

# Farmers' needs assessment for small-scale forage choppers in mixed farming systems

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## CGIAR Sustainable Farming Science Program Report

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## Introduction

Ethiopia has a large livestock population however, the demand for animal-source foods for its human population has not been met. This is mainly due to low animal productivity, which is compounded by inefficiencies in input supply (feed, genetic materials, and veterinary services) and output systems. Among these factors, feed shortage both in quantity and quality is considered a major constraint to the sustainable development of the livestock sector. Natural pasture and crop residues contribute about 56.23% and 30.06% respectively of the total livestock feed supply in Ethiopia (CSA, 2015). However, their availability and quality are influenced by agro-ecological conditions, crop types, accessibility of crop by-products, and production systems. The common problems associated with natural pasture and crop residues include marked seasonal variability in feed availability and poor nutritional quality, which have been consistently reported as major constraints to livestock production in developing countries (Teferi *et al.*, 2010).

Feed treatment and processing, in basic terms, can involve physical methods, primarily size reduction, which can be achieved using hand-operated or power-driven cutters and choppers. However, in Ethiopia, there is limited experience with feed treatment and processing methods aimed at improving the nutritional value of crop residues. Most farmers typically harvest grasses and crop residues for forage and cut them into short lengths for livestock feeding. Nevertheless, the bulky and fibrous nature of such feeds can restrict intake, and significant feed wastage is commonly observed due to selective feeding and the refusal of less palatable plant parts by animals. Studies have shown that appropriate chopping of forage into optimal particle sizes can improve physical characteristics that stimulate rumination, increase feed intake, reduce feed rejection, and consequently minimize feed wastage. In addition to increasing feed intake, chopping technologies facilitate the rapid removal of crop residues from fields after grain harvest, reduce leaf loss and senescence, homogenize plant material by mixing large and small particles thereby enabling better utilization of medium and low-quality forages, and allow timely storage while reducing storage space requirements and transportation costs (Hussien *et al.*, 2023).

Farmers in most parts of the country uses feed chopping by manual choppers that include traditional tools such as sickle, machetes and knives, that are too labor intensive and tiresome, especially in dry and fibrous materials, while it is also associated with dangers of cutting workers' fingers. However, some non-governmental organizations and research institutions have imported and/or adopted different types of small and medium power-driven forage choppers to solve feed resources utilization problems. This report summarizes need assessment for small feed chopper machines among smallholder livestock farmers in the Ethiopian highlands.

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### Objectives

- To assess the existing feed resources and feed chopping practices used by smallholder farmers in the Ethiopian highlands.
- To assess farmers' demand, preferences and willingness to pay for small feed chopper machines.
- To identify support requirements (operation, maintenance and business/entrepreneurship skills) for effective uptake of feed chopper technology.

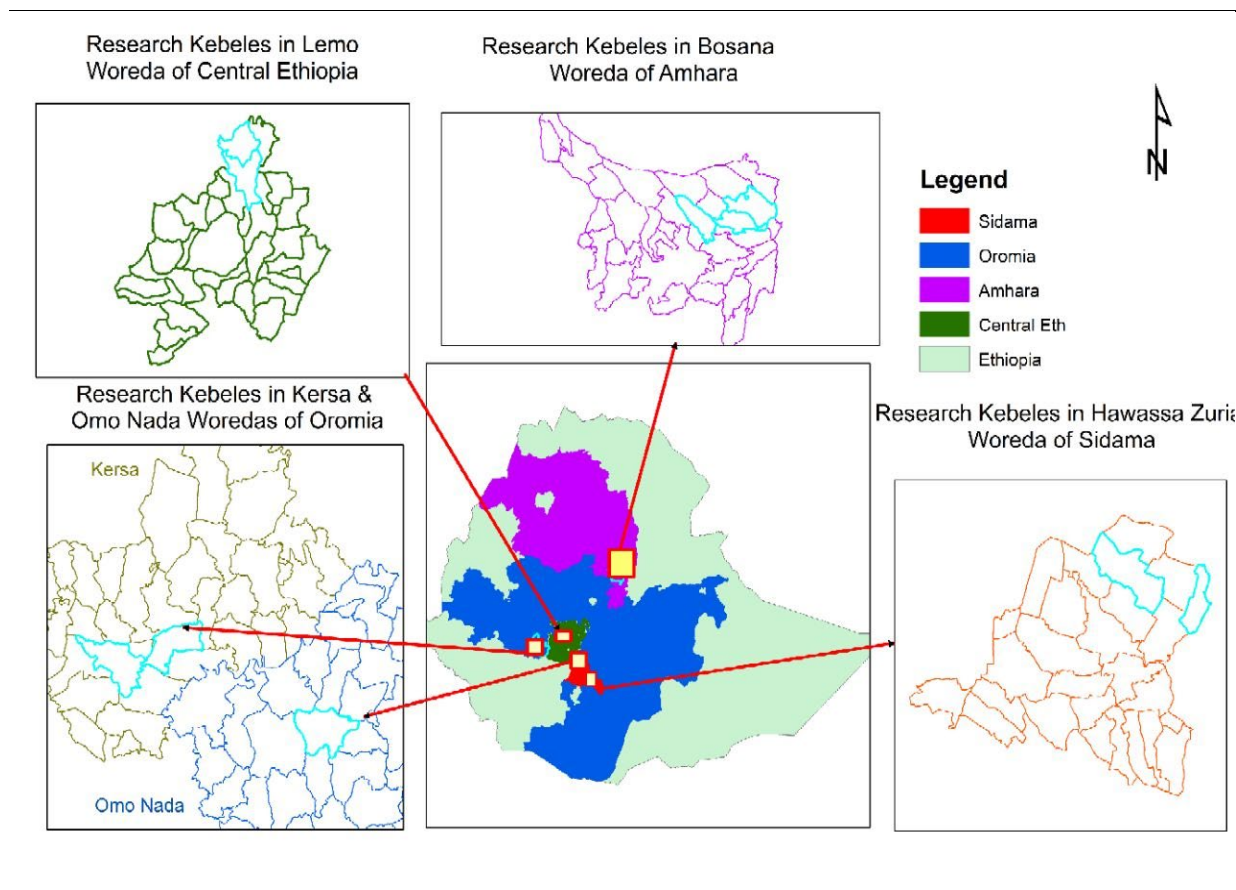
### Methodology

#### Study area, design and sampling

The study was conducted in selected districts of the Ethiopian highlands representing diverse agro-ecological conditions and livestock production systems (Table 1). The selected districts included Debre Birhan and Basona Worena (Amhara Region), Lemo (Central Ethiopia Region), and Kersa and Omo Nada (Oromia Region). These districts were purposively selected based on their high livestock population, dominance of crop livestock and dairy production systems, and widespread reliance on crop residues and natural pasture as major feed resources (Figure 1). A cross-sectional needs assessment study design was employed. Smallholder livestock-keeping households were selected using purposive and random sampling techniques to ensure representation of different farming systems within each district.

**Table 1:** Minimum temperature, maximum temperature, altitude, rainfall and cropping systems of the five districts.

Region	Woreda	Min. Temp	Max. Temp	Altitude (m)	Rainfall (mm)	Cropping system
Central Ethiopia	Lemo	7.4°C - 15.1°C	20.8°C - 28.5°C	1,780 - 2,780	1,115- 1,274	Enset-based mixed systems
Amhara	Basona	4°C - 10°C	19°C - 26°C	2,250 - 3,200	890 - 1,310	Cereal-based mixed systems
	Debre Birhan	8°C - 12°C	17°C - 23°C	2854	900-1,200	Cereal-based mixed systems
Oromia	Kersa	11.6°C - 14.4°C	25°C - 30°C	1600- 2660	2000- 2400	Maize-based mixed systems
	Omo Nada	11°C - 14°C	21°C -28°C.	1,000- 3,340	1066- 1200	Maize-based mixed systems



**Figure 1.** A map showing the districts where the feed chopper assessment study was conducted in the Amhara, Central Ethiopia and Oromia regions.

### Data Collection

Primary data was collected using structured household questionnaires (Annex 1) and supplemented with field observations. The questionnaires captured information on demographic characteristics; feed resources and feeding practices; current feed chopping methods; challenges related to feed preparation; awareness and use of feed chopper machines; ownership preferences, affordability and willingness to pay, access to financial services; and support needs related to feed chopper operation, maintenance and entrepreneurship. Data was collected using Kobo Toolbox, a digital platform for social research. Trained enumerators administered face-to-face interviews using mobile devices. Data was collected offline in remote areas and uploaded when internet access was available. Submissions were monitored in real time to ensure completeness and consistency. The final dataset was exported for cleaning and statistical analysis.

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### Data Analysis

Quantitative data was analyzed using descriptive statistics, including frequencies and percentages, to summarize household characteristics and responses across districts. Qualitative information from interviews and observations was analyzed thematically and used to explain variations and trends observed in the quantitative results.

## Results and discussion

### Demography of households

Demographic characteristics of the respondents are presented in Table 1. The results regarding the sex of the studied households indicate that most household heads were male in all the five districts (Woredas). The highest proportion of male-headed households (100.00%) was recorded in Omo Nada, followed by Debre Birhan (95.00%) and Kersa (92.31%) districts. Regarding age, the largest proportion of household heads fell within the 36–50 years age category. Lemo recorded the highest proportion (91.25%), followed by Debre Birhan (65.00%) and Omo Nada (60.00%), while the lowest proportion was observed in Basona Worena (55.00%) district.

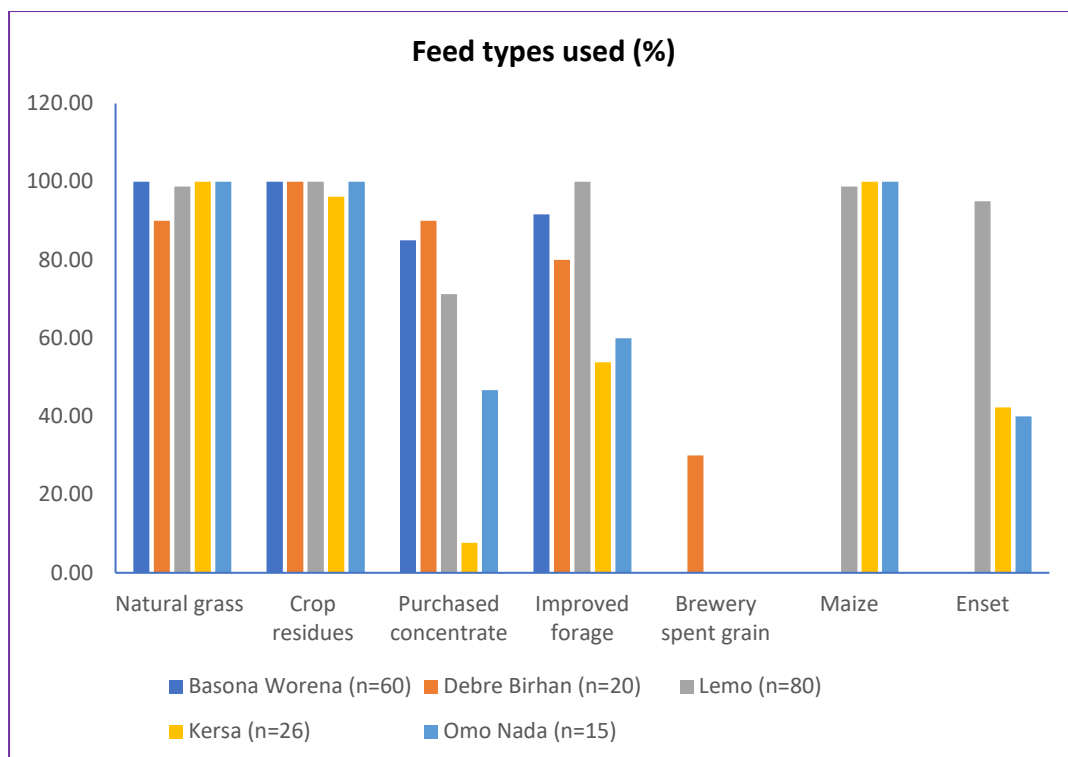
The educational status of household heads varied across the study areas. More than 50% of household heads had attained primary-level education in all locations except 44.33% for Basona Worena district. Moreover, higher levels of illiteracy were recorded in Basona Worena (53.33%). The study results further indicate that mixed crop–livestock farming systems were dominant across all the districts. Dairy farming was identified as the main livelihood activity in Debre Birhan (100%), Basona Worena (100%) and Lemo (98.75%) districts. Small and large ruminant fattening was mentioned as an important livelihood means for Basona Worena (95.00%) and Omo Nada (60.00 %) districts.

**Table 2:** Demographic characteristics of interviewed households from five districts.

Variables	Categories	Basona Worena	Debre Birhan	Lemo	Kersa	Omo Nada
Gender of household head (%)	Male	86.67	95.00	82.50	92.31	100.00
	Female	13.33	5.00	17.50	7.69	0.00
Age of household head (years)	25-35	10.00	10.00	7.50	19.23	20.00
	36-50	55.00	65.00	91.25	53.85	60.00
	> 50	35.00	25.00	1.25	26.92	20.00
Education level of household head (%)	illiterate	53.33	5.00	7.50	23.08	0.00
	Primary	43.33	70.00	56.25	53.85	80.00
	Secondary	1.67	25.00	28.75	23.08	0.00
	College & above	1.67	0.00	7.50	0.00	20.00
Main livelihood	Diary	100.00	100.00	98.75	38.46	60.00
	Fattening	81.67	45.00	40.00	46.15	60.00
	Mixed Farming	95.00	90.00	97.50	88.46	100.00

## Farmers feeding practices

Natural pasture and crop residues accounted for more than 90% of the feed sources in the five districts. This clearly indicates that farmers heavily depend on natural pasture and crop residues to feed their livestock. The use of purchased concentrate feed was reported at a high proportion in Debre Birhan (90.00%), followed by Basona Worena (85.00%) and Lemo (71.25%) districts. This indicates that farmers' orientation toward dairy farming in these three districts requires additional feed sources to meet the nutritional demands of their animals. The highest proportions of improved forage use as a feed source were reported in Lemo (100.00%), Basona Worena (91.67%), and Debre Birhan (80.00%) districts, indicating the effectiveness of previous extension efforts in these areas (Figure 1).



**Figure 1.** Farmer current feeding practices in five districts.

The use of brewery spent grain was reported at a notable proportion in Debre Birhan (30.00%), indicating that farmers are adapting to the use of by-products from two large brewery factories (Habesha and Dashen) located on the outskirts of Debre Birhan town. The use of maize stover as a major livestock feed was reported in Kersa (100.00%), Omo Nada (100.00%), and Lemo (95.00%) districts. Similarly, the highest proportion of Enset use was reported in Lemo (95.00%), followed by Kersa (42.31%) and Omo Nada (40.00%) districts.

The disparity in feed use among the five districts can be attributed to differences in agro-ecology and crop production systems which influence the availability of specific feed resources (Maize and Enset). Proximity to agro-industrial centers such as

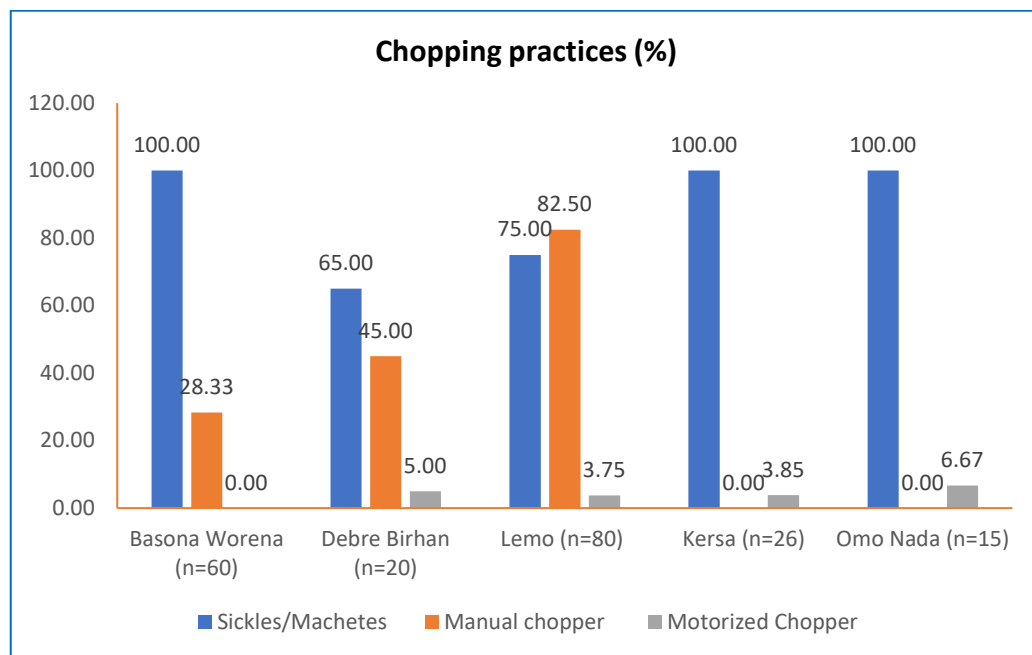


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breweries affects access to by-products like spent grain. The level of market orientation particularly toward dairy farming also increases demand for purchased concentrates. Additionally, variations in farming practices, land holding size and farmers awareness of alternative feed sources contribute to the observed differences. Crop residues, improved forages, maize stover and Enset (data not shown) were the main feed types commonly chopped by farmers using different methods across the study districts, with noticeable differences among study sites.

### Current chopping practices and challenges

Sickles and machetes were the most widely used fodder-chopping tools across all districts included in the study. Hundred percent use of sickles was reported in Basona Worena, Kersa and Omo Nada districts. Farmers in Lemo district demonstrated greater experience in the use of manual choppers (82.50%), which may be attributed to previous interventions by NGOs and government extension services (Figure 2).

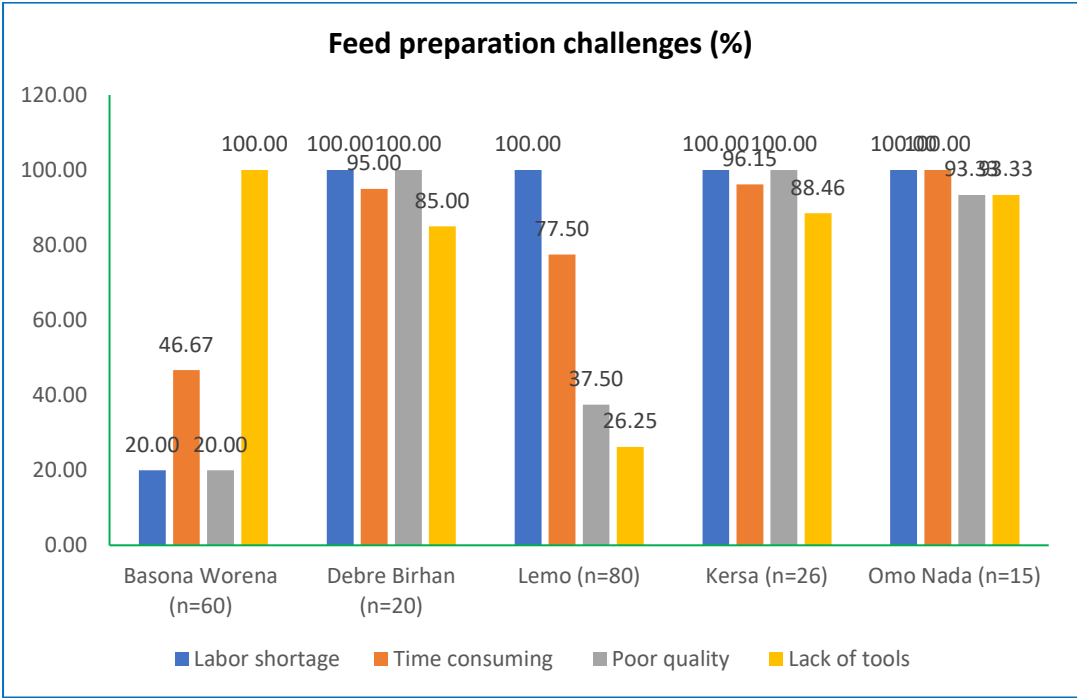


**Figure 2.** Chopping practices across the five study districts.

Motorized choppers were not widely used in any of the districts, with adoption rates ranging from 0% in Basona Worena to 6.67% in Omo Nada. The low level of adoption may be attributed to constraints such as limited availability, high initial investment costs, inadequate technical capacity and lack of awareness of the benefits of motorized choppers. This indicates a strong need for future demonstrations and the scaling up of motorized feed chopper technologies.

Labor shortage (family or hired) was identified as a major feed preparation challenge in Debre Birhan, Lemo, Kersa, and Omo Nada districts. Basona Worena district was

the least affected by labor shortages, with only 20.00% of respondents reporting this constraint. Similarly, the time required for feed preparation was reported as a significant challenge by respondents in Omo Nada, Kersa, Debre Birhan, and Lemo districts (Figure 3).



**Figure 3.** Feed preparation challenges for the five districts.

Poor quality of the currently processed feed was identified as a challenge in Debre Birhan (100.00%), Kersa (100.00%) and Omo Nada (93.33%) districts. In addition, more than 85% of respondents in Basona Worena, Omo Nada, Kersa, and Debre Birhan districts indicated a lack of tools and equipment as the main feed preparation constraint, whereas the lowest proportion was reported in Lemo district (26.25%). Variations in feed preparation challenges across the districts are mainly due to differences in labor availability, access to tools and equipment, and household economic capacity. Districts with better extension support, market access and infrastructure experience fewer constraints. Differences in livestock production intensity and the type of feed resources also influence labor and time requirements. In addition, varying levels of farmer awareness and exposure to improved technologies contribute to the observed disparities.

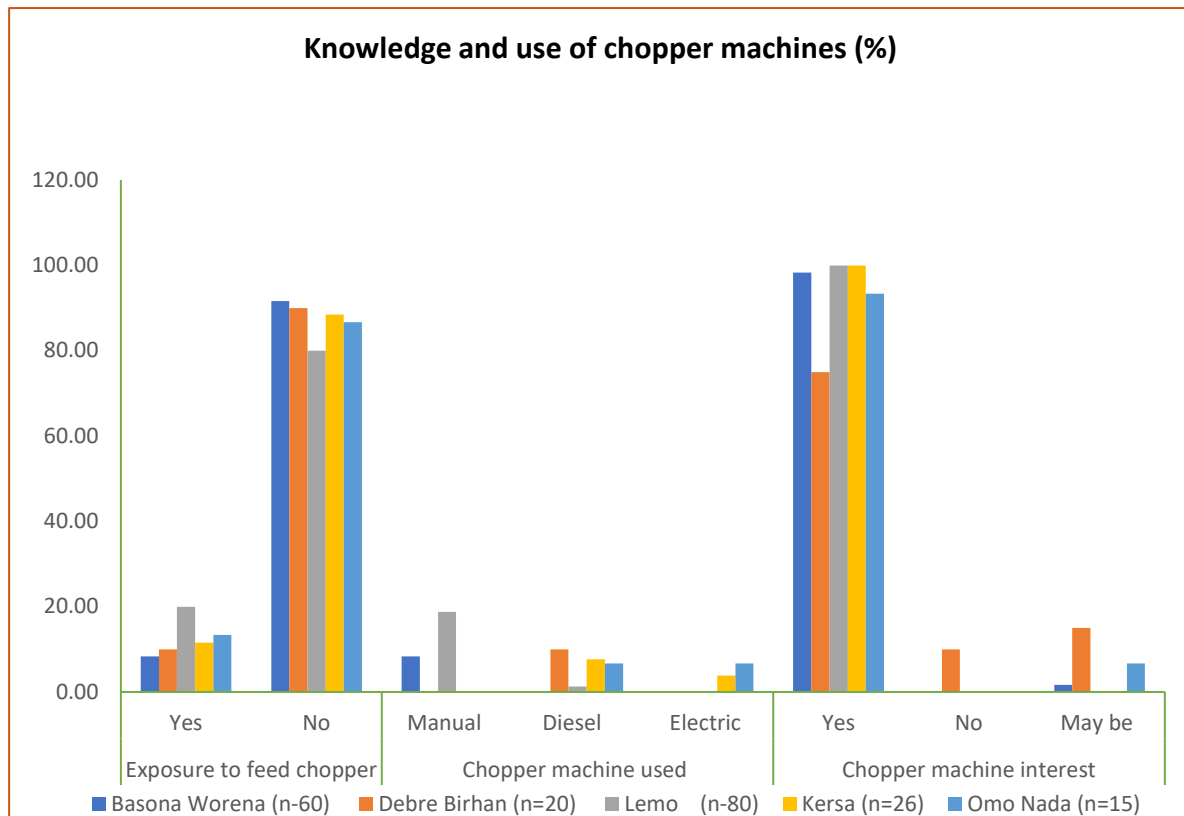
**Knowledge and use of forage chopper machines**

Most respondents did not have prior knowledge of feed chopper machines. The highest proportion of respondents lacking prior knowledge was recorded in Basona Worena (91.67%) followed by Debre Birhan (90.00%) and Kersa (88.46%) districts. Respondents who had experience using feed choppers were further asked about the type of machines they used. Among these respondents, manual feed choppers were



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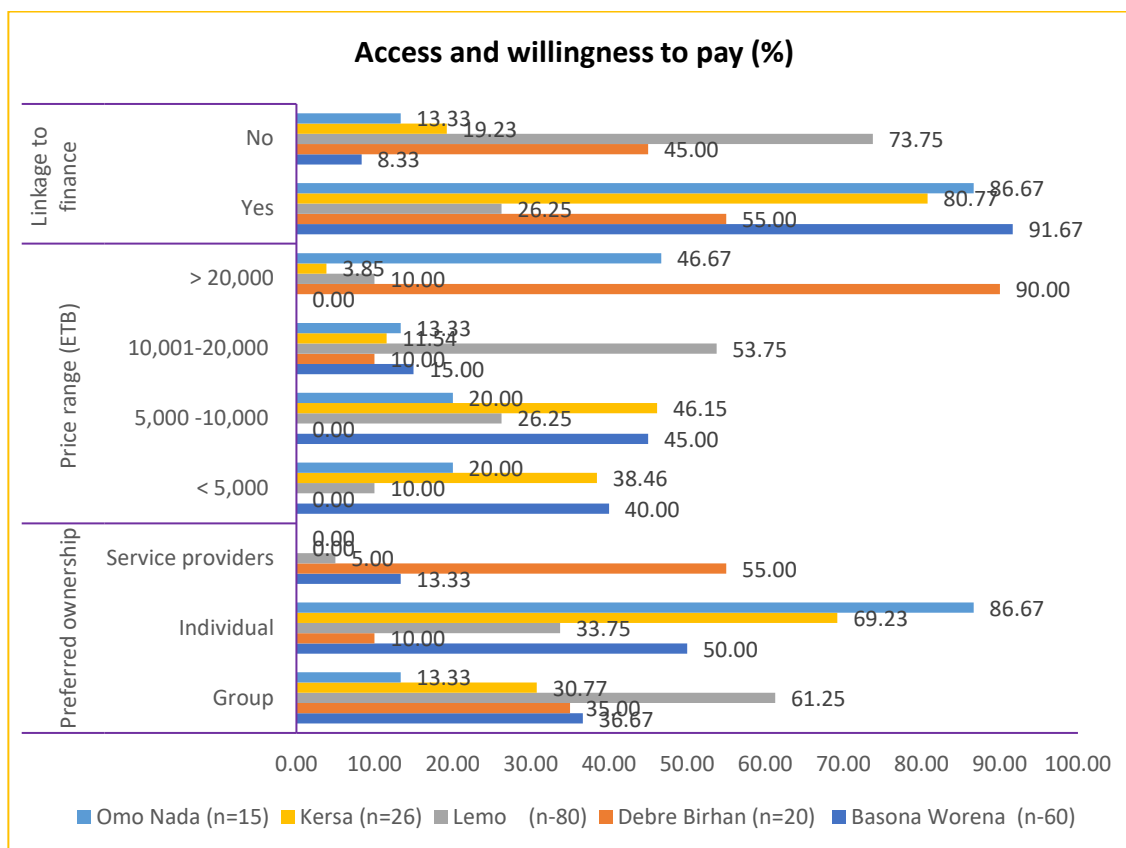
reported in Lemo (18.75%) district. However, the use of both diesel-powered and electric-powered types was below 10% in four of the districts. Despite the low level of awareness and use, respondents across all districts showed strong interest in accessing forage chopper machines. The highest demand was recorded in Lemo (100.00%) and Kersa (100.00%), followed by Basona Worena (98.33%) and Omo Nada (93.33%) districts (Figure 4).



**Figure 4.** Farmers knowledge and use of feed chopper machines across the sites.

### Access and willingness to pay for feed chopper machines

The preferred ownership arrangements for feed chopper machines varied among the study districts. Group ownership was most preferred in Lemo district, where 61.25% of respondents favored this arrangement. On the contrary, individual ownership was most common in Kersa and Omo Nada districts, where 86.67% and 69.23% of respondents respectively preferred to own chopper machines individually. The service-provider ownership model was reported with notable proportions in Debre Birhan districts (55.00%). The observed variations in ownership preferences may be attributed to differences in farmers purchasing power, the level of development of farmer group arrangements and the availability of service providers in each district (Figure 5).



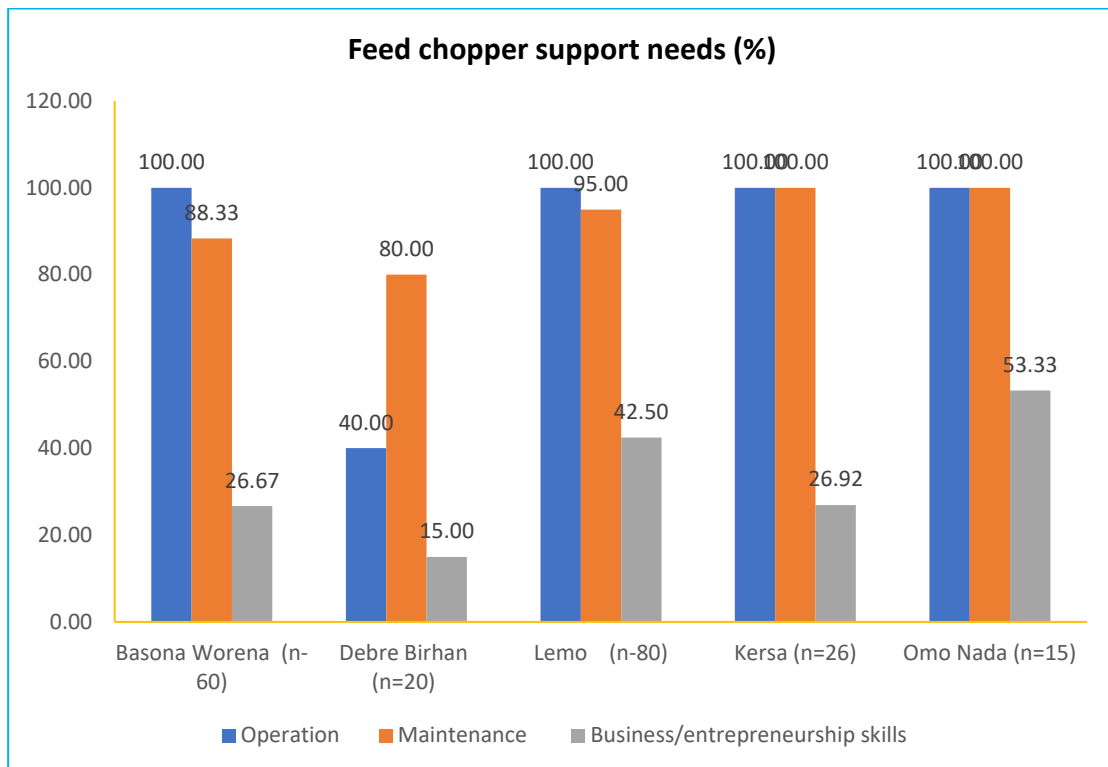
**Figure 5.** Farmers access and willingness to pay for feed choppers for the five districts.

The affordable price range for feed chopper machines varied across the study districts. The highest proportion of farmers in Basona Worena (40.00%) and Kersa (38.46%) preferred machines costing less than 5,000 ETB. Similarly, the highest proportions of respondents in Kersa (46.15%) and Basona Worena (45.00%) preferred chopper machines priced between 5,000 and 10,000 ETB. In Lemo district, 53.75% of respondents indicated an affordable price range between 10,000 to 20,000 ETB. Respondents in Debre Birhan district demonstrated relatively higher purchasing capacity, with the highest proportion (90.00%) indicating an affordable price of more than 20,000 ETB. However, the affordable price ranges reported by respondents are far below the current market price of diesel-powered feed chopper machines, which is approximately 240,000 ETB. This substantial price gap highlights the need to promote group ownership schemes and service-provider models to improve farmers' access to feed chopper machines across all study districts. In addition, farmers existing linkages to financial service providers and cooperatives were assessed. The highest levels of financial linkage were observed in Basona Worena (91.67) followed by Omo Nada (86.67%) and Kersa (80.77%) districts. Lemo district exhibited the lowest level of linkage to financial institutions and cooperatives, with only 26.25% of farmers reporting access.

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### Feed chopper machines support need

Farmers support needs related to the operation, maintenance and business/entrepreneurship aspects of feed chopper machines were assessed. Respondents from all four districts reported a high demand for training in feed chopper operation with proportions reaching 100.00%. However, respondents in Debre Birhan showed relatively lower demand for operational skills (40.00%). More than 80.00% of respondents in the five study districts requested support in maintenance skills. Business and entrepreneurship skill support was also mentioned, with notable proportions in Omo Nada (53.33%) and Lemo (42.50%) districts. Variations in support needs among districts are mainly due to differences in prior experience with feed chopper machines, access to extension and training services, and levels of technical knowledge. Districts with limited exposure require more operational and maintenance support, while areas with better awareness show lower demand. Differences in livestock production systems, economic capacity, and market access also influence the demand for business and entrepreneurship skills (Figure 6).



**Figure 6.** Feed chopper machines related support across the sites.

### Conclusion and recommendation

The study demonstrates that feed preparation remains a major bottleneck to efficient livestock production in the Ethiopian highlands. Smallholder farmers overwhelmingly depend on manual feed chopping practices that are labor-intensive, inefficient, unsafe, leading to low feed utilization and high levels of wastage. Although awareness and use of motorized forage chopper machines are currently very limited, farmers across all study districts showed strong demand for feed chopper technologies.

The findings underscore that affordability, access to appropriate ownership models, and institutional support are critical factors influencing the adoption of feed chopper machines. A significant gap exists between farmers willingness to pay and the prevailing market prices of available motorized choppers, indicating the need to promote group ownership schemes, service-provider models, and linkages with financial institutions and cooperatives.

Overall, the need assessment study confirms that introducing affordable, small-scale feed chopper machines alongside targeted support in operation, maintenance, and business skills is key to improving feed utilization, reducing labor and feed wastage, and enhancing livestock productivity in the Ethiopian highlands.

## **Acknowledgments**

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### Annex 1. Survey questionnaire

#### Needs Assessment Survey: Small Forage Chopper Machines in the Ethiopian Highlands

##### Part A. RESPONDENT INFORMATION

1. Name of Respondent: \_\_\_\_\_
2. Woreda / Kebele: \_\_\_\_\_
3. Gender:  Male  Female
4. Age Group:  <25  25–35  36–50  >50
5. Education:  illiterate,  primary,  secondary,  college certificate and above
6. Main Livelihood Activity:  Dairy  Fattening  Mixed Farming  Other:  
\_\_\_\_\_

##### Part B. CURRENT FEEDING AND CHOPPING PRACTICES

6. What feed types do you use? (Select all that apply)  Natural grass  Crop residues  Purchased concentrates  Improved forage  Others (specify):  
\_\_\_\_\_
7. Do you chop some feeds/forages before feeding? (Yes, No)
8. If no, why not?
9. If yes, what feed types do you chop?
10. How do you currently chop or prepare feed?  By hand  Sickles/machetes  Manual chopper  Motorized chopper  I don't practice chopping
11. What challenges do you face in feed preparation?  Labor shortage  Time consuming  Poor quality  Lack of tools/equipment  Others (specify):  
\_\_\_\_\_

##### Part C. KNOWLEDGE AND USE OF FORAGE CHOPPER MACHINES

9. Have you ever used a forage chopper machine?  Yes  No
10. If yes, what type?  Manual  Diesel  Electric  Don't know
11. Are you interested in using a forage chopper machine?  Yes  No  Maybe
12. What features are most important to you in a chopper machine? (Rank top 3)  Low cost  Portability  Safety  Speed  Manual operation  Electric powered  Diesel powered

##### Part D. ACCESS AND WILLINGNESS TO PAY

13. Preferred ownership or access model:  Individual ownership  Group ownership  Renting from other service providers
14. What is an affordable purchase price range (in ETB)?  < 5,000  5,000–10,000  10,000–20,000  > 20,000
15. Are you currently linked to any financial service providers or cooperatives?  Yes (specify): \_\_\_\_\_  No
16. If no, would like to be linked to any financial service provider? (Yes, No)
17. If yes, to which service provider?

18. If no, why not?

Part E. SUPPORT NEEDS AND SERVICE DELIVERY OPTIONS

16. What support or training would you need to effectively use and maintain the machine?  Operation  Maintenance  Business/entrepreneurship skills  None  Other (specify): \_\_\_\_\_

17. Are there youth groups or cooperatives or individuals in your area that could offer forage chopping services?  Yes  No  Don't know

