



Ethiopia Sheep and Goat Productivity Improvement Program

Achievements, Challenges and Sustainability

Proceedings of the Mid-term Conference
March 13 - 14, 2009
Hawassa, Ethiopia



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Implementing Partners:

Prairie View A&M University, Prairie View, TX, USA

Langston University, Langston, OK, USA

Ministry of Agriculture and Rural Development, Government of Ethiopia

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Welcoming Address

Desta Hamito

On behalf of myself and the Ethiopia Sheep and Goat Productivity Improvement Program, I would like to welcome you to the workshop which deals with the sustainability of the program beyond the project years. Special and warm welcome is due to those of you who travelled close to 15,000 miles just to participate in this conference.

As is well known to many of you, the program is the brainchild of His Excellency Mr. Addisu Legesse, Deputy Prime Minister of the Federal Ethiopian Government who, upon returning from an official visit to the United States, sanctioned a study which culminated in the establishment of the program.

Although for various reasons the first year did not see much activity, the Ethiopia Sheep and Goat Productivity Improvement Program has been operational since September, 2005. As the name implies, the objective of the program is to improve the productivity of indigenous sheep and goats of the country. This objective is fulfilled through the importation of improved germplasm, improving feeds and feeding management, and providing health and technical services to the farming and pastoral communities.

The program operates in six regions, namely, Afar, Amhara, Oromia, Somali, Southern Nations Nationalities and Peoples Regional State and Tigray. So far, its activities have been concentrated in 26 woredas: five each in Amhara, Oromia, Southern Nations and Nationalities, four in Tigray and three in Afar.

The program implements its activities through close cooperation and support of the Ministry of Agriculture and Rural Development, regional Bureaus of Agriculture and Rural Development, the Ethiopian Agricultural Research Institute, regional agricultural research institutes, and Haramaya, Hawassa and Mekelle universities.

A number of results have been achieved within the past three and one-half years. Improved genotypes of Dorper sheep and Boer goats have been imported from the Republic of South Africa. They are being multiplied as well as crossbred with indigenous goats and sheep. Several applied research and demonstration activities have been performed on feeds and feeding. Training on various aspects of sheep and goat production has been given to over 1,437 kebele development agents. Seventeen different technical bulletins have been published addressing various aspects of sheep and goat production. The Sheep and Goat Production Handbook for Ethiopia, which is the first of its kind in the country, was prepared, printed and distributed to governmental as well as nongovernmental organizations that work with small ruminants. Some of the technical bulletins are being translated into Amharic, Oromifa, Tigrigna and Somali languages to expedite the rate of adoption of these technologies. To control external parasites, which have a devastating effect on the quality of sheep and goat skins and hides as well as the

overall health of small ruminants, training has been given to 135 spraying/dipping service providers on the use of spraying and dipping equipment.

This workshop marks an important milestone in the implementation of the program. It is time to think about the future of activities and outcomes that have been produced and those planned to be accomplished in the coming two years. The theme of this workshop revolves around “Sustainability.” As you know, sustainability of project outcomes implies that the relevant outcomes and/or activities are maintained after the end of donor support. This program has generated, and is expected to generate outcomes that, if sustained, could make significant contributions towards productivity improvement in sheep and goats.

I believe this workshop will help us find ways to maintain and broaden program interventions to achieve sustainability of project accomplishments after the project’s termination when funds are no longer forthcoming from the donor agency.

I cannot conclude my address without recognizing the donor agency, the USAID, for making 5.5 million dollars available for the implementation of the program; the Ministry of Agriculture and Rural Development and others for enabling us to construct facilities by purchasing cement at a factory gate price when the market price was more than double that and also making available funds for the translation of our technical bulletins into four local languages; Hawassa University for providing funds for fencing the project premises; Haramaya University for allocating its own funds for constructing one Breeding, Evaluation and Distribution site; the Somali Pastoral, Agro-pastoral Research Institute for providing additional funds of 200,000 birr for completing the Nucleus site at Fafen, financing the construction of two bore holes to develop irrigated forage and provide water to the animals, and constructing a temporary facility for housing indigenous animals meant for crossbreeding; the Ethiopian Institute of Agricultural Research for permitting our program to renovate and use one of its facilities as a sheep barn and also for providing funds to fence the sheep barn premises at Worer; the Oromia Agricultural Research Institute for fencing the Nucleus and Breeding, Evaluation and Distribution farms at Adami Tulu; and the Amhara, Southern Nations and Nationalities and Tigray Agricultural Research Institutes for providing temporary shelters for housing indigenous sheep and goats. These contributions are over and above the provision of trained manpower to maintain the farms and animals. We are most grateful for these generous contributions.

I would also like to recognize Dr. George Wright, President of Prairie View A&M University, for taking time out of his busy schedule to come to Ethiopia three times to follow up the implementation of the program and give guidance; the project directors Drs. Freddie Richards and Tilahun Sahlu for overseeing project activities as well as being directly involved in the initiation and implementation of the program; and the short-term technical assistance provided in all four program components by scientists from Prairie View A&M and Langston Universities.

Last, but not least, I would like to recognize the Prairie View A&M Research Foundation for expediting the implementation of the program by making funds available on time.

Finally, I wish you a successful workshop and a fruitful stay in the town of Hawassa, which southerners think is the most beautiful city in the country.

Overview of the Ethiopia Sheep and Goat Productivity Improvement Program

Teffera Gebremeskel

Background

Ethiopia has one of the largest resources of sheep and goats among African countries, which has not been fully exploited. There is considerable room for improving productivity of this resource for local use and the export market. Small ruminants play a vital economic role for smallholder producers in Ethiopia in that they can bring about substantial changes in livelihoods in a relatively short period of time. Sheep and goats are becoming more important in the livestock sector. Their production is possible in areas characterized by high rural human population pressure, fragmented land holdings and scrub land. They are relatively drought tolerant, small in size, easily manageable, and are saleable resources that the family can use for ready cash.

The Ethiopia Sheep and Goat Productivity Improvement Program (ESGPIP) is a Cooperative Agreement between the Prairie View A&M Research Foundation (PVAMRF) and USAID/Ethiopia. The ESGPIP arose from the visit of His Excellency Ato Addisu Legesse, the Deputy Prime Minister and Minister of Agriculture and Rural Development, to the USA, including Prairie View A&M University near Houston, Texas in early 2005. The overall objective of this program is to sustainably increase the productivity of small ruminants in Ethiopia to improve food and economic securities.

In formulating the ESGPIP, consultations, meetings, and discussions among stakeholders and development partners from the Ministry of Agriculture and Rural Development, Prairie View A&M University, and Langston University were held and the following major limitations were identified:

- Limitation of the genetic potential for improvement of small ruminants, with a long period of time necessary for enhancement with reliance on indigenous animals.
- Sub-optimal health management, including inadequate vaccinations for disease prevention.
- Seasonal fluctuations in feed availability, with generally low nutritional value.
- Under-developed marketing systems.
- Limited technology transfer to producers in conjunction with inadequate supportive research.
- Limited availability of credit.
- Low level of technical services provided to farmers and pastoralists.

Scope of the ESGPIP

The ESGPIP is designed to address small ruminant productivity improvement through human and institutional capacity building, applied research and technology transfer, development of private providers of services in the control of external parasites and animal health care, and introduction of improved genetics in six regions of Ethiopia.

Regions and Woredas Covered

The program covers six regions, namely Afar, Amhara, Oromia, Southern States, Somali, and Tigray, where the small ruminant resource is predominantly found. Previously, it was envisaged that a large number of woredas within the six regions would be addressed by the ESGPIP. Given the limitation of professional staff that the program has, it was forced to focus on 26 woredas selected by the regional Bureaus of Agriculture and Rural Development of the six regional states. The woredas of focus are:

- Afar: Mile, Chifra, and Gewane
- Amhara: Ebnat, Kalu, Guba Lafto, Kobo, and East Belessa
- Oromia: Shashamane, Arsi Negelle, Fentale, Yabelo, and Adami Tulu
- SNNPRS: Damot Gale, Kedida Gamela, West Badewach, Alaba, Silti and Mesakn
- Somali: Jijiga, Aware, Harshim, and Gursum
- Tigray: Alamata, Abergelle, Wukro, and Hawzien

Cooperative Agreement and Funding

The Cooperative Agreement was signed in September, 2005 between USAID and Prairie View A&M Foundation (PVAMRF). The program was designed to be implemented by Prairie View A&M University as a main contractor and Langston University as a subcontractor, in close collaboration with the Ethiopian Government's Ministry of Agriculture and Rural Development. Initially, it was contemplated to support the program with 10 million USD over a 5-year period, but the amount was reduced to 6,999,998 USD. Also, the program was to address only goats in five regions, although sheep were later included as was a sixth region, Afar.

Due to the delayed initiation of activities, a decision was made by USAID to restructure the ESGPIP and reduce the budget. These changes occurred during FY 07, with a lessening of the total allocation by 1,499,998 USD to 5,550,000 USD.

Initial Objectives

- Enhance transfer of production and marketing knowledge and technologies to sheep and goat producers to increase animal health and productivity.
- Determine and teach improved management practices for indigenous breeds of sheep and goats and introduced improved breeds.

- Enhance communication capacity of the Ministry of Agriculture and Rural Development to transfer technologies resulting from sheep and goat research, and share knowledge through teaching, training, and technical assistance.

The restructured ESGPIP work plan re-defined five problem areas to be addressed. They are:

- Slow rate of gain and lack of uniformity and small carcass size of sheep and goats.
- Decreased value of sheep and goat skins and reduced growth rate and increased mortality due to ecto-parasite infestation.
- Limited efficiencies of small ruminant production and associated economic returns due to suboptimal nutrition and feeding management at herd and flock levels.
- Poor sheep flock and goat herd health management practices and lack of access to health management services and technology.
- Lack of technical services to pastoralists and smallholder sheep and goat producers.

Program Personnel

The program was structured in such a way that implementation at ground level would be carried out by agricultural extension workers and research personnel of Bureaus of Agriculture and Rural Development, Agricultural Research Institutes, and universities. For this reason, the program has a skeletal staff consisting of a Chief of Party, Deputy Chief of Party, four senior level professionals (i.e., Program Officers), and seven support staff. The staff members are placed to provide technical support and guidance to the regional staff participating in program activities.

The senior staff members are:

- | | |
|------------------------------|-------------------------|
| • Chief of Party | Professor Desta Hamito |
| • Deputy Chief of Party | Ato Teffera Gebremeskel |
| • Training Program Officer | Dr. Alemu Yami |
| • Genotype Program Officer | Dr. Kassahun Awgichew |
| • Production Program Officer | Dr. Girma Abebe |
| • Health Program Officer | Dr. Sileshi Zewdie |
| • Administrative Assistant | Mr. Shiferaw Abebe |
| • Accountant | Ms. Tersit Aseged |
| • Secretary/Receptionist | Miss Kelemua Taye |

Implementation Partners

The ESGPIP has an overall partnership with the Ministry of Agriculture and Rural Development. Entities that work closely with the ESGPIP include the following:

- Ethiopian Institute of Agricultural Research
- Six regional Agricultural Bureaus

- Six regional Agricultural Research Institutes
- Hawassa University
- Haramaya University
- Mekele University

Program Components and Implementation Status

There are four program components to address the challenging issues of small ruminant production of the country.

1. Training and enhancing technical services

An aspect limiting small ruminant production in Ethiopia is an insufficient knowledge base. Livestock extension has traditionally focused on dairy cattle management and improvement. Little or no attention has been given to management and husbandry of small ruminants. Thus, extension packages and training in small ruminants offered to development workers to extend to farmers have been limited. Under the ESGPIP training program, Kebele Development Agents (KDA) who work directly with smallholder producers are trained and continuously provided with technical bulletins that serve as fact sheets on specific topics. This provides support to KDA for focus on relevant topics when training producers. A handbook on small ruminant production has also been provided to KDA as a comprehensive source of information when undertaking their livestock field work. Activities covered so far are:

- 1,305 KDA (1,182 male and 123 females) have been trained to date. It is expected that over 20,000 farmers will be trained by these KDA.
- 20 technical bulletins (TB) on different topics relevant to farmers have been published. The TB produced thus far have received wide acceptance as a useful extension support tool.
- 8,000 copies of the Sheep and Goat Production Handbook for Ethiopia, the first of its kind, have been published and distributed to KDA, Bureaus of Agriculture and Rural Development, Research Centers, and various other institutions. The handbook is considered to be one of the major contributions of the ESGPIP.

The trained KDA have been instrumental in assisting and facilitating ESGPIP's technology demonstrations and in organizing field days and applied research activities.

2. Technology transfer

Another major component of the ESGPIP is applied research and transfer of knowledge of key production practices (applied research, demonstrations, and field days). Although there has been ample research of a number of useful technologies, adequate extension efforts for adoption by farmers have not occurred. Therefore, the ESGPIP has been conducting technology transfer activities focusing primarily on feed resources and feeding management.

Improvement of feed intake and feeding value

Ammoniation of low quality roughage has been demonstrated and field days have been conducted in many of the program woredas. Body condition and weight gain have been monitored. Where farmers heavily depend on crop residues, the technology has been readily accepted and adoption is extending fast, particularly in Shashemene, Alaba, Silti, and Western Badewacho woredas in the Southern Nations and Nationalities and Peoples State (SNNPR) and the Oromia region.

Forage development

The ESGPIP is focusing on strategically selected forage species with multiple uses (food, fuel and feed). On farms where land holdings are small and there is little or no grazing land, demand for fodder cuttings and seed is increasing, as seen in Alba Special Woreda of the SNNPR.

Improved feeding and feed management

To reduce feed wastage due to inappropriate feeding methods, the ESGPIP encourages farmers to construct practical feeding troughs from locally available materials. This technology has been readily adopted by many farmers and is becoming more widespread.

Organizing farmers for exchange visits

During demonstrations of various technologies, farmers from other areas who have not used the particular technology are invited to learn and share experiences. Groups of women farmers with improved feeding practices and farm households selected for establishing sire stations have made visits to research stations and farms to exchange experiences. This has proven to be a quick method of technology transfer.

Organizing women groups

An important factor in Ethiopia, particularly in the highlands, is that sheep and goats are under the control of women. Hence, the ESGPIP is organizing women into groups and providing training in management, which has positively impacted the role of women in the household.

3. Genotype improvement

Indigenous genotypes of sheep and goats in Ethiopia are generally low in productivity. There are different means by which breed improvement can be achieved, each with advantages and disadvantages. However, the approach taken in this program is to achieve marked impact in a short period of time. Boer goats and Dorper sheep have been imported from the Republic of South Africa and are now being used in pure lines at Nucleus sites and for crossbreeding at Breeding, Evaluation, and Distribution (BED) sites. Nucleus sites serve as sources of the improved stock. At BED sites, purebred sires are crossed with indigenous dams to obtain F1 sires for dissemination to farmers. The activities undertaken in this program so far are:

- A quarantine facility was designed and constructed at Sebeta to isolate up to 300 sheep and goats.
- The sheep and goat genotypes were safely received in Ethiopia and placed at Sebeta on July 1, 2007.
- In the period that these genotypes have been in Ethiopia, mortality has been low.
- Construction at the four Nucleus sites was completed. These facilities may be the first designed for such a purpose in Ethiopia.
- All genotypes were transferred to their respective locations in October, 2007 and mating at the sites has been underway since November, 2007.
- Insignificant kid and lamb losses have been occurred. Numbers of Boer goats and Dorper sheep have markedly increased.
- Despite delays in construction of most BED site facilities, crossbreeding has begun with temporary shelters (except for Hawassa University) provided by partner institutions.
- Construction at 8 of the 10 BED sites (including a BED site under construction by Haramaya University) either has or soon will be completed.

4. Animal health

Maintaining the health of small ruminants is one of the neglected areas in the livestock health services provided in Ethiopia. The death toll and loss of body condition as a result of heavy infestations of internal and external parasites and infectious diseases are very high in small ruminants. In this regard, one of the schemes that the ESGPIP has undertaken is the promotion of private service providers for external parasite control. It is believed that this will offer a long-term sustainable solution for the control of parasites and will also serve to generate income to the service providers. Lamb and kid mortality monitoring is another activity carried out in selected woredas. Close follow-up of animal health is also carried out at the Nucleus and BED sites.

External parasite control

A training curriculum was prepared to train selected farmers to become Spraying/Dipping Service Providers (SDSP). This training will enable selected farmers in communities of pastoral and farmer associations to acquire skills on the application of external parasite control treatments to become private service providers. Particularly, pastoral communities are in dire need of such services. Thus far, 105 SDSP have been trained in Oromia (Borena), Afar, and SNNPR (Areka) and provided with the required equipment and supplies.

Monitor major causes of lamb and kid mortality

The monitoring will identify causes of lamb and kid morbidity and mortality, which will help in implementing appropriate prevention and control measures. As a result, flock size will be increased, thereby increasing numbers of animals available for use as replacements, for household consumption, and for immediate sale. The information generated also will benefit professionals and regional governments in preparing and implementing sound disease prevention and control strategies. The monitoring is taking place in Oromia (Borena and Adami Tulu), Tigray (Wukro), and Amhara (Ebinat) woredas.

Follow up of health activities at Nucleus and BED sites

The health of sheep and goats kept at Nucleus and BED sites is regularly monitored. This is done through vaccinations (for anthrax and Peste des petits ruminants (PPR), contagious caprine pleurapneumonia (CCPP), Pasteurellosis, sheep pox, enterotoxaemia), treatments for internal and external parasites, and treatments such as for copper deficiency and infectious diseases.

Major Achievements

- The ESGPIP has established good communications, coordination and working relationships with government institutions, e.g., *regional Agricultural and Rural Development Bureaus and Research Institutes*
- Centers for animal multiplication and to serve as a source of pure genetic material in the country have been established, which will result in significant increases in meat production by small ruminants.
- The Sheep and Goat Production Handbook for Ethiopia has been published to serve as a resource for livestock extension workers and for use as a reference at higher learning and research institutions.
- Over 20 TB have been published that serve as fact sheets mainly for extension professionals working with small ruminants.
- The ESGPIP has established an expressed mutual sense of ownership of program activities by most partners, e.g., *SORPARI, Haramaya and Hawassa Universities*.

Major Constraints

- A National Steering Committee should have been established to follow, oversee, and guide implementation of program activities. The Ministry of Agriculture and Rural Development and all other partners were heavily involved in Business Process Re-engineering (BPR) the past 2 years.
- Initiation of some activities was delayed by approximately 1.5 years as a consequence of the replacement of the Chief of Party and the restructuring process. Planned tasks most impacted were *construction and importing and breeding of the improved genotypes*.
- Inflated prices of construction materials and fund reduction restricted timely performance of planned tasks, e.g., *construction of all BED site facilities has not yet been completed*.
- Time allowed for the program was too short for obtaining results from breeding activities, which was stated by the mid-term review team.

Need for Sustainability

A major problem with agricultural programs in Ethiopia is maintaining the strength of activities after implementation periods. Unfortunately, often programs terminate before full potential is realized.

The ESGPIP has been officially underway for nearly 3.5 years, with only 1.5 years remaining. It cannot be overlooked that the program has received great support from its partners. There have been services and material support provided by almost all partners at times when the program was facing critical limitations. Moreover, as is indicated in the table below, many partners have gone to the extent of making financial contributions needed for crucial tasks to be completed. At this juncture, the ESGPIP would like to acknowledge the good will and noteworthy support it has received from its partners.

Organization	Amount contributed (ETB)	Purpose of Contribution	Outcome
Hawassa University	300,000	Power supply, goat flock supply, fencing.	Fence completed, goat flock handed over, paid for a transformer. Installation by Ethiopian Power Supply Corporation awaited
Ethiopian Institute of Agricultural (EIAR) for WARC Nucleus and BED sites	190,000	Fencing, supply of, goats and sheep, granting old barn for nucleus stock.	Barn granted and renovated by ESGPIP, Fencing has been completed, sheep and goats handed to Program.
SNNPR Agricultural Research Institute (SARI) at Areka BED Site	360,000	Fencing and forage development.	Forage seeds and cultivars planted. Fence of the BED site will begin soon.
Oromia Research Institute (OARI) at ATARC	450,000	Fencing of Nucleus and BED sites.	Completed.
Somali Pastoral and Agro pastoral Research Institute (SOPARI)	1,740,00	Water supply, support for construction of BED sites, temporary shelter.	Deep wells dug, 2 reservoirs constructed, construction of BED site and fencing will commence.
Haramaya University	500,000	To fully cover construction of sheep BED site.	Sheep BED site under construction.
Ministry of Agriculture and Rural Development	600,000	Translation of technical bulletins into local languages.	The first set of payment for translation is in process

The ESGPIP is the most significant externally supported small ruminant livestock program received by the Ethiopian Government in the last two decades. Expectations that the program will improve productivity of the industry are high. Continuity of ESGPIP activities after its lifetime is vital if Ethiopia is to realize full, potential benefits from this rich resource, particularly to reduce poverty of the smallholder farmer and generate increased economic returns.

The ESGPIP is progressively meeting its program targets. However, it is imperative that these activities be maintained after the program for a lasting outcome. This requires increased and full-fledged involvement and support by all partners. It is a serious issue that all partners and stakeholders must resolve before the end of the program.

Overview of Technical Services and Training Program Activities

Alemu Yami and Roger Merkel

Background

Productivity of sheep and goats and associated economic returns could be markedly increased by adoption of proven cost-effective technologies and management practices by farmers and pastoralists. Under the technical services/training program, the ESGPIP conducts the following activities to bring about an increase in the productivity of sheep and goats and thus the incomes of producers.

Train Kebele Development Agents (KDA) to transfer knowledge and assist producers and pastoralists

A significant constraint in enhancing small ruminant productivity is the limited knowledge base of producers and lack of a vehicle for effective transfer of information. A sustainable training program to upgrade knowledge of KDA for more effective training of small ruminant producers is being carried out to address the constraint.

Produce and periodically update a sheep and goat production handbook

When the ESGPIP was initiated, there was no handbook or textbook on small ruminant production in Ethiopia upon which to base a training program for KDA. While the federal ATVET program had a curriculum on sheep and goat production, there were no written materials to support that curriculum. The need for information on small ruminant production specific to Ethiopia is targeted through the Sheep and Goat Production Handbook for Ethiopia. This handbook contains information on all aspects of small ruminant production and marketing and is the first of its kind produced in the country. The handbook serves as a useful reference for KDA and others working to transfer proven production technologies to livestock producers allowing them to improve production and take advantage of the growing international and domestic market for sheep and goat meat.

Produce technical bulletins on specific transferable technologies

As an extension of the handbook and to serve as tools that KDA can directly use in farmer training, technical bulletins focusing on appropriate technologies and topics are being produced and distributed. The technical bulletins are brief, concise documents written in simple to understand language with a "how to..." approach that introduces an important topic in small ruminant production to be transferred at the village level. Examples include urea ammoniation of crop residues, production of urea-molasses blocks, internal parasite control, selection of breeding animals, and bag silage making. This is an on-going activity throughout the project and expectations are that technical

bulletins will be produced by ESGPIP staff, other Ethiopian scientists, MoARD staff and RBoARD staff.

Support and monitor trained KDA as they train producers and pastoralists

The trained KDA are assisted in training sheep and goat producers by providing them with the handbook and technical bulletins. One animal production development agent in a kebele is responsible for technology transfer to 500 to 1,000 farming households. Activities and impact of KDA are estimated through completion of questionnaires that are returned to ESGPIP for analysis.

All the above activities are conducted in close collaboration with partners that include universities, the Ministry of Agriculture and Rural Development at regional and federal levels and agricultural research institutes.

Progress on Activities

Activities of the technical services/training program commenced after the employment of program officers in August, 2006. Progress is reported hereunder for each category of activity.

KDA training

Planning for the training of KDA began in September, 2006. An initial KDA training course curriculum was developed and regular revisions have been made thereafter. The first KDA training was held in the Afar region in October, 2006. Since that first training, 21 additional training sessions have been completed. A total of 1,437 KDA from the six ESGPIP target regions were trained between October, 2006 and February, 2009. Table 1 shows the breakdown by region, gender and training session.

Because of logistical, budgetary, and other considerations, training focused on KDA from ESGPIP target woredas, which are generally located near Nucleus and BED sites.

Training was initially planned to be conducted at ATVET colleges. But, because of budgetary constraints regarding limited funds for facility/resource upgrades at ATVET colleges and the uncertain future roles of those institutions, training sessions have been and will continue to be held at institutions with adequate existing facilities and resources and where experts are available to conduct the training.

The number of pastoralists and sheep/goat producers trained by project supported KDA is estimated at 50,420.

Course evaluations are done at the end of each training session. The feedback received from KDA on the content of the training program is overwhelmingly positive. This was also the finding of the USAID mid-term evaluation team. Trainees are especially positive about the practical sessions.

Table 1. Breakdown by region, gender and round of training

Region	Training session	Training Date	Number of trainees		Total
			Male	Female	
AFAR	1	October 3-6, 2006	17	7	24
	2	November 5-9, 2007	45	15	60
	3	July 14-18, 2008	55	17	72
	Total		117	39	156
AMHARA	1	April 16-20, 2007	30	2	32
	2	January 21-25, 2008	62	12	74
	3	June 23-27, 2008	44	8	52
	4	December 22-26, 2008	68	7	75
	Total		204	29	233
OROMIA	1	March 19-23, 2006	42	1	43
	2	September 17-21, 2007	52	11	63
	3	June 2-6, 2008	71	7	78
	4	January 12-16, 2009	75	7	82
	5	Feb 9-13	70	12	82
	Total		310	38	348
SNNPRS	1	December 25-29, 2006	55	5	60
	2	July 23-27, 2007	52	8	60
	3	May 12-16, 2008	67	11	78
	4	October 6-10, 2008	73	10	83
	Total		247	34	281
SOMALI	1	February 5-9, 2007	73	3	76
	2	December 3-7, 2007	52	7	59
	3	October 27-31, 2008	58	7	65
	Total		183	17	200
TIGRAY	1	August 27-31, 2007	56	3	59
	2	March 24-28, 2008	61	14	75
	3	August 11-15, 2008	74	11	85
	Total		191	28	219
ALL REGIONS	22		1,252	185	1,437

Initially, trainees were given a compiled packet of training material at the end of each session. This has been replaced by the printed handbook as of September, 2008.

PowerPoint training presentations have been prepared and supplied to trainers to provide for a uniform training content. This content is augmented by region-specific information as needed by the local trainers. The preparation and provision of the training presentation has assisted in making arrangements for training in a relatively short time as a result of the shorter preparation time required by trainers.

Handbook

Work on the Sheep and Goat Production Handbook for Ethiopia is now complete. It has been published and being distributed. The handbook was originally intended to be periodically updated. It was upgraded to be a comprehensive reference to be used not only by KDA but also by middle level training institutions (ATVET colleges), higher education institutions, research institutes, etc.

The outline for the handbook was prepared in December, 2006 and commented upon by different departments of the Ministry of Agriculture and Rural Development. Resource

persons to contribute the different chapters were identified and a writing workshop was conducted in January, 2007. Training materials prepared for KDA training served as starting materials for the handbook. A “zero draft” was produced at the end of January, 2007. The zero draft was sent to stakeholder institutions and experts for comments. Comments were incorporated and a first draft was produced in March, 2007. This draft was sent to stakeholders and others for review and comment. Feedback from stakeholders came extremely late and required a lot of prompting and reminding. The speed and level of response was not as expected. An additional chapter on “Meat Characteristics and Quality” was added based on comments and recommendations.

Extracts of the handbook were used for training development agents as of April, 2007. Evaluation formats were prepared and distributed to KDA that came for the training sessions to comment on the draft. Their comments were also taken into consideration during subsequent revisions. The revised handbook was formatted by a professional. The formatting took longer than anticipated. The printing of the handbook also was drastically delayed due mainly to country-wide power rationing.

Technical bulletins

The original plan was to produce what were referred to as “fact sheets.” The technical bulletins produced are complete guides with color illustrations or photos for use by KDA to demonstrate a specific technology.

An initial listing of potential topics for the technical bulletins was compiled in February, 2007. This list has been regularly revised thereafter as new ideas and technology needs emerge. Originally, the technical bulletins were produced solely by ESGPIP Program Officers (PO). However, due to the ever increasing activities in their own assigned areas of engagement, the PO could not sustain production to fulfill the scheduled numbers. Thus, the ESGPIP is now involving external resource persons in the preparation of the bulletins to complement efforts by the PO.

There is a very high demand for the technical bulletins by stakeholders. There is widespread expression of the usefulness of the bulletins for training farmers in the improvement of sheep and goat productivity. As a result, the ESGPIP increased the number of copies printed from the initial 2,000 copies to 4,000 copies per bulletin. Unfortunately, due to budgetary constraints and the increased cost of printing, the number of copies has been reduced to 3,000.

There was also an expressed interest from regional extension administrators to have the bulletins translated into local languages. The ESGPIP did not have funds to support the translation and the Rural Capacity Building Project (RCBP) of the MoARD was contacted and agreed to financially support the translation of the bulletins into four local languages, *Amharic*, *Oromiffa*, *Tigrigna*, and *Somali*. The translation of 11 of the bulletins into Amharic and review of the first drafts are now complete. These are being formatted for printing. Translation into the other languages will follow in due course. This commitment by the Extension Department of the MoARD and the RCBP shows tangible promise for the future sustainability of activities started by the ESGPIP.

The number of bulletins to be published in the life of the project has been increased to 48 due to the expressed interest of the extension system.

Support and monitor trained KDA

This is generally done through providing training materials such as the Sheep and Goat Production Handbook for Ethiopia and technical bulletins to KDA; strengthening the capacity of Farmer Training Centers (FTC) in target woredas to create an enabling environment for them to train farmers; and monitoring activities of trained KDA through regional, zonal and woreda bureaus of agriculture.

Challenges/Problems Encountered

KDA training

- Some training sessions had to be cancelled at the last minute due to the unavailability of trainees as a result of unforeseen assignments/commitment.
- Some training sessions had to be conducted with less than the planned number of trainees. This increased the cost per trainee since the overhead cost of conducting training (e.g., trainer costs) remains the same for smaller or larger number of trainees in a session.
- There were some instances where trained KDA appeared for training sessions for a second time. These had to be screened and turned back. There were also situations where ineligible candidates (not working as KDA in sheep and goat extension) came.
- There were discrepancies among trainees regarding level of interest for the training. Most trainees were very interested and the training/learning process was very good. This was also reflected in the drive to pass on the new skills acquired after the training. There were, however, instances where this was not the case.
- Practical sessions in some regions were not as effective as others due to the disparities in the availability of practical training facilities. This was the case in the pastoral regions.
- Feedback regarding the activities of trained KDA in transferring the skills acquired was very difficult to get. Responses were very low.
- The original plan was to strengthen the capacity of one ATVET college in each target region to build capacity for sustainability of the training after the life of the ESGPIP. About 25,000 USD was earmarked for each ATVET. This was later reduced to 5,000 USD during the restructuring of the ESGPIP. This sum was later believed to be too small to do any meaningful capacity building and these funds were transferred to augment construction of BED sites to fill the serious budgetary shortfall in this category.
- Trainees presented inflated transportation receipts and in many cases did not present receipts despite the strong message on the invitation letters for trainees to bring valid receipts based on official transport tariffs.
- Activities of the genotype program were delayed due mainly to delays in construction. The training program, which would have been more productive in conjunction with improved genotypes, is somewhat compromised due to the variation in the pace of the genotype and technical service support activities.

- The turnover rate of trained KDA through transfer, promotion, leaving their jobs and other reasons in many regions was high. This reduces the rate of transfer of technologies to farmers by the trained KDA.

Technical bulletins

- There is high demand for the technical bulletins by KDA, training institutions and other development actors. The ESGPIP has limited capacity to cater to this high demand.
- The bulletins were originally produced by ESGPIP program officers. The PO could not sustain production to fulfill the required production quota due to the ever increasing activities in their own assigned areas of engagement. The ESGPIP is now complementing the effort by involving external resource persons in the preparation of some of our bulletins.
- Skyrocketing printing costs have strained the resources envisaged for technical bulletin preparation. We are now printing some of the bulletins with smaller numbers of pictures in black and white rather than color to reduce cost.

Sheep and Goat Production Handbook for Ethiopia

- Formatting took longer than expected. The book became expanded with more content included in each chapter and the addition of a new chapter after initial drafts were completed. There was a general slowdown of activities due to the restructuring of the ESGPIP and the original target date had to be revised. The completion of the handbook was delayed even further due to country-wide power rationing instituted between May and July, 2008. This seriously hampered the printing process.
- Skyrocketing printing costs strained the resources envisaged for the preparation of the handbook.

Monitoring KDA

- A major constraint in monitoring the activities of KDA and evaluating the final impact of the training program is the non-return of questionnaires sent to stakeholders. Without this information, it is difficult to gauge impact at the village level. Ideas are being considered on how to increase participation of KDA in these survey instruments.

Future Activities

Because of logistical and budgetary constraints as well as an interest to train KDA in the target woredas to enhance the transfer of improved sheep and goat production technologies, training in the initial years of the ESGPIP focused on these woredas. Currently, training of KDA in these target woredas has by and large been completed.

The focus for year 4 and beyond will be:

- Training KDA in woredas adjacent to the target woredas.
- Training new KDA in the target woredas who arrived as a result of employment or transfer.
- Train KDA from high potential woredas as proposed by the regional bureaus of agriculture.
- Offer specialized training to target woreda KDA.
- Offer specialized training on the business aspects of small ruminant production.
- Increasing the engagement of collaborating institutions such as the RBoARD, research institutes, universities, etc., to take even more responsibility in the conduct of training. This pilot exercise will help to ensure sustainability of KDA training in the future.
- Continue to develop and enhance training materials including PowerPoint slides supplied to trainers and trainees. The development of these training materials has been very beneficial in making arrangements for training in a relatively short period of time due to the less time requirement for preparation by trainers.
- Post training materials on the ESGPIP website. The ESGPIP website is currently being constructed and will be released early in 2009. One section of the website will contain all of the training materials produced posted in both html and PDF formats. Interested persons will be able to download and print technical bulletins or handbook chapters. As translations of technical bulletins become available, they will be considered for posting in PDF format. Having electronic copies of these training materials available for viewing and downloading ensures their availability following the project's end and augments the limited number of copies of each technical bulletin that can be produced.

Thoughts on Sustainability

- Training materials produced by the ESGPIP (the Sheep and Goat Production Handbook for Ethiopia, the technical bulletins and also the PowerPoint training slides) will form the basis for sustained training of KDA by regional Bureaus of Agriculture, research institutes, NGOs or any other party. The ESGPIP is currently preparing the PowerPoint training slides on CD to reach a wider audience for continuation of training on sheep and goat technologies by concerned bodies beyond the life of the ESGPIP.
- Initially, the training of KDA was conducted by ESGPIP personnel. This was gradually shifted whereby currently all trainers are from partner institutions. This is a big step forward in the direction of gradually enabling partners to conduct the training on their own. In the future, more and more responsibility of preparing and conducting KDA training will be transferred to partnering institutions.
- Regional and woreda Bureaus of Agriculture were involved in the selection of trainees from the very beginning of the training program. These institutes can continue this beyond the life of the project.

- BSc. degree-holding Subject Matter Specialists (SMS) who coordinate livestock/sheep and goat extension at the woreda level have been included in the training programs. These SMS can organize training beyond the life of the ESGPIP.
- Posting technical bulletins, the handbook and other training materials on the ESGPIP website for downloading and use is a tremendous opportunity for sustaining the impact of the training program beyond the life of the project. It also allows for use of these training materials by trainers in other regions of Ethiopia that are not the focus of current activities as well as academic institutions, NGOs and organizations within and outside of the borders of Ethiopia. As the website is developed, so too are plans to allow for it to be hosted and available on the internet after the official end of ESGPIP activities, thus ensuring access to these training material by interested individuals.

Overview of Production Program Activities

Girma Abebe and Arthur L. Goetsch

Background

The productivity of small ruminants is constrained by inadequate feedstuffs, both in terms of quality and quantity. Even in areas where feed resources are available for a limited period of the year, proper practices of utilization and employment of available technologies for enhancing nutritive values of feeds is lacking. In addition, many farmers and even some 'experts' still have a view that small ruminants can thrive and produce without any concern for nutritional management. This is a formidable challenge that needs to be confronted at all levels and requires a concerted effort by all concerned actors. If improvement in productivity of small ruminants is to be achieved, it is imperative to address issues related to suboptimal nutrition. Moreover, introducing improved genotypes necessitates enhancement in nutrition and overall management practices to achieve desired levels of production. There is a wide array of evidence in developing countries, particularly from the dairy sector, that improved genotypes are doomed to fail in an environment where feed quality and quantity are poor and animal diseases are rampant. It is against this background that the ESGPIP is attempting to address the problem using different strategies. This paper briefly outlines activities undertaken to address the issue of feed shortage.

Progress on Activities

Technology transfer

Ammoniation of crop residues

Low quality roughages, especially crop residues (CR), are emerging as a dominant feed resource in crop-livestock systems. The notion that CR can be fed to sheep and goats seems to be alien to many people. However, shortages of grazing land that are intensifying primarily because of ever expanding areas of cultivated land is resulting in CR as a major feed resource. These residues are low in energy and protein and lack other essential nutrients for acceptable animal performance. Fortunately, simple and easy to use technologies are available that enhance the nutritive values of such resources.

Ammoniation by treatment of CR with urea is becoming a popular technology used to increase the crude protein content and digestibility. The process involves spraying or pouring a solution of urea on a dry mass of straw or stover and placing it in a pit lined with plastic sheets or in an airtight bag, which is then compacted and sealed. With adequate moisture and suitable temperature conditions, microorganisms produce the enzyme *urease* that hydrolyzes urea to ammonia, which then permeates through the material. During demonstration of these methods, farmers are clearly told of the benefits and precautions needed to be taken during treatment.

The ESGPIP has been promoting this technology in four regions, namely Amhara, Oromia, SNNPR and Tigray, where CR make a significant contribution to the feed resource of animals. Selection of farmers involved in demonstration activities has been by woreda experts using previously agreed upon selection criteria.

Apart from the labor, the only cost in ammoniation by urea treatment has been that of urea and plastic sheets. In some places indigenous technologies used for other purposes, e.g., “*Kocho*” fermentation, have been successfully employed in ammoniation. The leaves of ‘*enset*’ can be used for lining the pit and the cost of plastic sheets can be avoided, thus making the process even less expensive.

In some woredas near Alaba of the SNNPR approximately 100 large concrete pits were previously constructed for silage making from other funding sources. These pits have been used for ammoniation of CR. In fact, it now appears that farmers are using the pits more frequently for ammoniation than for ensiling.

Two approaches have been used to demonstrate ammoniation. The first approach involves direct involvement of ESGPIP personnel with woreda experts. With this approach, all inputs necessary for ammoniation are delivered and the process is demonstrated at a minimum of two farms. Thereafter, the woreda experts together with trained KDA are given the responsibility of conducting demonstrations, with the ESGIP monitoring and evaluating results. In the second approach, a sub-project agreement is signed between a regional Bureau of Agriculture and Rural Development (BoARD) or Regional Research Institutes, and the process of demonstrating the technology, monitoring and arranging field days is left to them.

Farmer perceptions about ammoniation

At the beginning of this activity some farmers were very skeptical and thought the CR would be wasted as a result of moistening and burying. In a few cases false information about hazardous effects of ammoniation had been circulated. The acceptability of ammoniated straw by sheep and goats was also questioned. However, these rumors did not last long, since no spoilage of treated straw or any casualties in terms of poisoning were reported.

In Silti woreda where wheat straw was traditionally burned in the field because of the belief or fear that consumption of wheat straw by animals will result in death, the introduction and promotion of ammoniation has greatly changed the attitude of farmers. Now, treated wheat straw is considered a useful feed resource in the area. An NGO operating in the woreda called Christian Children’s Fund (CCF) observed the interest created among farmers and supported 25 households to treat wheat straw in four kebeles. In fact, the woreda has now made a budget allocation for purchase of inputs for ammoniation.



Pits used for ammoniation in Alaba Woreda

Forage development

Widening the feed resource base for small ruminants is important for sustainable and profitable production. Cultivating forage on smallholder farms contributes to sustainability and is environmentally beneficial because it reduces erosion, enriches soil (legumes) and leads to intensive production systems. In the past, several attempts were made to advance forage production in many places in Ethiopia. By and large the production of forage has not been related to utilization. In some cases forage development was only performed for soil conservation. The only exception is the smallholder dairy development project that had a strong forage component.

The ESGPIP is trying to couple forage production with utilization by sheep and goats. The need to produce forage for sheep and goats was not realized in many places. This is primarily due to the attitude of farmers related to sheep and goats. In the minds of many, sheep and goats are thought to need little or no care. However, with the introduction of new genotypes for better performance and income generation, the need to have a suitable source of quality feed is of a paramount importance.

Most appropriate methods of forage production and development could differ among regions. For instance, whether to promote annual or perennial crops or multiple purpose forage crops is dependent on factors such as agro-ecology, land holding size and ultimate use of the produced fodder. For instance, annual crops like oats and lablab are highly favored in areas where landholding sizes are large. In these places farmers are not inclined to use perennial forage crops, as it limits their decision making options. That is, in some cases a given plot of land may need to be used for purposes other than forage development. In areas where land is limited, farmers opt for perennial crops like elephant (Napier) grass for backyard forage production. In all systems, multi-purpose crops that

have food-feed value are favored, because seeds are used for human consumption. Examples include pigeon peas and cowpeas, which are becoming popular.

In the third year of implementation of this activity, groups of selected farmers received training in basic forage production and at the end received forage seeds or planting materials such as cuttings. This approach has had a tremendous impact and almost all who participated in the training produced forage. The training was given by previously trained woreda experts. This implies that practical training to farmers, directly followed by activities that farmers can perform themselves is an effective approach to disseminate technology.

Bag silage making

In comparison with other technologies (hay making, urea treatment, etc.), silage making is not common in Ethiopia. Although several reasons could be mentioned, the most important factor is perhaps the belief (misunderstanding) that good silage can only be made from maize. In a country like Ethiopia, where maize is used as a staple diet in many places, it is hard to justify and advocate silage making from maize unless the opportunity cost favors it. On the other hand, any green biomass can be converted to good silage provided there are additives (source of sugar) and the right air-tight condition is created.

Introducing bags that contain 25 to 50 kg of wet material for ensiling purpose is an alternative to silos. In some ESGPIP target woredas, where Napier grass is abundantly available and harvested at intervals of 30 days, ensiling chopped grass after adding molasses has yielded good results. On farms where sugar cane is produced, a few stocks of sugar cane can replace molasses. In systems where green maize is sold, stover could result in good silage.

Feed blocks

Feed blocks, also called Urea Molasses Blocks (UMB), are solidified mixtures of agro-industrial by-products used for supplementing poor quality roughages and poor quality native range lands. When several nutrient sources are combined, UMB are considered to provide a balanced supply of the main nutrients, i.e., energy, nitrogen, minerals and vitamins, hence the name multi-nutrient block. The value of UMB lies in their role as cost-effective supplements and as a means for preserving high moisture agro-industrial byproducts, e.g., molasses.

In Ethiopia, feeding of UMB has been conducted at research stations primarily for cattle feeding as a strategic supplement, particularly during the dry season when forage biomass is limited and of poor quality. However, no attempt has been made to take this technology to farmers. Efforts to disseminate the technology of UMB should consider temporal and spatial availability of different agro-industrial byproducts in different regions and target end users, which could be farmers or feed producers.

Within the ESGIP, the introduction of this technology began as a result of training of KDA. A KDA who attended the training went back to his woreda and found out that molasses was sold in a woreda town. He convinced some farmers about the importance of

UMB and purchased all ingredients except cement, which is used as a binding material. The cement was supplied by the woreda BoARD. Later, the ESGIP supported some 30 farmers to go into the production of UMB. Since then there have been many farmers who bought all the materials needed and made blocks for their sheep and goats.

Table 1. Number of households reached with demonstration activities

Region	Woreda	Technology			
		Ammoniation	Improved forage	UMB	Others
Amahra	Guba-Lafto	10	15		
	Kalu	-	15		
	Kobo	10	15		
Oromia	Arsi-Negle	15			
	Fentale	3		4	
	Shashemene	35	20		
SNNPR	Alaba	60	40		3 farmers built separate pens
	Badewacho W	20			
	Kedida-Gemila	40	75		12 farmers built separate pens
	Meskan* Silti	34 21+(25)	15 19	61 10	
Tigray	Abergelle	15	15		
	Alamata	15	15		
	Hawuzen	15	15		
	Kilt-Awelaelo	15	15		

() = figures in parentheses indicate number of households supported by CCF

Lessons learned from demonstration activities

This activity brought to light the critical role of trained KDA and woreda experts who are committed to community development. Technology transfer was faster in kebeles with enthusiastic woreda experts and KDA. But it has to be emphasized that, like in any other sector of development, such committed people are few despite the training. Nevertheless, mechanisms should be put in place to reward KDA and woreda experts who perform best and could be examples for others. For this, general guidelines should be developed and implemented.

Applied research

Currently, there is a paradigm shift in research approaches followed and processes involved in research, especially when it comes to applied research. Some technologies that have yielded favorable results under “research station” conditions have performed poorly under on-farm conditions. Several factors could contribute to this disparity, among which are differences in environmental conditions and the degree of control that can be exerted. This has necessitated consideration of on-farm participatory research at least to complement or verify on-station results. The most obvious advantage of on-farm

research is that it shortens the gestation period of research undertakings, i.e., it avoids the need for on-station testing and verification before reaching farmers and producers. Furthermore, it provides an opportunity for farmers to learn the processes involved and evaluate the results together with the scientists in a participatory manner.

The ESGPIP follows two approaches in undertaking applied research. The first and most common one is to collaborate with institutes or universities that conduct research. In this approach, potential institutions are first directly contacted to explain the goals of the ESGPIP and the general area of interest. This is followed by development of a concept note that can be further developed into an Activity Description (proposal) with assistance of the ESGPIP Production Program Officer. The proposal is reviewed by the ESGPIP and Short-Term Technical Assistants (STTA) from Langston University. Once the proposal is accepted, a sub-project agreement is signed and funds are released to an official bank account of the partner institution. Monitoring is done by ESGPIP personnel. In particular, the launching phase is important where close follow-up is needed. In a few cases, slight modifications (usually additions) have been made during execution of the activity. The second and very limited approach has been direct involvement of ESGPIP staff in collaborative research with abattoirs, e.g., carcass shelf life studies.

In all cases, priority is given to the feed resources available in particular areas. For example, in Tigray utilization of cactus is important in on-farm studies. Conversely, in the south, investigating animal fattening performance and determining economic benefits from use of sweet potato vines and tubers are appropriate.

Table 2. List of applied research activities undertaken

Activity Description Title	Responsible Institution	Date Started	Status
Demonstration of on-farm small ruminant fattening	Admai-Tulu		Completed
Popularization of creep feeding of sheep and goats in rural areas of Ambo and Toke Kutaye Woreda	Ambo University College	Jul 2007	Completed
Improving utilization of crop residues to enhance sheep and goat fattening schemes under smallholder farmers in selected woredas of Tigray	Mekele Agricultural Research Center	Dec 2007	On-going
Improving utilization of cactus (<i>Opuntia ficus-indica</i>) feed on smallholder farms in cactus potential areas of Tigray	Mekele Agricultural Research Center	Dec 2007	On-going
Women focused small-scale sheep fattening and marketing	ARARI	Nov 2007	completed
Shelf-life of Highland and Lowland sheep and goat carcasses	ESGPIP, Organic Abattoir	Feb 2008	Completed
Supplementation of ammoniated maize stover with wheat bran for small ruminant fattening in Eastern Ethiopia: on-farm trial and demonstration	Haramaya University	Feb 2008	On-going
Enhancing the utilization of khat (<i>Catha-edulis</i>) leftovers as small ruminant feeds in Eastern Ethiopia	Haramaya University	Feb 2008	On-going
Performance assessment of goats fed poultry litter in Alaba	Hawassa University	Apr 2008	Completed
Demonstration of the use of Urea Molasses Blocks (UMB) for fattening goats in the Mid-Rift Valley	Adami-Tulu Agric. Research Center	Jun 2008	Completed
Sheep production systems in Damot Gale woreda and supplementary value of pigeon pea (<i>Cajanus cajan</i>) in sheep fattening diets	Hawassa University and BoARD	Oct 2008	On-going
Identification and characterization of feed resources for small ruminants in some woredas of SNNPRs	ATARC	Oct 2008	On-going
Enhancing fattening potential of sheep through utilization of urea-lime treated 'teff' straw and supplementation with wheat bran at Kilt-Awelaelo Woreda of Eastern Tigray	St. Mary College	Nov 2008	On-going
Use of urea molasses blocks for sheep fattening	Hawassa University	Dec 2008	On-going

Training in meat quality assessment

There is lack of trained personnel in Ethiopia in the area of meat science, which became apparent when the ESGPP began efforts to investigate causes of early meat darkening of Highland sheep carcasses. It was then that the idea for training was conceived. Training on meat quality was given to experts working on meat quality at the Ethiopia Meat and Dairy Technology Institute (EMDTI) in Debre-Zeit. The training was conducted by a meat scientist invited from Fort Valley State University in the USA. There were 29 participants from all over the country, representing the meat and slaughter industry, educational and research institutions, and the private sector. The hands-on part of the training program was conducted at the Organic Export Abattoir in Modjo.

Lessons learned from applied research

It was encouraging to see that in most places farmers were willing to participate in research activities even when they were not sure that the feed their animals would receive could improve weight gain. A good example of this is a broiler litter study undertaken with 40 households in SNNPRs. Participating farmers had no experience with feeding poultry litter and the concept itself was contrary to their normal feeding management practices. Despite this, farmers provided their own animals and in some cases purchased animals from the market when their own animals were not of the right type/weight for the study.

Field days

Field days are organized to create opportunities for interaction and discussion among technology users, non-users and policy makers. The events usually occur near the end of an applied research study, or during months where the technology is used on-farm (e.g., urea treatment when there is ample straw to be treated). The key actors in field days are farmers themselves, being involved in demonstrations of the technology, discussing benefits obtained, and sharing their future plans. A brief report of ESGPIP activities within the woreda is also presented by woreda contact persons. In most cases brochures are prepared for distribution. To date, 17 field days have been organized and the number of attendees is well over 2,500.



Field days offer opportunity to share experiences

Pilot buck distribution

Distribution of crossbred bucks to producers has been carried out on a pilot basis. The distribution took place near the Boer goat Nucleus site at Hawassa University. Prior to distribution, an assessment of the area was completed in cooperation with the respective BoARD of three woredas, namely Alaba, Kedida Gemila and Shabadino. The major qualifying criterion for the area was importance of goat production and whether or not farmers could practice a semi-intensive system of feeding management. Criteria for farmer selection were set in consultation with BoARD, which are listed below:

- Expressed interest in handling crossbred bucks.
- Adequate land to develop forage.
- Construction of a simple feeding trough and a separate pen (simple partition) for the bucks for night enclosure.
- Availability of a literate person in the household for recording purposes.
- Willingness to serve the community (if the norm of the area permits, buck handlers could charge service fees).
- Able to deposit 50 birr with the woreda BoARD (funds intended for use for drug expenses).
- Agreement to own the buck after 50 offspring are produced in the area.

Selected farmers along with their spouses visited the BED and Nucleus sites at Hawassa University and were shown the crossbred animal and facilities. During the visit, discussions were held on the management of crossbred bucks and precautions that need to be taken during the peak of the mating season.

Thus far, the nine bucks have bred 125 does. The only woreda where a service fee is being charged is Kedia Gemila, because of previous experience in use of crossbred bucks. In the other woredas the service is provided free of charge. Buck handlers who do not charge a fee are optimistic that they would do so in the future once the performance of the offspring are evaluated by their customers and, thus, plan to do so step by step.

Strengthening of Farmer Training Centers

Thousands of Farmer Training Centers (FTC) have been constructed throughout the country in almost all kebeles. Unfortunately, few FTC have become functional and are being used to train farmers. The FTC are poorly equipped to handle practical training. There is an urgent need to help strengthen the capacity of strategically selected centers so that they can serve their intended purpose, i.e., hands-on practical training.

A strategy to enhance training capacity of FTC includes construction of ammoniation pits, introduction of improved feeding troughs, provision of weighing scales, etc. It is believed that some of the technology demonstrations currently popularized by the ESGPIP could be sustained by FTC once such enhancements occur. In this regard, ten ammoniation pits were constructed at ten FTC (four in Tigray, two in Oromia and four in SNNPR).

Establishing women groups for income generation activities using sheep and goats

A few attempts were made to establish women groups to enhance productivity of sheep. This idea emanated from the fact that in the food safety program in many woredas, credit is given to women to work with sheep and goats. An attempt was made to work with women groups in fattening sheep. Three women groups have contributed straw for treatment and continuously fed their sheep with ammoniated straw and developed forage. Utilization of UMB was also tried with three women groups. Furthermore, in one group where the members wanted to practice intensive fattening under partial confinement, members have contributed materials and labor for construction of a simple shade for their sheep.

Women groups are excellent for technology demonstration and dissemination and are interested and motivated as long as they are regularly monitored. However, they are easily discouraged when one of their animals is sick and they have no one to call upon for health care. This is understandable because a loss of a sheep means a great deal to poor women. By-laws governing responsibilities and obligations of members need to be agreed upon. For proper group functioning, all actors need to work together.

Challenges/Problems Encountered

Ammoniation

The major challenge that could hinder widespread use of this technology is low *availability of urea* when it is needed for CR treatment. It is true that the current price of urea could be a potential prohibitive factor, but as has been indicated by some farmers, so long as they receive a good price for better-fed animals, the incurred costs could be covered.

It has been observed that whenever farmers have better quality feed they practice differential feeding of their animals. In areas where CR are abundant and cattle dominate the system, they prefer to use ammoniated straw for milking cows. On the other hand, in areas where sheep fattening is popular, treated straw has been successfully used for sheep. The ESGPIP believes that with the improved genotypes coming soon to farmers, improved feedstuffs will be made available to these genotypes and perhaps not to other animals.

Forage development

For forage development, there is a low availability of appropriate seeds, especially those of fodder trees that have multiple uses. Seed production at the farmer level is constrained by land scarcity. There is a need for timely supply of seed. Another problem related to forage production is timely use of produced forage. Farmers are not familiar with cutting and using forage at the right stage of growth. If this is not addressed through training, it will negatively affect forage production.

Applied research

The major challenge in applied research is lack of enthusiasm in undertaking on-farm research. The few enthusiastic researchers are faced with a lack of vehicles for transportation needed to go to the field to monitor the initiated research. This is especially true in universities where researchers have heavy teaching loads and other assignments. Furthermore, lengthy purchasing procedures of some collaborating institutions have delayed timely completion of projects.

In the case of other collaborators such as abattoirs, it is difficult to provide space for feeding and management of animals and to share in the cost of animals is unthinkable, because in most cases markets are unsteady and unreliable. When huge requests are made from their customers, facilities are fully occupied and there is no room for carcasses of experimental animals.

Thoughts on Sustainability

Technology transfer

In the remaining time of the ESGPIP, two approaches will be pursued for technology transfer. The first approach is to work on the delivery of technology inputs for the most desired technologies. This could be accomplished by making available urea on a cost basis and monitoring technology adoption. Establishing small forage seed sale shops in

strategic locations will also be explored. The second approach involves enhancing group formation in selected areas both for acquisition of technology and marketing of outputs. For instance, establishing community-based UMB producers is an option. Similarly, assisting private producers to become feed manufacturers will be pursued. Further, there will be close collaboration with NGO working on sheep and goats for technology adoption.

Ammoniation

The sustainability of feeding ammoniated low quality roughages requires making urea available at the time when it is needed, i.e., shortly after crop harvest. This could be achieved:

1. By advising farmers to buy urea needed for enhancing the nutritive value of low quality roughages during the cropping season when it is available and storing it for later use. Such advice should be accompanied by appropriate measures to be taken during storage
2. Depending on the expressed demand of each woreda, BoARD could approach fertilizer wholesalers or 'unions' distributing urea and make arrangements to deliver urea at the time of crop harvest. Alternatively, organized producers could make agreements with 'unions' to have urea available when needed.

Forage development

The sustainability of forage development is more complex, but two approaches may be pursued:

1. In areas where land suitable for forage-seed production is available, leasing land to groups of forage-seed producers or private producers who will consider forage seed production as a profitable business is a possibility. In such instances, a given forage seed production site might serve four or five woredas or even a zone.
2. The second approach is to establish '*seed collection centers*' in strategic locations and buy seed at the time of production, i.e., during the months of December-March. These seeds can be sold during planting seasons.

Applied research

In the case of applied research, feeding and management of improved genotypes will be a focal point. Moreover, an attempt will be made to conduct activities with woreda experts; although, research and collaborative activities with higher leaning institutes will be maintained. There will be efforts to efficiently use available feed resources.

It is also important to create linkages between producers and markets, as experience has shown that the lack of markets or low market incentives can have a negative impact in the dissemination of improved technologies.

A primary deterring factor for on-farm applied research is the distance between the implementing organization and the site where research is conducted. It may be important to select at least two communities in the vicinity of the research stations or universities and use them as 'field laboratories.' Once the link is well established and activities are underway, exchange visits (farmers from other communities or woredas) could be

arranged to share experiences. Exchange visits should last for 2 to 3 days to give the visitors an opportunity to learn the processes involved in the study and perhaps evaluate some results. Alternatively, Farmers' Research Groups (FRG) that are flourishing in many places could be strengthened and used for applied research. In all cases, the involvement of all stakeholders in the process should not be neglected.

As noted earlier, applied on-farm participatory research is very challenging. However, in Ethiopia it offers many attributes. A notable one not mentioned before is a general lack of on-station resources to conduct research under conditions that allow a direct extrapolation of findings to field settings. In order for on-farm research to continue and even increase in Ethiopia after the ESGPIP, it is necessary for research institutions and their administrators to have a realistic appreciation of its value. Hopefully, the final conference of the ESGPIP, where these activities of the project will be fully discussed, would aid in conveying this message. Thereafter, provision of the resources needed, such as vehicle availability and low to modest amounts of funds for materials and per diem for participating extension personnel, notably KDA, can be provided. Administrators should also consider requirements or promotional incentives for researchers to conduct on-farm participatory research. Relatedly, an entity such as the national government could take the lead in organizing a consortium of scientists and institutions conducting on-farm research with a regularly scheduled conference on findings, such as every 2 to 4 years.

Overview of Animal Health Program Activities

Sileshi Zewdie and Lionel Dawson

Background

The major activities of the Animal Health Program are: 1) efforts to decrease the incidence and severity of external parasite infestation in support of the hides/skins industry; 2) investigating causes of high lamb/kid mortality; 3) providing health leadership for imported sheep and goats during the quarantine period and at Nucleus and Breeding Evaluation and Distribution (BED) sites; and 4) supporting training activities.

External parasite control

Ectoparasite infestation is one of the most important health constraints in small ruminant production in Ethiopia, not only to skin/hide quality, but just as or more importantly in transmitting tick and insect borne diseases, limiting growth rate and often causing mortality. Until recently, Ethiopia's second largest earner of foreign income was the hides and skins sector where small ruminants, and in particular sheep, were very important. However, the percentage of skins having defects that downgrade quality has increased tremendously. Tanneries state that currently only 10 to 15% of harvested skins qualify for top grades, with the rest downgraded. These percentages are the direct opposite to those seen 20 years ago. There are a number of factors that cause skin defects, but most important are those caused by ecto-parasites, which are mainly lice, keds and mange mites. Lice and keds cause an allergic condition known as cockle (ekek in Amharic) in sheep. Cockle is characterized by the formation of skin nodules, which form ulcers that leave scars. The scars form blemishes after tanning that do not readily accept dyes, with the resulting hide either downgraded or rejected after tanning.

Cockle defects are not easily noticeable while the animal is alive, because the blemishes are located on the dermis, which is the layer next to the hair and the epidermis. This makes it difficult for skin selectors to reject the affected unprocessed skins when buying raw materials.

Adequate knowledge of the necessary and cost-effective management strategies exist for mitigation of this production constraint. The Animal Health Program has undertaken training and establishment of private Spraying/Dipping Service Providers (SDSP) to control external parasites. The control method offers a long-term sustainable solution to this problem and an economically viable opportunity for many individuals.

Study on major causes of lamb/kid mortality

National estimates of livestock number for 2005 indicate that Ethiopia has 23.2 million sheep and 22.8 million goats. The major cause of direct economic losses and a significant cause of poor productivity in livestock is the widespread prevalence of a range of diseases and parasites in all agro-ecological zones of the country. The direct loss due to

mortality is generally estimated to be 14 to 16% of the national sheep flock and 11 to 13% of the national goat herd per annum. In some parts of the country mortality rates of lambs and kids are estimated to be over 60%. Reducing the mortality of lambs and kids will increase productivity of small ruminants and increase the income of smallholder farmers and pastoralists. Knowing the cause of lamb and kid mortality would lead to the development of appropriate extension messages for farmers and pastoralists and to the formulation of sound disease prevention and control strategies. Therefore, a research project is being conducted to monitor lamb/kid mortality, determine the causes of mortality and design appropriate prevention and control strategies.

Provision of herd health leadership

To enhance the genetic potential of sheep and goats in Ethiopia, the ESGPIP imported Boer goats and Dorper sheep from South Africa. The herd health program has supported these activities through work on the quarantine and testing procedures for the imported animals. These animals have since been assigned to four Nucleus breeding sites. In addition, there are Breeding, Evaluation and Distribution (BED) sites where crossbreeding takes place to produce animals for village distribution and sale. The herd health program of the ESGPIP oversees the herd health at all of these sites.

Progress on Activities

External parasite control to improve quality of hides/skins

The main thrust of this activity is to train individuals to be SDSP. These individuals are selected by the community and assigned the task of providing external parasite control service. To start the external parasite control activity, SDSP must purchase knapsack sprayers, protective gear and acaricides. To cover their expenses and for the service they provide, owners of small ruminants are charged a small fee. The ESGPIP is trying to link SDSP with Service Cooperatives so that they could be one source of acaricides. Currently, Service Cooperatives buy supplies in bulk and sell to their members with small profits. In the same way they can buy acaricides in bulk and sell to the SDSP. In addition to training, the ESGPIP provides some supplies such as mobile dipping vats, knapsack sprayers and initial acaricides and safety equipment to communities and trained SDSP. The dipping vats and knapsack sprayers, in the majority of cases, will belong to the Peasant Associations. Should the person selected to be trained as SDSP cease providing service, these items are returned to the Peasant Association.

The current external parasite control activity of the program focuses mainly in areas where the Nucleus and BED sites are located and where their crosses are planned to be distributed in order to reduce the risk of introduction of ectoparasites and tick-borne diseases to these animals.

A training curriculum for SDSP was prepared in consultation with appropriate institutions. In six training sessions, 105 individuals have been trained as SDSP and were provided with dipping vats/knapsack sprayers, chemicals and protective gears. The ESGPIP contracted a consultant to conduct a financial cost-benefit analysis of SDSP. Suggestions of methods to make the service sustainable were provided. The main

findings of the study are as indicated below. In Tigray, Amhara and Afar regions, the first phase campaign of Ectoparasite Control Program (EPCP) was planned to be completed by the end of 2008. Thereafter, the campaign is expected to be run by Farmer/Peasant Associations (FA/PA). The SDSF will provide their services as entrepreneurs. Provision of technical expertise and guidance is to be availed by woreda agriculture and rural development offices (WARDO). The SDSF are recruited from the interested farmers in the associations and work on a part-time basis to improve their livelihood and food security. At other times, the SDSF conduct agri-businesses similar to the rest of their fellow farmers or pastoralists. This approach delivers built-in capacity and enables smallholder farmers and pastoralists to perform EPCP on their own, through FA/PA. The action provides employment opportunity and sustainable flow of income to SDSF.

Since poor smallholder farmers and pastoralists cannot afford to fund the EPCP from the outset, a seed money (working capital) scheme should be established. The fund is suggested to be run by an executive committee drawn from FA/PA in each of the program study woredas. Each WARDO should ensure that the accounts of the FA/PA are audited annually. Moreover, internal finance and accounting control mechanisms plus procedures of Commercial Bank of Ethiopia (CBE) branch office in each woreda need to be observed in using the blocked account seed fund. The fund must be under the direct management of an executive committee of an FA/PA and it should be used only for EPCP of sheep and goats. SDSF are to be paid by farmers or pastoralists, who get services through their FA/PA.

Parasite infestation downgrades the quality of skins and is a threat to the Leather and Leather Products Industry (LLPI) (including rural cottage industries) of the country. It is highly recommended that beneficiaries from improved productivity of sheep and goats, such as traders, exporters of live sheep and goats and carcasses, LLPI, and the Government of Ethiopia (GoE), be the major contributors to the seed fund. It should be viewed from a public-private partnership viewpoint.

Technical and management sustainability of EPCP activities is developed by periodic capacity building of SDSF and the executive committee members of FA/PA through provisions of training and expertise support from each WARDO. The projects are financially feasible, with very high returns to household heads and family labor. Sustainability of EPCP and SDSF employment are reliable, provided that the seed fund is in place and used only for running EPCP appropriately. The capacity and livelihood of SDSF and entire members plus families of FA/PA is expected to improve, including food security.

A workshop was held to discuss the findings of the consultant on June 30, 2008, at the ESGPIP office. The workshop was attended by pertinent professionals from Tigray, Afar and Oromia regions, and from FINTRAC, COMESA, Ministry of Agriculture and Rural Development and the National Animal Health Diagnostic and Investigation Center. Participants appreciated efforts of the consultant and recommended that the service be used by the regions as one option to provide sustainable external parasite control services for farmers and pastoralists. The finalized report was distributed to Bureaus of

Agriculture and Rural Development of Tigray, Afar, Oromia, SNNPR, Amhara and Somali regions and to FINTRAC, COMESA, Animal and Plant Health Regulatory Department and the National Animal Health Diagnostic Center of Ministry of Agriculture the Rural Development.



Practical training on control of external parasites

Study of major causes of lamb mortality

The study of lamb mortality was commissioned in the Amhara and Tigray regions in July, 2008. In 2009, causes of kid mortality will be studied in the Oromia Region. For the lamb study in the Amhara region at Ebinat woreda, two PA, Jiman Dergha and Zeha were selected. In each PA, 30 farmers were selected. In the Tigray Region at the Wukro woreda, two PA; Negash and Gemad, were selected. The ESGPIP Health Program Officer and other animal health professionals of the regions met the selected farmers and held discussions on the objective of the study and what was expected from farmers, ESGPIP and regional animal health staff. Subsequently, selected farmers were interviewed to collect base line data.

For each selected PA, one enumerator was hired based on the following criteria; residence in the PA, completion of the 10th grade and acceptance by members of the PA. The enumerators were expected to collect data from the selected farmers' sheep on birth, death, disease, entry of new sheep to the flock and exit of sheep from the flock. A memorandum of understanding describing the roles and responsibilities of each party was signed between the ESGPIP and Bahir Dar Laboratory of the Amhara Region and among ESGPIP and the Mekele Regional Animal Health Laboratory and Mekele University of the Tigray Region.

In the Amhara Region the monitoring activity started in July, 2008, and will run for one year. In Tigray, the monitoring activity was delayed because Mekele Regional Laboratory staff were busy with Business Process Reengineering. The enumerators

collect data from the selected farmers' sheep every week and regional laboratory staff collect fecal and other samples every month. Information on the first three months of monitoring activity in the Amhara region is summarized as follows.

The first three months of monitoring revealed respiratory disease, diarrhea, sudden death, orf (contagious ecthyma) and sheep pox to be important health constraints. Parasitological examination indicated that most study animals were infected with strongyle groups of helminth parasites. Other internal parasites such as liver fluke (*Fasciola*), stomach fluke (*Paramphistoma*) and blood fluke (*Schistosoma*) were rarely detected. Moreover, faecal culture was made for species identification of infective larval stage of strongyle groups of parasites. *Bunostomum* and *Strongyloides* were found in abundance and *Haemonchus* and *Ostertagia* were rarely encountered during observation of the fecal cultures.

The mortality rate of adult sheep (above six months of age) was 2.4% and of young sheep (six months of age and younger) was 7.8%. Mortality occurred due to diarrhea and pneumonia, respectively.

Animal health activities in the importation of Dorper sheep and Boer goats

Following purchase of the animals in South Africa, the quarantine requirements of the Ethiopian Veterinary Department for the importation of sheep and goats were prepared and sent to the South African Veterinary Services. Furthermore, in-country quarantine requirements and biosecurity measures to be implemented at the quarantine facility were prepared which are listed below.

- Before the arrival of sheep and goats from South Africa, all necessary preparations such as drugs, veterinary equipment, chemicals and consumables that were to be used for the quarantine animals were completed.
- In consultation with the ESGPIP Health Program Officer, a veterinarian and two animal health assistants were assigned by the National Animal Health Diagnostic and Investigation Center to monitor health of the animals while at the quarantine center.
- Animal attendants were recruited based on experience in animal care and not owning any small ruminants. Selected individuals were given an orientation on all necessary precautionary and security measures to follow during the quarantine period. Vaccination and fecal and blood sampling dates were set.
- Dr. Lionel J. Dawson, a consulting veterinarian from Oklahoma State University, visited the quarantine station at Sebeta. Dr. Dawson inspected the facilities and made suggestions for changes. After arrival of the animals, he assisted in initial treatment of sick animals. Dr. Dawson also participated in vaccinating and collecting blood samples for brucellosis, bluetongue and Maedi-visna tests. He also provided training to ESGPIP and Nucleus site veterinarians on vaccination, deworming and preventive medicine for goats and sheep.
- The trucks assigned to bring the sheep and goats from Bole airport to the quarantine center were cleaned and disinfected before loading and after unloading of the sheep and goats.

- On the first day of arrival, three diarrheic and five severely coughing animals were treated. One female goat, which was very depressed, diarrheic and dehydrated upon arrival, died the following day.
- To clear any possible illnesses resulting from travel stress, all animals were treated with long-acting oxytetracycline on the second day following their arrival.
- All animals were vaccinated for anthrax, sheep pox, foot and mouth disease and peste des petits ruminants (PPR). In addition, goats were vaccinated against contagious caprine pleuropneumonia (CCPP).
- A recommendation to the program was made to vaccinate the sheep and goats for Clostridium CD &T to prevent enterotoxaemia and tetanus.
- To prevent animals from having a dry cough, it was recommended to pull up shades and leave doors open at night for better ventilation and prevention of respiratory diseases. Animals that were coughing had normal temperature and respiratory rates. By keeping the plastic shades rolled up and doors open, coughing was reduced.
- Slatted flooring was removed in the 3rd week because there were four fractured legs in both sheep and goats.
- All animals were treated for internal and external parasites using Ivermectin.
- Blood samples were collected from all sheep and goats for testing of Maedi-visna, bluetongue and brucellosis as set out by the Animal Health Department of the Ministry of Agriculture and Rural Development. The animals were treated with a broad spectrum antibiotic at the Sebeta Quarantine Center to prevent respiratory diseases one day before they were transported to Nucleus sites.

Animal health activities at the Nucleus and BED sites

The following health related activities were undertaken at each of the Nucleus and BED sites.

- Fecal samples were tested for internal parasites.
- Thirty-four lambs born at the Sebeta Quarantine Center were vaccinated against anthrax, PPR, sheep pox, anthrax and Pasteurellosis at Werer and Fafen Nucleus sites.
- It is known that the Werer and Adami Tulu sites are copper deficient. Therefore, imported and local goats at Adami Tulu and imported sheep at Werer were given copper supplements.
- Female sheep and goats purchased by BED sites for crossbreeding were given a broad spectrum antibiotic before being transported to their respective BED sites to prevent transport fever.
- Female goats and sheep were also treated with a broad spectrum antibiotic on the second day after arrival at the BED sites. They were also treated against external and internal parasites and vaccinated for anthrax, sheep pox, Pasteurellosis, and PPR at the BED sites. In addition the goats were vaccinated against CCPP.
- Animal health guidelines for Nucleus and BED sites were prepared and distributed.

Training activities

In partnership with the Farmer to Farmer Program, Professors Dwight D. Bowman and Janice L. Liotta from Cornell University visited Ethiopia in late May and early June, 2007, to give training on internal parasite management in small ruminants. Initial training activities focused on training animal health laboratory staff in laboratory diagnostic techniques. In the two weeks of training, 34 animal health workers from the National Animal Health Diagnostic and Investigation Center, regional laboratories and Nucleus sites took part.

Drs. Bowman and Liotta also presented other training courses on the diagnosis of helminths, arthropods, and protozoal infections of goats and sheep. The training focused on the diagnosis of parasitic infections, methods for assessing resistance within populations of nematode helminths, and methods for isolation and immunologic and molecular identification of species of *Giardia* and *Cryptosporidium* in samples. Training consisted of lectures followed by hands-on laboratories assisted by members of the National Animal Health Diagnostic and Investigation Center. Visits were made to three of the regional sites where the new Boer×local goats and Dorper×local sheep were to be housed prior to distribution to regional centers and, ultimately, Ethiopian farmers. The three sites visited were Adami Tulu Research Center, Hawasa University and Werer Agricultural Research Center. There were discussions on methods to protect drinking water from contamination with pathogens from animal manure, methods for treating and disinfecting drinking water to destroy or inactivate pathogens, and methods for immune-detection and molecular characterization of stages of parasites found in drinking water, soil, feces, and manure.

Challenges/Problems Encountered

External parasite control

The SDSP faced the following challenges.

- The currently used hard plastic dipping vats are heavy, break easily, are short-lived and have to be fixed in a trench for use.
- Dipping demands a large volume of water and shortages in available water supply cause problems when it has to be transported from a long distance. This is a particularly significant issue in pastoral areas.
- Though no previous experience has been observed, there are worries on the part of farmers/pastoralists that pregnant sheep and goats will abort during the process of dipping.
- Farmers and pastoralists fear the transfer of ectoparasites and other diseases from infected to healthy animals at dipping sites.
- There is a problem of acquiring drugs from an efficient and high quality source.

Study on the major causes of lamb/kid mortality

- The animal health staff of Mekele Regional Animal Health Laboratory has been busy with BPR, so they could not undertake the study as planned.

Animal health activities at Nucleus and BED sites

- Animal health service activities in woredas where Nucleus and BED sites are located are weak.
- Some vaccines such as enterotoxaemia and supplements like copper are not available in the country.
- There is lack of animal health staff at Sirinka, Abergelle and Areka BED sites.
- Other animals have access to Worer nucleus site.

Steps Taken to Solve Problems

External parasite control

- The provision of hard plastic vats has been terminated. Knapsack sprayers are being provided.
- An attempt is being made to link SDSP with private veterinarians for sustainable drug supply.

Study of major causes of lamb/kid mortality

- A discussion was made with the head of the Mekele Regional Animal Health Laboratory to avail some staff for the study, and this has been done.

Animal health activities at Nucleus and BED sites

- A discussion was started with the Animal and Plant Health Regulatory Department of the Federal Ministry of Agriculture and Rural Development to urge regions to give priority and strengthen animal health activities in woredas where the Nucleus and BED sites are located.
- Vaccine for enterotoxaemia and copper supplement were imported.
- At some BED sites where there is no animal health staff, the ESGPIP has written letters to the appropriate authorities requesting them to assign Animal Health Assistants. However, temporarily they are making use of Animal Health Assistants from neighboring institutes. The biosecurity concern at the Worer Nucleus site has now been solved by fencing the premises.

Thoughts on Sustainability

External parasite control

- To make the exercise sustainable, the community should participate in the selection of candidate farmers/pastoralists for SDSP training. There should be a clear understanding within the community about incentives for SDSP to keep working and proper pricing of drugs.
- There should be support, regular training and supervision of SDSP from the respective office of Agriculture and Rural Development.
- A sustainable drug supply by private veterinarians or government veterinary services should be ensured.

Study of major causes of lamb/kid mortality

- The regional animal health laboratories should undertake the study near the laboratory so that they can overcome the problem of transportation.
- It is advisable to use externship veterinary students to undertake the study so that cost could be reduced.

Animal health activities at Nucleus and BED sites

- Sheep and goats at Nucleus and BED sites should be regularly vaccinated against endemic diseases of the country.
- Animal health staff of Nucleus and BED sites should get regular information about the sheep and goat disease status of the woreda where Nucleus & BED sites are located.
- Nucleus and BED sites should maintain linkages with regional animal health laboratories and the National Animal Health Diagnostic and Investigation Center for laboratory diagnosis of diseases.

Overview of Genotype Program Activities

Kassahun Awgichew and Terry A. Gipson

Background

Although Ethiopia has the largest livestock population in Africa, actual productivity or output per animal is among the lowest in the world, with the contributions of livestock to the economy simply due to the large number of animals. Limited genetic potential of indigenous goats and sheep has been identified as a major constraint to increased productivity. The available genetic resources of Ethiopian indigenous goats were reported at a conference held at Hawassa University in 2000. In addition to phenotypic characterization of goats of Ethiopia outlined in that conference, it has recently been determined, through DNA fingerprinting technologies, that there are four distinct genetic groups of goats in Ethiopia. A study using a combination of microsatellite analysis and morphological divergence has shown that Ethiopian sheep could be classified into six breed groups and nine breeds (Solomon Gizaw GebreMichael, 2008). Whereas these studies identified genetically distinct animal populations, they would not have substantial impact in a short or moderate time frame because selection within these distinct populations or crossbreeding among the populations would take decades to achieve any desired results. The most obvious and quickest means of greatly elevating meat goat productivity in Ethiopia is to take advantage of the heterotic effects of crossbreeding. The South African Boer goat was chosen as a primary candidate for crossing with Ethiopian goat breeds. Attributes of the Boer goat are well known and they include large size, considerable muscling, high dressing percentage, and fast growth.

There also exists the potential to increase productivity of sheep in Ethiopia produced for meat by introducing new genotypes and although unsuccessful, there have been previous efforts to do so. Dorper sheep, like Boer goats, were developed in South Africa. The Dorper arose from selection of crosses of Dorset Horn and Blackhead Persian breeds. This latter breed is essentially an improved Blackhead Somali, which is native to Ethiopia. Dorper sheep were introduced into Ethiopia in the Jijiga area in the late 1980s. On-station performance of crosses with Blackhead Somali sheep was very good, but there was apparently no on-farm evaluation. Due to later political instability and looting of the ranch near Jijiga, there are no known Dorper or Dorper crosses in Ethiopia from that original importation.

In another attempt, Boer goat semen was brought in 2006 from Langston University to cross indigenous goats through artificial insemination (AI) at Haramaya and Hawassa Universities. The results of the crossing of indigenous goats, one round in Haramaya University and two rounds in Hawassa University, were not encouraging. Not more than 10 to 12 crossbred bucks were produced from the three rounds of AI.

To improve the genetic potential of goats and sheep in Ethiopia, Boer goats and Dorper sheep were imported into Ethiopia, mainly for crossbreeding purposes. The ESGPIP Genotype Program activities include importation of improved genotypes, multiplication of purebreds, crossing with indigenous sheep and goats and distribution of both crossbred and pure exotic animals to producers. Additional Genotype Program activities encompass evaluation of the imported animals on farms and in research institutions. The imported improved animals will be initially multiplied and distributed in the six project regions.

Progress on Activities

Introduction of improved genotypes of Boer goats and Dorper sheep

Improved goat and sheep genotypes were purchased from 10 Boer and nine Dorper purebred breeders in the Northern Cape, Eastern Cape, and Free State provinces of South Africa to maximize genetic diversity. Purchased animals underwent a thorough health care and disease investigation protocol at the Embryo Plus Quarantine Center in South Africa as per the request of the Federal Ministry of Agriculture and Rural Development, regulations of the exporting country, and guidelines established by the World Organization for Animal Health (OIE). While in quarantine in South Africa, animals received immunizations for *Clostridium tetani* and *Clostridium chauvoei*, were dewormed, and were tested and found negative for brucellosis (*Brucella melitensis*), Maedi-visna, and Blue tongue.

In preparation for the importation, the ESGPIP worked with the National Animal Health and Disease Investigation Center at Sebeta to establish guidelines for the quarantine and testing of the imported animals. The ESGPIP also constructed a quarantine facility at the Sebeta compound that was later handed over to the Center.

Two-hundred-twenty-five animals (105 Boer goats and 120 Dorper sheep) were imported in July, 2007. The animals were kept at the Sebeta Quarantine Center for almost four months. They stayed longer at the Quarantine Center than necessary due to delays in the construction of facilities at the four Nucleus sites. Some of the imported females were pregnant and a number of kids and lambs were born during the quarantine period.

Selection and establishment of Nucleus breeding sites

In the third week of October, 2007, animals were taken to the four designated Nucleus sites, each located in a different region. Boer goats were placed at the Adami Tulu Research Center (Oromia) and Hawassa University (SNNPR). Dorper sheep were placed at Fafen (Somali) and Werer (Afar) Research Centers. The Nucleus sites were established in areas where close monitoring and follow-up could be undertaken and where there is a strong willingness to host the sites. Previous experience in small ruminant production and availability of appropriate professionals and facilities were also taken into consideration in selecting the sites. The distribution of animals to the four Nucleus sites at the end of October, 2007 is shown in Table 1.

Table 1: Animals distributed to the four Nucleus sites

Nucleus Site	Species	Animals Distributed			
		Does/ Ewes	Bucks/ Rams	Kids/ Lambs	Total
Adami Tulu Research Center	Goat	45	7	4*	56
Hawassa University	"	45	7	4*	56
Fafen Research Center	Sheep	51	9	18*	78
Werer Research Center	"	51	9	18*	78

* Kids and lambs born at the Sebeta Quarantine Center



Two units of the 3-unit Boer goat Nucleus site at Adami Tulu

At the Nucleus sites, purebred animals are being bred to produce pure offspring for multiplication and for the crossbreeding programs at the respective Breeding, Evaluation and Distribution (BED) sites. The main function of the Nucleus sites is to multiply the imported purebreds and provide a continuous supply of pure Boer goats and Dorper sheep to the BED sites, private commercial or cooperative farms and to those persons who may wish to establish their own pure breed producing farms. This will be possible if the existing Nucleus sites are transformed into independent commercial enterprise entities as recommended by the mid-term review team. Mating of the pure exotic breeds has been on-going since December, 2007 and the current number of purebred Boer goats and Dorper sheep is shown in Table 2.

Table 2: Current number of purebred Boer goats and Dorper sheep by Nucleus site

Nucleus Site	Imported Animals		Offspring born at the Nucleus site		Total Alive
	Females	Males	Females	Males	
Boer Goats					
Adami Tulu Research Center	43	7	24	22	90
Hawassa University	43	5	21	23	87
Dorper Sheep					
Fafen Research Center	47	8	24	23	97
Werer Research Center	48	7	29	25	105

The difference between the number of animals shown in the last column and the sum of those imported and born is the mortality, which is shown in Table 3.

Table 3: Mortality rate of imported animals and kids and lambs

Nucleus Site	Imported Animals		Offspring born at the Nucleus site	
	Total deaths	%	Total deaths	%
Boer Goats				
Adami Tulu Research Center	2	3.8	6/46*	13.0
Hawassa University	4	7.7	3/42*	7.1
Dorper Sheep				
Fafen Research .Center	6	10	7/49*	14.3
Werer Research Center	5	8.3	6/56*	10.7

*Includes kids and lambs born in Sebeta Quarantine



Five-month-old Boer kids at the Hawassa University Nucleus site



Boer crossbred kids a few days old at the Hawassa University BED site



A Dorper ewe with twins a few days old at the Fafen Research Center



Dorper ewes and their lambs at the Werer Research Center

Selection and establishment of BED sites

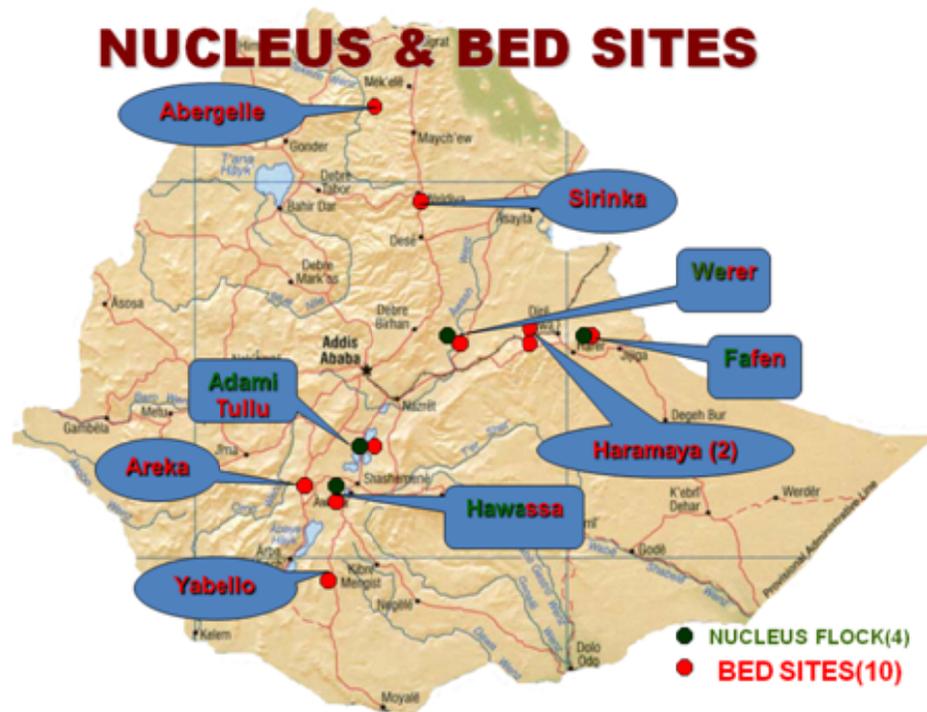
In addition to having a BED site at each of the four Nucleus sites, five more BED sites have been established by the ESGPIP. Thus, there is at least one BED site in each of the ESGPIP target regions. The BED sites were selected mainly based on the proximity to the small ruminant production potential areas and export routes. A tenth BED site has been established by Haramaya University to cross Dorper sheep with Blackhead Somali and Hararghe Highland sheep.

To achieve the primary function of BED sites, approximately 100 females of most prevalent and preferred indigenous genotypes have been assembled at each of the BED sites. The indigenous animals assembled for crossbreeding are mostly those which are exported live and also preferred by export abattoirs. These animals will be mated naturally with purebred Boer or Dorper sires transferred from the Nucleus sites. Based on pre- and post-weaning growth rate of individual kids and lambs, one or two young F1 (50% Boer or Dorper) males are selected for on-farm use starting in the fourth year of the program. The number of sires to be distributed increases in subsequent years in accordance with the increase in numbers of participating private sector farms. Males on farms are marketed for slaughter; females could be mated to 50% or higher grade males to continue improved genotype breeding at the farmers' level. BED sites also produce 25% males for on-farm use with 25% females, so that resultant progeny are also 25% exotic blood.

As indicated above, the main purpose of the BED sites is to produce crossbred animals of designated breeds to supply to producers, markets or abattoirs in their respective areas. To be sustainable, it is believed that BED sites will eventually be operated as independent business entities as recommended by the mid-term review team. Until then the hosting institutions are expected to play a significant role in building the capacity of BED sites.

It is assumed that once the numbers of breeding females at the Nucleus sites reach 100, females in excess of required replacement female stock (10%) will be distributed as follows: 50% will go to farmers and 40% will go to private producers and institutions wishing to establish Nucleus herds or flock. From the male expected offspring stock at the Nucleus sites, 10% will be retained as replacements (and of the remaining 90%), 20% will go to BED sites and 70% to private producers. At BED sites, produced crossbred animal distribution is planned as: 20% will be retained as replacements, 60% will go to farmers/pastoralists and 20% will go to private commercial farms.

The distribution of Nucleus and BED sites.



ESGPIP Nucleus and BED Sites

Criteria were developed to select and purchase female goats and sheep from areas where the BED sites are located. The criteria include the following:

1. Animals should be young, preferably about one year of age, judged by the milk teeth they have replaced.
2. Not be pregnant at the time of purchase.
3. Weigh between 20 to 25 kg.
4. No history of abortion.
5. No sign of communicable diseases such as orf.
6. No physical deformity either on their bodies or reproductive organs.
7. In acceptable body condition and have good body conformation.

After purchase, animals are treated with a long-acting antibiotic before transportation to their destinations where they are vaccinated. Four-hundred-twenty-seven goats have been purchased for the goat BED sites as shown in Table 2. In addition to these, 60 goats each from the old farms at Hawassa University goat farm and Werer Research Center were included making the total number of goats for the BED sites to be 547. For sheep BED sites, 487 ewes were purchased and 65 sheep from the Werer Research Center old farm were added to the Werer BED flock, resulting in 552 sheep at the BED sites. Purchasing indigenous female goats for Haramaya and Yabello BED sites, as well as sheep for Yabello, will be undertaken as soon as the BED site construction is complete. In summary, the total number of indigenous sheep and goats procured so far are 552 and 547, respectively. Purchasing indigenous animals at the other sites except for Hawassa and Adami Tulu has been possible because of the willingness and cooperation of the partner institutions to provide temporary shelter until the BED facilities are constructed. In addition, Hawassa University and the Werer Research Center have provided some local animals maintained in their existing goat farms. This has helped start the crossbreeding before the construction of the BED site facilities.

Animals assembled in the 10 BED sites are shown in Table 4. The number of indigenous animals assembled in the various BED sites varies due to unavailability of the desired breed and type during the time of purchase. Despite care taken, some pregnant animals were purchased, particularly animals in the early stages of pregnancy when diagnosis is difficult.

Maintaining Boer goat genetic diversity and activities to speed up crossbreeding – AI and buck use on-farm

There is a lag time before Boer goat and Dorper sheep derived from the imported stock can be used for crossbreeding on local farms. In order to achieve an earlier on-farm introduction of crossbred Boer goats and Dorper sheep, male lambs and kids born at the Sebeta Quarantine Center have been mated with the local females assembled for crossbreeding at the BED sites to produce F1 sire progeny, which could then be used on farm as described above. Goats at the BED sites not bred will be subjected to AI with semen stored at the National Artificial Insemination Center (NAIC). The Boer goat semen was previously imported from Langston University (USA) for a separate goat program at Hawassa and Haramaya Universities. In addition, 600 doses of Boer goat semen were imported from South Africa along with the Boer goats and Dorper sheep at the beginning of July, 2007, to replace semen used by the ESGPIP from the stock imported for Haramaya and Hawassa Universities and to increase the genetic base and diversity for future years. Another strategy planned to achieve an even earlier on-farm introduction of Boer goats at some sites is to take advantage of Boer semen stored at NAIC. F1 sires produced could then be used for the on-farm introduction of crossbred sires. If adequate numbers of crossbred sire progeny are available, some may be moved to other goat BED site(s).

Table 4: BED sites and indigenous breeds of goat and sheep by region

BED Site/Region	Indigenous Breeds/ Types assembled	Number Purchased	Offspring Born from the Indigenous	Offspring Born at the BED Site	Total Number
Adami Tulu Research Center*	Arsi-Bale	133	39		172
Abergelle Research Center	Abergelle	113	NA		113
Areka Research Center*		137	2		139
Fafen Research -Center (Golajo)*	Blackhead Somali	119	3		122
Haramaya University					
• Goats	Hararghe Highland	-			
• Goats	Somali	-			
• Sheep*	Blackhead Somali	80			80
• Sheep*	Hararghe Highland	70			70
Hawassa University					
• From Old Farm*	Different types and crosses	60			60
•	Somali Goats	120			120
Sirinka Research Center					
• Goats*		60			60
• Sheep*		80			80
Werer Research Center					
• Goats	Afar	60			60
• Sheep*	Afar	65			65
Yabello Research Center					
• Goats	Borena/ Somali	-			
• Sheep	Blackhead Somali	-			

* Crossbreeding already started

Further purchase of semen from South Africa is possible to increase stocks and genetic diversity. However, the use of AI in an attempt to accelerate the crossbreeding program at the Hawassa site earlier in the ESGPIP program has not been encouraging. One major contributing factor to the poor performance may have been the synchronization protocol used, as it was an experimental protocol using only prostaglandins that was necessitated by the lack of locally available synchronization hormones. If AI is to be considered again, a synchronization protocol incorporating FSH, HCG/PMSG, and (or) GnRH may be more successful.

Record keeping system development

Record keeping systems have been developed to be used at the Nucleus and BED sites. Individual animal recording formats to record periodic body weight, mating performance, lambing/kidding performance and health care interventions have been developed and are being used at all sites. In addition to this, an electronic database system has been developed and is being tested at the Nucleus sites. This will be further developed and simplified to be used at the BED sites. A preliminary training on the Access® based database operation has been given to four data managers from the four Nucleus sites and

one person from the ESGPIP office. Records will then be used to select animals for replacements and breeding at the Nucleus and BED sites or identify those to be culled based on their performance.

Evaluation of the effects of crossbreeding on carcass characteristics and skin quality

This activity has not yet been undertaken but will occur in year five. The influence of crossbreeding on skin quality and carcass characteristics of crossbreds will be evaluated in collaboration with Nucleus and BED site hosting institutions of the Ethiopian Institute of Agricultural Research (EIAR) and Hawassa and Haramaya Universities and tanneries. Skins of crossbred Boer goat and Dorper sheep and of local animals bred to these improved genotypes from at least five of the participating farms in each region will be evaluated for quality by the leather industry. Carcass characteristics will be evaluated in collaboration with abattoirs.

Challenges/Problems Encountered

Delays in the start-up and breed importation

- A decision was made to import both sheep and goats at the same time instead of one species at a time as originally planned. This necessitated making some changes to the planned quarantine facility to accommodate both species. The quarantine facility at Sebeta was completed in May, 2007, almost one year behind the original plan. The Boer goats and Dorper sheep were imported on July 1, 2007 and housed at the quarantine facility built at Sebeta.

Problems related to construction of facilities

- Temporary suspension of all construction activities including the start of construction at Nucleus sites was enforced before the redesign of the ESGPIP was completed (i.e., until April, 2007 for all constructions). This included delaying the extension of the Sebeta Quarantine Center to accommodate simultaneous importation of both sheep and goats until the second quarter of FY 2007. BED site construction took unexpectedly long time mainly due to: 1) inflated construction cost estimates; 2) redesigning facilities to minimize cost; and 3) new regulations on VAT, which demands that initial payments should be made in full followed by submission of a VAT waiver reimbursement request. Currently, the construction of six BED sites is completed; two are 90% complete and one is just starting. Because of delayed construction of Nucleus facilities, redesigning process and other unforeseen problems, the imported animals were forced to remain at the Sebeta Quarantine Center for almost four months, hence affecting the start of breeding at the Nucleus sites.
- The reduction of budget during the redesign process, coupled with high inflation, has driven the cost of construction materials to levels that could not be covered by the allocated budget. The postponement in construction has in turn led to delays in the start of the crossbreeding program, further postponing crossbred animal distribution to the farming and pastoral communities.

- Despite the above problems, the ESGPIP has been able to start multiplying the imported purebreds at the four Nucleus sites and also to begin crossbreeding using the imported sires at the Hawassa University BED site in early 2008.
- Because of these delays, it may not be possible to produce and distribute crossbreds to the farming community, establish private sire centers and see the impact of improved genotype animals within the remaining two years of the program. At least one additional year may be required to produce purebreds for distribution to BED sites and another year to get crossbreds either for sale or distribution. This shows that unless the program is extended for at least a year, it will be very difficult to measure any impact the program could bring in improving the livelihoods of farmers or pastoralists.
- For increased private sector involvement and growth, the ESGPIP will establish private crossbred buck and ram stations for use at surrounding farms late in year 4 and during year 5 of the program. This activity may lay the foundation for eventual private sector production of F1 bucks and rams. In addition, it is anticipated that in some areas use of purebred improved sire breeds may be appropriate. If so, in the future this can be facilitated by animal supply from the Nucleus sites.

Sustainable feed supply

- The challenge ESGPIP faced in making feed available for Nucleus sites was beyond what was expected. It had to transport feed from the highlands to the lowlands. The biggest challenge the ESGPIP faced in feed supply was transporting feed to the Fafen Nucleus site. In Fafen, the forage development program did not materialize satisfactorily mainly due to the lack of a permanent water supply. The ESGPIP is still buying and transporting feed to Fafen, which has become extremely expensive with a bale of hay sometimes costing up to 30 birr during the peak dry period. The ESGPIP had the same problem with Adami Tulu though not as serious as that of Fafen. Adami Tulu has now developed a large area of forage and is about to become self sufficient in forage production. With funds made available by ESGPIP, the Werer Research Center developed nearly 8 ha of forage which is now being used to feed the animals there. No hay from the highlands was sent to Werer except during the initial stages of forage development. The same is true for the Hawassa University Nucleus and BED sites which, with modest assistance, are producing their own feed.
- The other challenge was to provide concentrate feed for supplementation. This has been a very serious problem at all Nucleus sites except Hawassa University, which has been procuring the necessary concentrate feed components from Hawassa. Haramaya University is also self sufficient in providing the necessary feed for all animals at the two BED sites it maintains.

Inadequate resources to build dipping vats, farm offices, computers and feed stores

- Due to budget limitations and rising costs, funds allocated for facility enhancements at Nucleus and BED sites are not adequate for constructing dipping vats, provision of computers, constructing feed storage facilities, feeding troughs and shelters for farm attendants.

Actions Taken to Alleviate Challenges/Problems Encountered

Construction of facilities

- In close collaboration with the Werer Research Center, arrangements were made to place the Nucleus flock transported from the Sebeta Quarantine Center in a temporary shelter until construction of the Nucleus facility is completed.
- The construction of BED site facilities took much longer than anticipated. Only the Hawassa University and Adami Tulu Research Center BED sites facilities were ready on time to house purchased indigenous animals. Other partner institutions hosting BED sites allowed the ESGPIP to use their existing facilities with minor modifications to keep the indigenous animals purchased for crossbreeding. Crossbreeding began at some of the sites where the temporary shelter was adequate to undertake the crossbreeding program.

Feed supply

- Special arrangements were made with partner institutions to develop forage at the sites. To ease feed problems, arrangements were made with Werer, Hawassa, Adami Tulu, Areka and Fafen sites to develop their own forage sources.

Crossbreeding

- Some imported pure exotic sires and those born at the Sebeta Quarantine Center were used to start crossbreeding with indigenous females. This was done at Hawassa University, Adami Tulu, Haramaya University and Sirinka.
- In the Hawassa area, Boer crossbred sires were provided to farmers' groups as a pilot program to see the response of farmers to these improved animals and also to evaluate the performance of 25% Boer crossbred kids under the farmers' level of management. This will allow the ESGPIP to see what advice it could give to the farmers during provision of either pure or crossbred sires.
- To speed up the crossbreeding program and to make up for some of the time lost in the initial stages, the Genotype Program is planning to make available for sale some purebred Boer and Dorper male animals to selected farmers able to manage such animals.

Thoughts on Sustainability

Strengthening the Nucleus and BED sites

- As suggested by the USAID mid-term evaluation team, the Nucleus and BED sites should be encouraged and supported to function as economically viable enterprises. The current financial regulations should be amended so that Nucleus and BED site funds accrued from the sale of animals and improved forage produced be used to make the Nucleus and BED sites financially self-sufficient. The Federal Ministry of Agriculture and Nucleus and BED sites hosting institutions should raise this issue with the Ministry of Finance to obtain the necessary permission.

- As the ESGPIP has less than two years remaining to support activities, it is imperative that the institutions currently hosting the Nucleus and BED sites progressively take financial and management responsibility of their respective sites. As long-term funding is of concern, plans to make these sites economically viable entities need to be formulated as soon as possible. It is expected that within the next 12 to 16 months, each Nucleus and BED site should become self sufficient and no longer require the financial resources of the ESGPIP. Official communications should be made to Nucleus and BED sites hosting institutions to consider budget allocations for their respective Nucleus/BED sites in preparing budgets for the next Ethiopian Fiscal Year (2002 E.C.).

Promote establishment of private production stations of purebred and crossbred Boer goats and Dorper sheep

- For increased private sector involvement and growth to enhance sustainability, in years 4 and 5, private crossbred buck and ram stations should be established. Private commercial farms with adequate resources and having experience in managing pure exotic or crossbred animals should have a greater chance of being considered. There are four Nucleus sites where purebred Boer and Dorper are being multiplied and ten BED sites where crossbreds are produced for evaluation and dissemination. The multiplication of purebreds at the Nucleus sites and crossbreeding at the BED sites may lay the foundation for private sector adoption of the role of the Nucleus and BED sites in generating purebreds and F1 sires. The supply of pure exotic breeds or crosses when and wherever appropriate in the country can be facilitated by the Nucleus or BED sites where these purebreds and crosses are being multiplied.

Establish ram/buck circles

- Farmers' groups, cooperatives, and pastoral and agro-pastoral groups will be encouraged and initially supported to establish ram/buck circles. The formation of breed societies may help to facilitate the efficient use of the improved genotypes introduced in these areas. Groups can share expenses of feed development or procurement, medicines and even transporting of animals to the market or abattoir of their choice.
- This could also be done as a start up work for the newly drafted Animal Breeding Policy and Regulation of Ethiopia. With close collaboration of the Federal Ministry of Agriculture and partner institutions, the ESGPIP could assist in developing programs and establishing the ram/buck circles.

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The Awassi × Menz Sheep Crossbreeding Project in Ethiopia: Achievements, Challenges and Lessons Learned

Solomon Gizaw and Tesfaye Getachew

Project Background

A Menz sheep genetic improvement project was initiated in 1967. The breeding strategy adopted was crossbreeding of the local Menz sheep with exotic wool sheep breeds. The breeding goal was to improve the mutton and wool production of Menz sheep. Coarse fleece produced from Menz sheep is widely used by Menz sheep producers to weave carpet and traditional blankets called *Zitet* and *Banna*. The project also planned to supply finer and longer wool fiber produced from crossbred sheep to the Debre Birhan Blanket Factory.

The sheep crossbreeding project started with various exotic wool breeds. Initially, 50 Corriedale, six Hampshire and six Romney exotic rams were introduced. However, the exotic breeds were later abandoned because they were not accepted by the farmers as the breeds did not meet farmers' phenotypic preferences for horns and tails. In 1980, the Awassi breed, which has a similar phenotypic appearance to the local sheep, was introduced from Israel and has been well accepted by producers. The Awassi crossbreeding project operates at the Debre Birhan and Amed Guya Sheep Multiplication Ranches.

The Debre Birhan Agricultural Research Center is also involved in an Awassi crossbreeding project. A major component of the research project is evaluation and development of crossbred dissemination schemes discussed later in this paper.

Crossbreeding Scheme

The Awassi × Menz crossbreeding scheme involves importation of pure Awassi rams, production of Awassi × Menz crossbred rams in multiplication ranches, distribution of 6-month-old rams to villagers and upgrading of the village flocks to 75% Awassi. Lately, importation and maintenance of a small flock of pure Awassi rams and ewes to multiply the pure stock has been tried. The breeding scheme is presented in Figure 1.

Crossbreeding in multiplication centers

There has been a continuous importation of purebred Awassi rams and ewes since 1980 totaling 45 ram lambs and ewe lambs. One of the major achievements of the project is that the multiplication ranches have managed to maintain the small purebred flock with a total of 67 breeding rams and ewes at Debre Birhan and 13 at Amed Guya ranches by the end of 2004. However, the above figures show that flock buildup is very slow. The small flock sizes, particularly at the Amed Guya ranch, indicate that mating of related

individuals is unavoidable leading to inbreeding depression. The rates of inbreeding per generation derived from the number of breeding males and females (BoA, 2001) are 6.1% at Debre Birhan and 32.5% at Amed Guya. These rates are well beyond the acceptable level of 1.0%, particularly at Amed Guya. These facts show that maintenance of pure stocks with a small population size is a challenging task.

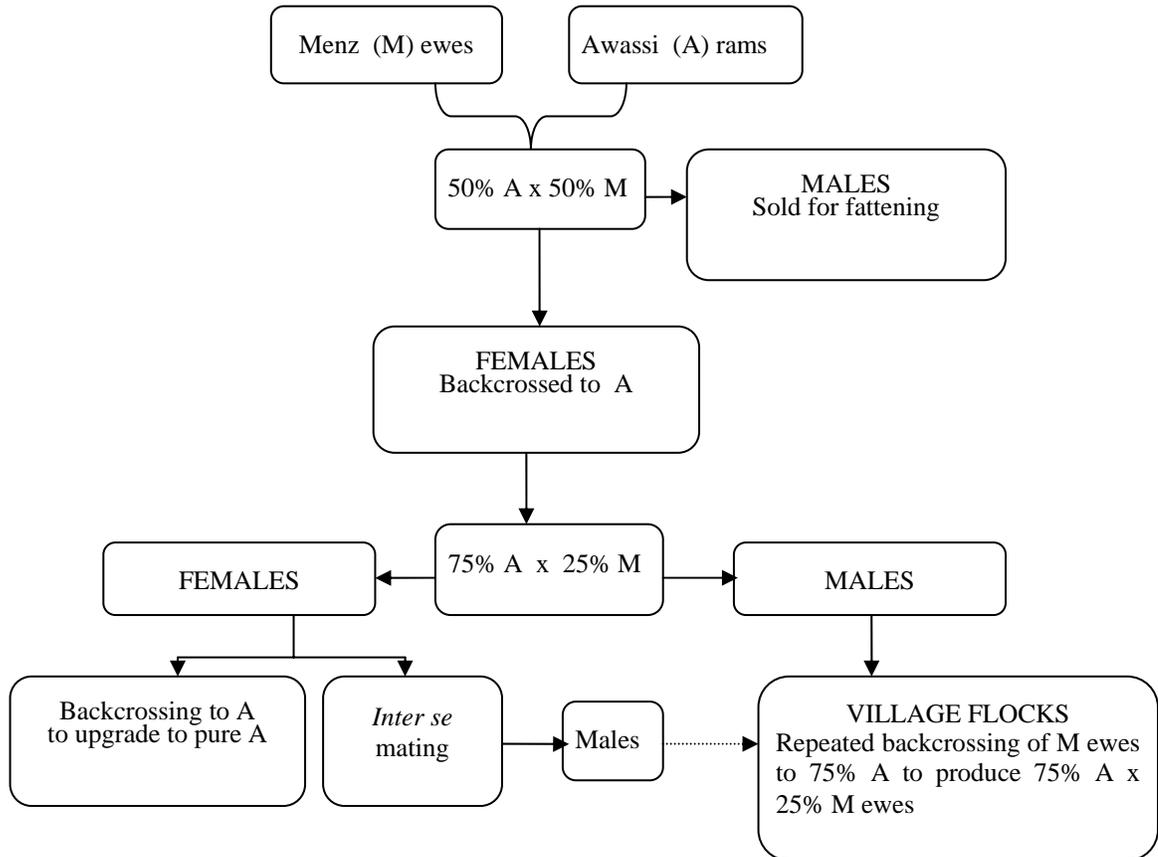


Figure 1. Schematic presentation of the Awassi × Menz crossbreeding scheme in multiplication ranches and village flocks.

The crossbreeding plan followed in multiplication ranches to produce crossbred rams with the desired blood levels requires a prolonged time (see Figure 1). Thus, output per year is expected to be low given the limited resources in the ranches. For instance, the Debre Birhan Multiplication Center has managed to produce and disseminate about 4,208 $\frac{3}{4}$ Awassi × $\frac{1}{4}$ Menz crossbred rams during the period of 1970 to 2000 (DBSBMC, 2006) and Amed Guya Center multiplied and distributed 355 during the period of 1996 to 1999 (BoA, 2001). This level of output could be considered low given the level of dissemination of crossbred rams aspired to at the inception of the project (see dissemination range in Figure 2). This should indicate the need for a reappraisal of the breeding plan and the overall crossbreeding scheme followed.

The multiplication ranches have been closed from 2004 to 2007 due to an outbreak of a respiratory disease (Maedi-visna). The catastrophe resulted in high mortality and disposal by slaughtering of animals that tested positive for Maedi-visna. However, the ranches managed to preserve the purebred Awassi flocks with great effort. Exotic diseases and biosecurity are other challenges associated with the importation of exotic germplasm that should be considered.

Dissemination Strategy

The Bureau of Agriculture and Rural Development is responsible for the dissemination of crossbred rams to villages. An achievement that merits mentioning again is that the Debre Birhan Multiplication Center has disseminated 4,208 crossbred rams for improving village flocks between through the Bureau of Agriculture. The impact of this dissemination effort has not been formally assessed. An informal survey to assess the status of rams distributed to farmers was carried out in 1997 by the Debre Birhan Agricultural Research Center in collaboration with district agricultural extension workers in major target dissemination zones of North Shoa and South Wollo in the Amhara state.

The following have been observed and learned from the survey:

- The dissemination strategy is in such a way that a ram is sold to selected farmers on an individual basis. Earlier attempts to distribute rams to farmer cooperatives were abandoned because the cooperatives were disbanded.
- Individual ownership and use of rams could lead to underutilization of the rams for breeding given that each farmer owns only few breeding ewes.
- Individual ownership (unlike collective ownership) made it easy for farmers to sell the rams for quick-profit benefits rather than long-term genetic improvements.
- Rams are provided at highly subsidized prices, so the profit margin from the immediate sale of the rams is tempting to farmers.
- We found that almost all rams distributed for breeding purpose in North Shoa and South Wollo were used for other purposes. The rams were either already sold or castrated for fattening.

It was noticed that the major drawbacks of the dissemination scheme followed were lack of farmers' awareness on the long-term nature of benefits from genetic improvements, lack of follow-up and feedback on distributed rams, inappropriate site and farmer selection, and that individual farmers were not liable for the rams provided at subsidy. There has also been loose institutional links between agricultural bureaus, multiplication ranches and research institutions. Research institutions play a role in the dissemination of information through demonstration, education and training. In addition, experimental results could lead to a reappraisal of dissemination strategies adopted.

The Awassi × Menz crossbreeding goal appears to be improvement of the wool-producing sheep breeds of the country such as Menz and Wollo sheep. However, as shown in Figure 2, the dissemination range does not consider the breed types, their merits/limitations and the ecology. It can be argued that this indiscriminate spreading of

the available crossbred rams to a wide range of locations has resulted in the dilution of the project efforts and its very low success. Such a dissemination strategy could also lead to indiscriminate crossing out of the adapted indigenous genetic resources.

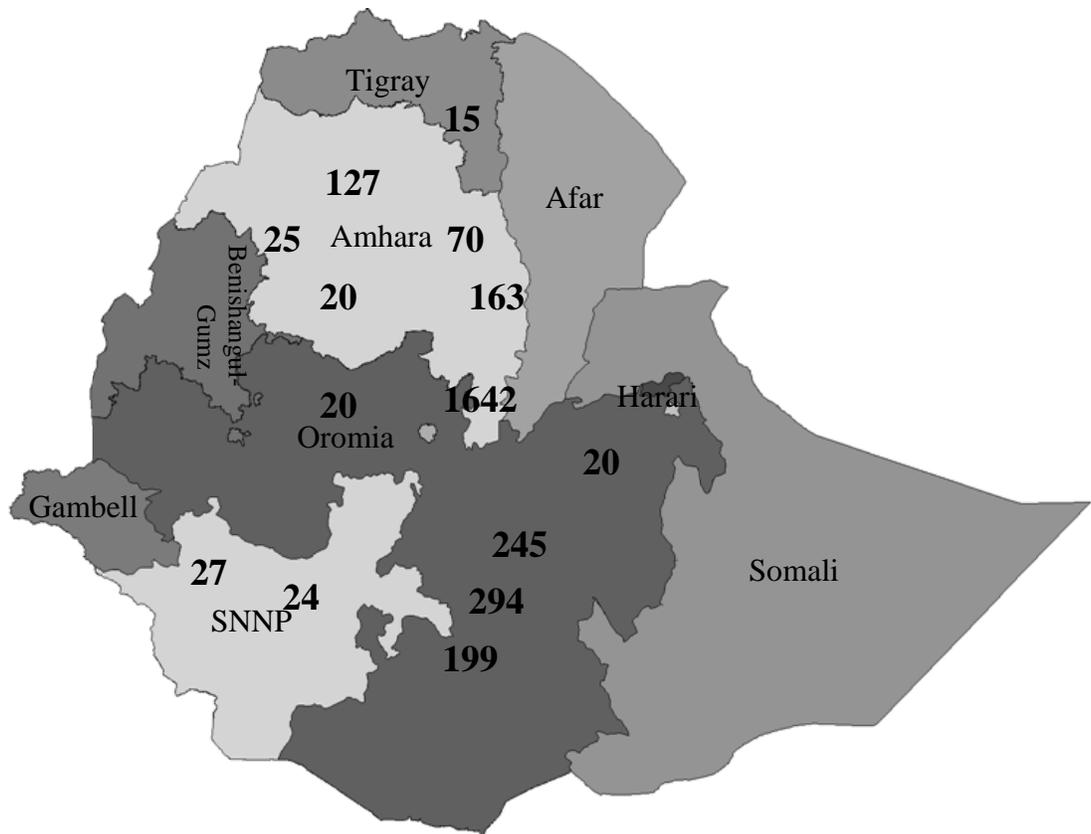


Figure 2. Numbers and locations in Ethiopia of Awassi × Menz crossbred rams disseminated from Debre Birhan Sheep Breeding and Multiplication Center.

Experiences from a model dissemination scheme

Results of the informal survey to evaluate the crossbred ram dissemination strategy followed by the Bureau of Agriculture and sheep multiplication ranches has led to the design of crossbred ram dissemination scheme in a pilot project by the Debre Birhan Agricultural Research Center. Project objectives were to evaluate the performance of crossbred sheep under farmers' management and evaluate the proposed crossbred ram dissemination scheme. The pilot project was launched in 1998 in three locations: South Wollo (Chiro kebele), North Shoa in Menz-Gera district and Angolelana-Asagirt district, Amhara state. This paper focuses on the experiences from South Wollo.

Approaches

Stakeholder participation

Participation of stakeholders in the design and implementation of development projects is the key to the success of development projects, particularly in traditional societies with diverse production objectives. To this end, meetings were held at the outset with farmers

and livestock development workers on the project concept. It was important to discuss with farmers that genetic improvement is a long-term venture and that project benefits may not be realized immediately. The farmers were appreciative of this fact since sheep rearing is their major enterprise. Ideally, farmers should participate in projects with the understanding that they will benefit in the long-run. However, projects should address farmers' immediate concerns as well. The current project addressed such immediate issues as flock health problems and technical knowledge by providing deworming and vaccination services and advice on animal breeding.

Site and farmer selection

Indiscriminate dissemination of crossbred animals disregarding ecological and farmers' socio-economic considerations has been one of the major drawbacks of livestock crossbreeding projects in developing regions. In the current project, the selected site (Chiro kebele in South Wollo) is located in the second largest sheep production zone in Amhara. The area is characterized by unreliable crop production; thus sheep production is the major source of farm livelihood. The project district, villages and farmers were selected in consultation with zonal livestock development workers. Farmers were briefed on the bylaws of the project, and only farmers willing to abide by the rules were selected.

Communal use of breeding rams

Individual ownership and use of crossbred rams distributed in previous disseminations was found to be inefficient. In the current project, farmers were organized into groups of 3-4 households based on neighborhood and use of a common grazing area. One crossbred ram ($\frac{3}{4}$ Awassi \times $\frac{1}{4}$ Menz) was lent to each group. The group farmers were responsible for use and care of the ram. There was no payment for the ram, but an alternative method would be that farmers refund the cost in installments.

Breeding rams were rotated both within group and among groups of farmers. Within group, rams were rotated among member farmers for nighttime mating. In order to avoid mating between relatives (thus minimizing inbreeding depression) and also to widen the gene pool, rams were also rotated among groups across villages.

Breeding plan and operational aspects

The breeding plan followed was as described in Figure 1. It takes five generations of repeated backcrossing to achieve the desired blood level of $\frac{3}{4}$ Awassi \times $\frac{1}{4}$ Menz in the village breeding scheme. Ram lambs unwanted for breeding (local rams and crossbred rams having less than 75% Awassi inheritance) were castrated or disposed of before breeding age to avoid indiscriminate mating, while crossbred ewe lambs were backcrossed to $\frac{3}{4}$ Awassi \times $\frac{1}{4}$ Menz rams. It is planned that once the desired blood level is reached in the flock, there could be *inter se* matings (i.e., matings between $\frac{3}{4}$ Awassi \times $\frac{1}{4}$ Menz rams and ewes) to produce a self-replacing flock.

Project follow-up included a quarterly visit by the research team, continuous monitoring by an enumerator, and record keeping. The enumerator was recruited from among the participating farmers and trained. He is responsible for facilitating communal ram use, record keeping, and assisting farmers in technical aspects in consultation with the

research team. Record keeping includes data on pedigree, birth weight, growth, reproduction and off-take.

Achievements

A model community-based sheep crossbreeding

A model community-based crossbreeding village has been established. The model scheme can be adopted to scale up the Awassi crossbreeding program and other crossbreeding programs in similar situations. Participating and beneficiary farmers increased from 28 in 1998 to 133 in 2000. There have been very limited replenishment of breeding rams from the project; farmers have started to breed their own replacement rams with high Awassi blood levels up to 65.6%.

Breeder farmers have been created.

An important component in the success of animal breeding programs is a range of sociological factors, including the human-animal relationships that distinguish between livestock users, keepers, producers and breeders (developed livestock industries). Neidhardt et al. (1996) pointed out that the application of breeding programs at the livestock user level will fail until the farmer has reached the level of a livestock breeder. Farmers in developing regions are generally classified as livestock users with little input and skills, keeping livestock as a secondary enterprise. Farmers participating in the Awassi project are being transformed to the breeder level, producing genetic material.

The project farmers have acquired animal breeding skills, and their perceptions and attitudes towards livestock breeding have changed. They actively collaborate on record keeping. Input use such as supplementary feeding has increased. They keep different crossbreds (Awassi and Corriedale) identifying their merits and demerits and utilizing them accordingly. They can now estimate exotic blood levels of crossbred animals, select or buy at high prices (up to 700 ETB) rams with high exotic blood for breeding, and are willing to dispose of rams unwanted for breeding.

Impact of the project

Contribution as a ram source

Some of the farmers in the project villages are producing crossbred rams with a high Awassi blood level for sale as genetic material. The villages can thus be further developed as Awassi crossbred ram sources to supplement production of crossbred rams by Debre Birhan and Amed Guya Sheep Breeding and Multiplication Centers. Crossbred rams produced in the project villages have been disseminated to other villages, districts (through SIDA), and private sheep ranches. The village has served as a demonstration for neighboring farmers, who have become interested to pay large sums for crossbred breeding rams, and for other districts.

The project villages have also managed to maintain a different exotic germplasm, Corriedale sheep, which had been introduced into the country but later abandoned by the Multiplication Centers because of farmers' phenotypic preferences. Corriedale is a dual-

purpose sheep producing fine wool, which is used by the project farmers to weave warm clothing locally known as *gabi*.

Contributions to farm livelihoods

The role of sheep rearing as a source of livelihood has increased in the villages. Farmers' cash income has increased. For instance, farmers in the model village sold 450 breeding rams 2005 and 2008 earning 122,700 ETB. Income from sheep sales has also contributed to increase in other livestock such draft oxen, milking cows, and transport animals.

Performance of crossbreds

It has been widely argued that crossbreeding with improved exotic breeds may not be a suitable breeding strategy for developing regions. Failures of crossbreeding projects in these regions are commonly attributed to low survival and performance of the exotic genotype under such conditions. In the current project, adaptive and productive traits were recorded to investigate whether the low success of the Awassi crossbred sheep project is due to biological reasons or inappropriate dissemination schemes. On-farm performance levels of crossbreds with different levels of exotic blood have been established. It was found that crossbreds have survived (Table 1), reproduced (Table 2) and performed well under village conditions (Figure 3), which is comparable to performances under on-station management (Solomon, 2000).

Table 1. Percentage pre-weaning (up to 90 days), up to 6-month and up to yearling (365 days) mortality of local and crossbred lambs under village management

Genotype	Number	Mortality (%)		
		Up to weaning	Up to 6-month	Up to yearling
Local	848	3.8	6.8	11.4
Awassi crossbred	782	2.0	5.6	10.1
Corriedale crossbred	359	1.4	3.3	9.4

Table 2. Reproductive performance of local and crossbred sheep under village management

	Lambing interval (days)	Age at first lambing (days)	Ewe postpartum weight (kg)
Local	228	662	26.0
Awassi crossbred	252	669	32.0
Corriedale crossbred	238	655	31.4

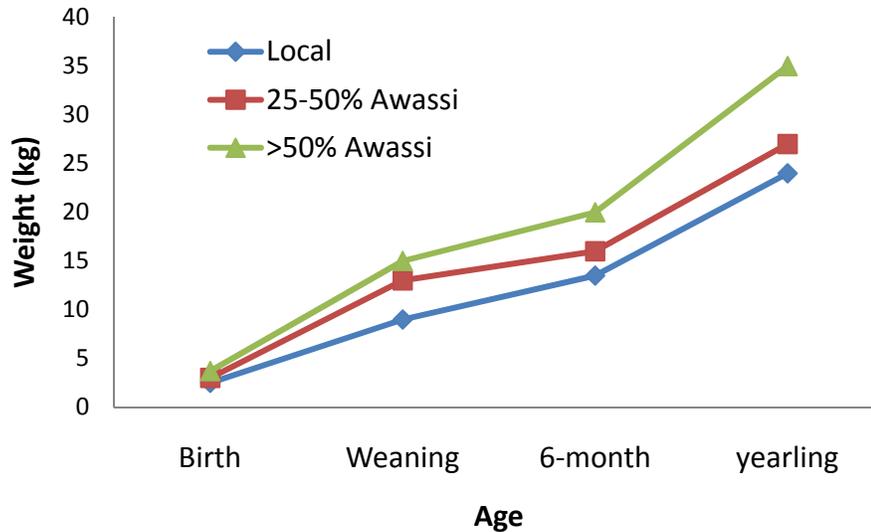


Figure 3. Growth rate of local lambs and their crosses under village management.

Challenges and Lessons Learned

The crossbreeding strategy adopted

The planned crossbreeding strategy was to upgrade the local village flocks to a 75% Awassi blood level. A substantial upgrading of the local flocks has been achieved. However, the crossbred population was found to be of varying Awassi blood level. This indicates that the strategy adopted needs to be relaxed. Crossbreeding programs involving crosses with specific breed combination are difficult to sustain at the farmer level and a range of blood levels should be envisaged (Aboul-Naga, 2000), but performance of the different blood levels needs to be investigated. The target blood level of 75% Awassi has also not been met. This is mainly due to the crossbreeding strategy followed, which inherently requires many generations of backcrossing. Secondly, the crossbreeding structure was such that the high grade crossbred rams were to be supplied from the research or multiplication centers. Structures that heavily rely on government institutions are less sustainable. However, in the current project, the farmers have been less reliant on government ram supplies and have produced their own crossbred rams. Nonetheless, the rams produced on-farm were of lower grade (less than 65.6% Awassi), which further prolonged the number of backcrossings required to attain the desired Awassi blood level. A supply of high grade Awassi rams from research or multiplication centers needs to resume in order to accelerate the grading-up of the model village flocks.

Alternative breeding options need to be considered.

A protracted upgrading strategy with the ultimate goal of creating a self-replacing high grade population may not be feasible for a wider application in the commercial flocks. Such a strategy may be feasible for villages at an advanced breeder stage (such as the pilot project villages in Chiro kebele) specializing in breeding ram production, albeit with varying blood levels. In general, the whole Awassi crossbreeding project including the

breeding plan in multiplication centers may need to be reviewed. Production of crossbred rams in the centers does not appear to be efficient and maintenance of the pure Awassi population is challenging. Thus, a sustainable breeding strategy such as formation of a self-replacing synthetic population using Awassi and Menz breeds need to be considered. This also provides a simple crossbreeding strategy that requires no special mating arrangements in the commercial village flocks.

Production and breeding objectives vary among groups of farmers.

For instance, the project villages opted for grading up their flocks, while some groups of farmers preferred to produce crossbred lambs for sale either because of socio-economic circumstances (immediate cash needs) or lack of skill. Thus, different crossbreeding strategies should be employed according to farmer needs and perceptions.

A mixed pure- and crossbreeding structure

A mixed purebred and crossbreeding flock structure could be considered. This mainly involves maintaining a purebred flock and assigning a portion of the ewes for crossbreeding. The crossbreeding strategy suitable for such a structure is terminal crossing; the crossbred lambs are sold as prime lambs for fattening elsewhere or fattened on-farm, and no crossbred population is maintained in the flock except the ram. Such a strategy was also observed among some of the project farmers. The strategy is possible if the sheep industry is structured into ram producers and mutton sheep producers. Currently such a structure is emerging in the Awassi crossbreeding area; the project farmers and multiplication centers could serve as ram sources. Terminal crossing is the simplest crossbreeding strategy that can be applied in village flocks in developing regions. This strategy is also suitable for conserving the adapted indigenous sheep resources.

Ecological and socio-economic considerations

The crossbreeding project is most successful in South Wollo (Chiro kebele) compared with North Shoa locations, particularly the Menz region. Evaluations in the three locations showed that crossbreds in the Menz region have the lowest performance (DBARC, 1998). Furthermore, the project could not be well established in Menz region. This indicates that ecological and farmers' sociological and economic circumstances need to be considered when planning crossbreeding projects. Of particular concern is that ecological zonation for production of purebreds and crossbreeding should be envisaged.

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