BRIDGE+
Practice Brief 01


A woman dairy farmer taking silage from a silo silage bag to feed to her cow.

Transforming Livestock Productivity Through Adoption of Improved Fodder and Feeding Technologies

May **2026**

Background

The livestock sector is a critical pillar of Ethiopia's economy, contributing 17–25% to the national GDP, 39–49% to the agricultural GDP, and accounting for more than 50% of rural household income. Despite its importance, livestock productivity remains low, largely due to inadequate quantity and quality of feed resources and widespread reliance on traditional production systems.

Feed resources, especially during dry seasons, are dominated by low-quality natural pastures and crop residues that are deficient in crude protein, vitamins, and metabolisable energy. To meet the growing demand for milk products and strengthen agricultural resilience, the adoption of **Fodder and Feeding Technologies (FFTs)** has become essential. These technologies offer pathways to enhance feed quality and availability, improve livestock productivity, and ultimately uplift rural livelihoods. Recent evidence from the BRIDGE project and the follow up phase BRIDGE+ in Amhara, Oromia and Sidama Regions has shown the transformative potential of FFTs when appropriately adopted and scaled.

BRIDGE+

Building Rural Income through inclusive Dairy Business Growth in Ethiopia (BRIDGE+) is a five-year (2023-2027) project financed by the Embassy of the Kingdom of the Netherlands, Addis Ababa and implemented by a consortium of SNV, Agriterra and Wageningen University & Research.

The project aims to foster a dairy value chain that creates inclusive and sustainable benefits for all participants, including the wider society, with a particular focus on smallholder farmers in mixed farming systems. It works across all functions of the dairy value chain, from production to end markets.

R&D Component:

Research and Development (R&D) is one of the ten components of the BRIDGE+ project. The component aims to generate evidence to inform project implementation and influence dairy related policy. It is jointly implemented by SNV and WUR. The component collaborates with more than 14 local implementing partners, including federal and regional agricultural research institutes, universities, and professional associations.

Embassy of the Kingdom of the Netherlands



A dairy farmer harvesting improved fodder beet for dairy cattle feed.

Given the low adoption rates despite ongoing interventions, it is essential to analyse the factors influencing farmers' decisions to adopt FFTs. Understanding these factors, along with conducting a cost-benefit analysis, can help identify practical, economic, and institutional barriers while also demonstrating the potential returns on investment, critical for informing policy and designing more effective, targeted scaling strategies.

Objectives

The main objective of this study was to identify adoption and scaling pathways and to analyse the cost-benefit for FFTs among specialised, market-oriented smallholder dairy farmers in Ethiopia, with the aim of promoting sustainable dairy production intensification.

The specific objectives include:

- To identify and categorise factors that influence the adoption and scaling of FFTs across different dairy communities.
- To assess the short- and long-term people-profit-planet costs and benefits of these technologies and to recommend optimal pathways for their widespread adoption and scaling within the Ethiopian dairy sector.

Livestock production requires a substantial amount of good quality feed and appropriate feeding systems for increased productivity and improved livelihood of the livestock keepers. Current practices heavily depend on traditional, low-input feeding systems that cannot meet the nutritional demands of animals, especially during dry periods. This feed gap threatens the sustainability of the livestock sector, even as demand for milk and other animal-source foods continues to grow. Recognising this challenge, the BRIDGE project initiated targeted interventions, including smart subsidies for forage seeds, establishment of demonstration plots, and promotion of crop residue treatment, supplementary feeding, and silage-making techniques. However, there remains limited empirical information on the adoption rates, scaling pathways, and cost-benefit outcomes associated with these FFTs. Accordingly, the FEED4MILK action research project was launched to address these knowledge gaps, specifically aiming to identify key factors influencing the adoption and scaling of FFTs, while simultaneously assessing the economic, social, and environmental costs and benefits of their use in smallholder livestock systems.

Methods

The research employed a mixed research approach encompassing various data sources and methodologies. Three distinct data collection instruments were administered. The household survey was collected from 160 households in Amhara, 276 households in Oromia and 134 households in Sidama regions, totaling **570 households**, using a structured questionnaire. Qualitative data was collected through focus group discussions (FGD), consisting of eight to twelve participants per district, and key informant interviews (KIIs) were held in each district.

Descriptive statistics and econometrics models were used to analyse the data. A multivariate probit model, that assumed multiple binary adoption decisions for each feed and fodder technology, was also used to analyse the determinants of Fodder and Feeding Technologies (FFTs) adoption.

The study was conducted in 13 districts: four in Amhara (Bahirdar Zuria, North Mecha, Dangila and Banja), seven in Oromia (Lemu Bilbilo, Digelu Tijo, Tiyo, Shashemene, Kofele, Adea and Adama), and two in Sidama (Wondogenet, and Aleta Chuko).

Key Findings

Adoption Patterns

According to the study, 70% of farmers have adopted one or a combination of Fodder and Feeding Technologies (FFTs). The highest proportion of adopters was reported in the Sidama region, where 95% of the surveyed farmers had adopted FFTs, followed by the Amhara region (66%) and the Oromia region (60%).

Among adopters, the study revealed notable variations in the adoption patterns of specific FFTs—namely Improved Forage Production (IFP), Crop Residue Treatment (CRT), and Silage Making Technology (SMT)—in the surveyed smallholder dairy farmers across the targeted regions. Overall, 65% of farmers adopted IFP, followed by SMT at 28% and CRT at 23%.

Adoption patterns also varied across regions. The highest proportion of farmers adopting Improved Forage Production (IFP) was reported in the Sidama region (95%), followed by the Amhara region (59%) and the Oromia region (55%). In contrast, adoption of SMT was highest in the Oromia region (36%), followed by the Amhara region (33%), while only 6% of farmers in the Sidama region reported adopting SMT. Regarding CRT, the highest adoption was observed in the Oromia region (29%), followed by the Amhara region (24%) and the Sidama region (11%).

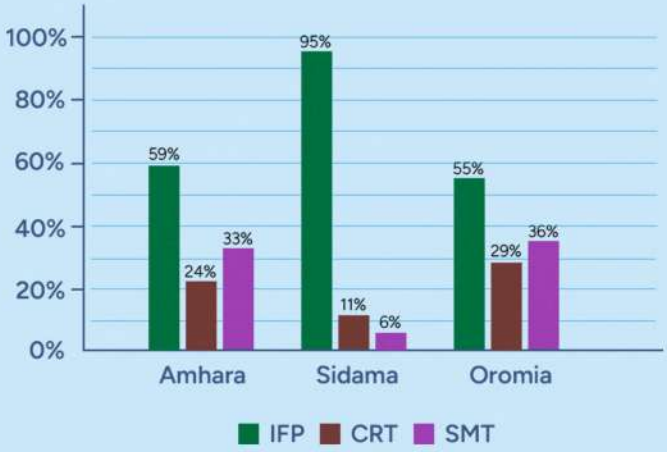


Figure - 1: Proportion of adopters of different Fodder and Feeding Technologies by Region.



Figure - 2: Proportion of overall adopters

Barriers

Forage production: Major challenges include land shortages, competition with crop production, limited access to quality forage seeds and planting materials, labour-intensive management, inadequate training, and security concerns. There is a general notion of prioritising cereal and vegetable production over forage crops and the tendency to allocate only marginal areas for forage production.

Crop residue treatment: Key challenges include lack of willingness, small quantities of crop residues produced, limited and costly inputs (e.g., molasses, effective microorganisms, urea, and plastic bags), safety concerns regarding urea, lack of choppers, and labour intensity.



Livestock extension experts participating in hands-on training on crop residue treatment.

Silage making: Several interrelated factors were mentioned as causal factors for the low adoption rate than the other feeding technologies. Key challenges include lack of proper awareness and know-how, limited access to additives, labour-intensive management, absence of a chopper, insufficient technical support, and a shortage of ensiling plastic bags or silos.

Table 1: Determinants of Dairy Farmers' Adoption of FFTs: Results from a Multivariate Probit Model

Variables	Description	IFP	CRT	SMT
malehhd	=1 if the household head is male	-0.144(0.222)	-0.241(0.218)	0.059(0.213)
age	Age of the HH head (Years)	-0.012(0.008)	0.003(0.008)	0.004(0.007)
landhol	Land holding in timad	0.012(0.012)	0.023*(0.013)	0.027**(0.013)
livholding	Livestock holding in tlu	0.003(0.018)	0.045**(0.020)	0.071***(0.019)
coop_village	=1 if the household lives in village coop.	-0.133 (0.182)	0.442***(0.161)	0.446***(0.157)
Training_FFT	=if the household get training on FFTs	0.065**(0.031)	0.047*(0.026)	-0.026(0.031)
Age 15_65	Active labour force (Number)	-0.281(0.221)	-0.401(0.255)	-0.018(0.223)
disroad	Distance to road (hours in one-way adult walking)	-0.225(0.143)	-0.440**(0.171)	-0.051(0.126)
disFTC	Distance to FTC (hours in one-way adult walking)	0.068(0.216)	0.475**(0.211)	0.363*(0.207)
dismkt	Distance to FTC (hours in one-way adult walking)	0.069(0.214)	0.490**(0.210)	0.479**(0.211)
educ2	Read and write with informal education	-0.358(0.486)	-2.495***(0.540)	-2.765***(0.555)
educ3	Grade level	0.065**(0.031)	0.047*(0.026)	-0.026(0.031)
Constant		-0.281(0.221)	-0.401(0.255)	-0.018(0.223)
r12	Correlation between FFP & CRT	0.150 (0.097)		
r13	Correlation between FFP & SMT	0.275***(0.100)		
r23	Correlation between CRT& SMT	0.502***(0.084)		
Log Likelihood				-693.67
Wald test chi2(36)				295.70
Obs.				452

Key Factors Influencing Adoption of FFTs

Our analysis revealed several important factors influencing the adoption of Fodder and Feeding Technologies (FFTs) among smallholder farmers.

- Training on FFTs emerged as the most influential factor, significantly increasing the likelihood of adopting IFP, CRT, and SMT.
- Larger landholdings were positively associated with IFP adoption, while greater livestock holdings significantly increased the likelihood of adopting CRT and SMT.
- Membership in village cooperatives had a mixed effect: it is negatively associated with IFP adoption but significantly and positively associated with CRT and SMT uptake.
- Age of the household head positively affected adoption of CRT, while distance to roads negatively influenced SMT adoption, reflecting the role of accessibility in technology use.
- Interestingly, distance to markets showed a positive effect on SMT adoption, possibly indicating that market-distant farmers prefer on-farm feed storage.
- Educational status, both informal and formal, associated with both CRT and SMT adoption.
- A significant positive correlation between CRT and SMT adoption decisions suggests complementarities between these two technologies, while their associations with IFP were positive but not statistically significant.

The findings underscore the multifaceted nature of FFTs adoption among smallholder farmers. The consistently positive and significant impact of training across all three technologies highlights the central role of capacity building in enhancing the uptake of improved feed practices.

This reinforces the need for robust extension services and farmer field schools focused on FFTs.

The positive impact of land and livestock holdings on IFP and CRT/SMT, respectively, reflects resource-based constraints and incentives. Farmers with larger land parcels are more likely to allocate space for forage cultivation, while those with more livestock may perceive greater returns from adopting CRT and SMT to sustain feed supply. Village cooperative participation presents a nuanced effect. While it is negatively associated with IFP adoption, its strong association with CRT and SMT adoption suggests that cooperatives may focus more on disseminating post-harvest or conservation-based feed technologies. This divergence implies that cooperative-based interventions should diversify their training and resource support to include forage cultivation.

The positive correlation between CRT and SMT adoption suggests a synergistic relationship; adopting one increases the likelihood of adopting the other, likely due to shared knowledge or resource requirements. However, the lack of significant correlation between FFP and the other technologies implies that forage production may be a distinct decision, influenced by different constraints or opportunities. Educational attainment, both formal and informal, appears to facilitate CRT and SMT adoption. This finding aligns with broader literature that emphasises the role of knowledge and literacy in enabling technology uptake, especially those involving technical handling or storage techniques.

Overall, the results suggest that promoting FFT adoption requires context-specific, multi-dimensional interventions, including access to training, consideration of household resource endowments, and better infrastructure, tailored to the specific technology being promoted.



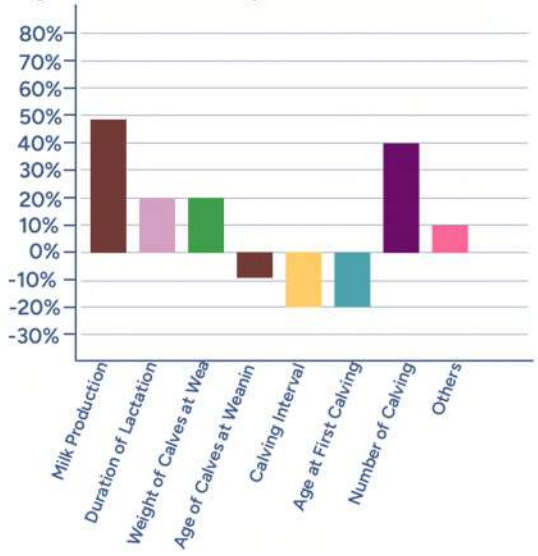
A dairy farmer harvesting improved fodder (Oats) for dairy cattle feed.

Impacts of FFTs Adoption (Performance Metrics)

The use of FFTs technology has a positive impact on dairy farmers by increasing milk production, extending lactation length, improving calf weaning weight, and increasing the number of calvings. It also contributes to reducing the age at weaning, shortening the calving interval, and lowering the age at first calving, among other benefits.

Figure-3 illustrates the percentage effects of FFTs on major dairy production and reproductive performance indicators. Substantial positive impacts are observed in milk production (48%) and number of calvings (40%), with moderate gains in lactation length and calf weight at weaning (approximately 20% each).

Figure 3: Percentage Effects of FFTs



Conversely, reductions in age at weaning, calving interval, and age at first calving indicate improvements in reproductive efficiency. Overall, FFTs enhance both productivity and herd reproductive performance.

Cost Benefit Analysis of FFTs

The comparative assessment of FFTs across Amhara, Sidama, and Oromia indicates that adoption entails higher input and management costs relative to the business-as-usual system but generates substantial productivity and income gains. Oromia allocates larger land areas and applies more compost and fertiliser, while Sidama incurs higher labour, transport, and land rental costs; Amhara shows relatively moderate costs except for higher seed expenses. Despite these cost variations, FFT adoption significantly increases milk yield and lactation duration compared to baseline practices, resulting in strong gross revenues and positive net benefits in all regions. Net returns are highest in Sidama, followed by Amhara, with Oromia recording comparatively lower, though still economically viable, benefit–cost performance. Overall, FFTs demonstrate clear financial and production advantages over conventional feeding systems.

The study concludes that FFT adoption significantly enhances dairy productivity and profitability. Net benefits, and consequently cost–benefit ratios, are highest in Sidama, followed by Amhara, while Oromia records the lowest returns, as reflected in its cost–benefit ratio. Nevertheless, the ratios indicate that FFTs are economically viable across all three regions, with particularly strong performance in Sidama and Amhara.

Table 2: Cost Benefit Ratios

Performance Indicators and Benefits	Administrative Region		
	Amhara	Sidama	Oromia
Milk production from FFTs in liter/cow/day	9.26(2.18) [103]	9.68(4.47) [67]	9.87 (3.54) [197]
Milk production from base scenarios in liter/cow/day	6.23(1.76) [150]	3.61 (2.10) [127]	6.66(4,983.99) [178]
Duration of lactation from FFTs in Days	236.19(42.62) [104]	236.92(51.02) [72]	224.11 (105.78) [178]
Duration of lactation from base scenarios in Days	196.74(24.05) [152]	196.74(24.05) [152])	196.74(24.05) [152]
Average Market price of milk in Birr/liter	49.47(9.41) [148]	53.92 (7.83) [127]	51.22 (6.83) [187]
No of dairy cows feed by FFTs	4.27(9.69) [94]	6.19(18.36) [127]	3.82(3.05) [207]
Gross revenue from milk	**188,440.12**	**528,401.14**	**176,422.5**
Net Benefit (Revenue minus cost)	**168,938.88**	**472,917.57**	**131,077.98**
Cost benefit Ratio	**9.66**	**9.52**	**3.89**

Note: The table reports mean values with standard deviations in parentheses and number of observations in brackets. All monetary values are measured in ETB. Source: field survey data from Amhara, Sidama, and Oromia (2025).

Recommendations

The study finds that the adoption of FFT is shaped by household resources, institutional support, and geographic access. Among all factors, training is the most consistent and significant driver of adoption, underscoring the importance of knowledge transfer and capacity strengthening.

Household characteristics like land size, livestock ownership, and education influence adoption patterns differently across technologies. Village cooperative membership also plays a role, especially for CRT and SMT, though its impact varies, suggesting the need for tailored engagement.

Geographic barriers, such as distance from infrastructure, limit adoption, particularly for SMT, pointing to the need for better rural connectivity.

To improve uptake:

- **Expand and strengthen training and advisory services:** through farmer field schools, digital extension messages, and other best-fit extension delivery mechanisms, to enhance farmers' skills and support the wider adoption of forage and feed technologies.
- **Target interventions based on household resources:** promote IFP to households endowed with relatively greater land holdings, and CRT/SMT to those with larger herds and limited alternative sources of feed.
- **Strengthen village cooperatives** and expand their capacity to deliver training and advisory services, as well as improve farmers' access to essential inputs.
- **Invest in infrastructures** such as mobile extension services, and local feed facilities to support remote farmers.
- **Integrate FFTs into national agricultural strategies,** enhance supply linkages for key inputs, and expand skill development opportunities to promote the adoption of improved forage production, fodder conservation, improvement of crop residue treatment and improved feeding management practices.

Implications for Policy and Practice

- **Prioritize Farmer Training and Experience Sharing Among Farmer Groups:** Training and demonstrating success stories through experience sharing visits among farmers groups is the most consistent driver of technology adoption. Expanding targeted, practical training through Farmer Field Schools and other extension services delivery mechanisms is essential for scaling FFTs.
- **Align Technologies with Household Resources:** Adoption is influenced by household assets. Tailor promotion strategies—encourage IFP for farmers with greater land holdings and CRT/SMT for those with larger livestock holdings—to maximize impact.
- **Strengthen and Diversify Village Cooperatives:** Cooperatives are vital channels for technology dissemination, especially for CRT and SMT. Broadening their focus to include forage cultivation and strengthening their institutional capacity can enhance their effectiveness.
- **Address Geographic Barriers:** Remote households face adoption challenges due to poor infrastructure. Invest in rural roads, mobile extension services, and decentralized input and feed processing systems to improve access.
- **Promote Access to Educational:** Boosting both formal and informal education improves farmers' capacity for greater adoption of forage production, feed technologies and improved feeding management practices, ensuring long-term sustainability and impact.



Farmers chopping oats and vetch to prepare silage.

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