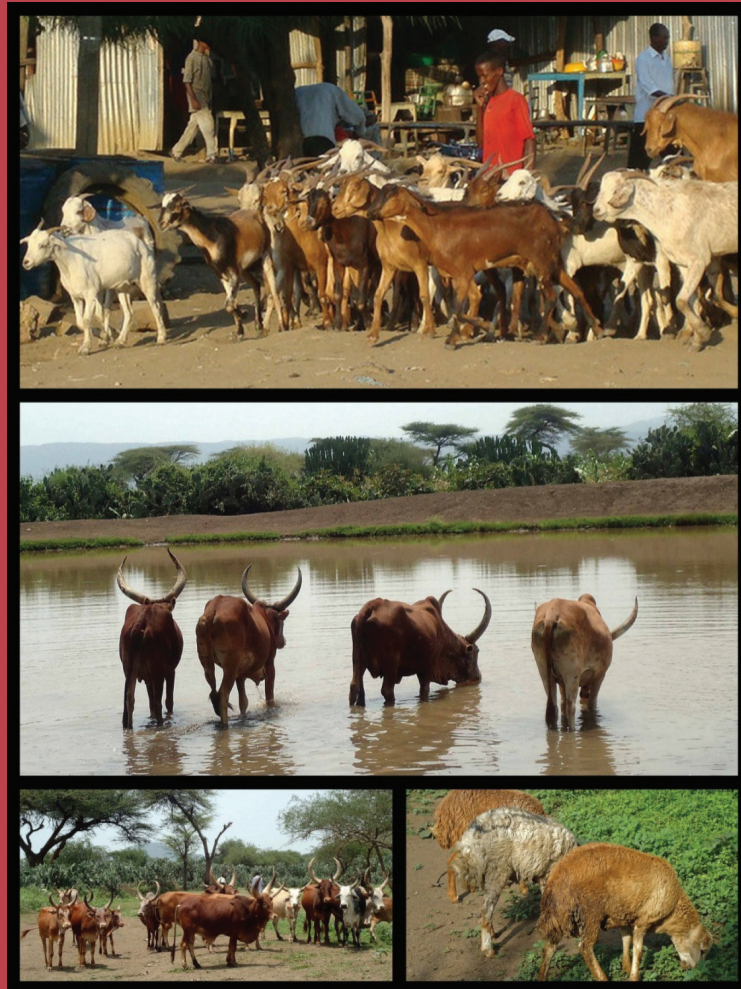




# Feinstein International Center

Strengthening the humanity and dignity of people in crisis through knowledge and practice



## Lifting Livelihoods with Livestock

*A review of REST's livestock value addition practices in  
Raya Azebo, Ethiopia and potentials for diversification*

by Yacob Aklilu



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# Acknowledgements

This review was financed by USAID Ethiopia under the PSNP Plus program.

We express our gratitude to REST staff, Tekle Haimanot and Brikti (based in Mehoni office), for providing information on the project implementation process, arranging appointments with beneficiary focus groups, and travelling with us to different sites to facilitate meetings. We also appreciate the interesting discussion we had with Zeration from Makalle REST office. We extend our appreciation to all those focus group informants whose contribution was critical for the production of this report.

The views expressed in this report do not necessarily reflect those of USAID Ethiopia.

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## Acronyms

<b>AARC</b>	Alamata Agricultural Research Center
<b>DA</b>	Development Agent
<b>DECSI</b>	Dedebit Credit and Savings Institution
<b>EM</b>	Effective Microorganism
<b>FAO</b>	Food and Agriculture Organization
<b>MSF</b>	Multi-Stakeholders Forum
<b>NGO</b>	Non-Governmental Organization
<b>PA</b>	Peasant Association
<b>PSNP</b>	Productive Safety Net Program
<b>REST</b>	Relief Society of Tigray
<b>UNICEF</b>	United Nations Children's Fund
<b>USAID</b>	United States Agency for International Development

# 1. Introduction

Launched in 2005, the Productive Safety Net Program (PSNP) is one of the government of Ethiopia's important policy initiatives to move millions of critically food-insecure people in rural areas from recurrent emergency aid into a more secure livelihood by smoothing consumption requirements and protecting and, to some extent, building assets through cash-based interventions. The PSNP was designed to assist chronically or "predictably" food-insecure households as opposed to households affected by transitory food deficits as a result of a specific event. The program provides either cash or food in exchange for labor on rural infrastructure projects, or direct cash and food transfers for households unable to participate in physical labor. The primary objective of the PSNP is to prevent chronically food-insecure households from selling their assets during times of drought and build community assets through involving these households in public works programs.<sup>1</sup> Ultimately participating households are expected to "graduate" from the PSNP and out of chronic food insecurity.

The livestock value chain project in Raya Azebo, Tigray, is part of the three-year PSNP Plus program funded by USAID and implemented by six NGOs in Amhara, Tigray, Oromia, and Dire Dawa regional states. The program was launched in late 2008 to support the graduation of beneficiary households from PSNP through formal and informal microfinance. The components of the program consisted of the establishment of village saving and lending associations, agricultural input credit provision, and linking participating households to market opportunities through value chain development of selected commodities comprising livestock, cereals, white pea bean, and honey.

The Relief Society of Tigray (REST) is one of the consortium NGOs in the PSNP Plus program. Its activities were largely focused on credit provision for agricultural inputs and informal loans for sheep and cat-

tle value addition to PSNP households in Raya Azebo woreda of Tigray Region. According to the Southern Zone Agricultural Office (2011),<sup>2</sup> the woreda is dominated by vast lowland plain areas, rugged terrain, plateaus, and mountains with altitude ranges of between 1,400 and 1,800 meters above sea level. Soil types are classified as fluvisol, vertisol, and cambisol with loam, silty loam, and clay loam texture. Rainfall is bimodal but erratic and inconsistent, characterized by late set and early cessation with annual precipitation variations of 400–700 mm. Farming consists of a rain fed, subsistence, mixed crop-livestock production system. Major crops consist of sorghum and teff in the woreda. However, despite the fertile soil in the valley, moisture stress (rainfall shortage) is ranked as the number one constraint for sorghum, teff, barley, maize, chickpea, and wheat crops production by the Alamata Agricultural Research Center (AARC).<sup>3</sup> Similarly, feed shortage is ranked as the major constraint, despite a significant livestock population in the woreda, providing 25% of the household income, according to the same source.

Production constraints include a shrinking land-holding base incurred by population growth. A 1997 study shows that marginal households in midland and lowland areas owned an average of 0.45 and 0.50 hectares respectively.<sup>4</sup> Small- and medium-size farming households, which made up the bulk of the farming communities, owned only 0.9 and 1.6 hectares in the midlands and 1.0 and 1.7 hectares in the lowlands. Those considered large-scale farmers owned 2.3 hectares in the midlands and 3.0 hectares in the lowlands. Further reductions in the average land holdings seem likely as human population continues to increase.

The total population of the woreda according to the

1 A. Pankhurst, 2009, "Rethinking Safety Nets and Household Vulnerability in Ethiopia: Implications of Household Cycles, Types and Shocks," Paper presented at the World Conference of Humanitarian Studies, Groningen, Netherlands, 4–7 February 2009.

2 Agricultural Development and Farming Systems in the Southern Zone of Tigray, 2011, Southern Agricultural Office, draft.

3 Tigray Agricultural Research Institute, Alamata Agricultural Research Center, 2010, "Problem appraisal and prioritization of Southern Zone, Tigray."

4 Tigray National Regional Government, 1997, "Feasibility Report of the Raya Valley Development Study Project," Volume 1, Main Report, Relief Society of Tigray.

**Table 1. Mean land holding per household by midland and lowland farming communities**

Farm size	Area (hectare)	Midland		Lowland	
		%	Mean	%	Mean
Marginal	0.01–0.50	15.7	0.45	8.7	0.50
Small	0.15–1.00	57.3	0.90	32.5	1.00
Medium	1.01–2.00	26.7	1.60	41.8	1.70
Large	>2.00	0.3	2.30	17.0	3.00
Total/ Mean		100	0.90	100	1.60

Source: Raya Valley Development Study Project, REST.

2007 census (as cited by the Southern Agricultural office, 2011) is 139,039, consisting of a rural population of 119,984. Of these, 59,733 individuals are covered by the PSNP,<sup>5</sup> which indicates a high level of poverty in the woreda.

By the time this review took place in early November 2011, 5,026 households were assisted with credit and loan provisions for agricultural inputs and livestock. Of these, informal loans were distributed to 2,243 households to buy either four to five sheep or a head of cattle, based on the choice of the beneficiaries. REST also sank nine deep wells for human and livestock use under this program. Five of these were connected to the main grid by the time the field visit took place. Four were awaiting connections with the main line.

The Feinstein International Center at Tufts University has been involved in the PSNP Plus program with the specific role of assessing impacts at the household level by comparing baseline data to actual income attributable to the intervention, and by analyzing pre- and post-project household expenditure levels and patterns through longitudinal surveys. Both the baseline and the impact assessment reports are available.<sup>6</sup>

This report reviews specific technical issues involving the livestock value addition component of the program with a view to draw lessons, identify gaps, and assess potential opportunities to take village-level value addition practices forward. ■

<sup>5</sup> Interview with Tekle Haimanot, REST office, Mehoni, 5.11.2011.

<sup>6</sup> See J. Burns, 2011, “Impact assessment of livestock value chain interventions: Final impact assessment of the PSNP Plus project in Raya Azebo Woreda,” Feinstein International Center, Tufts University.

## 2. Methodology

The project site was visited between 7 and 11 November 2011. Two sources of informants, viz. REST staff and beneficiary focus groups, were used to obtain technical information on the procedures followed in the value addition and marketing of finished livestock.

REST staff in Raya Azebo provided information on the following issues:

- Program objectives, implementation modalities, achievements, and constraints;
  - Program modifications necessitated by rising livestock prices, and resentment by some of the beneficiary groups on interest rate application;
  - Loan administration and recovery modalities;
  - Total number of beneficiaries;
  - Training programs in coordination with the local agriculture bureau;
  - Locally-available feed types and sources;
  - Initiatives taken to introduce urea/molasses blocks and Effective Microorganism (EM);
  - Major production constraints (mainly supplementary feed but also water);
  - Initiatives on market linkages with Abergelle and Sharif export abattoirs;
  - Staff workload;
  - The uncertainty regarding the future direction of the program.
- Types and ages of animals purchased;
  - Types of feed provided, including sources, animal health service provision, feed and veterinary drugs, and other operational costs;
  - Duration of the value addition process per finishing cycle;
  - Views on urea/molasses usage;
  - Potentials for fodder and oil crops production;
  - Interim use of animals, if any (for example, ploughing);
  - Marketing of finished animals (timing and place);
  - Number of fattening cycles carried out, profits earned and what they did with the profit, losses incurred;
  - Amount of loan repaid;
  - Labor requirements for value addition activities and how this was met;
  - Views on opportunities and constraints.

Some of the findings from the focus group interviews were later discussed with REST staff to explore and clarify different points of view. ■

REST staff also organized focus group discussions with beneficiaries in five peasant associations (PAs), consisting of two focus groups each in Mehoni and Kukuftu and one focus group in Chercher. These groups were chosen on the basis of representing the agro-climatic variations in the woreda and included followers of both the Muslim and Christian faiths.

The thrust of the focus group discussion was in obtaining technical information involving the procedures they followed on purchasing of animals, value addition, and the marketing of livestock. These included:



# 3. Review Findings and Issues

## 3.1 Program design and implementation

The program design entailed the distribution of loans to PSNP households either to buy sheep or a head of cattle for fattening, according to the preference of beneficiaries. Between 2009 and mid-2010, the loan amount given to households preferring to buy sheep or cattle amounted respectively to 1,000 and 2,000 Birr (US\$58–\$116). From mid-2010 onwards the loan amount was raised to 1,300 Birr (US\$76) for sheep and to 2,700 Birr (US\$117) for cattle due to local livestock price increases. An additional 400 Birr per household was also allocated for cattle feed provision in both cases.

The loan period was fixed for two years, with repayments taking place every six months. Interest was fixed at 18% per annum at the prevailing rate applied by other microfinance institutions in Ethiopia. However, REST made an arrangement with participating co-ops in which the co-ops would receive 15% of the interest if they managed to collect more than 70% of the loan repayments from the beneficiaries on their behalf. This arrangement eased the burden of collecting timely repayments from thousands of individual households by the three staff members running this program while positioning REST to accrue only 3% of the interest rate applied on the loans.

Training constituted part of the value addition program component and this was provided by the relevant agricultural offices in the woreda. The focus of the training program was on capacity building (business training), feed preparation (from crop stalks and residues), and introduction to fodder trees (tree Lucerne and Sesbania), loan repayment schedules and the like. Additional training was also provided on the use of urea/molasses blocks and Effective Microorganisms (EM). A study tour was also organized for 17 members of the co-ops to Eastern Hararghe to familiarize them with the practices of stall feeding of cattle and also to demonstrate inter-cropping techniques. Attempts were also made to forge market linkages with Abergelle and Sharif export abattoirs through a multi-stakeholders' forum (MSF). It was stated that the training program

took 60% of staff time reflecting the workload involved in this initiative.

## 3.2 Purchase arrangements

At the start of the program, the purchase of cattle and sheep was carried out by REST. Following complaints about this arrangement, beneficiaries were allowed to purchase livestock of their choice in subsequent phases. Beneficiaries bought sheep aged between one and half and two years, which allowed them to benefit from natural growth in addition to the value addition process. The age of cattle varied between three to five years, the older ones being preferred for ploughing purposes, while the younger ones were meant for value addition. Beneficiaries also made a distinction between cattle bought for fattening and ploughing.

## 3.3 Program reach

By the time the review took place, the program had provided loans for the purchase of sheep to 1,355 households and for the purchase of cattle to 888 households in a series of rounds over a period of three years.<sup>1</sup> On average, each household bought between four and five sheep or a head of cattle with the loan provided to them. A total of 6,368 sheep and 888 head of cattle were bought with the initial loan provided to households. However, most households that received loans (particularly in the first and second rounds) have bought and sold livestock as many as three or four times. The total number of livestock that have been transacted through the value addition process is, therefore, significantly higher than the above figure. Actual figures were not recorded due to staff shortage.

## 3.4 Program flexibility

The program was found to be flexible either by design or default.<sup>2</sup> This allowed beneficiaries to switch

1 REST staff could not verify the actual number of rounds although they estimate about ten.

2 This remark is made on the assumption of staff shortage to follow up on the re-investment decision of each household.

to whatever livestock species they wanted after selling the first batch of animals bought with the initial loan. Considerable variation in beneficiary behavior around livestock rearing, uses, and sales was evident, and, in general, this was a positive aspect of the program. For example:

- Some people switched from cattle to sheep, or vice versa;
- Some people started breeding activities by buying female sheep or goats;
- A few people started livestock trading on a weekly basis rather than value addition;
- Although beneficiaries were advised to fatten the sheep and cattle for a period of three months, some sold the animals sooner in the market, when they saw an opportunity to make a profit;
- Others kept animals for longer than three months (particularly cattle) in anticipation of better profits;
- Some beneficiaries have used the cattle they bought initially for ploughing and then sold them for profit. Conversely, others have bought plough oxen after selling the original sheep and cattle;
- A few people also bought heifers.

Participants were also allowed, if they wished, to add their own money to the loan to buy more or better quality animals. Whatever the case, this flexibility enabled beneficiaries to re-invest in their choice of animals as they saw it fit and sell their animals at an opportune time rather than according to a timetable set by the program. Beneficiaries were appreciative of this flexibility in the system. None of the focus group participants regretted their re-investment decisions or the timing of selling.

### 3.5 Coordination with agricultural offices

There was strong coordination between REST and the local agricultural offices, represented by *tabia* Development Agents (DAs). The DAs trained beneficiaries, followed up their activities, provided technical support, and arranged repayment schedules with the cooperatives. Tree Lucerne and Sesbania seedlings that were distributed to beneficiaries also came from nurseries run by the local agricultural offices. The support provided by the DAs was critical for the success of the program, as the few REST staff were overstretched and could not really cover the entire operational area. It also seems logical for them to draw on the locally available expertise. What needs to be recognized here is that this support from the agricultural offices may not be available to profit-oriented microfinance institutions unlike

REST, which has a non-profit status. Without such a support, similar initiatives that require continuous trainings for a number of years on new skills, practices, and mindsets, and includes the introduction of new technologies, may fail. This issue is a key concern when making decisions about the administration of the loan fund when the program phases out.

### 3.6 The value addition process

Despite its location immediately below a range of mountains, Raya Azebo woreda is known for its dry environment. Spate irrigation is common in areas adjacent to the foothills of the mountain ranges, but this is short-lived during the rainy season. Ground water is rather deep, at 100 meters or deeper, but with a very good discharge rate once struck. A number of boreholes have been sunk in the woreda by REST, UNICEF, the Orthodox Church, and other agencies for human and livestock use. Some are not operational, either because they were not connected to the main grid or because of faulty generators. Under the PSNP Plus program, REST has also sunk nine boreholes, of which five had been connected to the main grid; four are not yet connected.

The dry environment has turned the woreda into a mono-cropping area, dominated by sorghum production, followed to a much lesser degree by teff production. Of the five focus group areas visited during the review, only Warabaye PA, located at the foot of a hill, had a permanent water source that was used for growing and irrigating chat, coffee, various fruit trees, teff, barley, chickpeas, and pepper. It was only in this area that the tree Lucerne and Sesbania seedlings distributed by the program were well established and used as cattle feed during the dry months. In all the other areas, such seedlings failed to grow due to moisture stress and termite attacks. The other four sites visited during this field trip were characterized by moisture stress and, as a result, were dominated by sorghum. The only exception was Korma PA in Chercher, where farmers grew sesame that reportedly destroys a certain sorghum weed. Another shortcoming of the woreda is the lack of timber and fuel wood.

Despite these constraints, the fertility of the soil is regarded to be high courtesy of flooded top soil deposits from the highlands. This implies that there is good potential to maximize production from cereals, pulses, oil crops, fruit trees, vegetables, and forage crops, etc. if the moisture stress could be tackled in a proper way. For example, some investors are reportedly producing a staggering 100 tons of tomatoes per hectare using drip irrigation from a borehole. Of note, it is this potential that needs to be exploited for livestock feed production and developing the feed industry in the woreda,

to elevate the livestock value addition program to the next level.

### 3.7 Feed sources and types used for the value addition process

Not surprisingly, sorghum stalks provided the main form of livestock feed for the value addition process. These were usually chopped with machetes and axes before feeding to livestock. Additional livestock feed sources include crop residues such as teff straws and stovers, atela (traditional beer residue),<sup>3</sup> and salt. Pasture availability was limited in most areas except in Warabaye PA, where they had irrigation facilities, and to some extent in the open areas of Korma. Many farmers used crop residues and stovers from their own farms, while others had to buy these feeds. Those buying stalks spent between 15 and 75 Birr/month to feed a head of cattle, depending on the length of the value addition cycle. Two sacks of teff straw cost 13–20 Birr, and this amount was needed every week for five sheep for those people not owning any crop residue of their own. Some cattle value adders spent up to 300 Birr per cycle on feed. Although dictated by the local situation, the sole use of roughage feed without supplements invariably raises the question of whether this practice could really be considered as a value addition program. Given shortages of fuel wood and the continuous use of crop stalks as an energy source in the woreda, it becomes doubtful if supplies of the latter can be maintained in the required quantity to support the expansion of this feeding practice.

Yet REST made some attempts to introduce beneficiaries to other types of supplementary feed. It brought some molasses and sold it at 3 Birr per liter for demonstration (understandably, at much below the market price). The molasses was sprinkled on chopped sorghum stalks and given to livestock. Participants seemed to be keen on the molasses. REST collaborated with Abergelle Company, which brought some oil cakes and sold them at 5.50 Birr/kg. REST also invited a private company to demonstrate the importance of EM (sold at 17 Birr/liter) that induces palatability. There were also plans to install urea/molasses block-making moulds in four sites in collaboration with FAO. Although such blocks are given on an ad-lib basis, the use of urea, which costs around 7.50 Birr/kg (prices could still rise further), needs to be reviewed from the perspectives of cost effectiveness and reservations about urea-based meat products by many

<sup>3</sup> Farmers were advised not to use atela, since it can affect the teeth of the animals, but this advice seems not to have been heeded by participants.

consumers.<sup>4</sup> Urea/molasses blocks are rather good for the quick recovery of drought-stricken livestock, rather than for fattening. Also, the EM on its own does not contribute to weight gains, except by contributing to the palatability of wasted or spoiled feed, which does not seem to be a cause for concern in Raya Azebo. These cautionary notes point to the need to consider alternative options and develop the best cost ration formulation, as the margins from livestock value addition practices are directly influenced by feed costs more than other factors. Otherwise, given the prevailing moisture stress in the woreda and the numerous tasks the few REST staff had to execute,<sup>5</sup> there was not much they could do to improve fodder production in the period under review while focusing on other priorities. However, a next phase of the program should emphasize the development of a livestock feed industry in the woreda, if a genuine value addition program based on quality feed supplementation is to evolve.

### 3.8 Animal health

The woreda animal health office is located in Raya Azebo with clinics in Kukuftu and Chercher. Farmers buy drugs and sprays for internal and external parasites, which they apply themselves, but there seemed to be an acute shortage of knapsack sprayers in the woreda. Mortality was reported to be higher from predators (hyenas—see section 3.11 on Shelter below) than from disease (where only one focus group member reported the death of one cattle from unidentified disease). Drug costs were reportedly low, costing 5–10 Birr for spraying five sheep, or 3 Birr for a head of cattle. Farmers seem to be used to the practice of spraying cattle every two weeks or month. Out of the six major livestock production constraints listed by the AARC in the woreda, cattle disease is ranked as number five.

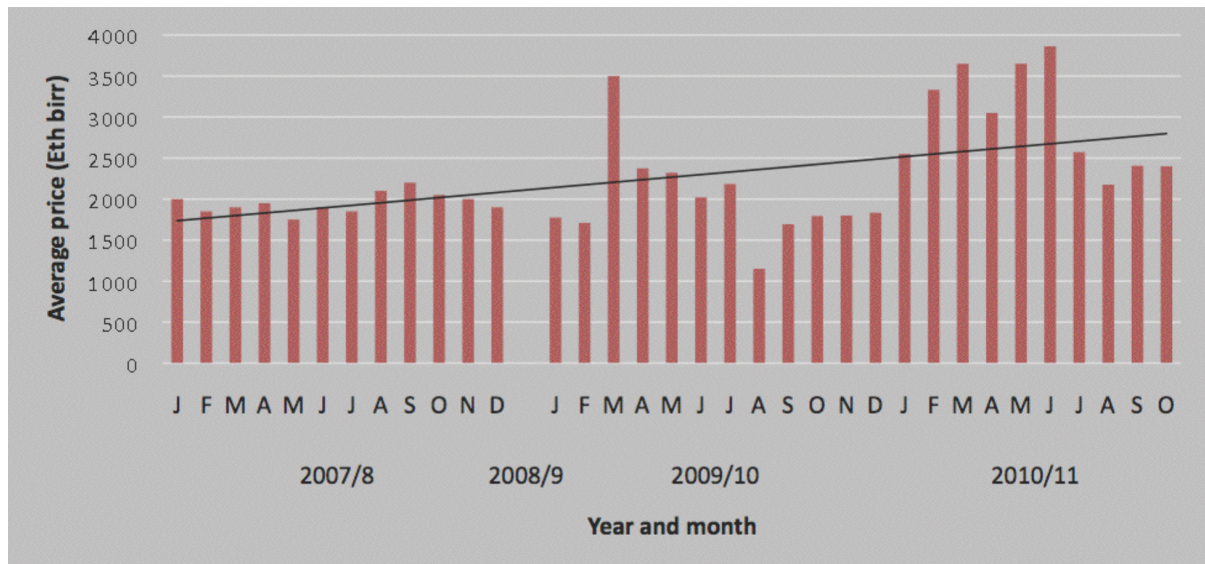
### 3.9 Water

As a moisture-stressed area, boreholes are the main supply of water sources for human and livestock consumption in the woreda. Beneficiaries have to pay varying prices for watering their animals. A jerry can of 20 liters cost 1 Birr on average, rising to 1.50 Birr between September and mid-October, when water

<sup>4</sup> Consumers in major towns like Addis and Adama increasingly discriminate against molasses-based meat products on the basis of low palatability while urea is perceived as purely a chemical additive.

<sup>5</sup> These include identification of beneficiaries, distribution of loans and collection of repayments, training and follow up, distributing seed loans to over 3,000 farmers, plus implementing other programs of REST.

**Figure 1. Trend in average cattle prices in Mehoni, 2007 to 2011 (source: Raya Azebo woreda agricultural office)**



Notes: Data for 2008/9 was not available; trend line generated by MS Excel software.

shortage becomes acute. This implies that cattle value adders may incur a cost of around 100 Birr over three months' time in some areas. A jerry can of water in the newly REST-sunk wells cost only 0.20 Birr, but may be revised later. Communities are responsible for collecting the money paid for water, which is used for the maintenance of the system, if the need arises.

### 3.10 Labor

With the expansion of schools and the increasing enrollment of children, labor was becoming a major constraint. This resulted in some sheep and cattle being tethered in the morning and being let out to the field when school children return in the afternoon.

### 3.11 Shelter

The woreda was also characterized by a shortage of timber and firewood. Many women complained that despite having the capacity to increase their sheep flock for value addition, they were constrained by the simple fact of having no access to timber to construct shelters for increasing numbers of livestock. This has not only affected potential returns from increased investment but has also led to mortality losses, caused by hyenas in some cases.

### 3.12 Reservations about interest application

There were complaints from Muslim beneficiaries about the application of interest on the loan and those

who took loans from the program were socially excluded by local religious leaders. REST tried to resolve this problem by bringing together the Imams to provide a solution, including a Muslim scholar from Makale University who explained to the religious leaders about the six types of financial arrangements accepted by the Muslim world. The meeting accepted the *murabah* system, which treats the loan as a loan in kind but in which the interest (service) charge is added to the loan amount from the very beginning.<sup>6</sup> This seems to be working for the moment. The Muslim population still has reservations about this system but has not refrained from taking loans.

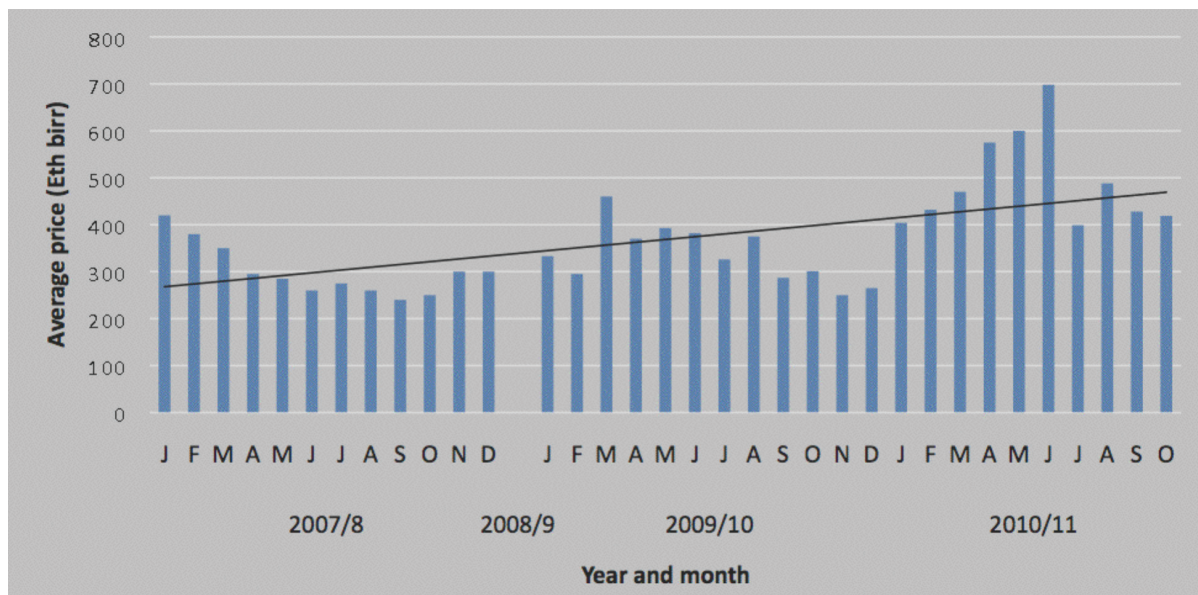
### 3.13 Marketing

Major livestock markets in the woreda are Kukuftu, Mehoni, and Chercher, in which most of the camels that go to Northern Ethiopia and Sudan are transacted. These markets also serve as feeder markets for cattle and shoats to Makalle. According to data obtained from the woreda agricultural office, livestock prices seem to peak between February and June due to the holidays of Easter and Arafa falling within these months. Prices also peak a little following the Ethiopian New Year holiday in September. Average cattle and sheep prices for 2007–11 are presented in Figures 1 and 2.

What is interesting is the rise in both cattle and sheep prices due to inflationary factors, increasing de-

<sup>6</sup> The Plus, (2010), "PSNP Plus links the Muslim community to income generating activities," Volume 1, Issue 2.

**Figure 2. Trend in average sheep prices in Mehoni, 2007 to 2011 (source: Raya Azebo woreda agricultural office)**



Notes: Data for 2008/9 was not available; trend line generated by MS Excel software.

mand, and rising costs of inputs for the years under review. This is particularly evident in the peak months of February–June. For example, the average cattle price increased from 1,850 Birr (US\$108) in February 2007/8 to 3,331 Birr (US\$194) for the same month in 2010/11, while prices for June 2010/11 doubled relative to June 2007/08 from 1,900 Birr (US\$111) to 3,862 Birr (US\$225). Similarly, sheep prices that showed a slight increase of 14% in February 2010/11 relative to the same month in 2007/08 rose by a staggering 168% in June 2010/11 compared to the same month in 2007/08.

What transpired during the focus group discussion was that beneficiaries strategize to sell their animals in the peak price months of February–June to maximize their income. *Of note, the profit realized by beneficiaries was derived more from this marketing strategy plus the predictable surge in livestock prices rather than actual body weight gains accrued via the “value addition” feed practices.* The 2009/10 drought also enabled participants to purchase livestock at low prices, which they then sold when prices peaked during the recovery phase. Otherwise, the livestock feeding regime practiced by the beneficiaries of this program is not much different than that of other Ethiopian farmers who also provide their livestock with similar crop residues and stalks. The main difference was that the PSNP Plus participants had to sell the animals for profit (because of the loan) rather than keeping them for long as other farmers do. And this profit motive has eventually persuaded them to buy and sell animals on a continuous basis after the initial loans. In short, they

have entered into “speculative markets” encouraged by the profit earned from each cycle, and participants sell even unfinished livestock at an opportune time within weeks of acquiring them. This should be considered as a positive step from the perspective of attaining increased income levels acquired through new business skills by PSNP Plus participants.

### 3.14 Implications for income and livelihoods

Twenty-two participating members of the five focus groups were asked at random to provide details of the transactions they carried out since accessing the initial loans. Although not statistically representative, the accounts they gave provide a glimpse of the positive impacts of the loans.

To begin with, many had repaid either half or most of their loans and a few had fully repaid. Although this is encouraging, it does not necessarily indicate a positive outcome of the intervention, since people are known to pay back loans by taking additional loans from other sources when needed. What was more interesting in this specific case—indicating the benefits of the project beyond doubt—was the livestock assets that participants still owned after paying half, most, or all of the loans, as demonstrated in the cases below (case studies are provided in detail for 22 individuals of the five focus groups, asked at random, in Annex I).

- Of the five cases listed in Annex I for Worebaya PA: three had repaid their loans in full and two of

them owned livestock assets with an estimated value of 12,000 Birr (US\$698); the third has built two houses with the proceeds after starting goat breeding and still owned six female goats; the fourth had paid half his loan in full and still owned five goats; the fifth had lost all benefit from the program because her husband sold the steer she had bought after their separation.

- For the three cases in Tsigea PA, all had paid half their loans; two went into sheep breeding and owned 15 sheep each; the third made a gross profit of 1,700 Birr (US\$99), enough to buy her three to four sheep.
- Of the four cases in Kukuftu, three of them had paid half the loan. Of these, one owned three sheep, the second a steer, and the third estimated making a gross profit of 900 Birr (US\$52) from three transactions. The fourth case owned a steer and had not paid back her loan due to not making a profit on the initial three sheep she bought, which became sick.
- Of the four cases in Warga PA, two have paid their loan in full and owned a bull each worth 10,000 Birr (US\$ 582) together. Of the other two, one owns an ox, which she uses for ploughing, plus four sheep, and the other owns three male and two female sheep. Each of the latter two had paid half the loan.
- The six cases in Korma PA paid most of their loans (about 90% repayment). Three of them owned a bull each, worth about 18,000 Birr (US\$1,048). One among them also owned two female sheep. The fourth and the fifth cases had gone into breeding and respectively owned 18 goats, and 8 female and 1 male sheep. The sixth case had become a livestock trader.

The above cases demonstrate that, despite feed shortages and traditional type value addition practices, the program helped in building the asset base of participating households through income diversification (further details are provided in Annex I). It was also reported that the potential to have even more livestock assets is constrained by lack of feed, labor, and shelter (particularly for sheep) rather than financial problems, as the program has induced participants to use their own cash sources in addition to the loans. In reality, what the program achieved is in changing the mindset of participating households to engage in alternative livelihoods. This implies that there are real possibilities for graduating PSNP participants through this program if at least two of the major constraints (feed and shelter) could be addressed properly.

The beauty of this program stems from its flexible approach. Despite being a “value addition” program,

it allows beneficiaries to make their own business decisions in terms the type of species they buy (sheep, goat, or cattle) and the purposes they buy for (fattening, ploughing, breeding, or simple speculation). Beneficiaries are also allowed to sell their animals at any stage of the value addition cycle if they see any benefit rather than waiting until the anticipated weight gain is achieved. This freedom has enabled participants to make informed business decisions at will and use individual talents to the full, as indicated in the following two examples:

- Jano Negus decided to buy six female goats for breeding rather than sheep for fattening in the second round, knowing that she can maximize her profit through this process as the goats in this area give birth to triplets and in few cases to quadruplets. She sold 30 offspring over two years and built two houses for rent. She still keeps the six original female goats.
- Despite having her own land and a single ox, Amsalu Reda used to receive only 1/3 of the crop harvest and sorghum stalks as a sharecropper. Determined to buy an additional ox to make a pair, Amsalu made five quick transactions by buying four to five sheep at a time and selling them within a month or two after she joined this program. She then succeeded in buying the ox she wanted most plus three sheep with the profit earned from the transactions she made. After having a pair of oxen, she now takes home a harvest of between 15–20 quintals of sorghum compared to the 3–5 quintals she used to receive as a sharecropper. In fact, all the sorghum stalks belong to her now, which she uses for fattening the ox and the sheep. She states that she will keep on selling the fattened ox and buy a replacement for ploughing and fattening every year. Her income is now boosted by the sorghum harvest besides the value addition of livestock.

Given the right support and freedom of choice, the above two cases demonstrate how individuals can unlock their potential due to the simple fact of knowing the local situations, opportunities, and limitations very well. This does not necessarily mean, however, that all participants will succeed. As in any business undertaking, there will always be some who under-perform, either because they are not astute enough, or due to facing unfortunate circumstances of their own making or beyond their control. For the time being, the numbers of weak performers in this initiative is rather low because the program has reached only a small proportion of the 59,733 PSNP households in the woreda. However, increasing the numbers of participating households in the same business line by significant numbers will likely produce disproportional cases of failures, as

business competition intensifies, prices of scarce inputs (crop residues and stalks) go up, and livestock prices fall with increased supplies to the market. It is proposed that the main focus should be on avoiding this pitfall and building on the gains made so far in the next phase.

### 3.15 Uncertain future directions

There was uncertainty about the future of the program when the initial phase ends in December 2011, due to legal issues. As a non-microfinance institute, REST will not have the legal mandate to distribute microfinance loans, charge interest rates, or collect repayments once the program comes to an end. This mandate rather belongs to the Dedebit Credit and Saving Institution (DECSI) in the Region, and there are talks about the potential transfer of funds from REST to DECSI when the current program phases out. It is suggested that the associated implications should be carefully reviewed before making such a move, for a host of reasons.

The transfer of REST's fund to DECSI implies continuing with the provision of loans for the same purpose—value addition of livestock. One major concern is that the scarce feed resource base in the woreda, both in quantity and quality (mainly of stalks and crop residues), is not capable of supporting the expansion of this scheme. Enlarging the numbers of value adders in significant terms is likely to result in diminishing returns as feed prices go up and livestock prices go down when supplies increase in the market. In addition, in contrast to REST, DECSI does not have the expertise to provide technical assistance to the borrowers or the mechanism to work in collaboration with the bureau of agriculture. As a bank, providing such support to the borrowers makes its operation rather expensive, even if it is willing and capable of extending such services. More importantly, DECSI is not short of funds to extend similar loan services if it wishes to. The complication regarding the future use of this fund seems to stem more from REST's legal position (of not having the mandate to provision microfinance loans) rather than DECSI's need for additional funds.

This prevailing situation points to a choice between two complementary options. Given the serious scarcity of livestock feed in quantity and quality, do we opt to expand the clientele base of more livestock value adders through the provision of loans, or does it make more sense to develop the feed industry in the woreda to bring qualitative changes to the prevailing practices? The beauty of the second option is not only in supporting ongoing value addition practices, but also in not directly competing against it while providing, at the same time, a diversified form of livelihood for those to be engaged in feed production and processing. The question is how to go about it. ■

## 4. Review recommendations

### 4.1 Proposed measures to develop the feed industry in Raya Azebo woreda

The measures proposed by this review are based on the assumption of REST being allowed to use the fund allocated for value addition loans instead for developing feed production and processing in the woreda.

As a moisture-stressed region, water remains the critical constraint for human food production, let alone for livestock feed production. So, is animal feed production a far-fetched idea in a region characterized by chronic food shortage? What should be recognized is that most livestock feed ingredients are bi-products of grains, legumes, or oil crops. The dual use of these crops for diversified purposes, therefore, makes economic sense. Second, even some fodder crops such as Rhodes grass and alfalfa yield better economic returns compared to sorghum, if cultivated in the proper manner and the right environment.

This necessitates looking into past efforts made to develop forage production in the Raya Valley. Feed production was one of the major components of the comprehensive development program undertaken by the Raya Valley Development Project<sup>1</sup> in which 2,549 hectares were to be brought under forage production and some 20,000 hectares of natural grazing lands were to be cleared of cactus and other undesirable plant species and managed.<sup>2</sup> A preliminary review report conducted by the Regional government (2001)<sup>3</sup> on the outcomes of this project outlines the reasons why it has not succeeded as expected. According to this report, the feed development component of the project in the mid- and lowland areas constituted:

- The clearing of cactus from grazing land and over-sowing of cleared sites with improved forage species;
- Weeding of unpalatable plant species;
- Application of minimum tillage to allow soil contacts for forage seeds on soil bunds;
- Plantation of significant numbers of fodder trees (Sesbania and Leucaena) on grazing land and around homesteads;
- Enforcement of extended enclosures of communal grazing lands until the forage seeds and the fodder trees were established;
- Over-sowing of grass/legumes mixture including Columbus grass seeds and cow pea and vetch on soil bunds;
- Under-sowing of different forage species;
- Utilization of crop residues;
- Limited forage development on irrigated sites (for example, alfalfa on a mere 456 m<sup>2</sup> land area) and some elephant grass cuttings.

On the outcomes of the program, the report stated that only 22% of the feasibility and revised plans were achieved and that the forage seedlings planted were only 24.5% of the target number. No account was given on survival rates. The report also added that, of the expected beneficiary farmers in improved forage cultivation, those who participated were only 4% and 4.4% respectively of the feasibility and the revised plan, and that the total area cultivated with improved forage seeds was about 10 and 12% of the feasibility and the revised plans, respectively (in highland, midland, and lowland common grazing areas).

The review outlines major constraints for the under-achievement as follows:

- Both the feasibility and the revised plans did not take into account the prevailing moisture stress in mid- and lowland areas that resulted in poor germination rates forage seeds;
- Too much focus on improving the pasture of com-

1 Tigray National Regional Government, 1997, "Feasibility Report of the Raya Valley Development Study Project," Volume I, Main Report, Relief Society of Tigray.

2 Different project components were designed to be implemented over a period of 1–10 years.

3 Tigray National Regional Government, 2011, "Raya Valley Integrated Agricultural Programme: A preliminary review of the feasibility study report of animal feed production component."



munal grazing land, which required the clearing of cactus and unpalatable species, sowing of cleared areas with improved forage seeds, and enforcing enclosures for extended period. Many farmers did not show interest in these activities and did not want the enclosures to be extended beyond the traditionally-accepted period (two months); most seedlings were damaged by free movement of animals in such areas;

- Farmers' suspicion of some grass species (Columbus, for example) and legumes establishing themselves as potential weeds for crop production;
- Farmers preference for eucalyptus and *Olea africana* to fodder trees; land scarcity and unwillingness to purchase and plant fodder tree seedlings;
- Cattle were not attracted to Leucaena and Tree Lucerne (perhaps because of lack of utilization technique) which led farmers to be skeptical about its' feed value.

The report summarizes that both the feasibility and the revised plans should have taken into account the prevailing moisture stress and the willingness of farmers to participate in this scheme from the outset and indicated that even the commonly-held view of farmers appreciating the clearing of cactus was not supported by all and in fact resisted by some. The review proposed some measures consisting of encouraging destocking (on the grounds of too much livestock for the available feed resource) and the clearing of spined cactus only from specific sites; improving the utilization technique of already-grown fodder trees; planting of sugarcane and local forage trees; and improving livestock watering points.

With the benefit of hindsight, some observations can be added to the review report mentioned above:

- The plan to bring some 2,500 hectares under forage production in a drought-prone area with no irrigation support was a little over-ambitious. Ironically, the project's water development program consisting of irrigation schemes (from surface and underground sources) was designed for the production of vegetables and fruit trees only to the total exclusion of forage crops. No attempts were made to compute the economic returns of irrigated forage crops;
- Despite the innovativeness of the idea that required a slow dissemination process, the project was trying to involve the participation of thousands of farmers in one sweeping move. Working with a few model farmers/opinion leaders initially could have helped the majority to follow suit;
- Communal grazing areas belong to all but to no

single individual. This makes it difficult for the latter to contribute in labor or otherwise, since the decision on how to use such resources is made by thousands of individuals at will with no one in control;

- The project failed to recognize the importance of cactus as the main source of feed for increasing numbers of camels being acquisitioned by better-off households. Ironically, camels have not been mentioned either in the feasibility study or the review report. This perhaps explains why farmers in some areas were opposed to the clearing of the species;
- Farmers did not see any economic rational in this intervention given the prevailing traditional livestock production motives at the time. It did not provide them with alternative and/or better economic livelihoods;
- The project was not directly linked to any value addition and marketing activities at the time. In short, there was no incentive (or demand) for farmers to engage in forage production.

However, times have changed. The livestock value addition program carried out by REST in the last three years has brought two fundamental changes of perceptions. The first is that livestock bought on loan have to be sold after some sort of value addition (often on profitable basis) in order to repay the principal loan with interest. The second is the recognition that profitability is commensurate with the quality and quantity of feed provided to livestock (notwithstanding speculations), creating a demand for livestock feed, as demonstrated by the purchase of mainly sorghum stalks and, to some extent, oil cakes and molasses during the ongoing value addition process. Apparently, the lack of adequate feed provision in quality and variety appeared to be more of a constraint than the intent of participants to purchase in the current value addition process. More importantly, what makes feed production attractive to farmers is if it provides better economic returns than and/or complementary household income to traditional crops.

Based on these assumptions, this review proposes the following measures to develop the feed industry in the woreda

***Irrigated forage and dual-use crop production***—Despite rainfall shortages, the woreda is known for its underground water potential with good discharge rates (about 6 liters/second on average), often in a depth of more than 100 meters. There are a few boreholes sunk in the woreda by various agencies, mainly for human and livestock consumption. REST alone has sunk nine wells under this

program, also meant for human and livestock use. On the other hand, private investors have begun sinking boreholes for commercial agricultural production in the woreda, using drip irrigation technology. This underscores the good soil fertility of the woreda, if only the water constraint could be tackled.

The review therefore suggests using five or six boreholes in different locations mainly for producing pasture, fodder, and dual-use crops to develop the livestock feed industry in the woreda. This could be done by rehabilitating some non-functional wells and also by sinking new ones. These could be connected to the main grid or served by generators, as the case may be, and the use of sprinkler irrigation system could be recommended, as irrigation drip is rather expensive. For the production of oil crops and legumes, the boreholes will serve as supplement to the main rainy season (to reduce cost) if a second production season is sought. Pasture production will require the regular use of water from boreholes outside of the rainy season. We assume that, if complemented by the main rainy season, each borehole could irrigate 20–40 hectares for the production of oil crops and legumes and less for pasture. This of course depends on the level of underground water discharge, the amount of rainfall in a given year, and the length of sprinkler pipes attached to each borehole. We suggest that REST look into developing between 150–200 hectares for this purpose in different locations. Water usage tariffs need to be set.

**Setting up demonstration farms**—The review recommends that REST set up some three demonstration sites of about a hectare each either in collaboration with farmers or on its own. In the former case, REST needs to guarantee farmers that they would receive at least the equivalent of what they used to get from traditional crop harvests, should things go wrong for unforeseen reasons. This helps to win their confidence. A field day should be organized for farmers at harvest time to provide details on nutritive values, utilization techniques, and the economic returns of the species being demonstrated relative to traditional crops. This would help farmers to switch to producing forage and dual-use crops if they see any economical benefit. The demonstration plots could serve for testing new varieties of fodder and dual-use crops in the ensuing years in collaboration with the research center at Alamata.

**Establishing dedicated livestock feed farms**—The review recommends REST to choose a few model farmers/opinion leaders who are known to take

on new ideas and willing to convert their farms for the production of fodder and dual-use crops. These farmers need to know about the potential returns and risks associated with making the transition from cereal to forage and dual-use crop production. At the initial phase, a total of 15 dedicated farmers (five in Kukuftu, five in Chercher, and another five in Mehoni) may suffice to demonstrate to others that feed production could bring better economic returns than cereal production. This will pave the way for others to follow suit in the ensuing years.

## 4.2 Comparative returns from feed-based investments

The widely-grown sorghum in the woreda yields a harvest of 30 quintals per hectare on average, in good years. At an average price of 500 Birr/quintal, the return from this investment is around 15,000 Birr or US\$873 (minus fertilizer, labor, and other costs). We compare this against a few of the pasture, oil, and legume crops we recommend for developing the feed industry.

**Rhodes grass**—With good irrigation, Rhodes grass yields an average of 70 bales per month in lowland areas. If we consider ten harvests per year at 30 Birr/bale, the gross return will be around 21,000 Birr (US\$1,222).

**Alfalfa**—Six to eight tons of alfalfa could be produced under irrigation from a hectare on a monthly basis, equivalent to 300–400 bales. Ten harvests per year would provide between 3,000 to 4,000 bales. At 50 Birr per bale, the annual gross return will be between 150,000 and 200,000 Birr or US\$8,731–11,641 (production may decrease in subsequent cuttings). A hectare of alfalfa also produces 500 kg of seeds under Ethiopian conditions,<sup>4</sup> which could be sold for an additional 20,000 Birr (US\$1,164).

**Peanuts**—Good varieties such as *Shulamiz* yield about 25 quintals in Babile and obviously more than 30 quintals under irrigation. This level of production (30 quintals) yields 900 liters of peanut oil and 2,100 kg of oil cake. At 50 birr/liter, the income from oil will be around 45,000 Birr and at 3,000 Birr/ton, the oil cake will provide a return of 6,300 Birr (a combined total of 51,300 Birr or US\$2,986). The peanut leaves could be fed to livestock.

4 Interview with Dadi Amosha (12.12.2011), forage expert at Elemtu Dairy Processing Share Co.

**Sugarcane**—Sugarcane production yields up to 150 tons per hectare under irrigation and proper management. Bi-products include molasses and cane tops for livestock feed and the crushed stem for feed (if properly chopped) or for fuel wood if cottage refinement of sugar is introduced (lessons can be drawn from India). Alternatively, the cane tops can be used for cattle feed if the raw canes are sold. In either case, the financial returns from sugar cane production will be far greater than sorghum and other related crops.

The above few cases demonstrate the comparative economic advantage of producing dual-use high value crops and fodder crops under irrigation. The list could be expanded to include pigeon peas, different varieties of beans, and other oil crops (Niger, rape, and sun flower seed, etc.), Napier grass, passion fruit, etc. Even spined cactus could be fed to cattle if it is initially dried to remove the sticky substance then cut, sliced, and chopped (there is a machine that can do this) and given in a 1/3 proportion in combination with other feed types. The combination could be flavored with EM to induce palatability.

What is required is undertaking proper economic and agronomic assessments to determine the types of grain, oil, fodder, and other crops to be produced under irrigation with a view to providing the right mix of protein, energy, and rumen requirements along with some minerals for the livestock value addition practice.

### 4.3 Outsourcing feed

REST also should investigate potential feed supply sources from neighboring and outlying areas. For example, sugarcane is grown year-round at Sanka, some 160 km from Raya Azebo. The cane tops are unused but could be compacted and brought to the woreda to provide the much-needed energy base for the livestock to be fattened. Similarly, REST could make an arrangement with oil seed and pulse exporters in Dessie to buy rejects, which can be milled and sold to value adders in Raya Azebo. REST should also explore the possibilities of setting up concentrate feed stores in Raya Azebo, Kukuftu, and Chercher on a trial basis for cost/benefit analysis and to familiarize value adders with the benefits. These stores could be supplied from their own production at a later stage. In the interim, the urea/molasses blocks, if produced in enough quantities, may fill the gap to some extent.

Machinery and equipment required to develop feed production and processing in the woreda include tractor, balers, small oil expellers, mills, and a combination of cutters, slicers, and choppers (three in one mill, available in Addis). ■

## 5. Conclusions

This review aimed to draw lessons by assessing the technical aspects of the livestock value addition program. Many of the households involved in the review appeared to benefit from the program by using their imagination, luck, and scarce local feed sources despite the absence of quality supplementary feed, i.e., a balanced ration with the correct protein content. The visible gains made by beneficiary households, despite scarce feed resources, led us to look into how this initial success could be capitalized upon. Increasing the number of value adding households through the provision of additional loans does not seem the right option while feed scarcity prevails. Instead, developing the feed industry seemed to be the logical next step for diversifying the income of additional PSNP households through feed production in a manner that complements, and not directly competes with, the efforts of existing value adders.

We would like to emphasize that the proposed measures for developing the feed industry in the woreda are suggested as mere indicators of potential intervention areas and do not take into account the fund that will be available should REST be allowed to use the available fund for feed production and processing. ■

# Annex 1. Performance of interviewed households

## Case 1 – Worebaye PA

Kebede Berhe – took a loan of 1,005 Birr and bought four sheep, sold them for 2,005 Birr and bought a bull for 3,000 Birr; used the bull for ploughing and sold it for 5,000 Birr; he then bought a steer for 3,500 Birr and a calf for 1,300 Birr that are estimated to be able to fetch a combined price of 9,000 Birr; he has paid his loan in full.

Molla Yimer – took a loan of 1,005 Birr and bought four sheep, sold them for 1,500 Birr, bought four sheep again for 1,300 Birr, which he sold for 2,000 Birr. He then bought five female sheep for breeding; he has paid half the loan.

Zbeida Saeed – bought four sheep for 1,300 Birr; one sheep was stolen and sold the three for 1,400 Birr; bought a steer and the husband sold it after they separated; she has not paid her loan.

Jano Nigus – bought four sheep with a loan of 1,006 Birr; lost one sheep and sold three sheep for 2,550 Birr; she then bought six female goats for 2,900 Birr that gave her 30 offspring, which she sold and built two houses with the proceeds; she has paid her loan.

Kiros Reda – bought a bull for 2,600 Birr, which he sold for 2,200 Birr (lost 400 Birr); he then bought another bull for 1,050 Birr, which was sold for 2,800 Birr; bought a steer for 1,700 Birr, which he hopes to sell for 3,000 Birr; he has paid his loan in full.

## Case 2 – Tsigea PA

Kahsay Woldu – took a loan of 1,300 Birr and bought an ox for farming which he later sold for 1,800 Birr; he then bought five sheep for 1,500 Birr and sold them for 2,100 Birr; he then bought five female sheep for 1,700 Birr and he now owns 15 sheep; he has paid half his loan.

Tsega Zamin – took a loan of 1,300 Birr and bought a bull, which she sold after a month for 1,800 Birr; bought another bull for 1,750 Birr and sold it after two months for 2,350 Birr; she bought a third one for 2,400 Birr and sold it within a month for 3,000 Birr. She estimates to spend up to 200 Birr a month for

the purchase of crop stalks and residues; she has paid her loan in full.

Shashu Dibab – bought five sheep for 1,400 Birr and sold three of them for 1,500 Birr; kept the two for some time and sold them for 1,000 Birr. She then bought six female sheep and she now owns 15 sheep; she has paid half the loan.

## Case 3 – Kukuftu PA

Asqual – bought four sheep for 1,300 Birr, which she sold for 1,600 Birr after incurring a cost of 25 Birr on crop stalks; she then bought sheep for 1,200 Birr, which were sold for 1,500 Birr after spending 25 Birr on feed costs; she then bought three sheep for 1,200 Birr yet to be sold; she has paid half the loan.

Washegna – bought four sheep for 1,200 Birr, which were sold for 1,700 Birr and then bought a steer which she has kept for the last seven months; she has paid half the loan.

Zibad – only remembers the profit she made in the first round (200 Birr), the second round (300 Birr) and in the third round (400 Birr) from purchase and sale of sheep. She usually keeps them for three months before selling; she has paid half the loan.

Alganesh – bought five sheep for 1,300 Birr and sold them for the same amount because they were sick. She now owns a steer; she has not yet paid the loan.

## Case 4 – Wargba Grable PA

Gebre Kiros – bought a bull for 2,500 Birr, which was sold for 3,500 Birr; bought a second bull for 2,700 Birr, which was sold for 3,400 Birr; bought a third bull for 2,600 Birr, which he hopes to sell for 5,000 Birr. Gebre also used the 600 Birr he was given (for feed) for the purchase of four sheep, which he sells after keeping them only for a month. He reckons making an average profit of 300 Birr per sheep every month; he has paid his loan in full.

Kahsu Reday – bought a bull for 2,500 Birr, which was sold for 3,000 Birr; she bought a second bull for 2,800 Birr, which was sold for 3,600 Birr; she then

purchased a third bull for 4,400 Birr, which she hopes to sell for 6,000 Birr. The 600 Birr she was given for feed purchase is rather used to augment the purchasing price of bulls; she has paid her loan in full.

Amsalu Reda – only remembers buying the first five sheep for 1,300 Birr; since then she has bought and sold sheep around five times. With the proceeds she has been able to buy an ox and she still keeps four sheep. The ox she bought with the profit has freed her from being a sharecropper on her own land. This has enabled her to harvest between 15 and 20 sacks of sorghum, whereas she used to get an annual harvest share of 3 to 5 sacks of sorghum as a sharecropper from the same land; she has paid half the loan.

Lemlem Eyob – bought five sheep for 1,200 Birr and sold them for 2,000 Birr; she bought another four sheep and sold them for 1,600 Birr. She now owns four male and two female sheep; she has paid half the loan.

## Case 5 – Korma PA

Guban Tafari – bought five sheep for 1,300 Birr, which were sold for 3,400 Birr after keeping them for six months; then bought a heifer for 900 Birr, which is currently pregnant and estimated to fetch a price of 4,000 Birr; he also owns two female sheep; he has paid back 900 Birr from his loan.

Sinday Agafari – bought an ox for 2,700 Birr, which was sold for 3,200 Birr; then bought a bull for 3,400 Birr, which was sold for 6,000 Birr; he bought a third bull for 3,200 Birr, which is estimated to be worth 6,500 Birr; he has paid back 900 Birr from his loan.

Teka Berhanu – bought a bull for 2,950 Birr, which was sold for 3,600 Birr (incurred a cost of 256 Birr for feed and drugs); bought a second one for 4,317 Birr, which he sold for 5,000 Birr; he still keeps a third bull bought for 5,245 Birr to be sold for 7,500 Birr; he has paid 1,100 Birr of his loan.

Hayelom Tefera – bought five sheep for 1,300 Birr and sold them for 1,500 Birr; he then bought three female goats and now owns 18; he has paid 1,100 Birr of his loan.

Redan Sheru – bought five sheep for 1,300 Birr but does not remember the price at which he sold; but he has paid back 1,100 Birr from his loan and now owns eight female and one male sheep.

Ibrahim – bought five sheep for 1,300 Birr which he sold after two months for 1,600 Birr; he then bought two pregnant females for 1,100 Birr and sold them with the offspring for 1,400 Birr; he now owns three female sheep and is engaged in livestock marketing on a weekly basis; he has paid 1,100 Birr of his loan. ■



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