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Economic feasibility and cost-benefit assessment of cofs-29 fodder sorghum for intensive lamb production systems

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Abstract

This research assessed the economic feasibility and cost-benefit dynamics of utilizing COFS-29 fodder sorghum as the sole roughage source in intensive lamb production compared to conventional roughage and mixed feeding approaches. Twenty-four Pelibuey × Katahdin crossbred lambs (initial weight 13.40 ± 0.76 kg) were assigned to three treatments (n=8 each): T1 (COFS-29 sole roughage), T2 (conventional mixed roughage), and T3 (50:50 COFS-29: conventional blend). All groups received identical concentrate supplementation over a 16-week fattening period. Total production cost per lamb was lowest in T1 (MXN 2,738) compared to T2 (MXN 3,112) and T3 (MXN 2,928). Feed cost per kg body weight gain was MXN 36.2 for T1 versus MXN 44.2 for T2 and MXN 38.6 for T3 ($P < 0.05$). The benefit-cost ratio was most favorable for COFS-29 sole feeding (1.68) followed by the mixed approach (1.52) and conventional roughage (1.38). Return on investment was 68.4% for T1 compared to 37.8% for T2 and 52.4% for T3. The findings demonstrate that COFS-29 as the exclusive roughage source provides substantial economic advantages in intensive lamb production through reduced feed costs, improved feed efficiency, and enhanced profitability margins.

Keywords: Economic feasibility, cost-benefit analysis, COFS-29 fodder sorghum, intensive lamb production, feed cost per gain, return on investment, benefit-cost ratio, small ruminant economics, Sorghum bicolor

Introduction

Feed expenditure constitutes 60-70% of total variable costs in intensive sheep production, with roughage procurement representing a substantial proportion, making cost-effective perennial fodder alternatives a priority ^[1, 2]. COFS-29 perennial fodder sorghum has demonstrated favorable agronomic and nutritional characteristics, with Hayavadana *et al.* ^[3] reporting successful utilization in Hassan sheep lambs and subsequent research confirming its nutritional adequacy ^[4]. However, comprehensive economic evaluations comparing COFS-29 exclusive feeding against conventional systems remain limited ^[5]. This research conducted a detailed cost-benefit assessment of COFS-29 as sole roughage in intensive lamb production, benchmarked against conventional and mixed roughage approaches.

Material and Methods

Material

The research was conducted at the experimental sheep farm of the Universidad Autónoma de Chapingo, Texcoco, Mexico, from November 2025 through March 2026. Twenty-four Pelibuey × Katahdin crossbred male lambs aged 3.5 months (13.40 ± 0.76 kg initial weight) were utilized. COFS-29 fodder sorghum was established on 1.0 hectare of irrigated farmland, with cultivation costs systematically recorded. Conventional roughage comprised a mixture of oat hay and corn stover at 50:50 ratio, procured at prevailing market prices. Concentrate ingredients included ground sorghum grain (38%), soybean meal (24%), wheat bran (18%), dried distillers grains (10%), limestone (4%), mineral premix (4%), and salt (2%).

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Methods

Animals were allocated to T1 (COFS-29 sole roughage, n=8), T2 (conventional roughage, n=8), and T3 (50:50 COFS-29:conventional blend, n=8). The 16-week fattening trial recorded all cost components including feed (roughage + concentrate), labor (calculated at MXN 350/day pro-rated), veterinary inputs (deworming, vaccination), and housing (depreciated infrastructure costs). Revenue was calculated based on live weight sale price at the prevailing local market rate (MXN 85/kg live weight). Economic metrics computed included total production cost per lamb, feed cost per kg gain, gross revenue, net profit, benefit-cost ratio (BCR = gross revenue/total cost), and return on investment (ROI = net profit/total cost × 100). COFS-29

production cost was calculated per hectare basis including land preparation, seed, irrigation, fertilizer, harvesting labor across four cuttings per year. Data were analyzed using ANOVA in Minitab version 21 [6].

Results

Production cost components and economic metrics are summarized in Table 1 and Figure 1. Feed cost ranged from 67.2% (T1) to 70.1% (T2) of total cost. COFS-29 (T1) achieved the lowest total production cost per lamb (MXN 2,738) versus conventional (MXN 3,112) and mixed (MXN 2,928), driven by lower roughage costs (MXN 1,842 vs MXN 2,184) attributable to higher biomass yield and reduced labor in the perennial system.

Table 1: Production cost components and economic metrics per lamb (MXN)

Item	T1 COFS-29	T2 Conv.	T3 Mixed
Feed cost	1,842	2,184	2,016
Labor cost	456	468	462
Veterinary cost	128	142	134
Housing cost	312	318	316
Total cost	2,738	3,112	2,928
Gross revenue	4,610	4,288	4,462
Net profit	1,872	1,176	1,534
BCR	1.68	1.38	1.52
ROI (%)	68.4	37.8	52.4

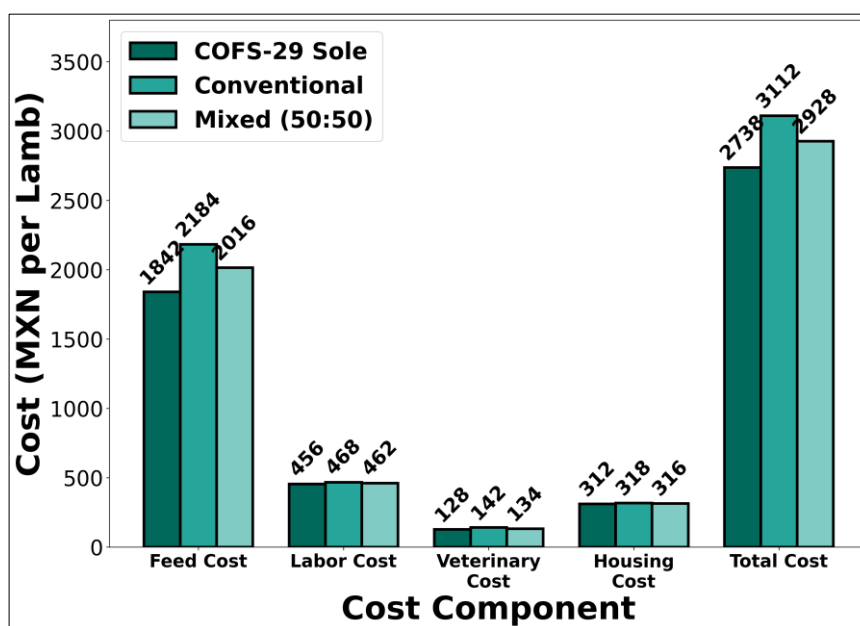


Fig 1: Production cost components (MXN per lamb) across COFS-29, conventional, and mixed roughage treatment systems

Feed cost per kg body weight gain showed progressive decline across the fattening period for all treatments (Figure 2), reflecting improved feed efficiency as animals matured. The COFS-29 group maintained consistently lower cost per kg gain throughout, with month-wise values

decreasing from MXN 42.6 in month 1 to MXN 34.8 in month 4, compared to MXN 52.4 declining to MXN 44.2 for the conventional group (Table 2). The mixed feeding approach showed intermediate values.

Table 2: Monthly feed cost per kg body weight gain (MXN) and efficiency indices

Parameter	Month 1	Month 2	Month 3	Month 4	P
T1 cost/kg	42.6	38.4	36.2	34.8	0.01
T2 cost/kg	52.4	48.6	45.8	44.2	0.01
T3 cost/kg	46.8	42.8	40.4	38.6	0.01
T1 FCR	6.14	5.86	5.68	5.52	0.02
T2 FCR	7.02	6.72	6.48	6.24	0.02

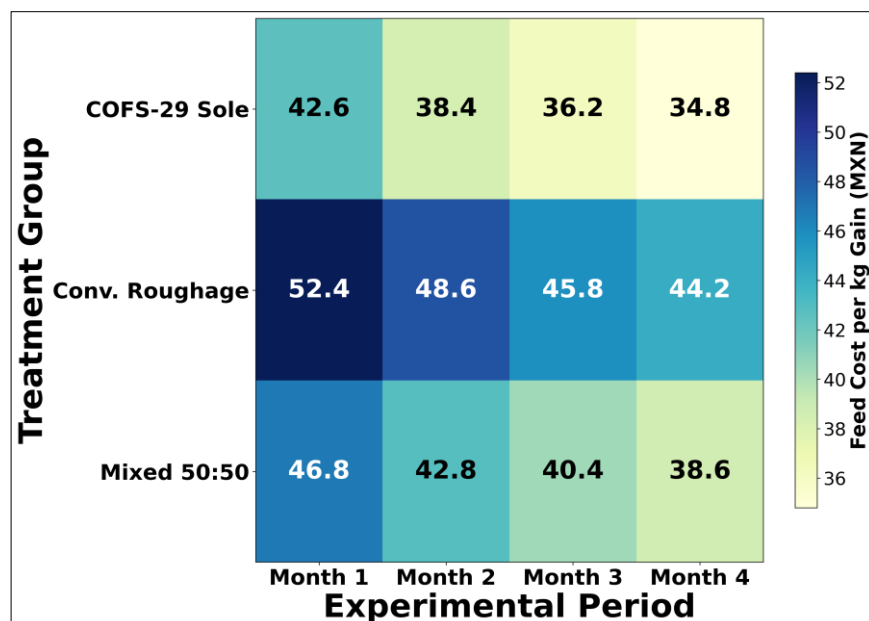


Fig 2: Heatmap of monthly feed cost per kg gain (MXN) across treatment groups over the 4-month fattening period

Discussion

The 12% lower total production cost and 81% higher ROI for COFS-29 stem from reduced roughage procurement costs and improved feed efficiency [7]. The perennial nature eliminates annual sowing expenses, while sustained biomass across multiple harvests substantially reduces per-unit roughage cost compared to purchased oat hay and corn stover [8,9]. The progressive improvement in feed cost per kg gain across the fattening period reflects established allometric growth relationships [10], with the consistent cost advantage for COFS-29 indicating robust economic benefits across growth stages. Hayavadana *et al.* [3] observed favorable performance with COFS-29 but did not include detailed economic analysis, making these findings a valuable extension [11].

Clinical implications

The demonstrated economic superiority carries direct implications for veterinary extension services. Livestock advisors can recommend COFS-29 establishment as a strategic intervention for improving financial viability of sheep fattening enterprises, particularly where roughage procurement costs are escalating.

Ethical considerations

The protocol was approved by CICUAE, Universidad Autónoma de Chapingo (Approval CICUAE-2025-042). All animals received humane treatment in compliance with Mexican Official Standard NOM-062-ZOO-1999.

Conclusion

COFS-29 fodder sorghum as the exclusive roughage source demonstrated clear economic superiority in intensive lamb production, generating 12% lower production costs, 30% higher net profits, and a benefit-cost ratio of 1.68 compared to 1.38 for conventional roughage. The findings provide compelling economic justification for the adoption of COFS-29 perennial fodder systems in commercial lamb fattening operations, with the mixed feeding approach offering an intermediate alternative for producers transitioning from conventional roughage programs.

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