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Boosting Dairy Cow Productivity: Economic Insights from Doum Palm Molasses Feeding in the Semi Arid Region

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A B S T R A C T
This study evaluates the performance metrics of dairy cows fed different dietary treatments, focusing on the effects of Doum palm molasses on milk yield and economic viability. Results indicate that cows in the T2 group (fed Doum palm molasses) produced an average daily milk yield of 2.90 liters, significantly outperforming the control group (T1), which yielded only 1.04 liters. Economic analysis shows that T2 not only generated higher milk revenue (34,800 Naira) but also reduced the cost per liter to 3.62 Naira, demonstrating enhanced profitability. Proximate composition analysis of the silages revealed favorable nutrient profiles, especially in treatments T2 and T3. These findings suggest that incorporating Doum palm molasses can improve milk production and economic returns for dairy farmers, advocating for its use as a sustainable alternative feed source.

INTRODUCTION

Feed resources are critical for optimizing livestock production, particularly in developing countries where dairy farming is essential for food security and income generation (Makkar, 2018). In regions like Sub-Saharan Africa, dairy cattle not only provide a vital source of nutrition through milk but also represent a significant component of rural livelihoods, contributing to cash income and nutritional diversity in household diets (FAO, 2022). However, the sustainability of dairy farming is increasingly threatened by the rising costs of feed and competition for conventional feed ingredients, which are often exacerbated by market volatility and climate change (Chaudhry et al., 2023).

Traditional feed ingredients, such as maize, soybean meal, and cane sugar molasses, have historically been staples in livestock diets. Cane sugar molasses, in particular, has been favored for its high energy content and palatability, enhancing feed efficiency and milk production (Beyene et al., 2023). Nevertheless, the escalating costs associated with these ingredients, driven by global demand and limited supply, have made them less accessible, especially for smallholder farmers who represent a significant portion of the dairy sector in developing countries (Mohammed, 2024).

As the competition for these traditional resources intensifies, there is a pressing need to explore alternative feed sources that can provide similar nutritional benefits at a reduced cost. One promising alternative is Doum palm molasses, derived from the fruit of the Doum palm tree (Hyphaene thebaica), which is prevalent in arid and semi-arid regions of Africa (Elhassan et al., 2023). Doum palm molasses is not only rich in carbohydrates but also contains essential minerals and vitamins, making it a potential substitute for cane sugar molasses in livestock diets (Almuhayawi et al., 2023).

Preliminary studies have indicated that incorporating Doum palm molasses into animal diets can lead to improved growth rates and milk production, particularly when combined with nutrient-rich feed like Napier grass silage (Mohammed, 2024). This combination could enhance the overall feed efficiency and economic viability of dairy farming operations. Moreover, the use of locally available feed resources like Doum palm molasses can contribute to the sustainability of livestock production systems by reducing dependency on imported feed ingredients and promoting local agricultural practices (Roberts et al., 2024).

This study investigates the economic implications of incorporating Doum palm molasses into Napier grass silage, focusing on its effects on dairy cow performance. By assessing the cost-effectiveness of this alternative feed resource, the research aims to provide insights that can help dairy farmers optimize their feeding strategies while ensuring sustainable production practices.

METHOD

A feeding trial was conducted with 30 dairy cows divided into three treatment groups: T1 (control), T2 (Doum palm molasses), and T3 (cane sugar molasses). Each group was fed Napier grass silage treated with their respective molasses types. Data on feed intake, weight gain, and milk yield were collected over a 14-day period. Economic analysis was performed using cost and revenue data associated with each treatment group.

Economic Analysis

The cost per liter of milk produced was calculated for each treatment, considering feed costs, operational expenses, and revenue generated from milk sales.

RESULT

Performance Metrics

Table 1 presents the performance metrics of dairy cows subjected to three different treatments, highlighting key indicators such as average daily milk yield, initial and final body weight, and total feed intake. The treatments are as follows: T1 (control group), T2 (fed Doum palm molasses), and T3 (mixed treatment).

Table 1 Performance Metrics Of Dairy Cows Under Different Treatments

Treatment	Average Daily Milk Yield (liters)	Initial Body Weight (kg)	Final Body Weight (kg)	Total Feed Intake (kg)
T1	1.04	200.33	206.00	172.21
T2	2.90	200.00	210.33	180.53
T3	2,66	200,53	209.00	179.87

T1: Napier grass silage (Control), T2: Doum palm based Napier grass silage and T3: Cane Sugar molasses based Napier grass

The results in table 1 indicate that cows in the T2 group produced an average of 2.90 liters of milk per day, significantly outperforming the T1 group, which yielded only 1.04 liters. The T3 group also demonstrated a commendable yield of 2.66 liters. This substantial difference in milk production suggests that the inclusion of Doum palm molasses in the diet enhances milk yield, likely due to improved nutrient availability and digestibility, which are critical for lactating cows (Mohammed, 2024). Initial body weights across the treatments were relatively consistent, with T1 at 200.33 kg, T2 at 200.00 kg, and T3 at 200.53 kg. However, the final body weights reveal a positive response to the feeding treatments. Cows in the T2 group achieved a final weight of 210.33 kg, reflecting a gain of 10.33 kg. In contrast, T1 only gained 5.67 kg, while T3 gained 8.47 kg. The increased weight gain in the T2 group indicates that Doum palm molasses

not only supports milk production but also contributes to better overall health and growth, which are essential for reproductive performance and longevity in dairy cows (Khan et al., 2023).

Total feed intake was highest in the T2 group at 180.53 kg, followed by T3 at 179.87 kg, while T1 had the lowest intake at 172.21 kg. The higher feed intake in the T2 group may be attributed to the palatability and nutritional quality of Doum palm molasses, which can enhance feed consumption and nutrient absorption (Mohammed, 2024). This aligns with findings that highlight the importance of feed quality in maximizing dairy cow productivity (Khan et al., 2023). From an economic standpoint, the enhanced milk yield observed in the T2 group suggests a favorable return on investment for dairy farmers. The increased production can lead to higher revenues, potentially offsetting the costs associated with using alternative feed sources like Doum palm molasses. Furthermore, the improved body weight gain in T2 indicates better health and productivity, which can reduce veterinary costs and improve reproductive outcomes, ultimately contributing to the sustainability and profitability of dairy operations (Khan et al., 2023).

Table 2: economics in treatments based on feed costs and milk production.

Treatment	Total Feed Cost (Naira)	Milk Revenue (Naira)	Cost per Liter (Naira)
T1	12,000	15,600	11.54
T2	10,500	34,800	3.62
T3	11,500	32,000	4.15

T1: Napier grass silage, T2: Doum palm based Napier grass silage and T3: Cane Sugar molasses based Napier grass

The substantial increase in milk revenue for T2 indicates that the inclusion of Doum palm molasses not only enhances milk production but also translates into higher financial returns for farmers. This aligns with findings that alternative feed sources can improve productivity and profitability in dairy operations (Mohammed, 2024). The dramatic reduction in cost per liter for T2 highlights the economic efficiency of using Doum palm molasses. This treatment not only lowers feed costs but also maximizes milk output, resulting in a more favorable cost structure for dairy farmers. Such efficiency is critical in enhancing the overall sustainability of dairy farming, particularly in resource-limited settings (Khan et al., 2023). The data clearly demonstrate that the use of Doum palm molasses (T2) is economically advantageous compared to traditional feeding strategies. With lower feed costs, significantly higher milk revenue, and a reduced cost per liter, this alternative feed source presents a viable option for improving the profitability of dairy farming operations.

Proximate Composition

Table 3 presents the proximate composition of silages from three different treatments (T1, T2, and T3), detailing key nutritional components that are critical for evaluating the quality of silage as animal feed. The proximate analysis includes dry matter (DM), moisture content (MC), crude protein (CP), crude fiber (CF), ether extract (EE), ash content, and nitrogen-free extract (NFE).

Table 3: Proximate Composition of the Silages Used in the Study

Treatment	DM (%)	MC(%)	CP (%)	CF (%)	EE (%)	ASH (%)	NFE (%)
T1	94.60	5.40	8.92	24.00	2.00	5.50	46.42
T2	94.20	5.80	8.57	22.00	2.00	2.58	43.07
T3	94.60	5.40	9.54	21.03	1.00	6.00	47.54

T1: Napier grass silage, T2: Doum palm based Napier grass silage and T3: Cane Sugar molasses based Napier grass

The high DM percentages across all treatments indicate that the silages are well-preserved, which is essential for maximizing nutrient density and minimizing spoilage during storage (Khan et al., 2023). The variation in CP content suggests that T3 may provide a better protein source for ruminants, which is crucial for supporting milk production and overall animal health (Mohammed, 2024). Lower CF levels in T2 and T3 indicate potentially better digestibility and nutrient absorption, which can enhance feed efficiency in dairy cows (Khan et al., 2023).

All treatments have similar EE values, with T1 and T2 at 2.00% and T3 at 1.00%.

The EE content reflects the fat content of the silage, which is important for energy supply. Although T3 has a lower EE, the overall energy balance should be evaluated in conjunction with other components. Ash content indicates the mineral content of the silage. Higher ash levels in T3 may suggest a greater mineral availability, which can be beneficial for animal health, but excessive ash can also indicate lower feed quality if it comes from soil contamination (Mohammed, 2024). NFE represents the readily available carbohydrates in the silage, which are crucial for energy. The higher NFE in T3 suggests it may be a more energy-dense feed option, potentially leading to better animal performance.

The proximate composition data from Table 3 indicate that T3 may offer the best overall nutritional profile, particularly in terms of crude protein and nitrogen-free extract, which are vital for maximizing dairy cow productivity. The differences in composition among the treatments highlight the importance of selecting appropriate feed formulations to enhance both animal health and economic returns in dairy farming.

CONCLUSION

The findings of this study clearly demonstrate that the inclusion of Doum palm molasses in the diet of dairy cows significantly enhances milk yield and economic profitability. Cows receiving this treatment showed a remarkable increase in average daily milk production and body weight gain compared to traditional feeding strategies. Economically, the reduced feed costs and increased revenue associated with Doum palm molasses present a compelling case for its adoption in dairy farming practices. Additionally, the favorable proximate composition of silages indicates that alternative feed sources can enhance nutrient availability and digestibility, crucial for optimal animal performance. Overall, these results advocate for the strategic use of Doum palm molasses as a viable option for improving the sustainability and profitability of dairy operations.

RECOMMENDATIONS

1. Dairy farmers should incorporate Doum palm molasses into their feeding regimens to enhance milk production and overall cow health.

2. Regularly assess the proximate composition of feeds to ensure optimal nutrient availability and digestibility, adjusting formulations as necessary.

3. Conduct economic evaluations to compare the long-term financial benefits of using alternative feed sources like Doum palm molasses against traditional feeds.

4. Provide training sessions for dairy farmers on the benefits and best practices for feeding with alternative feed sources to maximize productivity and profitability.

5. Encourage further research into the effects of various alternative feed sources on dairy cow performance to identify additional sustainable practices that can be implemented in the industry.

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