Evaluation of on-farm goat fattening practice using cow pea hay with concentrate

Reducing Land Degradation and Farmers' Vulnerability to Climate Change in the Highland Dry Areas of North-Western Ethiopia

TECHNICAL REPORT OF EXPERIMENTAL ACTIVITIES

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Science for Better Livelihoods in Dry Areas

In collaboration with

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Cover photo: Study area with goat feeding of 25% concentrates with 75% cow pea hay.
7 May 2004 | Picture by Tikunesh Zelalem

About ICARDA

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Synthesis

Activity type: Technology generation

Report submitted by: Tikunesh Zelalem

Summary report

In the framework of the project 'Reducing land degradation and farmers' vulnerability to climate change in the highland dry areas of north-western Ethiopia', an experiment was conducted in Das dinzaz kebele of Gumara Maksegnit watershed to evaluate fattening of 36 castrated goats at the age of one year and with initial weight of 28.2kg using cow pea hay and concentrate supplementation with different proportions. The treatments were browsing alone (T1), browsing +100% concentrate (T2), browsing +100% cow pea hay (T3), browsing+ 50% cow pea hay with 50% concentrate (T4), browsing +25% cow pea hay with 75% concentrate (T5) and browsing+ 75% cow pea hay with 25% concentrate (T6) for a duration of 105 days. Each animal has free access to browsing and pure water. Average initial body weight (28.2 kg) was not different between feeding treatment groups. The mean final weight (Kg), total body weight gain (Kg) and average daily weight gain (g) obtained were 33.88±4.00, 5.65±1.19 and 62.87±13.24, respectively. Total body weight gains and average daily body weight gain were significantly different ($p<0.05$) between treatments. The group fed on browsing plus 75% concentrate supplement plus 25 % cow pea and browsing plus 100% concentrate had better final body weight, total body weight and average daily body weight gain. The groups fed on browsing plus 100 % concentrate and browsing plus 75% concentrate with 25% cow pea hay had higher daily feed conversion efficiency while those fed on other feed groups. The highest daily gain from treatment 5(T5) is related to a good nutrient balance available in the commercial concentrate supplement despite the relatively higher crude protein content supplemented with 25 % cow pea hay with 75 commercial concentrate. Average dry matter intake and feed conversion efficiency were calculated for indoor fed treatment groups (concentrate with cow pea hay fed treatments) only. There was significant difference ($p<0.05$) in average daily dry matter intake (DM) between the treatments. Increased supplementation of concentrate with cow pea hay forage increased total DM intake, that treatment groups fed on 75 cow pea hay, 25 concentrate and sole cow pea hay had higher DM intake than the other treatments but the average daily weight gain of the animal is higher for treatment 2 and treatment 5 that means goats fed on concentrate alone and 75% concentrate with 25% cow pea hay had better daily weight gain compared to the other treatments. Therefore, based on the results treatment 5(75% concentrate with 25% cow pea hay) was recommended but as famers point of view T6 (25% concentrate with 75% cow pea hay) was preferred to reduce the concentrate level.

Schematic summary of information

Location: Easting: Northing: Elevation	Dinzaz Village, Gumara Maksegnit watershed 37° 33' 55'' to 37° 35' 39'', 12 ° 26'44'' to 12 ° 25'41.7'' 1933 to 2852masl l
Period of implementation: Duration of trials:	2014/2015 1 year
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1 Background and rationale

Livestock production is an important integral part of the farming systems in all parts of Ethiopia and it plays a vital role in the livelihoods of the majority of people in the country. Livestock derive most of their feed from natural pasture and crop residues. Out of the total supply of livestock feeds in Ethiopia, 38.71% is derived from natural pasture, 33.09% from crop residues, 0.6% from improved feeds, 12.03% from hay, 0.76% from agro-industrial by-products and 12.46% from other sources (CSA, 2011/12). Natural pastures contribute the major feed resources providing more than 90% of the livestock feed either in the form of grazing or forage conserved in the form of hay for dry season use. However, feed resources derived from pastures could not fulfil the nutritional requirement of animals particularly in the dry season, due to poor management and inherent low productivity and poor quality (Alemayhu Mengestu, 2003). The implications of such poor nutritional values are slow growth rates, poor fertility, high rates of mortality and consequently reduced production of livestock, especially during the dry season (Adugna Tolera et al., 2000; Getahun Legesse, 2001). The length of dry season varies from year to year and influences the quality and quantity of available feed resources. Young growing animals suffer most during periods of feed shortage, and their body growth is affected.

However, the productivity of the most livestock reared by farmers is low, especially during dry period where there are no enough protein supplement feeds. Dietary nutrients, especially energy and protein are the major factors affecting productivity of sheep. The lowest energy density at which the sheep does not lose weight is between 8 and 10 MJ/kg DM and the minimum protein level required for maintenance is about 8% in the DM. However, the most productive animals such as rapidly growing lambs and lactating ewes

need about 11%. Depending on age, different classes of livestock require 8-18% crude protein (CP) DM basis in their diet to achieve a good nutrient digestibility, rumen microbial function, maintenance and production (Perry et al., 2003). These energy and protein levels are considerably higher than the average values found in natural pastures and crop residues (Gatenby, 2002). Animal performance can be improved by supplementation of protein sources. If protein rich supplement feeds are added to balance low protein roughages, the activity of microorganisms increase on high protein ration and consequently they attack the crude fibre more vigorously (Ranjhan, 1997). Thus, to improve the utilization of poor quality feed resources, it is important to develop protein supplementation strategy using available sources.

Concentrate feed sources especially grains are expensive and highly valued as human food and most by products are expensive and frequently not readily available to farmers. Therefore, it is necessary to look for other cheap and alternative feedstuffs to sustain and improve the ruminant husbandry. Such alternatives should not compete with feedstuffs suitable for mono gastric animals and man (Almaz Ayenew, 2008) but should exhibit moderate nutrient concentration. Agro-industrial by product feed stuffs in the diets of ruminants should support growth and lactation and result in the production of edible food for human beings.

Goat is a multi-functional animal and plays a significant role in the economy and nutrition of landless, small and marginal farmers managing under extensive and village production systems and goat husbandry has been developed based on the range land and pastures as main feed resources, but cereal stubbles and supplements are becoming more important sources of feed for efficient goat production in Ethiopia and across the globe (Fazaeli, 2008). Goats are efficient converters of forage feeds whether they are farmed in cool, temperate, arid or tropical conditions (Sere and Steifeld 1996, Richards, 2002; Lebbie, 2004). Perhaps their greatest advantage relative to large ruminants is low cost, small body size, suitability to smallholdings and its triple purpose use for meat, milk and fibre (Oregui and Falagan, 2006). Cowpeas are generally too valuable as food but they are only occasionally used to feed livestock. Cowpea forage (vines and leaves), fresh or as hay /silage is often used for fodder. There have been attempts of using cowpea leaf meal in pig feeding. The haulms, which are the crop residues of seed production, contain about 45-65% stems and 35-50% leaves and sometimes roots (Anele et al., 2012) and are an important by-product in Sub-Saharan Africa (Savadogo et al., 2000; Singh et al., 2010). Cowpea pod husks obtained after threshing are also used to feed livestock (Oluokun, 2005).

2 Objective

The main objective of this research activity was to evaluate fattening potential of castrated goats fed on combinations of cow pea hay with concentrate and to develop forage based feeding strategy for fattening purpose.

3 Experimental Methods and results

Feed Cultivation and Preparation

For feed cultivation purpose, about 0.7 ha land was rented from farmers. This was to produce the required 17 quintals of dry matter to feed 32 goats for 105 days of feeding period. Accordingly, the required agronomic practices were undertaken. Finally, the feed was collected, properly dried and stored till commencement of feeding trial. Moreover, concentrate to be fed for four of the treatment groups were purchased from agro-industries and was made ready prior to feeding period.

4 Statistical aspects

Animal management

A total of 36 entire yearling male goats were used. The experimental animals were from participant farmers. The animals were de-wormed and sprayed for internal and external parasite and vaccinated for common diseases of the area during a two-week adaptation period. The experimental animals were allocated randomly for six feed treatment groups after stratified by their body weight. The feeding period was 105 days including adaptation period. The treatments were:

- T1=Browsing alone
- T2=Browsing + 400g concentrate (50% Noug seed cake and 50% wheat bran)
- T3= Browsing + 350g cow pea hay
- T4=Browsing + 175 g cowpea hay + 200g concentrate
- T5=Browsing + 87.5 g cowpea hay + 300 g concentrate
- T6=Browsing + 262.5 g cowpea hay + 100 g concentrate

Feed and feeding management

Cow pea was planted during rainy season (July 15 2014/September 10 2014) at Gumara Maksegnit watershed and harvested at 50% flowering. The experimental animals were housed in individual pens during the entire experimental period. The supplement feeds were offered in two equal proportions at morning and evening. All experimental animals had free access to water. Body weight was measure fortnightly. The feed offered and refusal was recorded. Partial budget analysis was done to evaluate economic profitability.

Data collection and analysis

Body weight of animals was taken every fifteen days interval with a Salter balance (50 kg capacity of 200 g precision). Feed offered and refusals were collected and weighed daily. Data were analysed using the general linear model procedure of SAS (SAS 9.1). The model used for the analysis of growth and feed intake was:

Yij = μ + Ti + eij .
Where:
Yijk = the observation on weight and feed intakeμ = Overall mean
Ti = The fixed effect of treatment and
eij = effect of random error

5 Results

Average initial body weight (28.3 kg) was not different between the treatment groups. The mean final weight (Kg), total body weight gain (Kg) and average daily weight gain (g) obtained were 33.88±4.00, 5.65±1.19 and 62.87±13.24, respectively. Total body weight gains and average daily body weight gain were significantly different ($p<0.05$) between treatments.

Table 1: Initial Weight (kg), Final Weight (kg), Total Weight Gain (kg) and Average Daily Weight Gain (g) of fattening goat.

Treatments	Initial weight	Final weight	Total weight gain	Average daily weight gain
Browsing alone	28.03	29.30^{c}	0.93^{c}	10.37^{c}
100% concentrate	27.3	35.33^{a}	8.03^{a}	89.26^{a}
100% Cow pea hay	28.7	32.87^{b}	4.17^{b}	46.3^{b}
50%con[1]+50%Cow pea hay	29.5	34.76^{ab}	5.27b	58.52^{b}
75%con[1]+25%Cow pea hay	27.23	36.8^{a}	9.56^{a}	106.3^{a}
25%con[1]+75%Cow pea hay	28.53	34.51^{ab}	5.98^{b}	66.48^{b}
Overall	28.2	33.88	5.65	62.87
LSD	4.7	4.69	2.02	22.46
CV	14.13	11.56	19.56	19.52

[1] con = concentrate (50%,49% &1% wheat bran, noug cake and salt)

Figures in a column with different superscripts are significantly different at $P<0.0001$

Feed intake

Figure 1: Cow pea at 50% flowering stage. May 2004| T. Zelalem

Average dry matter intake and feed conversion efficiency were calculated for indoors fed treatment groups (concentrate with cow pea hay fed treatments) only and are presented in Table 2. There was significant difference ($p<0.05$) in average daily dry matter intake (DM) between the treatments. Protein intake and DM intake has a close relationship (Nguyen, 1998). This result is inconsistent with literature that cow pea hay increased total DM intake (Mekoya 2008; Manaye et al 2009). Kahindi et al (2007) reported that the increase in supplementation of Napier grass with Madras thorn forage legume had increased DM and CP intake by growing goats.

Table 2: Average DM intake (kg) and feed conversion efficiency (gram body weight gain per kg feed intake) of goats

Treatments	Average daily dry matter intake, g	Feed conversion efficiency, Gain, g/ feed, g
100% concentrate (T2)	392.82±1.01^{c}	0.24±0.01^{a}
100% Cow pea (T3)	409.65±14.56^{c}	0.11±0.02^{b}
50%con[1] +50%Cowpea (T4)	529.03±11.15^{a}	0.09±0.004^{b}
75%con[1]+25%Cow pea (T5)	500.68±0.16^{bb}	0.26±0.004^{a}
25%con[1]+75%Cowpea (T6)	522.03±3.33^{b}	0.12±0.01^{b}

[1]con = concentrate (50% wheat bran 49% noug cake and 1% salt maize+grass pea grain)
Figures in a column with different superscripts are significantly different at $p<0.05$.

Feed conversion efficiency calculated as gram body weight gain per g feed was significantly higher for treatment groups fed on 75% concentrate and 25 % cow pea hay mixtures (T5) and 100 % concentrate T4 (Table 2). That is animals fed on higher proportion of concentrate with low proportion of cow pea hay and thus 100 % concentrate had higher conversion efficiency. This is in agreement with the above discussion that higher level of concentrate (though it has higher protein content) had better feed conversion efficiency.

The better body weight gain observed by a goat on different proportion of cow pea hay with concentrate supplementation treatment as compared to control treatment of this study was a reflection of adequate crude protein and energy for legume hay supplementation diet.

Table 3: Partial budget analysis

Parameter	Treatments					
	1	2	3	4	5	6
Purchase price of bucks	608.33	608.33	608.33	608.33	608.33	608.33
Cost of concentrate (90 days/head)	0	126	0	63	94.5	31.50
Cost of cow pea hay (90 day)	0	0	200	100	100	150
Labor+ feed cost	133.20	309.20	325	288	327.70	306.50
Gross income	811.67	1368.33	1315	1570	1696.67	1615
Total return	210.67	633.33	706.67	961.67	1033.67	1006.67
Net return	70.14	550.30	381.67	673.67	818.84	700.17
Change net income		480.16	311.53	603.53	748.70	630.03
Change TVC		126	191.80	154.80	194.50	173.30
MRR (ratio)		3.81	1.62	3.89	3.85	3.62
MRR (%)		381	162.42	389	385	362.50

6 Conclusion and recommendation

T5, 75% concentrate with 25% cow pea hay was effective both in economically & biologically. T6 (75% cow pea hay with 25% concentrate) is also recommended to reduce the level of concentrate. Farmers can effectively fatten their goats by planting these legumes with under sowing for other crops or the border of their farm lands. It has to be noted that it was challenging to conduct this experiment in the village, and not in an experimental station, using farmers' houses as feeding pen and replication sites.

Figure 2: Goat feeding of 25% concentrates with 75 % cow pea hay. May 2014. T. Zelalem

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***NOTE**: The data presented in this report are currently being elaborated for scientific publication, thus some of them are not final. The aim of this report is to summarize the nature and quality of the activities conducted and of the dataset generated, and to illustrate the main results obtained.*

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