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Development Strategy for Bali Cattle Farming Based on Forage Availability within a Sustainable Agribusiness Framework

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Abstract
Forage availability constitutes a decisive constraint in the development and sustainability of Bali cattle agribusiness within smallholder production systems. This study aims to formulate robust forage-based development strategies for Bali cattle farming under a sustainable agribusiness framework. A mixed-methods design was employed, integrating quantitative assessments of forage biomass production, carrying capacity, cattle productivity, and economic performance with qualitative strategic analysis. Primary data were obtained through structured field observations, in-depth interviews, and focus group discussions involving Bali cattle farmers and key stakeholders in Kecamatan Rendang, Karangasem Regency. Strategic positioning was evaluated using the Internal Factor Evaluation (IFE), External Factor Evaluation (EFE), Internal-External (IE) matrix, and SWOT analysis. The results demonstrate that forage availability remains moderate and spatially uneven, directly constraining carrying capacity and production efficiency. The IFE and EFE scores of 2.71 and 2.89 place Bali cattle agribusiness in a selective growth and stability position. SWOT integration confirms that forage-based intensification, crop-livestock integration, and forage conservation practices increase forage availability by 25-32%, improve average daily gain by 18-24%, and reduce feed costs by 15-20%. Sustainability assessment further verifies improvements in nutrient recycling efficiency, soil organic matter, labor productivity, and income stability. These findings conclusively establish forage optimization as a strategic leverage point for strengthening productivity, competitiveness, and sustainability of Bali cattle agribusiness in tropical environments.

Keywords:
Bali cattle, forage availability, sustainable agribusiness, SWOT analysis, development strategy

1. Introduction

The development of Bali cattle farming constitutes a strategic pillar in regional agribusiness systems, particularly in eastern Indonesia, where Bali cattle significantly contribute to rural income generation and domestic beef supply. Empirical studies report benefit-cost ratios exceeding 1.4 in

major production centers, indicating strong economic feasibility under appropriate management conditions [1]. Competitiveness remains uneven across regions due to persistent structural constraints in feed management, with forage costs representing more than 60% of total production expenditures in smallholder systems [2]. Insufficient forage availability directly suppresses growth performance, reduces reproductive efficiency, and weakens farmers' market positioning within the beef value chain [3]. These conditions position forage availability as a decisive factor in shaping sustainable and competitive Bali cattle agribusiness development.

Forage availability functions as a central determinant of production efficiency and economic performance in Bali cattle systems. Quantitative evidence demonstrates that variability in forage quantity and nutritive value significantly influences average daily gain, feed conversion efficiency, and net farm income [4]. Physiological assessments indicate that Bali cattle exhibit adaptive capacity under tropical climatic stress; however, limited forage availability under elevated temperature-humidity index conditions increases metabolic load and constrains productivity [5]. Controlled feeding trials reveal that improved forage quality through grass-legume integration increases live weight gain by approximately 18-25% while reducing feed cost per unit of output [6]. These findings confirm that forage management represents a strategic leverage point rather than a subsidiary production component.

Land resource utilization plays a critical role in determining forage-based development potential. Spatial analysis of land use and land cover shows that only 42-55% of suitable agricultural land in several cattle-producing regions is allocated for forage production, indicating substantial inefficiencies in resource allocation [7]. Integrated agro-livestock systems demonstrate measurable increases in forage biomass production of up to 30% through the utilization of crop residues and rotational land management practices [8]. Nutrient recycling efficiency improves significantly under integrated systems, reducing dependence on external feed inputs and synthetic fertilizers [9]. These data emphasize the necessity of territorial and spatial planning approaches in forage-based Bali cattle agribusiness strategies.

Agribusiness management performance is strongly dependent on forage availability stability. Farm-level assessments indicate that production units with a consistent forage supply achieve higher output continuity, enabling stronger contractual relationships with traders and processors [10]. Adoption of improved forage cultivation practices, including bioorganic fertilizer substitution and multi-species forage associations, increases forage productivity by more than 20% while enhancing soil fertility indicators [11]. Utilization of agro-industrial by-products as supplementary feed further improves cost efficiency and reduces production risk [12]. These outcomes demonstrate that forage-centered management strategies are instrumental in transitioning Bali cattle farming toward market-oriented agribusiness models.

Sustainability performance in Bali cattle systems is closely linked to forage-based production structures. Circular agribusiness models integrating forage cultivation with livestock waste management achieve significant reductions in nutrient losses and greenhouse gas emissions [13], [14]. Life-cycle assessment results indicate that manure-based fertilization practices reduce synthetic fertilizer use by up to 40%, generating measurable cost savings and environmental benefits [15]. Forage-driven intensification enables herd expansion without proportional increases in ecological pressure, reinforcing long-term system resilience [16]. These empirical results position forage availability as a nexus between economic viability, environmental stewardship, and social sustainability.

The development strategy for Bali cattle farming based on forage availability requires integrating technical, spatial, managerial, and sustainability dimensions within a unified agribusiness framework. Empirical evidence consistently demonstrates that improvements in forage availability and quality enhance productivity, profitability, value chain integration, and environmental performance [1, 6, 9, 13]. Strategic interventions should prioritize forage resource optimization through land-use planning, integrated agro-livestock systems, and the implementation of circular agribusiness, supported by institutional alignment. Such a framework strengthens the competitiveness of Bali cattle farming while ensuring its contribution to sustainable agribusiness development and rural economic transformation in tropical regions.

2. Methods

This study employs a mixed-methods research design, integrating quantitative assessments of forage availability and agribusiness performance with qualitative strategic analysis to formulate development strategies for Bali cattle farming within a sustainable agribusiness framework. The quantitative component focuses on measuring forage availability, carrying capacity, cattle productivity, and cost-income structures at the farm level. In contrast, the qualitative component examines institutional arrangements, management practices, and sustainability orientations influencing business development. The study is conducted in Kecamatan Rendang, Kabupaten Karangasem, an area characterized by smallholder Bali cattle production systems that depend heavily on natural and cultivated forage resources, diverse land-use patterns, and varying levels of agribusiness integration, making it suitable for analyzing forage-based development strategies [17].

The research population includes Bali cattle farmers, forage producers, agricultural extension officers, cooperatives, and local livestock-related institutions. Respondents are selected using purposive sampling based on farm ownership, experience in forage management, and involvement in agribusiness activities. Primary data are collected through semi-structured in-depth interviews, field observations, and focus group discussions to obtain detailed information on forage sourcing, feeding systems, production performance, input utilization, and business management [18]. Field observations verify forage availability, land utilization, and feeding practices, while focus group discussions capture collective perspectives on constraints, opportunities, and strategic priorities. Secondary data are obtained from institutional records, statistical reports, and relevant policy documents to support and validate primary data [19].

Data analysis integrates quantitative and qualitative approaches. Quantitative data are analyzed to construct forage availability indices based on forage biomass production, seasonal variation, and carrying capacity, as well as productivity and profitability indicators of Bali cattle farming. Strategic analysis is conducted using the Internal Factor Evaluation and External Factor Evaluation matrices to identify key strengths, weaknesses, opportunities, and threats related to forage-based agribusiness development. The Internal-External matrix is applied to determine the strategic position of the farming systems, followed by SWOT analysis to formulate alternative development strategies that align with forage optimization, agribusiness management improvement, and sustainability objectives. Validity is strengthened through source and method triangulation. At the same time, ethical considerations are ensured through informed consent, voluntary participation, and anonymization of respondents, ensuring that the resulting strategies are empirically grounded, ethically sound, and applicable to sustainable Bali cattle agribusiness development in the study area [20].

3. Results and Discussion

3.1 Forage Availability and Carrying Capacity Performance

Forage availability constitutes the primary biophysical foundation shaping the development strategy of Bali cattle farming within a sustainable agribusiness framework. Field-based quantitative measurements in Kecamatan Rendang demonstrate that annual forage biomass production ranges from 7.8 to 9.2 tons dry matter (DM) ha^{-1} $year^{-1}$, indicating moderate productivity under smallholder-dominated management systems. This level of production is consistent with empirical evidence showing that feed availability remains the dominant cost and productivity determinant in Bali cattle farming, accounting for more than 60% of total production costs when forage supply is insufficient [1, 4]. Variability in forage output is closely associated with land-use typology and management intensity, confirming that forage scarcity represents a structural constraint rather than a seasonal anomaly [2, 7].

Quantitative disaggregation by land-use type reveals that cultivated forage plots exhibit the highest biomass production and stability, averaging 9.2 ± 0.7 t DM ha^{-1} yr^{-1}. In comparison, natural grasslands produce only 7.8 ± 0.6 t DM ha^{-1} yr^{-1} and show pronounced seasonal fluctuation. Seasonal coefficients of variation (CV) exceeding 28% in natural grasslands indicate substantial dry-season vulnerability, which directly elevates feed risk and suppresses cattle performance under tropical climatic stress conditions [5]. Integrated systems utilizing crop residues achieve intermediate productivity (8.6 ± 0.5 t DM ha^{-1} yr^{-1}) with improved seasonal stability, supporting previous findings that crop-livestock integration enhances biomass availability and nutrient recycling efficiency without increasing land pressure [8, 9].

Table 1
Forage Biomass Production, Seasonal Variability, and Carrying Capacity in Kecamatan Rendang

Land-use Type	Forage Biomass (t DM ha^{-1} $year^{-1}$)	Seasonal Variability (CV %)	Carrying Capacity (Livestok Unit ha^{-1})
Natural grassland	7.8 ± 0.6	28.4	1.6
Cultivated forage plots	9.2 ± 0.7	17.9	1.9
Integrated crop residues	8.6 ± 0.5	21.3	1.8

Source: Primary data analysis (2025)

Carrying capacity analysis confirms that existing forage resources in Kecamatan Rendang can sustainably support 1.6-1.9 livestock units (LU) ha^{-1}, depending on forage source and management system. Exceeding this threshold generates statistically significant declines in biological performance, with average daily gain decreasing by 12–18%, reflecting suboptimal nutrient intake and heightened competition for feed resources. Such performance deterioration aligns with physiological evidence indicating that Bali cattle, despite their adaptive capacity, experience increased metabolic stress and reduced growth efficiency when forage quantity and quality are inadequate [5, 25]. These findings reinforce the need to align herd size with forage-supported carrying capacity as a prerequisite for sustainable intensification.

The economic consequences of a forage-livestock imbalance further underscore the strategic importance of forage availability. Farms operating beyond carrying capacity rely more on purchased concentrates and agro-industrial by-products, resulting in more than a 20% increase in total production costs and heightened income volatility. Farms maintaining stocking rates within forage-supported limits demonstrate improved feed cost efficiency, greater production continuity, and stronger capacity to engage in market-oriented agribusiness arrangements [1, 3, 10]. Integrated forage-based systems also contribute indirectly to sustainability performance by reducing

dependence on external inputs and supporting circular agribusiness practices, such as manure recycling and soil fertility enhancement [6, 13, 14].

3.2 Economic Implications of Forage-Based Production Systems

Economic performance analysis in Kecamatan Rendang demonstrates a robust, statistically significant relationship between forage availability and the profitability of Bali cattle farming within a sustainable agribusiness framework. Production units that maintain year-round forage adequacy consistently achieve higher economic returns compared with farms exposed to seasonal forage deficits. As presented in Table 2, forage-adequate farms record net farm incomes that are 22-27% higher than those in forage-deficient systems, reflecting structural efficiency in cost allocation and output generation. This income differential is primarily driven by lower dependency on purchased concentrates and improved feed conversion efficiency, confirming that forage availability functions as a central economic driver rather than a supporting technical factor [1,4]. These findings align with previous evidence indicating that feed costs dominate production expenditure in smallholder cattle systems, often exceeding 60% of total costs under forage-scarce conditions [2, 24].

A detailed cost-income decomposition further illustrates that feed cost share in forage-adequate farms remains below 50%, whereas on forage-deficient farms it exceeds 60% of total production costs (Table 2). The higher total production cost observed in forage-deficient systems (IDR 9,020,000 head^{-1} yr^{-1}) reflects increased reliance on external feed sources to compensate for inadequate on-farm forage supply. In contrast, forage-adequate farms achieve cost efficiency by optimizing the utilization of locally available forage resources, resulting in lower total production costs (IDR 7,450,000 head^{-1} yr^{-1}) and higher net returns per animal. Empirical studies consistently report that improvements in forage productivity and management reduce unit feed costs while enhancing cattle growth performance and profitability [6, 8, 9]. Consequently, forage-based production systems strengthen the economic viability of Bali cattle agribusiness by internalizing feed resources and reducing exposure to market price volatility.

Table 2

Cost-Income Structure of Bali Cattle Farming Based on Forage Availability in Kecamatan Rendang

Indicator	Forage-Adequate Farms	Forage-Deficient Farms
Feed cos share (%)	47.3	62.8
Total production cos (IDR head^{-1} yr^{-1})	7,450,000	9,020,000
Net farm income (IDR head^{-1} yr^{-1})	4,320,000	3,410,000
Income variability (CV, %)	18.6	31.4

Source: Primary data analysis (2025)

Beyond income level effects, forage availability also significantly influences income stability and financial resilience. Income variability, measured by the coefficient of variation (CV), is substantially lower in forage-adequate farms (18.6%) compared with forage-deficient farms (31.4%), indicating more predictable cash flow and reduced production risk (Table 2). A stable forage supply enables farmers to maintain consistent production schedules, improve their bargaining power within local beef value chains, and engage more effectively in market-oriented agribusiness arrangements [3,10]. These results corroborate broader findings that forage-centered management strategies enhance not only profitability but also resilience and sustainability in tropical beef cattle systems [16, 23]. The economic evidence confirms that forage management constitutes a core determinant of agribusiness performance and should be prioritized in development strategies for Bali cattle farming under resource-constrained smallholder conditions.

3.3 Strategic Positioning of Bali Cattle Agribusiness

A strategic positioning analysis using the Internal Factor Evaluation (IFE) and External Factor Evaluation (EFE) frameworks indicates that Bali cattle agribusiness in Kecamatan Rendang occupies a growth-oriented yet resource-constrained strategic position within a sustainable agribusiness context. The composite IFE score of 2.71 indicates that internal conditions are moderately vigorous, reflecting the inherent competitiveness of Bali cattle farming systems when supported by adaptive local genetics, accumulated farmer experience, and the availability of crop residues as supplementary feed resources. These internal strengths are widely recognized as fundamental comparative advantages in smallholder beef systems, enabling production continuity under variable environmental conditions and contributing positively to farm-level efficiency and profitability [1, 2, 23]. The internal assessment also reveals structural weaknesses, particularly the limited allocation of land for forage cultivation and the low adoption rate of forage conservation technologies, which constrain the system's capacity to scale production sustainably [6, 7].

Table 3
Internal Factor Evaluation (IFE) Matrix of Bali Cattle Agribusiness Based on Forage Availability

No	Internal Factors	Weight	Rating	Weighted Score	Strategic Interpretation
Strengths					
1	High adaptability of Bali cattle to local forage resources	0.12	4	0.48	Supports stable productivity under forage variability
2	Availability of natural forage and crop residues	0.11	3	0.33	Reduces dependence on purchased feed
3	Farmer experience in traditional forage utilization	0.1	3	0.3	Enhances feeding efficiency and herd management
4	Low mortality rate associated with forage-based feeding	0.09	3	0.27	Improves herd sustainability
5	Integration potential with crop farming systems	0.08	4	0.32	Enables circular agribusiness practices
Weaknesses					
6	Limited land allocation for cultivated forage	0.13	2	0.26	Restricts biomass production expansion
7	High seasonal fluctuation in forage availability	0.12	2	0.24	Increases feeding risk during dry season
8	Low adoption of forage conservation technologies	0.1	2	0.2	Limits feed stability across seasons
9	Dependence on natural pasture during dry periods	0.08	2	0.16	Reduces carrying capacity reliability
10	Limited financial capacity for forage intensification	0.07	2	0.14	Constrains investment in improved systems
	Total IFE Score	1.0		2.7	Moderate internal strength

Source: Primary data analysis (2025)

From the external perspective, the EFE score of 2.89 signifies a relatively favorable environment for agribusiness development. Growing regional beef demand, strengthened institutional support for integrated farming systems, and increasing policy attention toward sustainable livestock development collectively create strategic opportunities for Bali cattle enterprises [1, 4, 27]. Institutional integration, including extension services, cooperative-based input provision, and market facilitation, enhances farmers' access to knowledge and value chains,

reinforcing agribusiness competitiveness [10, 22]. These opportunities are counterbalanced by significant external threats, notably climate-induced forage seasonality, increasing competition for agricultural land, and rising land-use opportunity costs in peri-urban areas [5, 7, 16]. Such threats amplify production risks and underscore the vulnerability of forage-dependent systems when strategic resource management is inadequate.

Table 4
External Factor Evaluation (EFE) Matrix of Bali Cattle Agribusiness Based on Forage Availability

No	External Factors	Weight	Rating	Weighted Score	Strategic Implication
Opportunities					
1	Increasing regional demand for beef cattle	0.14	4	0.56	Expands market absorption capacity
2	Government programs supporting forage development	0.13	3	0.39	Enhances access to inputs and training
3	Policy support for integrated crop-livestock systems	0.11	4	0.44	Strengthens circular agribusiness
4	Availability of agro-industrial by-products as feed	0.1	3	0.3	Improves feed cost efficiency
5	Growing awareness of sustainable agribusiness practices	0.08	3	0.24	Encourages environmentally sound intensification
Threats					
6	Climate variability affecting forage production	0.14	2	0.28	Raises production risk
7	Competition for land with food crops and tourism	0.12	2	0.24	Limits forage expansion
8	Rising labor costs in rural areas	0.08	2	0.16	Increases production cost
9	Degradation of communal grazing areas	0.06	2	0.12	Reduces carrying capacity
10	Price volatility of supplemental feeds	0.04	2	0.08	Affects cost stability
	Subtotal Threats	0.44		0.88	
	Total EFE Score	1.0		2.81	Favorable external environment

Source: Primary data analysis (2025)

The integration of IFE and EFE scores through the Internal-External (IE) matrix places Bali cattle farming in Cell V, which corresponds to a strategy of selective growth and stability rather than aggressive expansion. This strategic position implies that development efforts should prioritize internal resource optimization to exploit external opportunities without exacerbating existing constraints [18]. In the context of Kecamatan Rendang, forage-based intensification emerges as the most rational strategic pathway. Rather than increasing herd size, which would intensify pressure on limited land and forage resources, targeted interventions that improve forage productivity, conservation, and integration with crop systems offer higher marginal returns and lower ecological risk [8, 9, 28]. Empirical evidence suggests that such strategies enhance biomass availability, stabilize feed supply, and improve nutrient recycling efficiency, thereby strengthening both economic and environmental performance [6, 9, 13].

Table 5
Internal-External (IE) Matrix Position of Bali Cattle Agribusiness in Kecamatan Rendang

Dimension	Score	Strategic Category
Internal Factors (IFE)	2.7	Medium
External Factors (EFE)	2.81	Medium–High
IE Matrix Position	Cell V	Selective Growth and Stability

The strategic positioning analysis confirms that Bali cattle agribusiness development in Kecamatan Rendang should be anchored in forage-centered resource optimization within an integrated agribusiness framework. Selective growth strategies aligned with forage availability not only enhance internal efficiency but also improve resilience to external shocks, supporting sustainable competitiveness in the long term. These findings are consistent with broader assessments of tropical beef systems, which emphasize that sustainable intensification rather than extensification is the most viable pathway for smallholder-based livestock agribusiness under land and climate constraints [16, 27].

3.4 Development Strategies Based on SWOT Integration

The integration of SWOT analysis generates empirically grounded development strategies that position forage optimization as the primary driver of internal competitiveness in Bali cattle agribusiness. The synthesis of internal strengths and external opportunities indicates that substantial performance improvements can be achieved through forage-based intensification without land expansion, by leveraging the biological adaptability of Bali cattle, accumulated farmer experience, and a supportive policy and market environment [1, 18, 23].

Table 6
Projected Impacts of Forage-Based Development Strategies

Indicator	Baseline Condition	Post-Strategy Projection	Change (%)
Forage availability (t DM ha^{-1} yr^{-1})	6.8	8.5 - 9.0	+25 - 32
Average daily gain (kg $head^{-1}$ day^{-1})	0.48	0.57 - 0.60	+18 - 24
Feed cost (IDR kg^{-1} live weight)	18,500	14,800 - 15,700	-15 - 20
Carrying capacity (LU ha^{-1})	1.2	1.5 - 1.7	+0.3 - 0.5

Source: Primary data analysis (2025)

Scenario-based projections demonstrate that the implementation of forage-oriented strategies results in significant technical and economic gains (Table 6). Adequate forage availability increases by 25-32%, leading to an improvement in average daily gain (ADG) of 18-24% and a reduction in feed cost per kilogram of live weight by 15-20%. In addition, carrying capacity improves by 0.3-0.5 LU ha^{-1}, reflecting more efficient biomass utilization and spatial productivity [4, 8, 28].

Priority interventions include intercropping and border planting of forage species, crop-livestock integration to utilize crop residues and agro-industrial by-products, and the adoption of basic forage conservation technologies such as silage and haymaking. These interventions enhance feed stability across seasons and reduce production risks associated with climatic variability [9, 12, 16]. Institutional strengthening through farmer group coordination, targeted extension services, and digital communication support further improves implementation effectiveness and market integration [2, 10, 22].

3.5 Sustainability Performance of Forage-Based Agribusiness

Sustainability assessment confirms that forage-based development strategies deliver measurable environmental and socio-economic benefits. Farms integrating forage cultivation with manure recycling reduce synthetic fertilizer use by up to 40%, while increasing soil organic matter content from 2.1% to 2.8% (Table 7). These changes indicate improved nutrient cycling efficiency

and enhanced soil quality, which are critical for the long-term sustainability of forage production systems [6, 13-15].

Table 7
Environmental Sustainability Indicators under Forage-Based Management

Indicator	Conventional System	Forage-Based System
Synthetic fertilizer use (kg ha^{-1} yr^{-1})	210	125
Soil organic matter (%)	2.1	2.8
Nutrient recycling efficiency (%)	42	68
Manure utilization rate (%)	45	78

Source: Primary data analysis (2025)

From a socio-economic perspective, forage-based systems demonstrate improved labor efficiency, increasing productivity from 6.2 to 8.1 head per worker, and a shift in income stability from low to moderate-high (Table 8). Higher feed self-sufficiency and reduced reliance on external inputs strengthen household income resilience under price volatility and climatic stress [3, 16, 23].

Table 8
Socio-Economic Sustainability Performance

Indicator	Conventional System	Forage-Based System
Labor productivity (head worker^{-1})	6.2	8.1
Feed self-sufficiency (%)	48	72
Income stability index	Low	Moderate-High
Adaptive capacity to climate stress	Low	Moderate-High

Source: Primary data analysis (2025)

These findings highlight that forage management functions not only as a technical input but also as a strategic mechanism for reinforcing social and economic resilience in smallholder cattle systems [9, 28].

3.6 Integrated Agribusiness Development Implications

The results demonstrate that the development of Bali cattle agribusiness based on forage availability must be framed within an integrated agribusiness perspective, linking production efficiency, environmental stewardship, institutional capacity, and market performance. Quantitative forage assessment and strategic analysis consistently indicate that forage optimization acts as a key leverage point for enhancing productivity, profitability, strategic positioning, and sustainability outcomes [16, 18, 23].

The integrated implications of forage-based development are summarized in Table 9, which illustrates the alignment between the strategic dimensions and policy relevance. Development pathways emphasizing forage-based intensification, spatial land-use optimization, and institutional strengthening offer a realistic, scalable model for improving the competitiveness of Bali cattle agribusiness in tropical regions.

Table 9
Integrated Agribusiness Development Implications

Dimension	Strategic Implication	Policy Relevance
Production	Forage-based intensification	Local forage development programs
Environment	Circular nutrient management	Green livestock incentives
Economy	Reduced feed cost volatility	Access to microfinance
Institution	Farmer group strengthening	Extension services and digital advisory

These findings directly address the research objectives and provide empirically grounded guidance for policy formulation and managerial decision-making in pursuing competitive and sustainable tropical livestock agribusiness systems [18-20, 22, 25].

4. Conclusion

This study unequivocally demonstrates that forage availability is the core determinant governing the performance and sustainability of Bali cattle agribusiness in smallholder systems. Quantitative and strategic analyses confirm that forage-based intensification without land expansion, combined with crop-livestock integration and basic forage conservation technologies, delivers substantial gains in productivity, cost efficiency, and carrying capacity. The strategic position of Bali cattle agribusiness falls within a selective growth and stability category, indicating that internal resource optimization is the most effective development pathway under existing structural constraints. Forage-based management generates tangible environmental benefits through enhanced nutrient recycling and soil quality, while simultaneously strengthening socio-economic resilience by improving labor productivity and stabilizing household income. Accordingly, forage optimization must be treated as a central agribusiness strategy rather than a supplementary technical intervention, providing a transparent, scalable, and policy-relevant foundation for sustainable Bali cattle agribusiness development in tropical regions.

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