



More meat milk and eggs by and for the poor

CLEANED Environment Assessment of small ruminant production systems in Ethiopia

Baseline validation workshop report



25th June 2021 | Virtual. Teams

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1. Introduction

The SmARt pack project is the implementation of integrated approaches of small ruminant production and productivity improvement technologies of breeds through community-based breeding improvement, feed & nutrition, animal health, collective marketing, and environmental sustainability in Ethiopia. Part of the Livestock CRP operating in Menz,Bonga, Abergela and Doyogena.

In the framework of this project, the Alliance of Biodiversity International and the International Center for Tropical Agriculture (CIAT) and the International Center for Agriculture Research in the Dry Areas, (ICARDA), together with their partners, are jointly working on Comprehensive Livestock Environmental Assessment for Improved Nutrition, a Secured Environment and Sustainable Development (**CLEANED**) of the Small Ruminant value chain, in Menz, Bonga, Doyogena and Abergela, in Ethiopia.

This report presents the discussions and outputs of the virtual CLEANED internal expert validation workshop that took place on Teams 25th June 2021. Due to the political unrest and COVID-19 situation in Ethiopia, this was an internal validation workshop. Together with experts from CIAT, the International Livestock Research Institute (ILRI) and ICARDA.

The workshop aimed to validate the environmental impacts quantified by CLEANED for small ruminant systems in Ethiopia. CLEANED runs were carried out for Menz, Bonga, Doyogena and Abergela with key input data including farm inputs, herd composition and animal whereabouts. Based on these data, the model quantifies land use and water requirements, nutrient balances and greenhouse gas emissions (GHGe). This is a first step in understanding environmental trade-offs in the modeled systems and forms the basis for designing systems with a reduced environmental footprint and that enhance ecosystem services.

2. CLEANED Validation Workshop Objectives

1. **Share** and **discuss** preliminary model results
 - Representation of types (production/animal numbers)
2. To **develop** future scenarios for model implementation that reflect best-bet integrated intervention packages per system.
 - Which combination of interventions makes sense for the different types?

The event was facilitated by Ms. Jessica Mukiri. Table 1 gives an overview of the participants and their expertise. The full presentation guiding through the workshop can be found [here](#).

Table 1 CLEANED Ethiopia Internal Validation Participants

Name	Institution	Expertise	Email
Abiro Tigabie	ICARDA	Coordinator	A.Tigabie@cgiar.org
Barbara Rischkowsky	ICARDA	Team Lead/ Genetics	b.rischkowsky@cgiar.org
Mesfin Mekonnen	ILRI	Health	M.Mekonnen@cgiar.org
Jane Wamatu	ICARDA	Feeds and Forages	J.Wamatu@cgiar.org
Tesfaye Getachew	ILRI-ICARDA	Genetics	T.Getachew@cgiar.org
Jessica Mukiri	Alliance Bioversity-CIAT	Environment	j.mukiri@cgiar.org
Aemiro Kehaliew Ashagrie	Holetta Agricultural Research Center	Animal Nutrition - CLEANED Consultant	aemiroasha@gmail.com
Worku Bedeke Beraedo	Southern Agricultural Research Institute	Livestock research coordinator - CLEANED Consultant	bworku2002@gmail.com

3. Small Ruminant Systems modeled for the different regions

The small ruminant systems as seen in Table 2 were identified, characterised and verified by the team before the assessment began. This was based on a literature review and expert opinions

Table 2 Small Ruminant Systems Ethiopia

Site	Livestock systems	Season	Season Months	Management system	Breed type	Type and No. of animals	Type of feed
Abergele, Lowland	Extensive - goat	Wet	July to Sep	Grazing	Indigenous breed	Goats Does : 18 Goats Bucks: 2 Goats - Fattening Bucks: 2 Kids: 15	Grazing 100%
		Dry	Dec to June				Grazing – 70% Sorghum residues – 13% Cow pea 8% Natural pasture Hay – 5%, Concentrate 4%
Doyogena Highland	Extensive sheep	Wet	May to Oct	Grazing	Indigenous breed	Sheep Ewes : 1.83 Sheep Fattening Rams: 0.12 Sheep Lambs: 0.80 breeding ram : 0.90	Grazing – 50% False banana supply – 17% Avena sativa– 5% Concentrate - 11% Wheat straw - 4%
		Dry	Nov to April				Grazing – 50% False banana supply – 17% Avena sativa– 6% Concentrate - 15% Wheat straw - 11% Natural grass hay - 1%
Menz	Extensive	Dry	Nov to May	Grazing with supplementation	Indigenous breed	Sheep Ewes : 19 Sheep Breeding Rams: 3 Sheep Fattening Rams: 3 Sheep Lambs: 6	Natural pasture grazing 70%, Aftermath grazing-20%, Barley straw -3%, Lentil residue-2%, wheat straw-2% and faba bean residue- 3%
		Wet	Jun to Oct				Natural pasture grazing 85%, Aftermath grazing-10%, Barley straw -5%
Bonga	Extensive	Dry	Feb to May	Grazing with supplementation	Indigenous breed	Sheep Ewes : 4 Sheep Breeding Rams: 1 Sheep Fattening Rams: 2 Sheep Lambs: 4	Natural pasture grazing-90%, Aftermath grazing-5%, False banana waste-4%, Banana waste-1%
		Wet	June to Jan				Natural pasture grazing-90%, Aftermath grazing- 4%, False Banana waste- 4%, Banana waste-2%

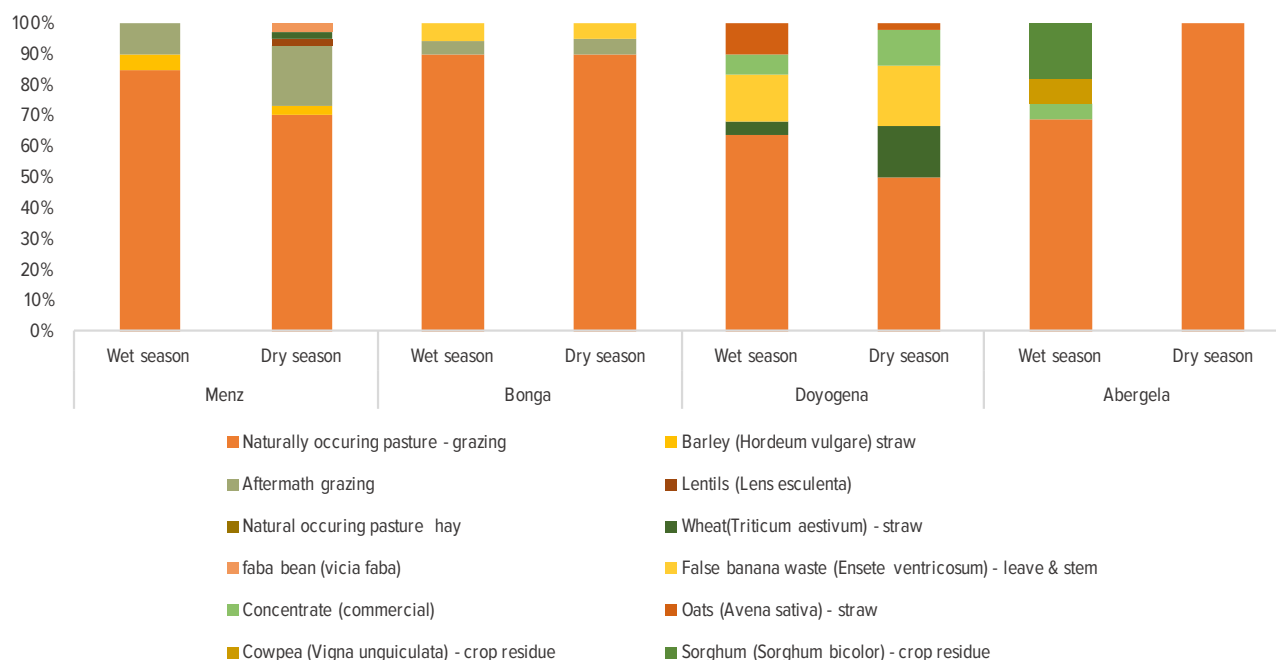


Figure 1 Feed diet composition for the difference systems

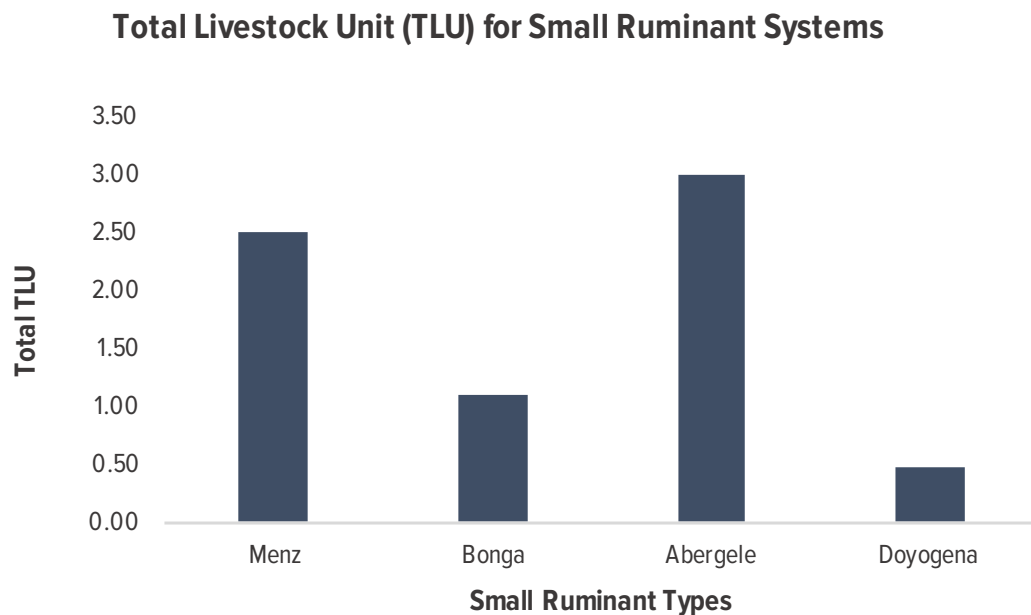


Figure 2 Total TLU Small Ruminant System

CLEANED Baseline Results

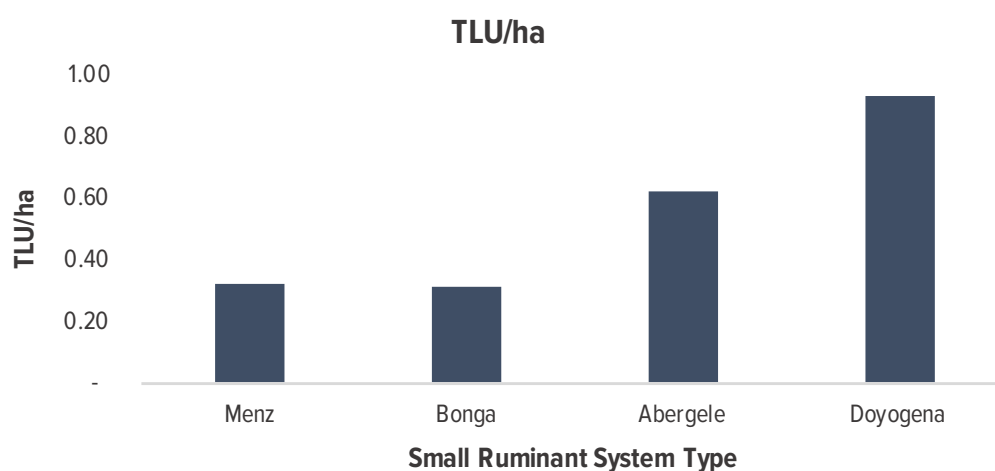


Figure 3 TLU/ha

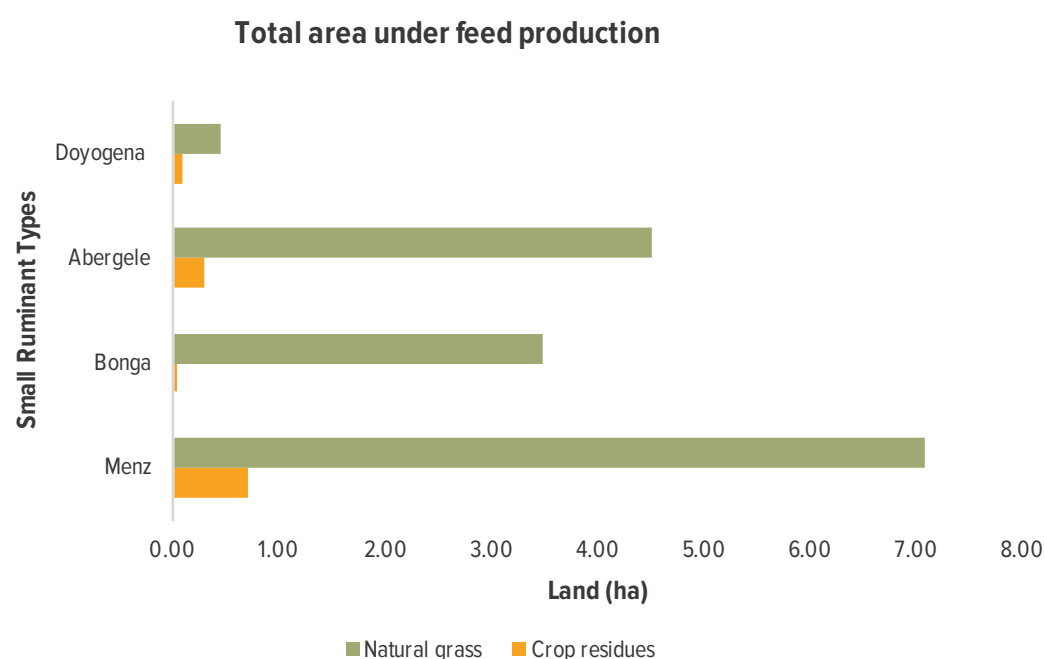


Figure 4 Land requirements for feed production

- » Most systems rely heavily on the use of natural pastures
- » Abergele and Menz similarly had the biggest land requirement as both systems had the bigger animal herds
- » Doyogena has the highest TLU/ha being the most efficient system amongst the other three

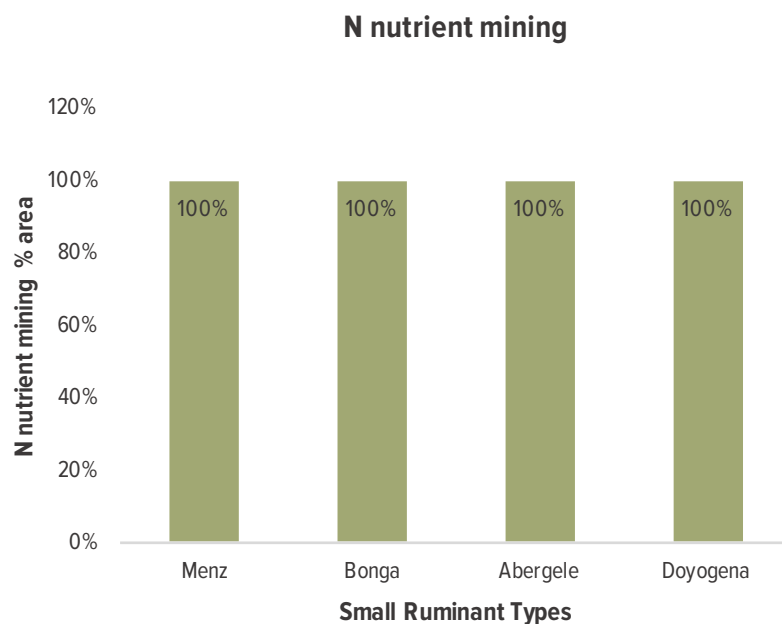


Figure 5 Percentage of the feed producing area where nutrient mining occurs

- » All the systems are heavy in nutrient mining as little or no nutrients are coming in

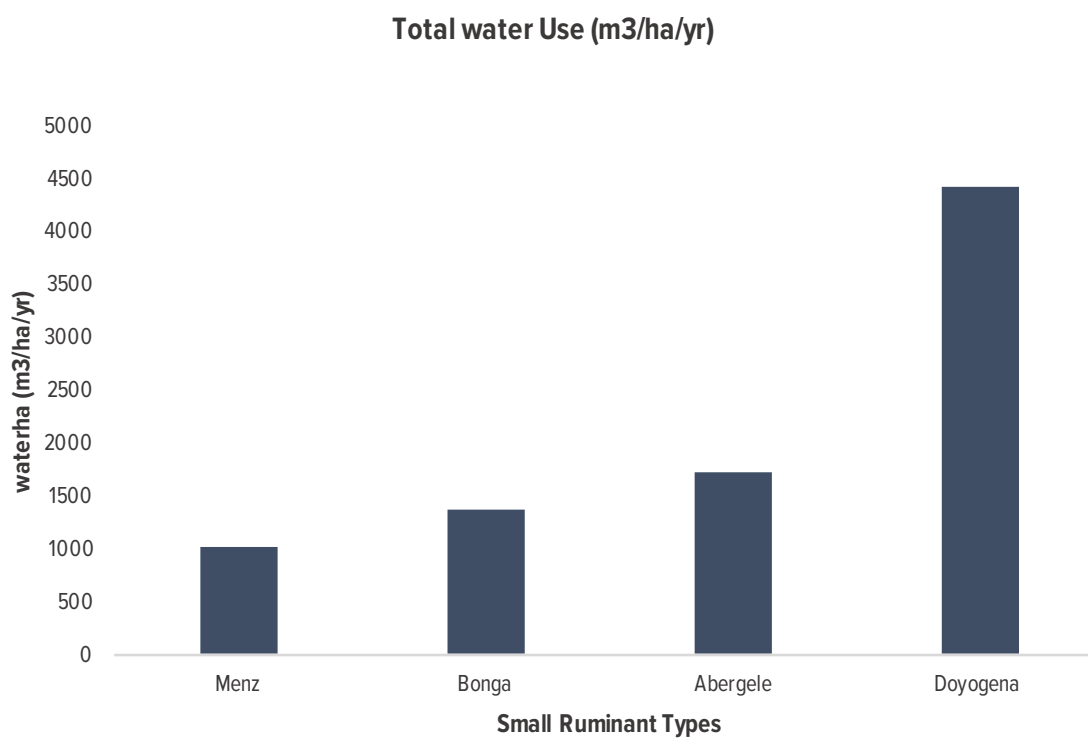


Figure 6 Water requirements for feed production

- » High water use in Doyogena is due to feed lower productivity of animals and high water use of feed items such as false banana waste

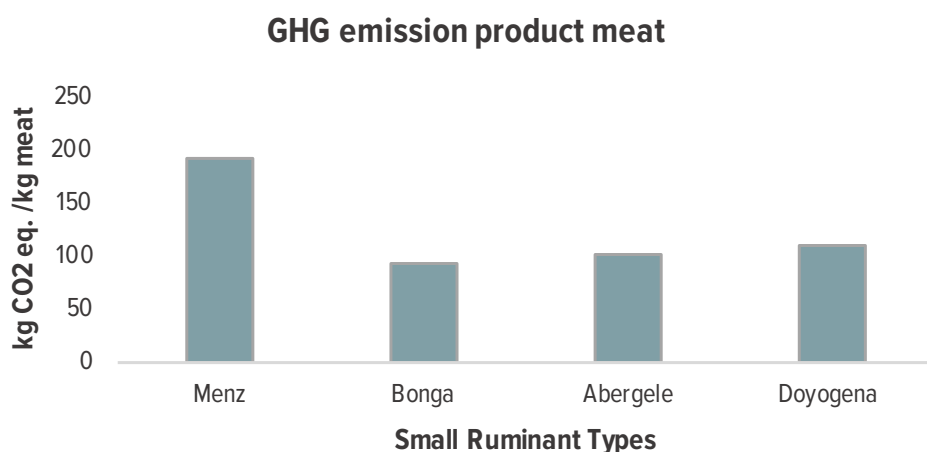


Figure 7 GHGe kg meat

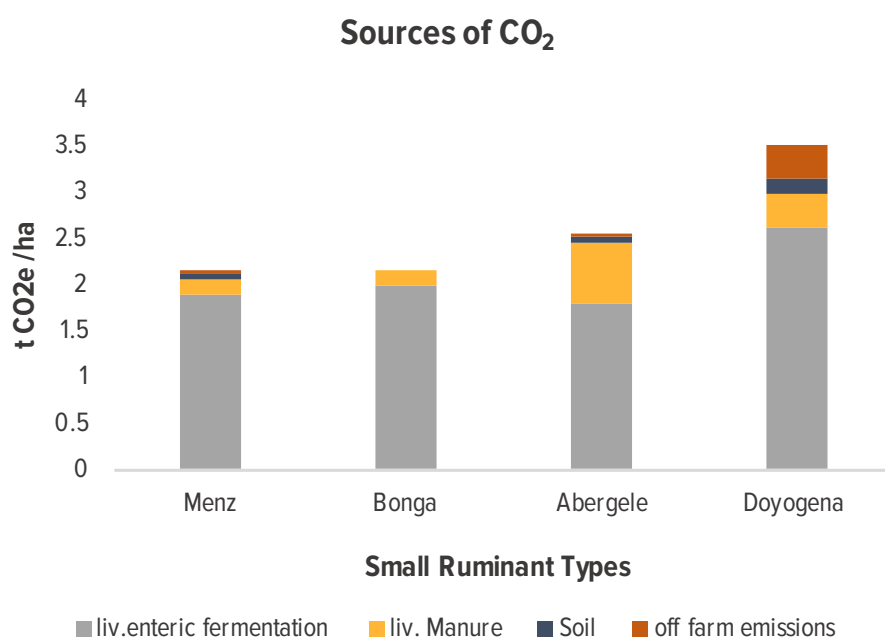


Figure 8 GHGe

- » In all the systems enteric fermentation was the main source of GHGe followed by manure use diet.
- » Total GHGe were below 4 tons of CO₂e a hectare, with Doyogena having the highest emission and the smallest TLU
- » Bonga small ruminant system was the most efficient releasing the least amount of CO₂ per kg meat

General comments

The participants felt that the total land area for feed production was overestimated, especially so in Menz. They felt that there was a need to review the feed basket as there was an over-reliance of grazing, however, cut and carry is also practiced within the systems. Moving forward, feed baskets will be recalibrated to reflect the assessments on the ground.

For the other results the team had no further comments.

Packages

The Smart Pack interventions have been operational for an extended period in Ethiopia, the calendar of activities are placed below and highlighted based on the area they belong too (Herd health, Feeds and Forages and Genetics).

Table 3 Intervention Packages in the different regions

Legend

Herd health

Feeds and Forages

Genetics

Menz	Bonga	Sekota/Abergela	Doyogena
Deworming SR for GI parasites and lungworms	Deworming SR for GI parasites and lungworms	Deworming SR for GI parasites and lungworms	Deworming SR for GI parasites and lungworms
Deworming dogs for coenuruses	Deworming dogs for coenuruses	Vaccination for ovine pasteurellosis	Vaccination for ovine pasteurellosis
Vaccination for ovine pasteurellosis	Vaccination for ovine pasteurellosis	Vaccination for PPR	Vaccination for PPR
Vaccination for PPR	Vaccination for PPR	Vaccination for sheep pox	Vaccination for sheep pox
Vaccination for sheep pox	Vaccination for sheep pox	Vaccination for Anthrax	Vaccination for Anthrax
Vaccination for Anthrax	Vaccination for Anthrax	Vaccination for CCPP	Targeted feeding for pregnant ewes/does
Targeted feeding for pregnant ewes/does	Targeted feeding for pregnant ewes/does	Targeted feeding for pregnant does	Smart nutritional strategies development and flushing of breeding ewes and rams
Smart nutritional strategies development and flushing of breeding ewes and rams	Smart nutritional strategies development and flushing of breeding ewes and rams	Establish breeder cooperatives in new sites	Integration of identified cultivated forages into the feeding systems
Integration of identified cultivated forages into the feeding systems	Integration of identified cultivated forages into the feeding systems	Breeding bucks selection and ranking	Breeding ram selection and ranking
Establish breeder cooperatives in new sites	Breeding ram selection and ranking	Pregnancy testing, mass synchronization and artificial insemination	Pregnancy testing, mass synchronization and artificial insemination
Breeding ram selection and ranking	Pregnancy testing, mass synchronization and artificial insemination		Breeding sire procurement and avail best rams for breeder cooperative, distribute to the new intervention site and other beneficiary

Menz	Bonga	Sekota/Abergela	Doyogena
Pregnancy testing, mass synchronization and artificial insemination	Breeding sire procurement and avail best rams for breeder cooperative, distribute to the new intervention site and other beneficiary		
Breeding sire procurement and avail best rams for breeder cooperative, distribute to the new intervention site and other beneficiary			

These interventions have been tested and the main productivity gains include:

- Reduced mortality
- Increased productivity as a result of better health and genetics and feeding

For the interventions the team agreed on two packages to be tested:

1. Herd health interventions in combination with the Genetics interventions
2. Herd health, Genetics interventions together with a Fattening intervention from the Feeds and Forages package.

4. Workshop Summary

The objectives of workshop were met. The next steps included Tesfaye to send the values of various inputs that changed and for the CLEANED Teams to sit with Jane to refine the feed basket and discuss the intervention.



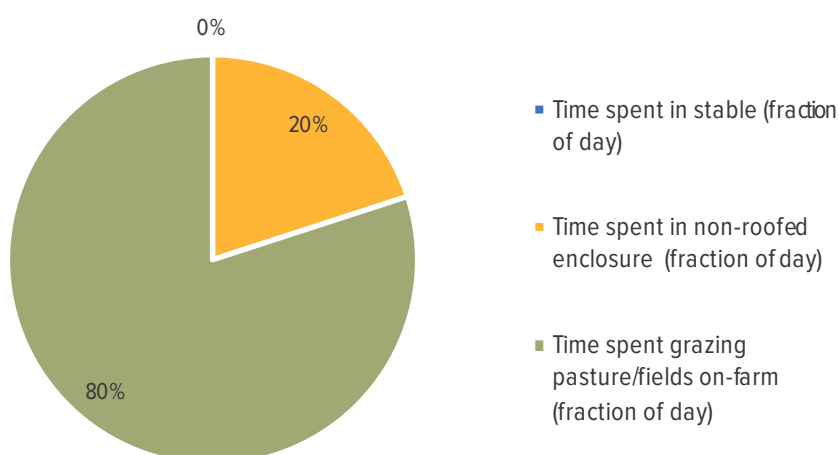
Photo: Apollo Habtamu/ILRI

Annex 1 CLEANED Input Data

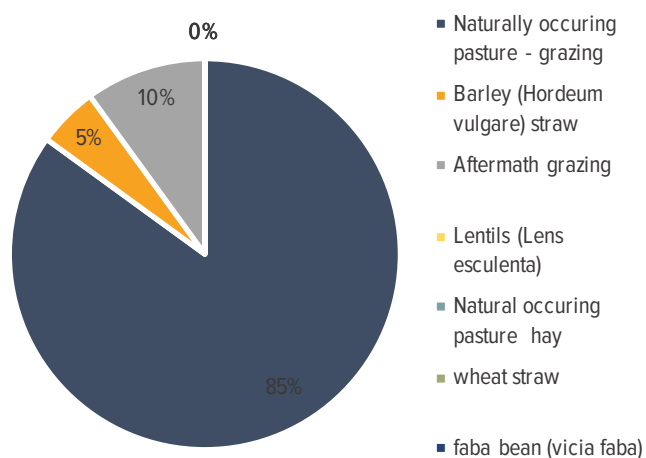
Menz

	Herd composition (nr)	Average annual growth per animal (kg)	Average Body weight (kg)	Parturition interval (years)
Sheep Ewes - Menz	19	0.39	22	0.7
Sheep - Breeding Rams - Menz	3	5.4	24	
Sheep - Fattening Rams - Menz	3	7.2	25	
Sheep - Lambs - Menz	6	17.2	10	

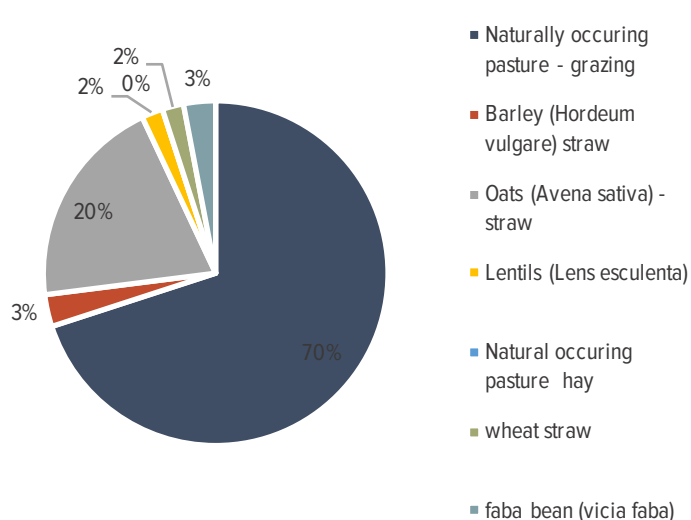
Whereabouts of animal



Season 1 Menz Feedbasket



Season 2 - Menz Feedbasket



Reference List

Input/ Parameter	Value	Reference
Herd composition (nr)	31	ILRI, 2009
Ewe -Average annual growth per animal (kg)	0.39	Expert (Tesfaye and Aemiro)
Breeding Rams -Average annual growth per animal (kg)	5.4	Expert (Aemiro and Tesfaye)
Fattening Rams -Average annual growth per animal (kg)	7.2	Expert (Aemiro and Tesfaye)
Lambs - Average annual growth per animal (kg)	17.2	ILRI data (2009)
Ewes -Average Body weight (kg)	22	EIAR, 2017,ILRI, 2009, Expert opinion (Aemiro, Tesfaye)
Breeding Rams -Average Body weight (kg)	24	EIAR, 2017,ILRI, 2009, Expert opinion (Aemiro, Tesfaye)
Fattening Rams -Average Body weight (kg)	25	EIAR, 2017,ILRI, 2009, Expert opinion (Aemiro, Tesfaye)
Lambs -Average Body weight (kg)	10	EIAR, 2017,ILRI, 2009, Expert opinion (Aemiro, Tesfaye)
Parturition interval (years)	0.6	EIAR, 2017
Feedbasket/ Diet	see pie charts	Expert opinion (Aemiro, Abiro, Tesfaye) , Tarekegn et al., 2016; Gizaw et al., 2012, Thorpe, W. R., & Duncan, A. J. (2012)
Animal Whereabouts	see pie chart	Expert Opinion (Aemiro, Tesfaye)
Barley	2.55	Seyoum et al., 2007, Holeta nutrition lab data
Natural pasture grazing/DM Yield tonne/ha	2.10	Seyoum et al., 2007, Holeta nutrition lab data
Natural pasture hay/DM Yield tonne/ha	1.98	Seyoum et al., 2007, Holeta nutrition lab data
Wheat /DM Yield tonne/ha	2.87	Seyoum et al., 2007, Holeta nutrition lab data
faba bean (vicia faba)/DM Yield tonne/ha	2.34	Seyoum et al., 2007, Holeta nutrition lab data
Lentils (Lens esculenta)/DM Yield tonne/ha	1.50	Seyoum et al., 2007, Holeta nutrition lab data
Aftermath /DM Yield tonne/ha	0.00	FAO (1987)
UREA N kg total per/ha	100	Farmers practice
DAP N total per/ ha	18	Farmers practice

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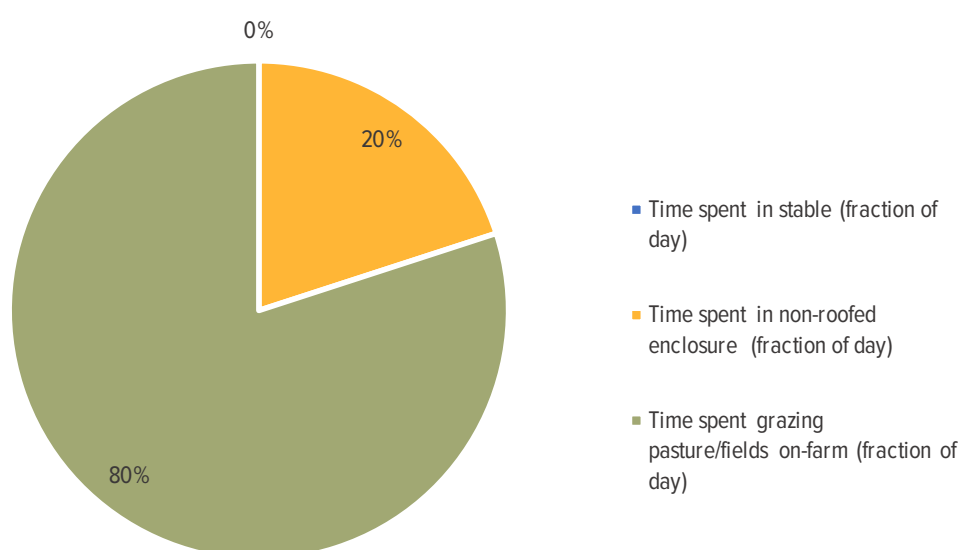
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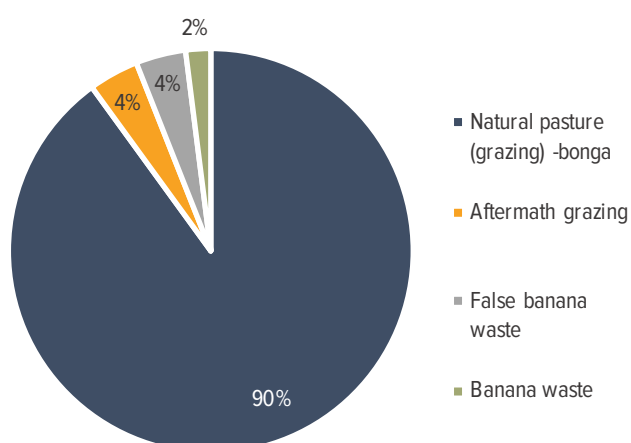
Bonga

	Herd composition (nr)	Average annual growth per animal (kg)	Average Body weight (kg)	Parturition interval (years)
Sheep Ewes - Bonga	4	1.3	30	0.7
Sheep - Breeding Rams - Bonga	1	7.3	31	
Sheep - Fattening Rams - Bonga	2	12.6	32	
Sheep - Lambs - Bonga	4	26	15	

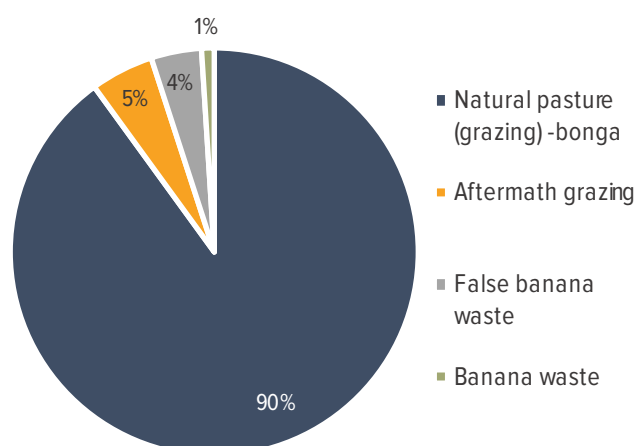
Whereabouts of animals



S1 Bonga Feedbasket



S2 Bonga Feedbasket



Reference List

Input/ Parameter	Value	Reference
Herd composition (nr)	11	ILRI, 2009
Average annual growth per animal (kg)	1.3	Expert (Tesfaye and Aemiro)
Breeding Rams -Average annual growth per animal (kg)	7.3	Expert (Aemiro and Tesfaye)
Fattening Rams -Average annual growth per animal (kg)	12.6	Expert (Aemiro and Tesfaye)
Lambs - Average annual growth per animal (kg)	26	ILRI data (2009)
Ewes -Average Body weight (kg)	30	EIAR, 2017,ILRI, 2009, expert opinion (Aemiro, Tesfaye)
Breeding Rams -Average Body weight (kg)	31	EIAR, 2017,ILRI, 2009, expert opinion (Aemiro, Tesfaye)
Fattening Rams -Average Body weight (kg)	32	EIAR, 2017,ILRI, 2009, expert opinion (Aemiro, Tesfaye)
Lambs -Average Body weight (kg)	15	EIAR, 2017,ILRI, 2009, expert opinion (Aemiro, Tesfaye)
Parturition interval (years)	0.5	EIAR, 2017
Feedbasket/ Diet	see pie charts	Expert opinion (Aemiro, Abiro, Tesfaye) , Tarekegn et al., 2016; Gizaw et al., 2012, Thorpe, W. R., & Duncan, A. J. (2012)
Animal Whereabouts	see pie charts	Expert opinion (Aemiro, Tesfaye)
Natural pasture /DM Yield tonne/ha	2.1-3	Seyoum et al., 2007
Banana/DM Yield tonne/ha	5.7-12	Zinabu et al., 2019
Aftermath/DM Yield tonne/ha	0.5	FAO (1987)
Kocho/DM Yield tonne/ha	6-12	Pijls et al., 1995, Chiche (1995), CSA (2008-2011)

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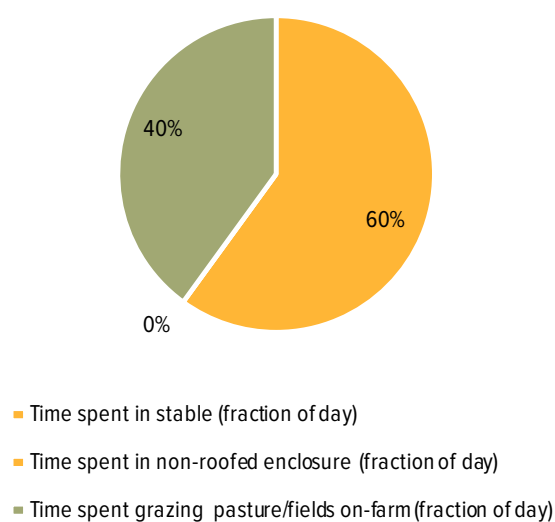
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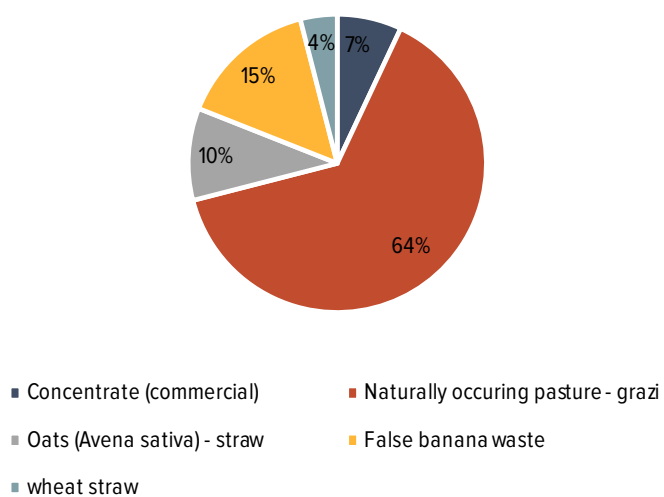
Doyogena

	Herd composition (nr)	Average annual growth per animal (kg)	Average Body weight (kg)	Parturition interval (years)
Sheep Ewes - Doyogena	1.83	0.97	31.5	0.7
Sheep - Breeding Rams - Doyogena	0.9	12	34	
Sheep - Fattening Rams - Doyogena	0.12	12	38	
Sheep - Lambs - Doyogena	0.8	28.1	13.5	

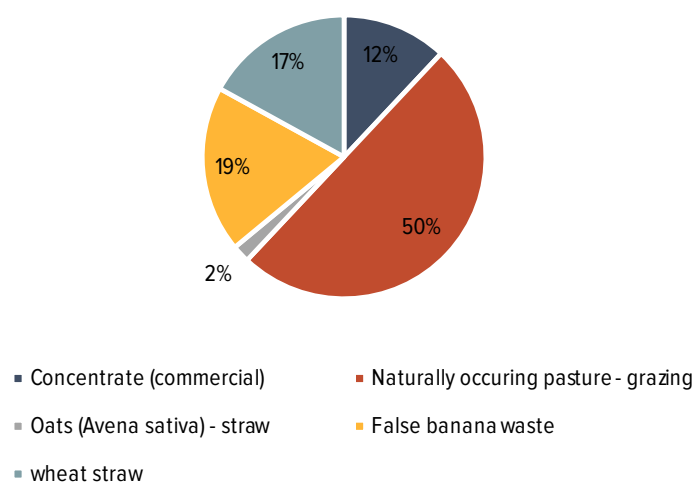
Where abouts of the animals



Feedbasket Long Rain Season - Doyogena



Feedbasket Dry Season - Doyogena



Reference List

Input/ Parameter	Value	Reference
Herd composition (nr)	3.65	Taye et.al, 2016
Ewes -Average annual growth per animal (kg)	0.97	Dr. Tesfaye ICARDA Staff
Breeding Rams -Average annual growth per animal (kg)	12	Dr. Tesfaye ICARDA Staff
Fattening Rams - Average annual growth per animal (kg)	12	Dr. Tesfaye ICARDA Staff
Lambs - Average annual growth per animal (kg)	28.1	Dr. Tesfaye ICARDA Staff
Ewes -Average Body weight (kg)	1.83	Taye et.al, 2016
Breeding Rams -Average Body weight (kg)	0.9	Taye et.al, 2016
Fattening Rams -Average Body weight (kg)	0.12	Taye et.al, 2016
Lambs -Average Body weight (kg)	0.8	Taye et.al, 2016
Parturition interval (years)	0.7	Taye et.al, 2016
Feedbasket/ Diet	see pie charts	
Animal Whereabouts	see pie charts	
Natural pasture/DM Yield tonne/ha	2.5	Taye et.al, 2016
Wheat /DM Yield tonne/ha	3.96	Taye et.al, 2016
Oats /DM Yield tonne/ha	2.88	Taye et.al, 2016
Enset/DM Yield tonne/ha	8.8	Taye et.al, 2016
NPK N kg per/ha	150	Farmer Practice

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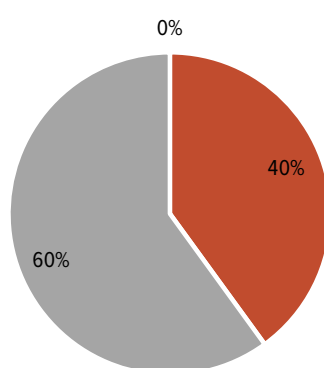
Dr. Tesfaye Getachew

Taye et.al, 2016. Characterization of production system and breeding practices of sheep producers in Doyogena district, Southern Ethiopia

Abergele

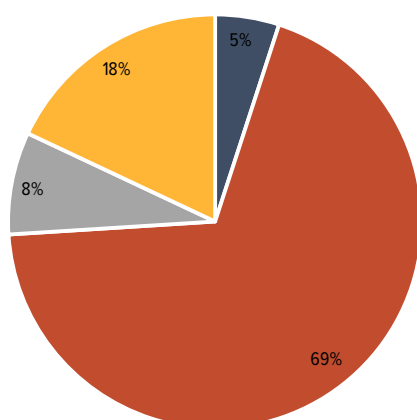
	Herd composition (nr)	Average annual growth per animal (kg)	Average Body weight (kg)	Parturition interval (years)
Goats Does	18	0.67	25	0.7
Goats - Bucks	2	9	32	
Goats - Fattening Bucks	2	12	26	
Goats -Kids	15	10	12	

Where abouts of the animals



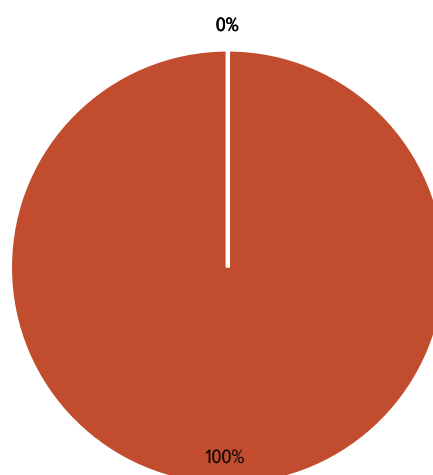
- Time spent in stable (fraction of day)
- Time spent in non-roofed enclosure (fraction of day)
- Time spent grazing pasture/fields on-farm (fraction of day)

Feedbasket Long Rain Season - Abergele



- Concentrate (commercial)
- Naturally occurring pasture - grazing
- Cowpea (Vigna unguiculata) - crop residue
- Sorghum (Sorghum bicolor) - crop residue

Feedbasket Dry Season - Abergele



- Concentrate (commercial)
- Naturally occurring pasture - grazing
- Cowpea (Vigna unguiculata) - crop residue
- Sorghum (Sorghum bicolor) - crop residue

Reference List

Input/ Parameter	Value	Reference
Herd composition (nr)	37	ICARDA technical report by Bekahgn Breeder at Abergele
Does -Average annual growth per animal (kg)	0.67	Dr. Tesfaye, ICARDA staff
Bucks -Average annual growth per animal (kg)	9	Dr. Tesfaye, ICARDA staff
Does -Average annual growth per animal (kg)	12	Dr. Tesfaye, ICARDA staff
Kids -Average annual growth per animal (kg)	10	Dr. Tesfaye, ICARDA staff
Goats Does	18	Bekahgn Wondim, Mulatu Gobeze, Baye Biresaw (2019)
Goats - Bucks	2	Bekahgn Wondim, Mulatu Gobeze, Baye Biresaw (2019)
Goats - Fattening Bucks	2	Bekahgn Wondim, Mulatu Gobeze, Baye Biresaw (2019)
Goats -Kids	15	Bekahgn Wondim, Mulatu Gobeze, Baye Biresaw (2019)
Parturition interval (years)	0.7	
Feedbasket/ Diet	see pie charts	
Animal Whereabouts	see pie charts	
Natural pasture grazing/DM Yield tonne/ha	2.5	Bekahgn Wondim, Mulatu Gobeze, Baye Biresaw (2019)
Cowpea/DM Yield tonne/ha	6	Bekahgn Wondim, Mulatu Gobeze, Baye Biresaw (2019)
Sorghum/DM Yield tonne/ha	4	Bekahgn Wondim, Mulatu Gobeze, Baye Biresaw (2019)
UREA N kg total per/ha		Bekahgn Wondim, Mulatu Gobeze, Baye Biresaw (2019)

Bibliography

Bekahgn Wondim, Mulatu Gobeze, Baye Biresaw (2019) ICARDA technical report from Abergele unpublished

Dr. Tesfaye for Herd and annual (growth/gain)

Feed Resource Availability, Livestock Migration Pattern and Synthesis of Feeding Calendar at Wag-Lasta, Ethiopia Daagu International Journal of Basic & Applied ResearchDIJBAR. volume1, Issue-1, pp (26-40)

Annex 2 CLEANED Results

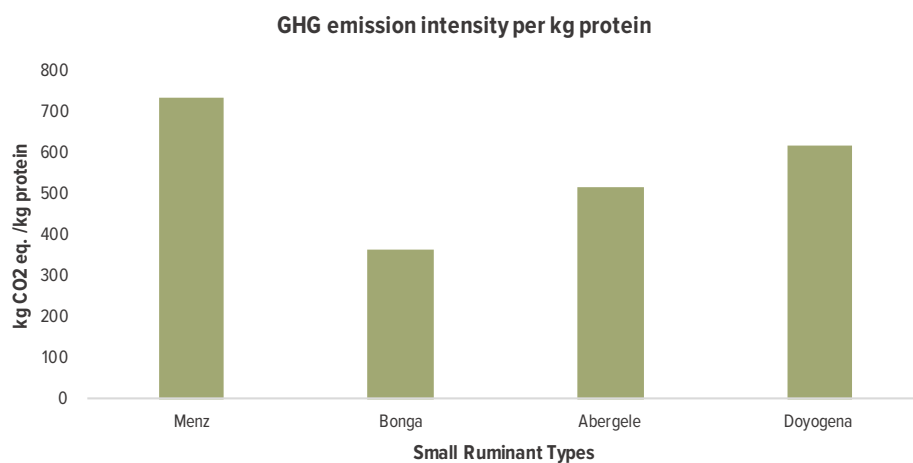
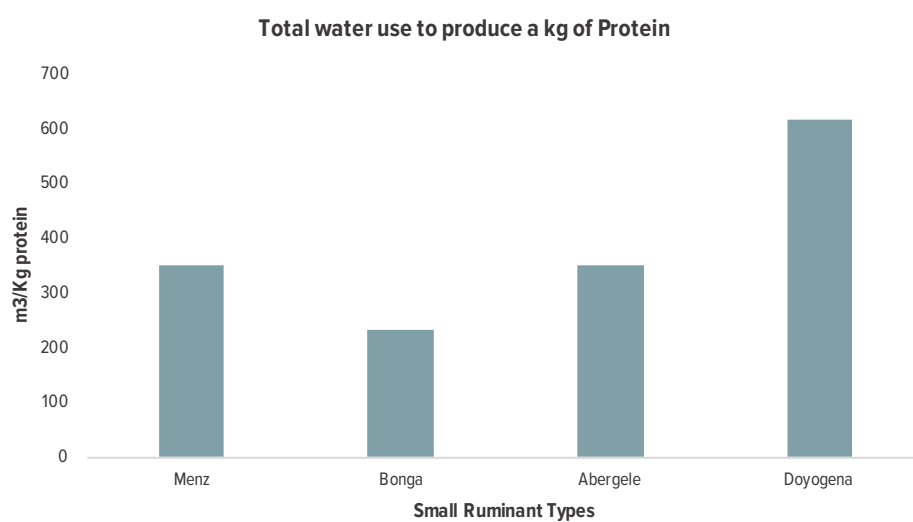
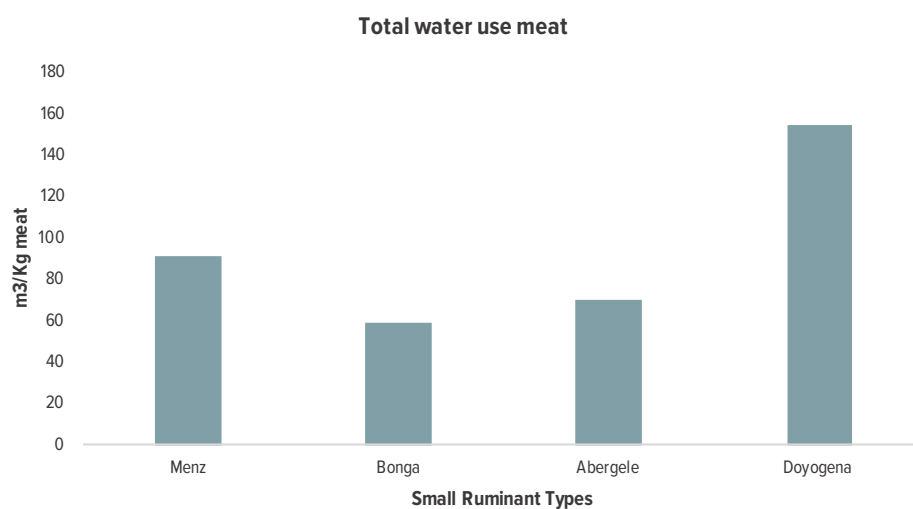




Photo: Zerihun Sewunet/ILRI

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