# Development and implementation of a pilot village-based goat improvement scheme

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**

ICARDA
Science for Better Livelihoods in Dry Areas

**In collaboration with**

ARARI

BOKU

**Funded by**

AUSTRIAN DEVELOPMENT COOPERATION

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CGIAR RESEARCH PROGRAM ON Dryland Systems

# About the Project

### Implemented By

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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

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*Cover photo: Selection and ear tagging of young bucks | 09-2013 | Solomon Abegaz*

# 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.

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# Synthesis

**Activity type:** Technology generation

**Report submitted by:** Solomon Abegaz

## Summary report

Community based goat breed improvement was established to improve the productivity performance of goat through selective breeding and to demonstrate community based utilization and conservation of local breed. The community based breeding with 56 participant farmers have been established since March 2012 at Dinzaz Village Gumara Makseget watershed. 12 bucks user group were established for easy management of the selected bucks. The data were recorded through trained enumerators and best bucks were selected and distributed for buck user group. A total of 57 best bucks were selected in five round selection based on their breeding values of six months weight and farmers selection criteria. Unselected bucks were culled through marketing and castration. The analysis of the performance data showed improvement in growth performance. For instance, there is the improvement of birth in 0.21kg (2.67 kg at the beginning and 2.88kg at the third year). Successful implementation of, data recording, buck selection and management and cooperative establishment are the good indicators of the sustainability and further scale up of village selection scheme.

## Schematic summary of information

| | |
|---|---|
| Location: | Dinzaz Village, Gumara Maksegnit watershed |
| Easting: | 0348242 |
| Northing: | 1374788 |
| Elevation | 2120masl |
| Period of implementation: | March 2012 to December 2015 |
| Duration of trials: | 4years |
| Activity leader(s): | Solomon Abegaz,<br>Email: solomonabegaz@gmail.com |
| Other researchers involved: | Alayu Kidane, Samrawit Tsehay, Aynalem Haile, Teshome Wondie and Kifetew Adane |

# 1 Background and rationale

Goats are mostly kept by smallholders and the rural poor, including women-headed households. They contribute substantially to the livelihoods of Ethiopian smallholder households as a source of income, food (meat and milk), and non-food products such as manure, skins and wool. They also serve as a means of risk mitigation during crop failures, property security, monetary saving and investment in addition to many other socioeconomic and cultural functions. (Herpa and Adane, 2008; Legesse et al., 2008; Abegaz et al. 2013).

Demand and prices for sheep and goat meat show an increasing trend owing to urbanization and increased income in the cities and increased demand from the Gulf countries. However, the annual meat production from small ruminants is relatively small compared with the number of heads. The average annual off-take rate and carcass weight per slaughtered animal for the years 2000-2007 were estimated at 32.5% and 10.1 kg, respectively (FAO 2009)—the lowest among sub-Saharan African countries.

Selective pure breeding of the adapted indigenous breeds is the best possible option of genetic improvement in the tropical countries. Indigenous breeds in harsh tropical environmental conditions have special adaptive features such as tolerance of a wide range of disease, water scarcity tolerance and ability to better utilize the limited and poor quality feed (Baker and Gray, 2004; Kosgey and Okeyo, 2007). The recent approach of establishing community based breeding programs is advocated for low input traditional smallholder farming systems (Sölkner et al., 1998; Kahi et al., 2005; Haile et al., 2009, Wurzinger et al., 2011).

This is because community based breeding programs take into account the needs, views, decisions, and active participation, from inception through to implementation, and their success is based upon proper consideration of farmers' breeding objectives, infrastructure, participation, and ownership (Mueller 1991; Sölkner et al. 1998; Wurzinger et al. 2011). There are a number of practical examples for successful implementation of community level livestock breed improvement in different part of the world. Those are: fiber improvement for Liamas in Bolivia (Wurzinger et al. 2008), Dairy improvement for goat in Mixico (Wurzinger, 2013), meat improvement of sheep in Ethiopia (Haile et al. 2012) and meat improvement for pig in Vetnam (Valle Zairate and Markeman, 2010).

# 2 Objective

The main objective of this research activity was to increase productive performance to increase economic value of indigenous goats through selective breeding and to develop & demonstrate model village for community-based utilization & conservation of local breed.

# 3 Experimental Methods and results

### Community Mobilization

Prior to commencement of the actual field work, the community were sensitized about objectives, intentions and possible outcomes of the project for their genuine participation during data collection. Accordingly, community meetings were organized at the village. The meetings were generally helpful in establishing mutual understanding with the local people while avoiding unrealistic expectations. During the meetings, the research center and participant farmers agreed to participate in the selection of breeding sires/bucks and to cull the unselected ones to avoid uncontrolled mating in communal grazing land or watering points. Synchrony and agreement on when and how to cull undesirable males and on effective use of the selected young males for breeding before they are sold off were reached. After this agreement, village level goat improvements with 56 participants were established at Das dinzaz village. The participants have been grouped in 12 buck user groups based on their proximity and number of breeding does to facilitate easy management of selected bucks. Executive committee with 7 members was elected to facilitate the overall activities.

### Data collection and Follow-up

To restrain goats and facilitate selection of superior sires by farmers, temporary wooden crash (holding yard) were constructed at the village. ID number on plastic ear tags was given for all goats of the participants. Two trained enumerators were employed at the village for day to day follow-up of activities undertaking by 56 participant farmers. Moreover, farmers' perception and other relevant data (productive and reproductive performance data) continuously have been collected throughout the experimental period.

### Bucks selection and management

Selections of young bucks were undertaken at the age of six months based on their performance breeding value. The candidate bucks are collected at central place and the final selection is done by the representative farmers. The selected bucks have been

distributed to the organized bucks' user groups based on a reasonable male to female ration. The bucks were rotated between the buck user groups to avoid inbreeding problems. Undesirable males were culled before they reach puberty (i.e. before they can serve) through castrating, selling or slaughtering.

# 4 Statistical aspects

Prior to analysis, the data was checked for the normality test by using UNIVARITE procedure of SAS and the largest and smallest out layer values were filtered out from the data. Data were analyzed using Statistical Analysis System (SAS) version 9.1.3. Productive data (birth, three month six month, nine month and yearling weight) and reproductive performance (litter size) were analyzed using GLM of SAS. Sex, parity, type of birth, year of birth and Post-partum weight of the doe were considered as the fixed effect in the model

# 5 Results

### Buck selection

The mean of the selected bucks and their counter parts at different round of selection are described in Table 1. A total of 27 breeding bucks were selected based on simple sire selection methods (without recording). A total of 28 bucks (12 in the first round, 6 in the second round and 10 in the third round) have been selected based on their breeding value (growth performance) and farmers selection (color and conformation).

**Table 1: he number and the mean weight of the candidates and the selected bucks at six months of age**

| Round of selection | Potential candidates | Selected bucks | Proportion of Selected | Mean of contemporary | Mean of selected |
|---|---|---|---|---|---|
| 1 | - | 15 | - | - | - |
| 2 | - | 12 | - | - | - |
| 3 | 90 | 12 | 0.13 (12/90) | 17.25 | 20.4 |
| 4 | 37 | 6 | 0.16 (6/37) | 17.78 | 20.83 |
| 5 | 50 | 10 | 0.2(10/50) | 18.35 | 21.70 |

## Growth performances

The weight at different age (Birth, 3 months, 6 months and 9 months) weight of the local goat in the study watershed is presented in Table 2. The overall least square mean of weight at birth, at three months, at six months and nine months of local goats were 2.64±0.109, 8.86±0.297, 11.99±0.36 and 15.98±0.562 kg , respectively.

Sex had a significant effect (P<0.05) on birth weight however it had no significant effect (p>0.05) on the others weight categories considered in this study. Except at 9 month weight, type of birth has a significant effect on the growth performance. Single born kids were heavier (P<0.001) at birth than those born as twin & triple. This is may be due to the dependence of differences on young animals on their mothers. The animals at earlier ages are more dependent than the later age. Year of birth had a significant effect on birth and three months of weight. Animal born at 2005 Ethiopian calendars (the base year) had significantly lower weight than the animal which were born in the second (2006 Ethiopian calendars) and third year (2007 Ethiopian calendars) of selection. This may be the genetic gain due to our selection scheme.

**Table 2: Factors affecting birth, three and six month weights of Central Highland goat (local goat breeds of the study watershed) breed**

| Sources of Variation | Birth Weight (Kg) LSM±SE | 3 Months Weight (Kg) LSM±SE | 6 Months Weight (Kg) LSM±SE | 9 Months Weight (Kg) LSM±SE |
|---|---|---|---|---|
| Overall | 2.64±0.109 | 8.86±0.297 | 11.99±0.36 | 15.98±0.562 |
| CV% | 23.8 | 16.45 | 19.25 | 9.47 |
| Sex | * | NS | NS | NS |
| Male | 2.693±0.109 | 8.78±0.31 | 12.02±0.37 | 17.23±0.58 |
| Female | 2.601±0.12 | 8.93±0.309 | 11.97±0.38 | 16..94±0.57 |
| Type of Birth | *** | * | * | NS |
| Single | 2.916±0.108[a] | 8.94±0.223[a] | 12.99±0.22[a] | 16.16±0.458 |
| Twin | 2.70±0.104[b] | 8.98±0.219[a] | 12.58±0.21[a] | 15.77±0.474 |
| Triple | 2.26±0.149[c] | 7.88±0.63[b] | 10.88±0.97[b] | 15.00±1.172 |
| Year | ** | ** | NS | * |
| 2005 | 2.67±.117[b] | 8.49±.293[c] | 13.00±.37 | 15.75 ±.467 |
| 2006 | 2.74±.114[b] | 9.757±.310[b] | 12.58±.365 | 15.95±.468 |
| 2007 | 2.88±.114[a] | 10.34±.428[a] | 12.98±.58 | 21.12±1.158 |

# 6 Special issues

- Productivity improvement through selective breeding is slow but permanent therefore it needs more time to evaluate the genetic response.
- The number and the type of data collected in community based breeding are many therefore we need the support of ICARDA to develop simple data base system for data management.

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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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