EQUIP: STRENGTHENING SMALLHOLDER SYSTEMS FOR THE FUTURE:
Feed and Fodder Learning Session
OUTLINE

• Livestock Systems Innovation Lab

• Landscape analysis

• Forage / Fodder development

• Feed efficiency

• Feed by genetics interaction

• Role of gender in feeding
• **Vision:** To sustainably intensify livestock production to improve the nutrition, health, incomes and livelihoods of the poor.

• **Scope:** Manage 45 field-to-fork research for development projects in 8 countries.

• **Motivation:** Animal-source foods (ASF):

  - Are the best, high quality nutrient-rich food for 6-23 mo. olds (WHO, 2018);
  - 59% of children are not fed much-needed nutrients from ASF (UNICEF, 2020)
PREMIER PARTNERSHIP PROJECT

The LSIL is the first project funded by the USAID – Bill & Melinda Gates Foundation strategic partnership.

Our EQUIP project leverages USAID funds that established the Livestock Systems Innovation Lab.
THE UF FEED PROJECT TEAM

**Dairy management and genetics**
- Geoff Dahl
- Francisco Penagaricano

**Agronomy**
- Ken Boote
- Jose Dubeax
- Esteban Rios

**Animal Nutrition**
- Mulubrhan Gebremikael
  - Project Coordinator
- Gbola Adesogan
  - Director

**M & E lead**
- Erica Odera

**Gender lead**
- Lacey Harris-Coble

**Comms Manager**
- Jim Harper

**CFO**
- Damien Chevaillier
LANDSCAPE ANALYSIS

PI Name & Institution:
For ET: Dr. Adugna Tolera, Hawassa University
For BF: Dr. Augustine Ayantunde, International Livestock Research Institute (ILRI)

Collaborators:
For ET: Ethiopian Institute for Agricultural Research (EIAR), Tanager-ACDI/VOCA and ILRI
For BF: Institute de l’Environnement et de Recherche Agricole (INERA)
Milestone: Approximately 8000 new feed entries made into new (BF) and existing (ET) feed databases on listing types, availability, quality, prices, etc.

Opportunities:
- Allows formulation of least cost, environmentally benign rations that optimize productivity
- Allows contingency planning by governments/other stakeholders
- Highlights low productivity of private sector feed mills, providing an opportunity for improvement

<table>
<thead>
<tr>
<th>Item</th>
<th>ET</th>
<th>BF</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of feeds reviewed/sampled</td>
<td>2175</td>
<td>1658</td>
</tr>
<tr>
<td>No. analyzed by EQUIP with NIRS</td>
<td>1491</td>
<td>1804</td>
</tr>
<tr>
<td>Total entries in the feed database</td>
<td>4433</td>
<td>3857</td>
</tr>
</tbody>
</table>
Milestones:
• Mapped the feed supply-demand scenario across BF
• Showed 6 tons surplus feed produced for BF but a 2-ton deficiency in the north (Sahel zone)

Opportunities:
• Increase feed production with drought tolerant hybrids in the Sahel Zone
• Increase feed conservation and transport from other areas to the Sahel Zone.
• This can create business opportunities for smallholders especially women and youth
Linking livestock keepers and feed traders 800 km apart in Niger reduced feed costs by 30% and increased feed sales by 12.6 tons in 4 months ($3,600) in 2019, and by 9.5 t ($2,700) in 2020.

Ramana Doni earned 33% more money from sales of her (well-fed) sheep.
IMPORTANCE OF CROP RESIDUES

**Milestones:**
- Crop residues are by far the most important feed source in LMICs and their contribution is growing
- Crop residues are notoriously poor in quality

**Opportunities:**
- Physical, chemical and biological methods can be used to improve crop residue quality
- Investments in technologies and training on crop residue improvement, transport and storage are needed
- These can present business opportunities for small/medium enterprises
Milestone: Little/no relationship between feed quality and price
• Caused by lack of awareness for feed quality
• Limits livestock productivity and increases emissions

Opportunities:
• Raise awareness on importance of feed quality
• Develop a feed quality index that will inform pricing, incentivize quality and increase productivity
• Use cheap hand-held NIRS systems to assess quality (business opportunity)
FODDER/FORAGE DEVELOPMENT

PI Name & Institution:
For ET: Dr. Fekede Feyissa, M. Menta, and A. Ashagrie, EIAR
For BF: Nouhoun Zampiligré, INERA and Dr. Ken Boote, UF

Collaborators:
For ET: Drs. Boote, Esteban Rios and Jose Dubeaux, UF
For BF: Drs. Boote, Esteban Rios and Jose Dubeaux, UF
VALIDATION OF BEST BET INTRODUCED FORAGES

Milestones:
- Validated the improved productivity and nutritive value of introduced and local best-bet forages in various countries
- Several have been recommended to the govts. for release

Opportunities:
- Expedite approval of release of these varieties, and provide an enabling seed system environment
- Focus on traits that enhance livestock performance not just agronomy e.g. those that improve nutritive value (low lignin/FAE/BMR, leafy, fibrolytic enzymes, high N/ low tannin, etc.)
- Target dual-purpose hybrids to smallholders; develop forage-only hybrids to maximize livestock productivity

Liveweight gain by sheep fed stover of local and improved dual-purpose millet varieties
Milestones:

• Substituting improved forages for concentrates did not reduce milk yield.

• When farmers grew and fed cows our improved forages, milk yield increased by 36% and profits by 49% compared to farmers’ practice.

• Showed that farmers were willing to pay for improved fodder, but this varied with region, livestock system, etc.

Opportunities

• Examine and understand barriers to adoption of improved forages, particularly by women.

• Raise awareness, provide training and sustained private sector-led extension support on adoption / use of improved forages.

Effects of farmer’s practice (left) and improved forage (right) diets on milk yield (l/d) and milk income (Birr/day) in ET.
# FACTORS AFFECTING WTP FOR IMPROVED FORAGE

| Variable                                      | Coefficient | t     | P>|t|
|-----------------------------------------------|-------------|-------|-----|
| **Cotton cake prices 2017**                  | 0.056429*** | 5.62  | 0.00|
| **Crop residue expenditures**                 | -0.0001111  | -0.46 | 0.646|
| **Trans-boundary trans-humance**             | -111.79**   | -2.49 | 0.014|
| **Ethnic group**                              | -69.41114*  | -1.89 | 0.06|
| **Practice of fattening**                     | -28.10858   | -0.81 | 0.422|
| **Number of years of experience**             | 0.990793    | 0.73  | 0.465|
| **Knowledge of forage crops**                 | 137.89***    | 3.05  | 0.003|
| **Practice of grazing**                       | -47.17054   | -0.65 | 0.516|
| **Practice mowing and conservation**          | -9.985132   | -0.28 | 0.778|
| **Livestock number**                          | 0.0024388   | 0.03  | 0.978|
MODELING NUTRITION IMPACTS

- Mapped areas suitable for irrigated fodder production
- Showed that adopting irrigated fodder and crossbred cows can increase substantially milk production and consumption of eggs (28-fold) and milk (3-fold) in the home

Areas suitable for growing Desho grass in Ethiopia
FEED ANALYSIS

PI Name & Institution:
For ET: Dr. Alan Duncan, ILRI (late Michael Blummel)
For BF: Dr. Augustine Ayantunde, ILRI

Collaborators:
For BF: Dr. Nouhoun Zampaligre, INERA
MOBILE NIRS SYSTEMS ARE AS GOOD AS TRADITIONAL SYSTEMS

Milestones:
- Showed that mobile NIRS systems costing 3% of the cost of desktop systems are just as accurate for feed analysis
- This will be a game changer for feed analysis in LMICs

Opportunities:
- Creates opportunities that can revolutionize feed analysis leading to feeding balanced rations, improved livestock productivity and lower emissions.
- Feed marketing with accurate labelling on quality and safety.
- Presents business opportunities for smallholders

<table>
<thead>
<tr>
<th>NIRS</th>
<th>$R^2$ crucible</th>
<th>$R^2$ plastic bag</th>
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<tbody>
<tr>
<td>FOSS XDS</td>
<td>0.94 - 0.99</td>
<td>0.94 - 0.99</td>
</tr>
<tr>
<td>Brimrose</td>
<td>0.85 - 0.97</td>
<td>0.81 - 0.97</td>
</tr>
<tr>
<td>microPhazir</td>
<td>0.90 - 0.98</td>
<td>0.86 - 0.97</td>
</tr>
<tr>
<td>TellSpec</td>
<td>0.84 - 0.96</td>
<td>0.85 - 0.97</td>
</tr>
<tr>
<td>SCI/O</td>
<td>0.62 - 0.81</td>
<td>0.50 - 0.66</td>
</tr>
</tbody>
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ESTABLISHMENT OF NIRS CONSORTIA

Milestone:
• Established a community of practice (ET) and PPP (BF) aimed at sharing equations and capacity development, and advancing feed analysis

Opportunities:
• Prevents continued accumulation of dysfunctional donor-funded NIRS machines in LMIC labs
• Need to create an Africa-wide consortium for more pronounced improvement of capacity in feed analysis
FEED EFFICIENCY

PI Name & Institution:
For ET and BF: Dr. Ermias Kebreab, University of California - Davis

Collaborators:
For ET: A. Ashagrie, EIAR, A. Tolera, Hawassa University
For BF: INERA, N. Zampaligre
RATION FORMULATION SOFTWARE

Milestones:
• 94% of farmers who used our ration formulation app in Nepal reported improved milk production
• Developed software for formulating balanced rations in BF and ET in local languages
• Updated the software with our meta analysis data on local feed quality and nutritional requirements of tropical cattle

Opportunities:
• Train technicians and farmers to use the software; and provide sustained private sector led, IT-enabled extension support
• Creates a business opportunities for entrepreneurs
• Need to develop a smart phone-based app for ET and BF
FEED X GENETICS INTERACTION

PI Name & Institution:
For ET: Dr. Carl Birkelo and Dr. Bayissa, Tanager (ASI) - ILRI

Collaborators:
Dr. Geoff Dahl, UF; Dr. Francisco, Penagaricano, UW
Ethiopian Regional Cooperative Extension Service,
IMPROVED FEEDING CRITICAL FOR OPTIMIZING PRODUCTIVITY

Milestone:
• Showed that improving feeding increased milk production by 42% (pre break) to 59% (post break).
• Showed that improving genetics without simultaneously improving feeding yields little to no benefits
• Improved feeding must be a component of livestock productivity improvement strategies

Opportunities:
• Raise awareness and provide sustained IT enabled-private sector led extension support for improving feeds and feeding
• Complement existing genetics investments with feed supplements to maximize impacts

Effects of adding feeding and management to a genetics (PAID) intervention on milk production (kg/day)

- Post break period: May-Oct 2020
- Amhara, Oromia, SNNP
ROLE OF GENDER IN LIVESTOCK FEEDING

Milestones:
• Submitted a journal paper on the topic
• Showed that women were more often involved in feeding of livestock, feed preparation, and feed processing while men were more often involved in grazing, feed purchase and transport.
• Showed that women play an important role in marketing feed.
• Some farmers in ET prefer purchasing feed from women at higher cost, because the quality is better and the feed is less likely to be adulterated.

Opportunities:
• Need to build capacity and empower women to ensure adoption of feed innovations
• More information needed for some feed tasks
TAKE HOME MESSAGES

• Feed is the most potentially impactful and expensive factor limiting livestock production

• Interventions that ignore proper feeding will have little to no benefits.

• Need to invest in research, training and extension in various areas to advance quality feed production and proper feeding in LMICs.

• Great opportunity for private sector engagement in many facets of feed production, conservation and trade

• Need to address farmer-herder conflicts urgently, particularly in W.Africa.

• Women as well as men are highly involved in feed activities

• The FEED team including the Livestock Lab partners are highly capable to address the feed sector research, teaching, extension and private sector engagement needs highlighted.