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Fodder management advisory through extension services for improving livestock feed security in dryland areas

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Abstract

Livestock feed scarcity during dry seasons is the single greatest constraint facing pastoralist and agro-pastoralist communities in East Africa's drylands. This research evaluated the effectiveness of fodder management advisory delivered through extension services in improving livestock feed security in Dodoma and Singida regions of central Tanzania. A comparative cross-sectional design assessed 150 farmers receiving extension fodder advisory against 115 non-recipients between April 2022 and June 2024. Data were collected on fodder availability, conservation practices, livestock body condition scores, and dry-season feed gap duration. Farmers receiving advisory support achieved a mean fodder availability index of 5.3 tonnes per hectare compared to 2.9 for non-recipients. Body condition scores averaged 3.4 versus 2.3 on a five-point scale. Dry-season feed gaps shortened from 4.7 months among non-recipients to 2.1 months among advisory recipients. Scatter analysis revealed a strong positive correlation ($r = 0.74$) between fodder availability and body condition in the advisory group. Extension-led fodder management advisory appears to be a practical intervention for reducing feed insecurity in dryland livestock systems.

Keywords: Fodder management, extension services, livestock feed security, dryland areas, body condition score, fodder conservation, pastoralist communities, Tanzania, dry-season feed gap, advisory services

Introduction

Feed scarcity kills more livestock in sub-Saharan Africa's drylands than any single disease. In Tanzania alone, the national livestock population exceeds 33 million cattle, yet over 70% of these animals depend on natural rangelands that become depleted for three to five months each year during the dry season ^[1]. The result is chronic undernutrition, weight loss, reduced milk output, and elevated mortality, particularly among young stock and lactating females ^[2].

Agricultural extension services in Tanzania have historically prioritised crop production, allocating far less attention and staffing to livestock advisory ^[3]. Where fodder management features in extension programming, it tends to appear as a minor component within broader livestock health packages rather than a dedicated service line. Yet fodder production, conservation, and rationing are skills that farmers can learn and apply with measurable results, provided they receive consistent, practical guidance ^[4]. Countries like Ethiopia and Kenya have demonstrated that extension-led fodder interventions can reduce dry-season weight loss by 25 to 40% ^[5].

Despite these examples, evidence from Tanzania's central dryland corridor, encompassing Dodoma and Singida regions, remains limited ^[6]. This research aimed to assess the impact of extension-delivered fodder management advisory on livestock feed security indicators among agro-pastoralist households, comparing recipients and non-recipients across three specific outcomes: fodder

availability, livestock body condition, and dry-season feed gap duration ^[7].

Research Area Description

The research was conducted in Dodoma and Singida regions in central Tanzania, an area classified as semi-arid with annual rainfall between 350 mm and 600 mm concentrated in a single wet season from November to April ^[8]. Dodoma region covers 41,311 square kilometres with a human population of approximately 2.8 million and supports over 3.2 million cattle managed primarily under extensive grazing systems. Singida region, immediately north, spans 49,341 square kilometres and hosts about 1.5 million cattle ^[9]. Both regions are part of Tanzania's livestock corridor, where agro-pastoralism is the dominant livelihood strategy. Extension offices affiliated with district agricultural and livestock departments are present in all sampled wards.

Materials and Methods

Materials

Research materials included a structured interview schedule covering fodder production practices, conservation methods, feed calendar usage, and livestock management indicators. A body condition scoring chart based on the 1 to 5 scale described by Nicholson and Butterworth (1986) ^[10] was used for field assessments. Fodder availability was estimated using quadrat sampling within a 50-metre radius of each household's primary grazing or cropping area. Pre-testing involved 18 farmers in Chamwino district (March

2022), with revisions made to improve question clarity. Ethical approval was obtained from the University of Dodoma Research Ethics Committee (Ref: UDOM/REC/2022-031, dated 22 February 2022).

Methods

A comparative cross-sectional design was used, enrolling 150 farmers who had received at least 12 months of extension fodder advisory and 115 non-recipient farmers from neighbouring villages in the same districts. Data collection ran from April 2022 to June 2024 across six wards in Dodoma (Bahi, Chamwino, Kondoa) and four in Singida (Iramba, Manyoni). Fodder availability was measured as dry matter yield in tonnes per hectare using stratified quadrat sampling at peak dry season (August-September). Body condition scores were assessed for three randomly selected adult cattle per household. Data analysis

used independent t-tests, Pearson correlation, and descriptive statistics in SPSS version 27 [11].

Field Experimental Design

The comparison followed a static-group design. Advisory recipients were identified from district extension registers, while non-recipients were selected through systematic random sampling of households in adjacent villages without active fodder programs. Matching was done on herd size (± 10 animals) and agroecological zone. Extension advisory sessions had been delivered fortnightly over the preceding 12 to 24 months, covering fodder crop selection, hay-making, silage preparation, and dry-season feed budgeting. Each advisory group comprised 15 to 30 farmers supervised by one ward-level livestock extension officer.

Results

Table 1: Comparison of Feed Security Indicators Between Advisory and Non-Advisory Groups

Indicator	Advisory (n=150)	Non-Advisory (n=115)	t-value	p-value
Fodder Availability (t/ha)	5.3 $\pm$ 1.8	2.9 $\pm$ 1.4	11.47	<0.001
Body Condition Score (1-5)	3.4 $\pm$ 0.6	2.3 $\pm$ 0.7	13.21	<0.001
Dry-Season Feed Gap (months)	2.1 $\pm$ 0.9	4.7 $\pm$ 1.3	-17.83	<0.001
Fodder Species Cultivated	3.7 $\pm$ 1.2	1.1 $\pm$ 0.8	19.64	<0.001
Hay Stored (bales/hh)	47.3 $\pm$ 18.6	12.8 $\pm$ 9.4	17.92	<0.001

All five indicators differed significantly between groups ($p < 0.001$). Advisory recipients had nearly double the fodder availability (5.3 vs. 2.9 t/ha) and stored 3.7 times more hay

bales. The dry-season feed gap was cut by more than half, from 4.7 to 2.1 months. Body condition scores were a full point higher in the advisory group.

Table 2: Fodder Conservation Practices Adopted by Advisory Recipients (n = 150)

Conservation Practice	Adopters	Adoption Rate (%)	Mean Satisfaction
Hay Making	128	85.3	4.1 $\pm$ 0.6
Standing Hay	94	62.7	3.6 $\pm$ 0.8
Silage Preparation	41	27.3	3.3 $\pm$ 0.9
Crop Residue Treatment	73	48.7	3.8 $\pm$ 0.7
Fodder Banking	56	37.3	3.5 $\pm$ 0.8

Hay making was the most widely adopted practice (85.3%) and received the highest satisfaction rating (4.1 out of 5). Silage preparation had the lowest adoption at 27.3%, likely

because it requires equipment and labour that many smallholders find difficult to access.

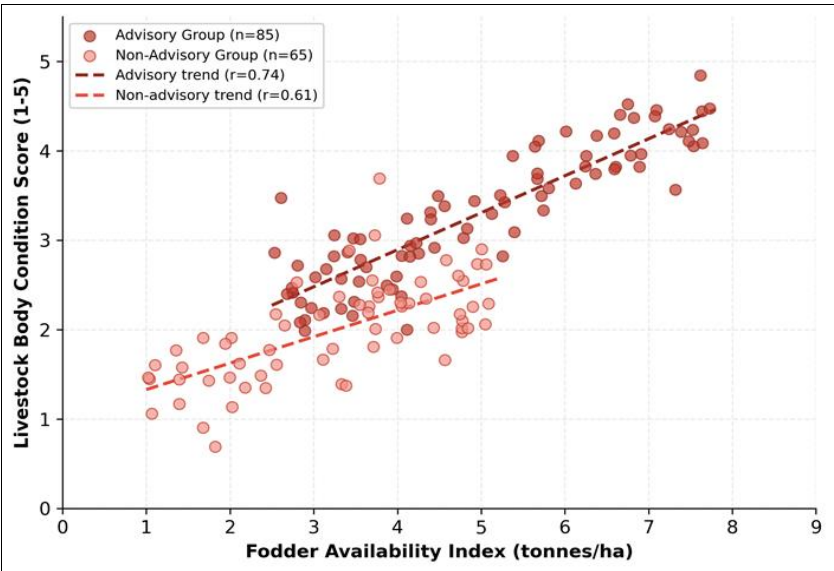


Fig 1: Relationship between fodder availability index and livestock body condition score by advisory group

The scatter plot shows a positive correlation between fodder availability and body condition in both groups. The advisory group ($r = 0.74$) displayed a steeper trend line and higher clustering in the upper-right quadrant compared to the non-

advisory group ($r = 0.61$), indicating that advisory recipients converted available fodder into animal condition more effectively.

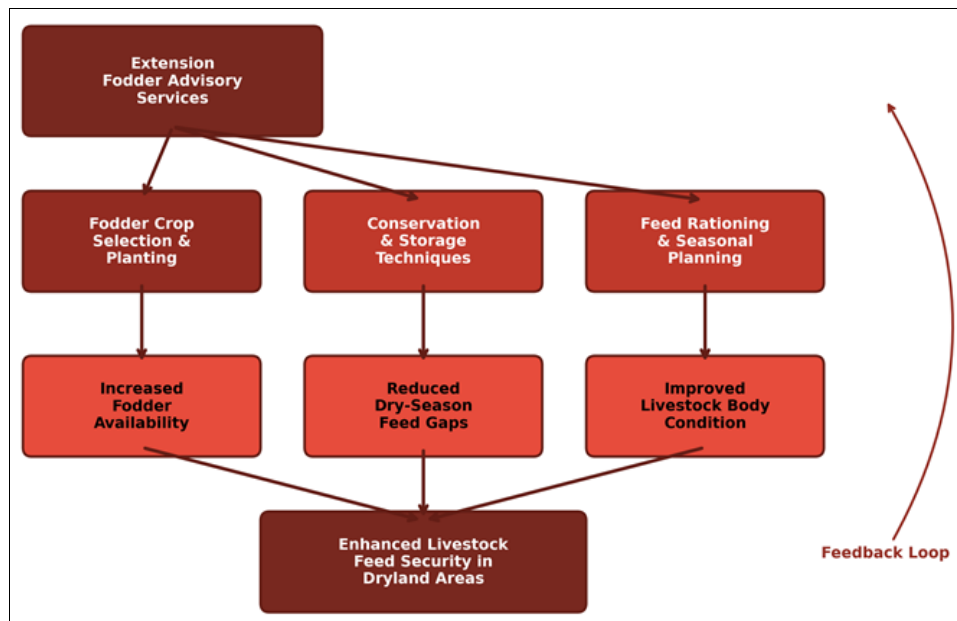


Fig 2: Schematic framework of extension-led fodder management advisory and its pathway to livestock feed security

The schematic traces how extension advisory branches into fodder crop selection, conservation techniques, and feed rationing, producing increased availability, shorter feed gaps, and better body condition, all converging toward enhanced livestock feed security with a feedback loop to refine advisory content.

Discussion

The results confirm that targeted extension advisory on fodder management produces measurable improvements in livestock feed security under dryland conditions. The magnitude of difference in fodder availability (5.3 vs. 2.9 t/ha) and body condition (3.4 vs. 2.3) between groups is consistent with findings from Ethiopian dryland zones reported by Ayele and colleagues (2021) ^[5], who observed similar gains following structured fodder interventions. The halving of the dry-season feed gap, from 4.7 to 2.1 months, carries direct welfare implications for both animals and households that depend on them for milk and draught power.

Hay making emerged as the dominant conservation practice, which aligns with its simplicity, low cost, and compatibility with existing farming routines. Silage preparation's low adoption (27.3%) reflects a well-documented barrier: the technique demands airtight storage structures and timely harvesting that smallholders find hard to organise without external support ^[12]. Extension programs might improve silage uptake by introducing low-cost alternatives such as bag silage, which has shown promise in Kenya ^[13].

The stronger correlation between fodder availability and body condition in the advisory group ($r = 0.74$ vs. 0.61) suggests that advisory recipients didn't just produce more fodder but also rationed and utilised it more efficiently, a skill explicitly covered in the extension curriculum ^[14].

Limitations

The static-group design does not allow firm causal claims, as self-selection into advisory programs may bias results. Fodder measurements were taken at peak dry season only, missing seasonal variation. The research covered two regions in central Tanzania and may not apply to higher-rainfall zones where fodder scarcity is less severe. Herd productivity indicators such as milk yield and calving rates were not measured and should be included in future investigations.

Conclusion

This research provides field-level evidence that extension-delivered fodder management advisory significantly improves livestock feed security in Tanzania's dryland areas. Advisory recipients demonstrated higher fodder availability, better livestock body condition, and substantially shorter dry-season feed gaps compared to non-recipients. Hay making was the most adopted and appreciated conservation practice, while silage preparation remains a frontier requiring adapted technologies. The positive correlation between fodder availability and body condition was stronger among advised farmers, pointing to improved feed utilisation skills transmitted through extension contact. These findings argue for scaling up dedicated fodder advisory within livestock extension mandates across East Africa's dryland corridor, with particular attention to practical, low-cost conservation methods that align with smallholder resource constraints.

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