organized. Farmers were selected based on their willingness to participate and previous experience in cattle fattening. Farmers contributed money to purchase bulls, grazing land, construct fattening shade and labor for the fattening purpose. Adami Tulu Agriculture Research Center provided dietary ration (concentrate feeds) and technical aids during the fattening exercise. Theoretical and practical training were provided for farmers, district livestock development expert and development agents on mixed ration preparation, feeding management, animals' health keeping, bulls fattening and marketing the finished bulls.

2.3. Experimental animals' selection and feeding management

Ages of the bulls were determined by dentition techniques. Accordingly, the bulls were two-two and half years old with an average initial live weight of 216.6 ± 12.9 kg. A total of twenty bulls were purchased from Borana Zone of Oromia Regional State, Ethiopia. They were transported by truck to study site. They were treated against internal and external parasites before the commencement of the fattening trial. All experimental bulls were randomly assigned to one of the two dietary treatment groups as indicated below in the next section. They stayed on adaptation to feeds for fifteen days before the 90 actual feeding days. The animals were supplied with their daily dietary ration amount; half in the morning and the remaining half in the afternoon. The concentrate feeds were given to the animals at a rate of 2.5% of their body weights and adjusted on every 15 days weight change. Bulls were kept on grazing for eight hours a day plus few tinning of maize crop whenever available and watering was freely or adlib during the whole day.

2.4. Experimental ration formulation

Dietary rations were formulated from different feed ingredients; wheat bran, Noug seed cake, crushed maize grain and cotton seed cake. Two dietary rations were formulated in such a way that they contain similar amounts of energy and protein.

Treatment 1, Eight hour grazing + 20% maize grain + 45% wheat bran + 35% Noug seed cake

Treatment 2, Eight hour grazing + 35% cotton seed cake + 65% wheat bran.

2.5. Chemicals composition of experimental feeds

Table 1.Ingredients and chemical composition (%)

Dietary ration	Ingredient	DM	CP	TDN
	Maize grain (10, 85)	20	2.00	17.00
T_1	Wheat bran (13, 67)	45	5.85	30.15
	Noug cake (29.75, 66)	35	10.41	23.10
	Total	**100**	**18.26**	**70.25**
	Wheat bran (13, 67)	65	8.45	43.55
T_2	Cottonseed cake (28, 75)	35	9.80	**18.25**
	Total	**100**		**69.8**

T = Treatment, DM = Dry matter, CP = Crude protein, TDN = Total digestible nutrient, Number written in bracket indicates dry-matter bases

2.6. Growth performance assessment

Record sheets and check lists were prepared to collect data on the amount of feed offered and fortnightly live weight changes. The total and average daily body weight gain was calculated as follows:

$$\text{ADW} = \frac{(FBW - IBW)}{\text{D}}$$

$$\text{TWG} = \text{FBW} - \text{IBW}$$

Where: ADG = Average daily gain, TWG = Total weight gain, FBW = Final body weight, IBW = Initial body weight and D = Total fattening days

2.7. Cost-benefit ratio analysis

All variable costs incurred in conducting the trials were recorded. Total variable costs such as animal purchase, transportation, feeds cost, labor and veterinary costs were included in the cost-benefit analysis. At the end of the fattening period, the gross revenues were obtained from prices of the bulls sold at market. Fixed costs incurred for feeding the animals were not included in cost benefit analyses.

2.8. Statistical analysis

Data was coded and entered to micro soft excel 2007 and checked for any error. Data on all live weight changes and economic parameters were analyzed using t-test of R software 3.5.2 version.

3. Results and Discussion

3.1. Growth performance of bulls

Growth performances of the young Borana bulls were analyzed after fattening period and final body weight, total and average daily weight gains of the bulls are as depicted in Table 2.

Table 2. Growth performance of Borana bulls at on-farm level

Weight	T_1	T_2	Overall
IBW (kg)	214.3 ±10.9	218.8±14.7	216.6± 12.9
FBW (kg)	301.6±7.8	298.1±10.9	300.3±9.4
TWG (kg)	87.3±5.2	79.3±8.4	83.8±7.7
ADG (kg)	0.83±0.07	0.76±0.08	0.79±0.07

IBW = Initial body weight, FBW = Final body weight, ADG = Average daily gain, TWG = Total weight gain, Values are not significant across raw at $P<0.05$, T_1 (eight hour grazing + 20% maize grain + 45% wheat bran + 35% Noug seed cake), T_2 (eight hour grazing + 65% wheat bran + 35% cotton seed cake)

The study results indicate that there is no statistically significant difference in final body weight between the two treatments (T_1 and T_2). This is similar to the finding of Mieso *et al*., (2013) who conducted similar study on the yearling Borana bulls. Similarly, Girma *et al.,* (2015) reported that dietary rations have similar effect on final body weight of two years old Borana bulls.

Total and average daily weight gains for the experimental bulls didn't also showed significant difference between the two treatments at 105 days of fattening. In previous studies (Mieso *et al.,* 2013; Girma *et al.,* 2015; Ashebir *et al.,* 2019; Tesfaye *et al.,* 2018; Aman *et al.,* 2019; Tesfaye *et al.,* 2019) conducted at on-station on yearling Borana bulls, two years old Borana bulls, yearling kereyu bulls, two years old Kereyu bulls, yearling Arsi bulls and two years old Arsi bulls fed on similar dietary ration reported no significant differences in total weight gains among the treatment groups.The current average daily weight gains of the bulls at the end of the fattening period was found to be similar to the finding of Girma *et al.,* (2015) who reported a daily weight gain of 0.801 and 0.753 kg for two years old Borana bulls. Furthermore, this study indicated that the Borana bulls can attain export market body weight demand in fifteen weeks of their fattening period.

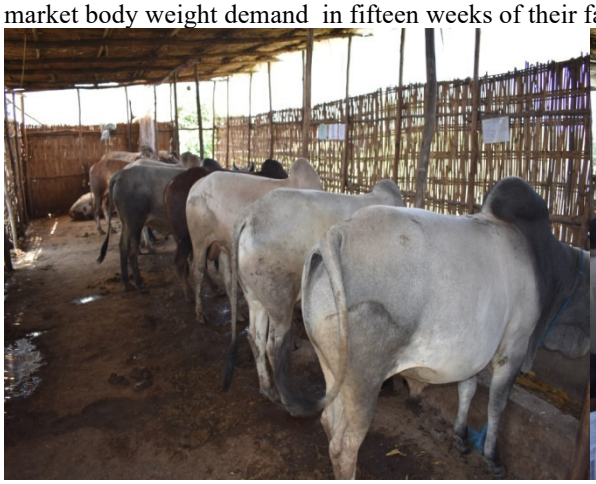

Figure 1. Bulls at fattening shade

Figure 2. Farmers field days

3.2. Cost-benefit analysis

The result of partial budget analysis of fattening the young Borana bulls fattening at on-farm level is given in Table 3. Even though, there was no significant difference among the treatments the result indicated higher total gross margin for experimental bulls fed dietary feed (T_1) than those fed dietary ration T_2 . This study was similar to Mieso *et al.*, (2013) where the Borana bulls, which received crushed maize grain, gave better profit than those

received cotton seedcake.

Table 3.Economic return from Borana bulls fattening at on-farm level

List of items	T_1	T_2	Overall
Feeds costs per bull (ETB)	4635.05	4798.425	4716.7375
Purchasing price per bull(ETB)	8500	8500	8500
Transport cost per bull(ETB)	700	700	700
Labor cost per bull(ETB)	150	150	150
Veterinary cost per bull (ETB)	55	45	50
Total variable cost per bull(ETB)	**14040.05**	**14193.425**	**14116.738**
Total gross output per bull(ETB)	19355.5	19140.2	19247.85
Gross margin per bull(ETB)	5315.45	4946.775	5131.1125
Total gross margin (ETB)	**53154.5**	**49467.75**	**51311.125**

ETB: Ethiopia Birr; Values are not significant across raw at $P<0.05$, T_1 (eight hour grazing + 20% maize grain + 45% wheat bran + 35% Noug seed cake), T_2 (eight hour grazing + 65% wheat brain + 35% cotton seed cake)

4. Conclusion and Recommendation

Twenty four young Borana bulls were randomly assigned on two dietary rations and kept on feeding for fifteen weeks. Growth performances of the bulls were assessed and there is no statistically significant difference in final body weight, total daily weight and daily weight gain, which may be attributed to the similarity of the CP and TDN of the ration provided to the experimental bulls. Numerically bulls fed on dietary T_1 were more profitable than bulls fed on dietary T_2. However, as there were no significant differences in major parameters among the treatments, any one of the feeding options can be used depending on availability of the feed ingredients in the area.

Acknowledgment

The authors would like to thank, Ethiopian Institute of Agricultural Research (EIAR) for funding this activity financially through national beef commodity and Oromia Agricultural Research Institute for the logistic support to accomplish the activity as well as the development agents and farmers for their valuable contribution during the entire course the on-farm feeding trial experimentation.

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