

Full Length Research Paper

Pre-scaling up of urea treated rice straw and supplements on fattening performance of oxen along the Rib-river, South Gondar Ethiopia

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Received 29 November, 2016; Accepted 9 May, 2017

The main objective of the study was to create a wider demand and assess the farmer's perception on ox fattening technique by using locally available rice straw and concentrate supplementation. A total of 55 oxen with similar age and body condition were selected for the study from 44 volunteer participant farmers. Urea treated rice straw used as a basal diet and 3 kg concentrate as a supplement per ox per day were used as the experimental animals. The feeding experiment was done for 105 days including 15 days acclimatization period. The analytical result showed that the average weight of the fattened oxen changed from 313.4 to 407.2 kg. The partial budget analysis result also showed that ox fattening by using the above method of feeding and management was profitable with average net benefit of 1654 ETB. The sensitivity analysis result showed that if the price of output becomes constant and the price of the inputs rise by 20%, the fattening by using the above method has a positive return. Farmers report on the fattening technology during field day is very appreciable and they are willing to continue with the same method of fattening. Based on the result, fattening sector generates an alternative income for small holder farmer's livelihood diversification.

Key words: Cattle fattening, rice straw, concentrate, pre-scaling up.

INTRODUCTION

Ethiopia has the largest cattle population in Africa with an estimated population of 52.1 million heads of animals (CSA, 2014/15). As total livestock sector development brings 8.2% of the country's GDP during GTPI (Ethiopian growth and transformation plan, 2015) with their large number and diversity of products, cattle contribute more to the national economy than any other livestock species.

They provide about 45% of all domestic meat consumption with small surplus which generates export income mainly from the sale of live animals. However, the earning from export of live animals and processed meat is very small as compared to the potential of the country.

The potential beef production in Amhara region of Ethiopia is characterized by the use of the indigenous

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cattle breed in mixed smallholder system and low quality and quantity feed availability. The farming system in Libokemkem and Fogera districts is mixed crop livestock system. Farmers in this district cultivate crops and rear livestock for various purposes. The major crop cultivated in the area was rice. In 2010, Ethiopia cultivated about 222,000 ha of rice in 565,000 farmers land (Savitri, 2012). According to the study, as cited by Afework and Lema (2015), Fogera districts is one of the main producers of rice which contributes 58% of the region and 28% of the national production of rice. The major share of livestock feed at fogera district is obtained from crop residues which account for about 58% of share (Getachew et al., 2015). Rice straw is used mainly as a source of livestock feed at all seasons (Simegnew et al., 2014).

Straw can provide some carbohydrate but it is very deficient in other nutrients mainly protein. Also, because of the high lignin content, digestibility is poor. One of the most successful procedures to improve digestibility of crude plant material is through treatment with ammonia/urea. This weakens the hard cell walls, allowing better penetration by rumen microorganisms to produce more effective fermentation and liberation of nutrients.

Therefore, measures should be taken to improve these huge animal feed resources in the district. To do so, treating the straw with urea were one of the most appropriate and friendly method recommended by Adebabay et al. (2013). Participatory technology evaluation and demonstration was done to incorporate farmer's contribution and to create demand on it, finally in that area participant farmers show a demand to continue on the fattening technology (Simegnew et al., 2014). Scaling up is one way of technology diffusion at a larger scale. Consequently, this scaling up activity was conducted to meet the following objectives.

1. To create a wider demand and disseminate fattening technology
2. To assess the farmers perception on the demonstrated technology
3. To create linkage with possible actors in fattening sector

MATERIALS AND METHODS

Location and study area description

The study was conducted in two kebeles (AbewanaKokit and ShinaTsion) in the Borders of Fogera and LiboKemkem districts along Rib River which is the mandate area of the research funding project, Ethio Nile irrigation and Drainage project. Fogera district is one of the districts of the Amhara Regional State and found in South Gondar Zone. It is situated at 11° 58' N latitude and 37° 41' E longitude. Woreta, the capital of the district is found 625 km from Addis Ababa and 55 km from the Regional capital, Bahir Dar. The district is bordered by LiboKemkem district in the North, DeraWoreda in the South, Lake Tana in the West and Farta district in the East. Two selected rural study kebeles are 10 km from Woreta town.

Farmer's selection

Discussions were undertaken in both districts and kebeles with agricultural experts for selection of participant farmers. From the two districts, a total of 44 farmers: one female and 43 male were selected purposively by using the following criteria that is voluntariness and experience on fattening practice, able to purchase ox and able to share cost with the research center that is used for concentrate feed purchasing. Farmers research extension group (FREG) is a method or a tool used by research organization, and then FREG was organized to increase the linkage between researchers, farmers and extension staffs.

Extension methods used to disseminate a technology

To disseminate and diffuse the fattening technology at larger scale, farmers research extension group (FREG) was used as group extension methods. Participatory practical and theoretical training by using leaflet, printed photograph, power point presentation and on job training was given to the selected farmers and extension workers. The content of the training were on improved fattening practice which is focused mainly on improved feeding and management system, oxen selection for fattening, health management and record keeping. Field day was organized at the farmers field and all possible actors (Regional and district Agriculture officers, Regional and local Administration staffs, Farmers Cooperative Union, Trade and Industry expansion Office, Researchers, Hotels and Persons who are working in the fattening sector etc..) were invited to conduct a result demonstration and create linkage for further scaling of the technology. Joint field visit and experience sharing with farmers, extension workers and researchers was done to hold method demonstration especially on urea treatment, animals feeding methods. Urea treatment fattening technology manual was prepared in Amharic version and distributed to the agricultural extension structure.

The recommended fattening technique and procedures

A total of 55 oxen were used for fattening. The experimental animals were examined for their health status and treatments were done for internal (shestomiasis disease) and external parasites (ticks and mites) using broad spectrum anthelmintics before commencement of feeding trial. For each ox, 3 kg concentrate were given as supplementation per day with basal supplementation of urea treated rice straw; water was provided *ad libitum*. The feeding trial was undertaken for 105 days including 15 days of acclimatization period.

Urea treatment was done by farmer's participation with the assistance of DAs and assistance researchers of ALRC; which makes the participant farmers familiar with the methodology of urea treatment. A rice treatment was done with the ration of 80 L water, 5 kg urea and 100 kg air dried rice straw. Concentrate feed were prepared and distributed to the participant farmers with the formulation of 58% maize grain, 40% Nougé seed cake and 2% salt, purchased from Merkeb union animal feed preparation factory.

Data collection and analysis

Body weight changes from initial to final, input cost used for ox fattening (ox purchasing and feed, medicament and labor) cost incurred and benefit gained from fattened ox sell were collected. The perception of farmers towards the demonstrated fattening system was collected by using semi-structured questioner after the end of fattening period during the field day. The collected data was coded and entered into the computer by using Excel and SPSS

Table 1. Household characteristics of the participant farmers.

Variables	Attributes	Percent (%)
Sex	Female	96.7
	Male	3.3
Marital status	Married	93.3
	Single	6.7
Education status	Illiterate	56.7
	1-4 grade	13.3
	5-8 grade	26.7
	College and university	3.3

(version 16). Simple descriptive statistics were employed to analyze the collected data. Likert scale analysis also used to measure the farmer's perception. Partial budget and sensitivity analysis were conducted to compute the variable cost of fattening, income from selling of fattened animals and cost benefit ratio. Sensitivity analysis was also calculated by considering the price of input increases and the price of output is constant.

RESULTS AND DISCUSSION

House hold characteristics

As indicated in Table 1, the sex of the participant households were 96.7 and 3.3% male and female, respectively, the number of female farmer was small because the female headed farmers in the selected villages are small. The marital statuses of the participants were 93.3 and 6.7% married and single, respectively. The educational status of the participant was 56.7% illiterate, 13.3% from grade 1 to 4th, 26.7% from grade 5th to 8th and the remaining 3.3% participants has college and university level. The educational status of a majority of participant's was illiterate (56.7%), this shows that the demonstrated fattening techniques can be simply done by farmer's indigenous knowledge without having formal education.

Household asset

On average, one participant farmer owned 2.23 oxen, 1.28 cows, 0.85 heifer, 0.97 bulls, 0.3 calves and 0.61 small ruminants. The average land holding for an individual participants were 1.1 hectare, with maximum of 2.5 and a minimum of 0.25 ha (Table 2). On the other hand, farmers had an alternative to produce their crop through renting land from peoples that do not have oxen or human resource to cultivate their land. The average rented land amount of land by individual participant was 0.47 ha.

Table 2. Average cattle holding.

Cattle type holding	TLU
Ox	2.23
Cow	1.28
Heifer	0.85
Bull	0.97
Calf	0.3
Small ruminant	0.61

TLU = Total livestock unit.

Table 3. Body weight gain of the fattened ox.

Parameter	Average in kg
Initial body weight in kg	313.4
Final body weight in kg	407.2
Body weight gain in kg	93.84
Body weight gain in %	29.94

Kg= kilo gram.

Body weight change

The average weight of the fattened oxen changes from 313.4 to 407.2 kg with a final body weight gain of 93.84 kg at the end of experiment by feeding treated rice straw as a basal diet and supplementing of 3 kg formulated concentrate (Table 3). The result obtained was in line with the report of Simegneu et al. (2014). They reported that it is possible for fatten ox to feed on treated rice straw with supplementation of 3 kg concentrate which leads to average body weight gain of 88.96 kg after 90 days of feeding.

Partial budget analysis

As indicated in Table 4, ox fattening by feeding on treated rice straw with supplementing of concentrate for 90 days is profitable (average net benefit of 1654 ETB). The sensitivity analysis result showed that if the price of output become constant and the price of the inputs rose by 20% and the fattening had a positive return. Similarly, a report of Simegneu et al. (2014) on the same feeding type work done reported that ox fattening for 90 days gives average net benefit of 1519 ETB.

Marketing of fattened oxen

The average distance on foot for the nearest livestock market was 2.02 and 2.32 h for "Woreta" and "Yifag" town livestock markets, respectively. All fatteners (100%)

Table 4. Cost benefit analysis.

Variables	Partial budget analysis (ETB)	Sensitivity analysis (ETB)
Fattened oxen selling price	9698	9698
A. Total Benefit	9698	9698
Price of oxen purchase	5696	6867.66
Concentrate	1653	1993.02
Plastic	360	434.05
Medicament	12	14.46
Labor for urea treatment	200	241.14
Urea	123	148.30
B. Total Cost	8044	9698.65
Net benefit (A-B)	1654	-0.65
Benefit/Cost ratio (A/B)	1.20	0.99

ETB= Ethiopian birr.

Table 5. Marketing information on oxen fattening.

Parameter		N	Frequency
Where is the livestock market for you	“Woreta” and “yifag “	30	100
How did you sold your fattened ox	Directly at a market	30	100
For what type of buyer did you sold your fattened oxen	Individual consumer	5	16.7
	Traders and/exporters	25	83.3
Did you got livestock market information formally	Yes	11	39.3
	No	17	60.7
Is there any livestock fattening cooperative around your village	Yes	0	0
	No	30	100
What are the market problems do you faced	The selling price of the fattened ox was not attractive	11	64.7
	No alternative buyer	6	35.3

N= sample.

sold their fattened oxen directly at a market. A majority of participants (83.3%) and 16.7% also sold for individual consumers and traders, respectively. Most of the participant farmers (60.7%) did not have formal livestock market information for their decision but the remaining 39.3% participants got informal market information from their relatives and friends. There is no fattening cooperative around the study area (Tables 5 and 6).

Perception of farmers

During the field day, most of the participant and nonparticipant farmers demanded to continue with the demonstrated way of fattening experience. As indicated in Table 7, Likert scales result showed that oxen fattening sector were highly profitable, profitable and not profitable which accounts for 90, 6.7 and 3.3%, respectively. Treated rice straw were highly palatable, palatable and not palatable (86.7, 10 and 3.3%, respectively) for their oxen.

Also, rice straw can be easily treated by 60% farmers and it can also be done at home by 40% of farmers. 100% farmers strongly agreed that concentrate feed was palatable and use full for ox fattening and 56.7% of farmers responded that by taking the formula and raw materials, they can prepare the concentrate feed at home. 80% of respondent farmers strongly agreed that fattening activity can be managed by women easily at home, also, the remaining 20% farmers agreed next to the above. Among the farmers, 36.7% of agreed that there is no market problem for fattened ox but 43.3% disagreed and believed that if the fattening activity is not linked with the hotels and restaurants, there is high market problem especially after holidays.

CONCLUSION AND RECOMMENDATION

According to the Likert scales analysis result, the fattening technique was accepted by the farmers and the extension linkage was created with the responsible

Table 6. Average livestock market distance in hour from participant's residence.

Parameter	N	Min	Max	Mean	SD
How far woretta livestock market from your residence in hour	30	1.00	3.00	2.02	0.63
How far yifag livestock market from your residence in hour	29	1.50	3.00	2.32	0.44

N = total sample, Min = minimum, Max = maximum SD = standard deviation.

Table 7. Farmer's perception of the demonstrated technology.

Questions/variables		Strongly agree	Agree	Neither	Disagree	Strongly disagree
The ox fattening sector was profitable	N	27	2			1
	%	90	6.7			3.3
The treated rice straw was useful and most palatable by oxen	N	26	3			1
	%	86.7	10			3.3
Treating of rice straw was easy to me	N	18	12			
	%	60	40			
The concentrate was useful and most palatable by oxen	N	30				
	%	100				
The concentrate can be prepared at my home by using the formulation	N	8	17	2	3	
	%	26.7	56.7	6.7	10	
An ox fattened by feeding concentrate and treated rice straw was preferable by the consumers than the traditional one	N	21	9			
	%	70	30			
There is no market problem on the fattened oxen at my nearest livestock market	N	3	11	1	13	2
	%	10	36.7	3.3	43.3	6.7
Fattening activity can be managed by women easily at home	N	24	5			1
	%	80	16.7			3.3
In my house hold, there is no labor shortage in participating in oxen fattening	N	16	9	1	4	
	%	53.3	30	3.3	13.3	

N= total sample.

actors. Therefore, the fattening technology linked is to be disseminated at larger scale in the areas that has an abundant potential to produce rice. Partial and sensitivity analysis result shows that fattening sector generates an alternative income for small holder farmer's livelihood diversification. Therefore, fattening technology shall be highly promoted especially at the areas which has ample source of rice straw and crop residues.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

ACKNOWLEDGEMENT

The authors thank the Etho Nile Irrigation and Drainage Project (ENIDP) and the Andassa livestock researchers and drivers for their help in the success of this research work.

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