

Evaluation of growth performance of yearling sheep using cultivated forages developed under stock excluded area

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



TECHNICAL REPORT OF EXPERIMENTAL ACTIVITIES JUNE 2016

Implemented by



In collaboration with



Funded by



Contributes to



About the Project

Implemented By

International Center for Agricultural Research in the Dry Areas (ICARDA)
Project Agreement No. 100202

Funded by

Austrian Development Agency (ADA)
Project Reference No. 2012/04

Duration

01 April 2013 to 30 June 2016

Project coordinator

Dr. Claudio Zucca

Partners

Dept. of Water, Atmosphere and Environment, Institute of Hydraulics and Rural Water Management, BOKU - University of Natural Resources and Applied Life Sciences, Vienna Austria

Amhara Region Agricultural Research Institute (ARARI), Bahir Dar, Ethiopia

Ethiopia Institute of Agriculture Research (EIAR), Ministry of Agriculture and Rural Development, Addis Ababa, Ethiopia

Cover photo: Fattened sheep after the feeding trial | 7 May 2004 | Tikunesh Zelalem

About ICARDA

The International Center for Agricultural Research in the Dry Areas (ICARDA) is the global agricultural research Center working with countries in the world's dry and marginal areas, supporting them for sustainable agriculture development to help increase their productivity, raise incomes for smallholder farmer families, improve rural nutrition and strengthen national food security. With partners in more than 40 countries, ICARDA produces science based-solutions that include new crop varieties (barley, wheat, durum wheat, lentil, faba bean, kabuli chickpea, pasture and forage legumes); improved practices for farming and natural resources management; and socio-economic and policy options to enable and empower countries to improve their food security. ICARDA works closely with national agricultural research programs and other partners worldwide in Central Asia, South Asia, West Asia, North Africa, and Sub-Saharan Africa.

International Center for Agricultural Research in the Dry Areas (ICARDA)
PO Box 950764, Amman 11195, JORDAN
www.icarda.org

Synthesis

Activity type: Technology generation

Report submitted by: Tikunesh Zelalem

Summary report

An experiment was conducted in Das dinzaz kebele of Gumara Maksegnit watershed for fattening of 18 yearling sheep with age of one year with initial weight of 20.46 kg using Napier grass and Sesbania fresh biomass supplementation for 105 days. The treatments were: T1 grazing alone; T2 grazing with 400gm concentrate, and T3 grazing plus 85% Napier grass with 15% Sesbania (85 N 15 S). Average initial body weight (20.46 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 24.8, 4.34 and 48.27, respectively. Final body weight and average daily body weight gains were not significantly different ($p>0.05$) between treatments. The group fed on grazing plus concentrate supplement and 85%Napier grass with 15% Sesbania had better final body weight and average daily body weight gain. Average daily dry matter (DM) intake was calculated only for those groups fed indoors because of the difficulty of determining feed intake in grazing animals. The groups fed on 85N15S had higher dry matter intake and grazing plus concentrate had better feed conversion efficiency. The results indicated the possibility of increasing sheep production in areas where grazing land is a problem while the production of these forage species is possible. For a fattening practice, these forage feeds should be supplemented with concentrate feed for which the level of supplementation needs to be set. The partial budget analysis showed that feeding of 85%N with 15% S gave a better return for sheep production and fattening purpose in the study area.

Schematic summary of information

Location:	Dinzaz Village, Gumara Maksegnit watershed
Easting:	37° 33' 55'' to 37° 35' 39'',
Northing:	12° 26'44'' to 12° 25'41.7''
Elevation	1933 to 2852masl l
Period of implementation:	2014/2015
Duration of trials:	1 year
Activity leader(s):	Tikunesh Zelalem tikuzel@gmail.com
Other researchers involved:	Belete Shimelash, Alemu Tarekegn, Solomon Abegaz (PhD) & Aynalem Haile (PhD)

1 Background and rationale

Sheep production is an integral component of the mixed crop-livestock production systems in Ethiopia. Sheep contribute as a source of cash income, food, manure and fiber for smallholder farmers. Sheep production in the mixed crop-livestock production system is based on communal grazing land which is shrinking due to cropping encroachment and gully erosion (Benin et al., 2002; Mengistie, 2008). Therefore, there is a need for an alternative feeding strategy which could alleviate livestock feed problem. The use of cut and carry system is a key principle for the successful integration of livestock and cropping systems to control grazing of stock exclusion and cropping areas and to preserve uplands, catchments and recharge areas essential for sustainable water supplies (Alemayehu 2003). Napier grass is being adopted owing to its high dry matter, palatability and suitability to cut and carry system. Napier grass has a mean CP level of 5.9-13.8 % (Kahindi et al 2007; Kanyama et al., 1995). However, this level is below the ARC (1980) recommended dietary CP levels of growing lambs (167 g CP/kg DM). *Sesbania sesban* is one of the exotic multipurpose fodder tree species that has been introduced in the Ethiopian highlands to alleviate feed shortages, maintain soil fertility and prevent land degradation. *Sesbania* is a potential source of protein having 24.0 - 31.9 % CP (Kanyama et al., 1995, Mekoya 2008). Feeding of *Sesbania* forages have desirable characteristics as a potential feed supplement to improve the utilization of Napier grass to ruminant animals. Nutrient content and digestibility could be enhanced by feeding *Sesbania* with Napier grass (Tessema and Baars, 2004). The objective of the current experiment was therefore, to evaluate the growth of ram lambs fed on different combinations of *Sesbania* and Napier grass and develop Napier grass based feeding strategy for cut and carry system.

2 Objective

The main objective of this research activity was to evaluate fattening potential of yearling sheep fed on combinations of *Sesbania* and Napier grass and to develop Napier-*Sesbania* grass based feeding strategy for cut and carry system.

3 Experimental Methods and results

Forage production and management

Napier grass (Acc. Number 19383) and Sesbania (*Sesbania sesban*) were planted at the border of stock excluded area of Dinzaz kebele for cut and carry system. It was irrigated at 7-15 days interval when the soil gets dry.



Figure 1: Cultivated Napier grass for feeding trial 18 November, 2014
By Tikunesh Zelalem

4 Statistical aspects

Animal and experimental design

A total of 18 yearling male sheep 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 three feed treatment groups after stratified by their body weight. The supplemental feeds were providing at morning and evening. The feeding period was 105 days including adaptation period. The treatments were:

- T1 grazing alone
- T2 Grazing plus 400gm concentrate (50 % Noug cake & 50 % wheat bran)
- T3 Grazing plus 85Napiergrass15Sesbenia freshly cut mixture.

Data collection and analysis

Body weight of animals (Initial, every fifteen days interval and Final) was measured with a Salter balance of (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). Partial budget analysis procedure was used for economic analysis.

5 Results and discussion

Difference, and CV Coefficient of variance

There were no significant differences in final weight, total weight gains and average daily weight gain between the different Napier-Sesbania combination treatment groups. It is unlikely that animals fed different level of Sesbania performed similarly. This effect might be because of the nutritional value of the Napier grass was better. This type of effect is also reported in the literature (Manaye et al., 2009).

Table 1: Body weight change

Treatment	Initial weight kg	Final weight kg	Net gain in kg	Daily weight g
T1	20.47	22.95b	2.48b	27.59b
T2	20.00	25.28a	5.21a	57.96a
T3	20.90	26.17a	5.27a	58.52a
Overall mean	20.46	24.8	4.34	48.27
LSD	2.47	1.57	1.79	19.84
CV	9.8	5.16	33.4	33.4

Define here: T1 grazing alone, T2 Grazing+400gcon, T3 85N15S, LSD least significance Difference, and CV Coefficient of variance



Figure 1: Fattened sheep after feeding trial. Nov 2014. T. Zelalem

The growth performance obtained in the Napier-Sesbania fed treatment groups is below the expected given that Sesbania has high values of dry matter digestibility and better nutrient content (Nguyen, 1998a; Wambui et al., 2006; Nguyen et al., 2009). However, the weight gains obtained in the Napier-Sesbania fed treatments is consistent with the results reported in the literature for goats (Lam and Ledin 2004; Wambui et al., 2006). Moreover, Kanyama et al. (1995) found out that goats fed on above 30% Sesbania lost weight. The relatively low weight gains in Sesbania supplemented treatment groups might be related to the protein binding effect of tannins in the Sesbania (Kanyama et al 1995; Wambui et al., 2006). On the other hand, Nguyen (1998b) and Manaye et al. (2009) reported much higher weight gains from supplementing Sesbania.

The expected weight gain for a profitable fattening should be around the weight gains achieved from concentrate feeding in this experiment (Treatment 2). However, Napier-Sesbania feeding could be comparatively economical feeding and fattening strategy compared to concentrate feeding. Moreover, Napier-Sesbania feeding results indicate the possibility of increasing sheep production in areas where grazing land is a problem, in stock exclusion areas, and in areas where there is irrigation. Inclusion of a certain amount of concentrate in Napier-Sesbania based fattening rations may improve fattening practices based on these forage feeds.

Table 2: Average DM intake (g) and feed conversion efficiency (gram body weight gain per gm feed intake) of sheep

Treatments	Average daily dry matter intake, g	Feed conversion efficiency, Gain, g/ feed, g
T2	376.67 ^b	0.150 ^a
T3	2258 ^a	0.026 ^b
Over all	878.22	0.090
LSD	146.14	0.020
CV%	13.52	17.78

Defined here: T1 grazing alone, T2 Grazing+400gcon, T3 85N15S, LSD least significance

Difference, and CV Coefficient of variance

Feed conversion efficiency calculated as gram body weight gain per kg feed was significantly higher for treatment groups fed on concentrate plus grazing but average daily dry matter intake was higher for 85% Napier with 15% Sesbania mixture (Table 2).

Table 3: Partial budget analysis

Parameter	Treatments		
	1	2	3
Purchase price	600	600	600
Cost of concentrate for (90 days/head	0	126	0
Cost of Napier& Sesbenia (90day)	0	0	100
Total cost that vary	200	326	300
Gross income	900	1320	1370
Total return	300	720	770
Net return	100	394	370
Change net income		294	270
Change TVC	-	126	100
MRR (%)	-	233	270

6 Conclusion and recommendation

T3 (85N15S) had better weight gain and MRR. Farmers can feed and fatten their sheep by planting Napier & Sesbania without incurring extra cost.

7 References

Alemayehu Mengistu 2003 Country Pasture/Forage Resource Profiles, Ethiopia. <http://www.fao.org/ag/AGP/AGPC/doc/Counprof/Ethiopia/Ethiopia.htm>

ARC (Agricultural research council) 1980 The nutrient requirements of ruminant livestock. Commonwealth Agricultural bureaux, Farnham Royal, UK. 351 p

Benin S, Ehui S and Pender J 2002 Policies for livestock development in the Ethiopian highlands. Socioeconomics and Policy research working paper 41. ILRI (International Livestock Research Institute), Addis Ababa, Ethiopia. 29 p

Kahindi R K, Abdulrazak S A and Muinga R W 2007 Effect of supplementing Napier grass (*Pennisetum purpureum*) with Madras thorn (*Pithecellobium dulce*) on intake, digestibility and live weight gains of growing goats. *Small Ruminant Research* 69: 83–87

Kanyama Phiri G Y, Powell C and Gill M 1995 the effect of levels of supplementation with *Sesbania sesban* foliage on intake and live weight changes in goats. *African Feed Resources Network*. pp. 117-121

Manaye T, Tolera A and Zewdu T 2009 Feed intake, digestibility and body weight gain of sheep fed Napier grass mixed with different levels of *Sesbania sesban*. *Livestock Science* 122: 24–29

Mekoya A K 2008 Multipurpose fodder trees in Ethiopia; Farmers' perception, constraints to adoption and effects of long-term supplementation on sheep performance. PhD thesis, Wageningen University, Wageningen, The Netherlands. 220 p

Mengistie Taye 2008 On-farm performances of Washera sheep at Yilmanadensa and Quarit districts of the Amhara National Regional State. M. Sc. Thesis. Hawassa University, Awassa. 133 p

SAS 2003 SAS User's Guide: Statistics. Version 9.1. Cary, NC: Statistical Analysis System Inc.

Tessema Z and Baars RMT 2004 Chemical composition, in vitro dry matter digestibility and ruminal degradation of Napier grass (*Pennisetum purpureum* (L.) Schumach.) mixed with different levels of *Sesbania sesban* (L.) Merr. *Animal Feed Science and Technology* 117: 29–41.

***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.*

Project Manager

Claudio Zucca
Soil Conservation/Land Management Specialist
CGIAR Research Program on Dryland Systems
ICARDA
Marrakesh, Morocco
C.Zucca@cgiar.org

Science for Better Livelihoods in Dry Areas