Development and promotion of sorghum forage
technologies in Ethiopia

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Outline

- Current status and opportunities - on development and promotion of sorghum feed technologies
- Potential user groups and forage sorghum product needs
- Current research activities and development of sorghum forage products for different user groups
- How are the sorghum technologies linked to market demand?
- Way forward
Current Status: development and promotion of sorghum feed technologies

- Sorghum is an excellent source of green and dry fodder (Stover), demands for which are extremely high during the summer seasons in the arid and semiarid regions.
  - These areas are characterized by mixed sorghum-livestock farming where sorghum Stover is the sole dry period feed for cattle.
- Past research activities focused on developing early maturing and drought tolerant varieties which are also improved for grain yield.
Current Status: development and promotion of sorghum feed technologies

- Only one forage sorghum variety- *Guta* is developed so far

- Existing information on key nutritional compounds, the processability of our sorghum cultivars to optimize both food and feed processing is limited.
Opportunities- development and promotion of sorghum feed technologies

- Opportunity to develop enhanced alternative products
  - Utilization of sorghum as green chop, hay, and silage
  - Inclusion of sorghum grain in poultry feed/ration

- Government plan and policy to ensure Nutritional Security: Meat, Milk and Egg
Customers/users group product needs

1. Mixed sorghum-livestock system farmers

- Dual-purpose sorghum that can meet the needs for food and feed (Stover).
  - Sorghum Stover/residue (late maturing sorghum landraces) is a vital feed source for livestock raised by sorghum-livestock farmers in the eastern part of Ethiopia, particularly for fattening.
  - Majority of the beef supply comes from mixed-crop-livestock system.
Customers/users group product needs…cont’d

- Nowadays, the traditional late-maturing sorghum production system is prone to multiple drought events.

- Dual-purpose sorghum -both for food and fodder (Stover) that could meet the needs of mixed-sorghum livestock farmers
Customers/users group product needs…cont’d

2. Urban and semi-urban businesses that produce dairy products, and beef

- **Quality hay and Silage** - developed from forage and/or dual-purpose (grain and fodder)
  - These products are suitable utilization options for filling shortage of seasonal feed supply.

- For instance, in West Hararghe, Odabultum woreda, Cherecher Odabultum coops union dairy and fatting farm, with members of more than 6000 farmers, is highly constrained by shortage of seasonal feed supply.
The union is forced to buy teff residues – “Chid”, and other feed by-products from the central part of Ethiopia that incur additional cost to their farm business.

To alleviate this, the cooperatives obtained 300 ha of land from the local government to improve forage/fodder production and processing.

- Efficient home-grown forage production is critical for the long-term sustainability and profitability.

- Development of improved forage sorghum technologies with their alternative utilization as green chop, haymaking, and silage is required.
3. Semi-intensive and intensive poultry farms

- maximize the value of sorghum in Poultry rations (to replace corn or other grains in rations)
  - Poultry producers in Ethiopia are constantly complaining about the high cost and low quality of poultry feed on the market (Woldegiorgiss et al. 2017; Ebsa et al. 2019).
  - Sorghum (Sorghum bicolor) grain is an important feed ingredient in many parts of the world (Sedghi et al., 2011).

- For Sorghum to replace corn (or other grains) in rations
  - Know the differences in nutritional value
Current Research Activities

- Starting from the 2021/2022 cropping season, some research activities on forage and dual purpose (grain and forage) sorghum were planned and are currently being carried out with the support from of the SMIL-II project.

- The activities are planned based on needs of different customer/user groups, and the main goals and purposes of the research activities tailored to the product needs of each group.
Activity 1: Characterization and evaluation of the core sorghum germplasm sub-population for forage sorghum quality attributes

Objective: to characterize and evaluate of the sub-core sorghum collection for forage sorghum quality attributes

Status: Total of 360 genotypes from the SMIL sub-core collections were evaluated for forage sorghum attributes at three stages:

- At booting stage- for hay, at early hard-dough stage- for silage, and at maturity or immediately after crop harvest- for dual-purpose
- Data on major morphological and physiological traits were recorded.
Activity 2: Characterization and evaluation of landraces of sorghum (West and East Hararghe collections) for feed quality attributes (grain and fodder)

Status:

- Total of 70 sorghum landraces (West and East Hararghe collections) were evaluated at two stages:
  - for silage making-early hard dough stage, and
  - for dual purpose -at maturity, immediately after grain harvest.
- Data on major morphological and physiological traits were recorded.
Activity 3: Evaluation of introduced forage sorghum for hay and silage

Objective: to evaluate and classify the forage sorghum cultivars based on their target use as hay and silage

Status:
- 150 forage sorghums introduced from ICRISAT were evaluated at two stages:
  - for green chop, hay at booting and silage making between hard and soft dough stage.
  - Data on major morphological and physiological traits were recorded.
Chemical Composition and Nutritional value (activity 1 to 3)

- Samples are currently being ground and made ready for **Key nutrient analysis** that will be carried out using bench-top -FOSS 5000, and hand held -Tellspec NIRS.

- Key nutrient analysis: Dry matter (DM), Ash, crude protein (CP), Neutral detergent fiber (NDF), acid detergent fiber (ADF), acid detergent lignin (ADL), and in vitro dry matter digestibility (IVDMD).

- Based on their **Relative feed value** promising lines will be selected and advanced to multi-location performance trial in respective of their utilization option.
Activity 4: Evaluation of grain quality attributes of introduced sorghum for inclusion in poultry diets as an energy source

Objective: to evaluate and select suitable grain sorghum lines for inclusion in poultry diets as an energy source

Status:
- 82 high lysine and 71 high grain quality sorghum lines were tested at two locations (Chiro and Miesso), each.
- Data on major morphological and physiological traits were recorded.
Activity 4: Evaluation of grain quality attributes---cont’d

- **Physical properties**
  - grain size, shape, color, hardness, vitreousness

- **Nutrient composition (NIRS)**
  - Crude protein, Crude Fat, Crude Fiber, Ash
  - Amino acid profile including lysine.

- **Anti-nutritional compounds (outsourced)**
  - Tannins
  - Phytochemicals: Phytic acid, oxalic acids
  - Phenolic compounds: phenols and phenolic acids, hydroxycinnamic acid derivatives, and flavonoids

Promising sorghum lines with quality characteristics for inclusion in poultry ration (broilers and layers) will be identified and promoted for multi-location performance trial.
Activity 5: Developing NIRS equation for sorghum feed (grain and forage) quality traits

Objective: To develop NIRS equation for sorghum feed (grain and fodder) quality attributes

Status:
- Diverse sorghum (grain/forage) working collection (>700) ~ 3000 samples will be assayed using NIRS.
- Correlating optical spectral signatures with physico-chemical properties of the sample matrix (Stover and grain attributes), a robust calibration (well-refined equation) will be developed.
- Nutrient profiling information will be developed that could be used in food-feed-forage evaluation and improvement work.
How are the sorghum technologies linked to future market demand?

- Through the use of superior dual-purpose sorghum cultivars that provide feed (quality stover).
- Current policy direction/strategies that encourages use of quality feed to meet the export demand.
- Availability of different sorghum technologies for different use, including:
  - Enhanced alternative utilization ...as hay, and silage fills seasonal feed supply gap.
- Existence of feed processors.
Way forward

- Identify sorghum major value chain actors and their roles (production, trading, consumption, and import and export).
- Identify major gaps (constraints and opportunities) of forage sorghum in the value chain.
- Develop a value chain map for sorghum feed (grain and forage).
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