



## **Demonstration of Maize-Nougcake Concentrate Based Sheep Fattening in Horro District, Oromia Regional State, Ethiopia**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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### **ABSTRACT**

This activity was conducted in Horro district of western Oromia, Ethiopia with the objective of popularizing proven sheep fattening technology. The study sites were Leku and Gitilo kebeles where community based sheep breeding project is underway. The rams to be fattened were weighed; body condition was recorded, de-wormed and sprayed against internal and external parasites. Initial price of the rams was estimated by a panel of three price informed estimators. The rams were supplemented with 400 g/h/day concentrate composed of 49.5% Noug cake, 49.5% ground maize, 1% salt for 90 days fattening period. The mean initial weight, final weight, initial price and selling prices of the rams were 21.05 kg, 28.51 kg, 517 birr and 1577.5 birr, respectively. Total body weight gain (TWG) of the rams on average was 7.5 kg over the fattening period with a range of 4.5-13.5 kg. The average daily gain (ADG) for the fattening period was 83.3 g/h/ day. The difference between initial and final body weight (7.5 kg) and initial and final body condition (1.7 kg) were statistically significant ( $p=0.00$ ) and ( $p=.04$ ), respectively. On average, a net return of birr 456.7 was accrued to the farmers from sale of the fattened rams. An increase in input price by 10%, keeping the price of fattened rams constant would result in marginal return of 1.6 and a net

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return of 396 birr. The technology is still profitable on the face of the expected escalation in input prices. The escalation is counteracted by the current attractive sale price of fattened rams. It is thus important to go for further scaling up in areas where there is access to these inputs.

*Keywords: Average daily gain; breeding rams; community based; Gitilo' Leku; total weight gain.*

## 1. INTRODUCTION

The small ruminant population of Ethiopia, including expert estimates from the pastoral areas, is about 66 million of which about 35 million are sheep [1]. They provide about 46% of the national meat consumption and 58% of the value of hide and skin production [2]. Small ruminants have many advantages over large ruminants for most smallholder farmers, including among others: lower feed costs, quicker turnover, easy management and appropriate size at slaughter [3-5]. They also suffer far less mortality during periods of drought than large ruminants [6,3]. In addition, subsistence farmers prefer small ruminants as the risk of large ruminants dying and leaving them with nothing is greater [7].

In Ethiopia, sheep are the second most important species of livestock, with diverse breeds and ecotypes and the population is distributed from cool alpine climate of the mountains to the arid pastoral areas of the lowlands. These are primarily owned and managed by resource-poor smallholder farmers and pastoralists under traditional and extensive production systems. Market-oriented or commercial production is almost non-existent. Thus the level of production and productivity of sheep in the country is generally low. For instance, the average carcass weight per slaughtered animal for the years 2000 to 2007 was about 10 kilograms (kg) [8]. In the western region as it is common elsewhere in the country, the great majority of sheep sent to market for slaughter are unfinished milk tooth lambs with live weights ranging between 10 and 18 kg [9]. That means, the meat yield and the income farmers acquire from this category of animals is indeed low and it may be a wasteful system for it does not make use of the growth potential of these lambs through finishing practice for larger weights. The demand and prices for sheep is increasing in the domestic market due to increasing urbanization and income. According to the Ethiopian Institute of Biodiversity Conservation [10], the demand for sheep is especially pressing given that the current population of the country is expected to rise to nearly 130 million by the year 2030. Even

though Bako agricultural research center has developed and verified sheep fattening package for Horro sheep, the indigenous sheep breed in the area, farmers in the study area still follow traditional, grazing based and year round long period fattening that is neither economical nor convenient to operate. Furthermore, there is less effort to popularize this feeding package to the farming community in the area inclusive of the community in the study area considered. As it is common elsewhere in the country, small scale sheep producers in this specific site sell their animals either before attaining their mature body weight or without improving their condition through supplementation. As a result, they fetch lower prices from sale of their animals. This activity was then conducted with the objective of filling knowledge gap in sheep fattening/finishing and improves income of the group through sale of fattened rams.

## 2. MATERIALS AND METHODS

### 2.1 Location

The activity was conducted in a purposively selected district, Horro district of Horro Guduru Wollega, western Oromia specifically Gitilo and Leku farmers' Association where ILRI/BOKU funded community based Sheep breeding project is implemented. The task of fattening rams that are out of breeding was part the breeding work to help the community improve their income and control of inbreeding. The two sites are adjacent to each other and are located at about 315 km from Addis Ababa, to the west direction. Mixed crop-livestock agriculture is the mainstay of the farming communities. Livestock species raised in the district include cattle, sheep, horses, poultry, goats, donkeys and mules. Major crops are wheat, barley, tef, field peas, linseed, maize, sorghum, oats, Noug and Faba beans. Based on information from Horro district office of agriculture, the human population of the district is 47866 (23,454 males and 24,412 females). The district is bordered by Horro Buluk, Jimma Geneti, Abay Chomen and Abe Dongoro districts from north, south, east and west, respectively. There are 9576 male- and 395 female-headed households in the district. Total land area of the

district is 35580.94 hectares (ha) of which 8.3% is allocated for grazing. The proportion of highland, mid-highland and lowland areas in the Horro district are 49.8%, 48.9% and 1.24%, respectively. The district has one long rainy season that extends from March to mid-October with mean annual precipitation of about 1800 millimeters [11]. The mean, average maximum and average minimum temperatures of the area are 22°C, 27°C and 12°C respectively. Total livestock population of the district is 512105 heads, of which cattle and sheep accounted for 25.55%.

## 2.2 Selection of Rams for Fattening

The rams used for this fattening activity were selected from In this community based sheep breeding scheme, breeding rams are selected at the age of 6 month, and the rams left behind after selection (rams that couldn't fulfill the breeding criteria) are either sold immediately, or castrated and kept in the flock until sale. On top of this, rams selected for breeding are allowed to serve only for two successive years after which they are castrated, sold or transferred to other site farmers' associations for breeding. The reason to restrict the rams' breeding activity to two years was to avoid mating of the rams with their offsprings so as to reduce incidence of inbreeding. The rams involved in the current fattening activity were, thus, a combination of these two categories, the lion's share coming from the unselected group. Accordingly, 20 rams, 12 from Leku and 8 from Gitilo site were used for this specific fattening activity.

## 2.3 Data Requirement

As the community based sheep breeding cooperatives in both of the sites have one enumerator each, they collaborate with the researcher to collect biological data, feed offered and left over. As the rams consumed the feed offered with no left over, data were collected on initial, middle and final body weight and body condition. Accordingly, before commencing the fattening, initial body weight and body condition scores were recorded. Body weight was recorded after overnight fasting and in the morning before the animals are exposed to the feed materials and natural pasture. Moreover, a panel of three individuals with up to date information on live sheep price was formed. Each of the estimators estimated individual ram's price separately to avoid dictation by dominant estimator. The mean of this price was taken as initial price of the rams.

An acclimatization period of one week was used to acquaint the rams with the feed. The rams were de-wormed and sprayed for internal and external parasites, respectively. The feed material is composed of 49.5% Noug cake, 49.5% ground maize, 1% salt. Up on the commencement of the actual feeding the rams were supplemented with 400 g concentrate/h/day. Of the three fattening periods identified by Bako Agricultural Research Center, the June-August round that elapsed 90 days was used targeting the market at the Ethiopian yearly celebrated Meskel ceremony. Meskel is the festivity of the finding of the true cross celebrated at the middle of the month of September every year. During the ninety-days fattening period body weight and body condition scoring was also recorded both in the middle and at the end of the activity.

## 2.4 Ram Final Price Estimation and Selling Price

At the end of the fattening period the rams were weighed, and body condition score was recorded. Total weight gain of the rams was calculated as the difference between the initial and final body weight, whereas daily body weight gain was calculated as the total weight gain divided by the number of feeding days. The same estimators were called back to estimate the final price of the fattened rams adhering to similar estimation procedure used in the initial price estimation. This was taken as estimated final price of the rams. Finally, the actual selling price of the rams was recorded by enumerators that were working for the community based sheep breeding in both of the sites. The reason behind estimation of the final price based on market information of the estimators was to increase the confidence of the farmers and improve the bargaining power of the farmers in the market. This final information-based price estimation was found to be spectacular strategy to challenge the conspiracy of the middle-men to cheat the farmers in the markets.

## 2.5 Methods of Data Analysis

Two different tools were used to analyze the data. Biological data such as body weight and condition; and price changes were analyzed using SPSS (Statistical package for Social sciences) version 20, whereas economical data were analyzed using partial budget analysis. Paired sample t-test was used to test whether there is statistically significant difference between

initial and final weight, initial and final body condition, and initial and selling price of the rams. Cost and benefits were calculated using partial budget analysis. Sensitivity analysis was made to predict what happens to the marginal rate of return and net benefit if the variable costs increased by about ten percent.

### 3. RESULTS AND DISCUSSION

Results of change in body weight and condition, initial and final price is depicted in Table 1. The overall initial body weight of the rams ranged from 16 kg-29 kg with the mean of 21 kg. For the final body weight, the value ranged between 23.5 kg and 39.5 kg, with the mean final body weight of 28.5 kg. The analysis reveals that the mean difference between initial and final body weight was statistically significant ( $p < 0.001$ ). On average the rams have gained 7.5 kg during the ninety-days fattening period, with a range of 4.5 kg-13.5 kg. The average daily gain of the rams was 83.3 g/h/day. The result of a study [12,13] as cited in Abegaz et al. [14] on the same breed have demonstrated that concentrate supplementation improves the growth performance of growing lambs. The value for total weight gain (TWG) and average daily gain (ADG) of the rams was similar with that of Assefa et al. [15], but is a bit greater than that reported for the same breed of rams by Abegaz et al. [14], where they reported 7.1 kg for an eighty-two days fattening period. Molla et al. [16] also reported a total weight gain of 7.5 kg for the 75 days fattening period for washera sheep of Ethiopia. The value of the average daily gain (90g/h/day) was also similar with the finding of the current study. The difference in the fattening duration between the current study and that of Molla et al. [16], i.e., (15 days) might have been compensated by the difference in nutritive content between lupin and the feed used for the current study.

The body weight change in the current study is also in harmony with findings of Tekilu et al. [17] on Arsi- Bale sheep fed on straw of different fababean varieties and concentrate made of Noug cake and salt. The authors reported an average daily gain ranging from 50 gram to 100 gram for different treatments. According to Gebru et al. [18], Washera supplemented with 00 g/day of different forms of white lupin to Rhodes grass hay basal diet gained between 16 to 25 g/day. This value is substantially lower than the value

for the current study and that reported by Molla et al. [16]. Tesfaye et al. [19] also reported Yearling Washera sheep grazing natural pasture supplemented with 300 to 700 g/day (grass pea and maize grain at a ratio of 4:1 mixture) are reported to grow at the rate of 88 - 126 g/day. Increase in daily gain in their study might have been due to plane of nutrition. On the contrary, the overall mean total weight gain (about 15 kg) and mean average daily gain (105 g/day) reported by [12] for 120 days fattening period were higher than those obtained in the current study. Mohammad et al. [20], from use of high level (600g/h/d) of concentrate of feeding of Arsi lambs have reported a total weight gain of 18.5 kg which is higher than reported in the current study. Nevertheless, the feeding period (two years and four months) and daily weight gain (29 g/day) reported in their study were by far longer and lower than 84 days and 75.7 g/day in the present study, respectively. Similarly, there was a remarkable improvement in body condition score of the rams during the fattening period elapsed. On a 1-5 point measurement scale, the mean initial body condition score of the rams was 2.3, while the value for final body condition score was 4.00. The mean difference between the initial and final body condition was also statistically significant ( $p = 0.04$ ).

This implies that the fattening ration had a remarkable contribution in improving both body weight and condition of the rams under consideration. Though there are cases where an increase in body weight does not necessarily accompanied by increase in body condition, the current result revealed that the change in the live weight of the rams from 21 kg to 28.5 kg was accompanied by an increase in body condition from 2.3 to 4.00, with concomitant increasing trend. The cohort of the two parameters is instrumental in fetching good price on the markets. In their study entitled "On-farm verification of sheep finishing technology in Eastern Wollega zone", Abegaz et al. [14] reported a small difference in weight gain between supplemented and control, but markedly higher selling price of supplemented rams. This is a result of good body condition possessed by finished lambs as opposed to control lambs. On the local markets like that of ours where price of animals mostly depends on body condition than weight, improvement in body condition plays an influential role in price attraction.

**Table 1. Change in body weight, body condition, initial and final price of the rams**

Parameters	Mean	Sd	Sig. value
Ram IW	21.05	3.60	
Ram FW	28.51	4.60	0.000
Ram IC	2.27	0.62	
Ram FC	4.00	0.513	0.043

Source: own data; IW = Initial body weight; FW; FW=final body weight; IC= initial condition; FC= Final condition

**Table 2. Economic analysis of sheep fattening technology using partial budget**

Sheep purchase price	517.32
Sheep sale price	1577.5
A. Gross return	1060.18
Input costs Noug cake	81.00
Salt	0.08
Medication	5.00
B. Total cost	603.4
Net return	456.78
Marginal return (A/B)	1.76
<b>Sensitivity analysis (10%)</b>	
Gross return	1060.18
Cost of fattening	663.74
Marginal return (A/B)	1.6
Net return	396.44

The result also reveals that there is a marked variation between the initial (purchase) and selling price of the rams. The mean initial and selling (final) price of the rams was 517.32 Ethiopian birr (ETB) and 1577.5 Ethiopian birr, respectively with a difference of 1060.18 birr referred to as gross return. The study reveals also that there is statistically significant mean difference ( $p < 0.01$ ) between initial (purchase) and selling price of the rams under consideration. Results from partial budget and Marginal return (MR) analysis are presented in Table 2. The partial budget analysis indicated that yearling Horro rams finished for 90 days with 400g/head/day of maize and Noug cake was found to give an average net return of Birr 381. This sum is by far greater than the value reported by Solomon et al. (2004) in which they reported a 40.24 birr net return for the same breed, the same type and amount of concentrate, but 84 days fattening period. The value is again greater than the findings of Solomon et al. [12] from on-station study of Birr 21.0 per head for 120 days feeding period using yearling Horro rams. This much variation is due increasing demand and price of live sheep in today's market situation.

The result of partial budget analysis reveals that the total variable cost i.e. costs incurred for the

fattening summed up to ETB 603.4, while the income accrued from sale of fattened sheep on average was ETB, 1577.5. This sum is termed as gross return because this category does not entail cost items. The difference between the costs incurred and the revenue accrued to the farmer, which represents net return, was ETB 456.78. The marginal return (MR) is 1.76 (176%) implying for each birr invested, the farmer would spare the spent birr and gains an extra 1.76 birr as net return.

It is obvious that costs change from year to year, despite the difficulty to predict these changes with accuracy. There is, however, techniques researchers use to consider their recommendations in view of possible changes in farmers' economic circumstances. Sensitivity analysis is one of the tools used to deal with unpredicted changes in prices of inputs. In the current study a sensitivity percentage value of 10 % was used. The assumption here is that if the price of inputs is increased by 42% and the gross benefit (revenue accrued to the farmers from sale of the animals) is kept constant, total costs that vary (TVC) would rise to ETB 663.74 and net benefit per animal would be reduced to ETB 396.44. The marginal return (MR) at this projected price increase would be reduced from 1.76 (176%) to 1.6 (109) percent. At the 10%

increase in price of inputs, keeping gross benefit constant, for each 1 ETB incurred, the farmers would recover their 1 birr and receive an extra 1.60 birr which is still profitable.

#### 4. CONCLUSION

The current study aimed at popularizing improved sheep fattening technology in Horro district proved itself of improving body weight, body condition and market price of the fattened rams. The study reveals that supplementation of Horro rams with 400 g concentrate/head/day for ninety days is still profitable with 10% increase in input price when the price of output is held the same, implying the necessity of scaling up to other similar areas where the inputs are readily available to run the business. Harmonizing fattening periods with cultural festivities where fattened sheep are highly demanded is strategy to fetch attractive prices.

#### THE WAY FORWARD

Resource is a prohibitive factor to address large number of clients with the technology. Delivery of inputs along with all the scaling up process doesn't seem practical as it incurs expenditure of much resource. Thus, it seems rational to gear towards teaching the techniques to the farmers rather than delivering inputs that advances dependency. Sustaining the technology seems to be constrained given the difficulty of input acquisition for small number of animals. The formed community based breeding cooperative should be strengthened and; cooperatives should be formed in other farmers' associations to enable them collectively access inputs from their sources.

#### ETHICAL APPROVAL

As per international standard informed written ethical approval has been collected and preserved by the author.

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#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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