

Comparative Biomass Yield and Regrowth Performance of Forage Grasses

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Progress Report on performance and regrowth of *Urochloa* and *Megathyrsus* grasses in northern Ghana



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Abstract

This study evaluated (1) the third-year biomass yield using Napier grass (*Cenchrus purpureus*) as the reference species and (2) regrowth performance of selected *Urochloa* (*Brachiaria*) and *Megathyrus* (*Panicum*) (cultivars and hybrids under semi-arid savanna conditions.

Third-year biomass yield and regrowth were assessed across replicated plots to determine relative productivity, persistence, and resilience under repeated cutting. Napier recorded the highest mean yield (15.2 t DM ha⁻¹), while *Urochloa* hybrids Cobra and Camello and *Megathyrus maximus* cv. Mun River showed moderate yields relative to Napier.

Regrowth analysis revealed clear differences in persistence between the different cultivars and hybrids, with *Megathyrus maximus* cv. Massai and B. Camello exhibiting high persistence, while several *Urochloa* and *Megathyrus* cultivars showed low persistence under intensive defoliation.

Overall, the findings demonstrate that biomass yield alone is insufficient for forage selection; combining high-yielding species with more persistent and stress-tolerant forages is essential for stabilizing feed supply. The study provides robust evidence to guide climate-smart forage diversification, fodder bank development, and dry-season feed strategies in smallholder crop–livestock systems of northern Ghana and similar agro-ecologies.

Objectives

- Completion of third-year biomass yield assessment across seven forage grass varieties with four replications each.
- Establishment of Napier grass as a productivity benchmark (100%) for relative performance comparison.
- Quantification of mean dry matter yield (kg DM/ha) and variability for all tested species.
- Completion of two-season regrowth and persistence analysis (2023–2024 and 2024–2025) for *Urochloa* and *Megathyrus* cultivars and hybrids.
- Classification of forage varieties into high, moderate, and low persistence categories based on regrowth performance.

Third-year biomass yield performance

This section analyzes the third-year biomass yield performance of seven forage grasses relative to Napier grass, which serves as the reference species due to its superior yield and proven adaptability under semi-arid savanna conditions.

Each treatment was replicated four times, and dry matter yield (Kg DM/ha) was recorded. Napier's mean yield was used as the baseline (100%) for expressing relative productivity among the other species.

Table 1. Mean third-year biomass yield of *Urochloa* and *Megathyrus* cultivars and hybrids

Variety	Mean Biomass (Kg DM/ha)	% of Napier Yield	Std Dev	Relative Performance
Napier (Ref.)	15,201 ^b	100%	7,674	Benchmark
M. Mombasa	2,485 ^a	16%	1,158	Moderate
M. Mun River	4,330 ^a	28%	1,629	Stable Panicum cultivar
U. Camello	4,271 ^a	28%	3,166	Moderate persistence
U. Cayman	3,514 ^a	23%	1,543	Reliable under stress
U. Cobra	5,844 ^a	38%	3,700	High-yield Brachiaria
U. Mestizo	1,782 ^a	12%	1,130	Low performer
U. Okapi	2,871 ^a	19%	1,405	Low vigor

Values with different superscripts are significantly different (P<0.05)

Reference Performance: Napier Grass

Napier (*Pennisetum purpureum*)

Mean yield: 15.2 t DM/ha (range: 6.1–24.4 t).

Observation: The most productive species, demonstrating robust growth, excellent regrowth ability, and adaptability to varying soil moisture conditions.

Implication: Serves as the productivity standard for the other varieties, showing how management intensity and nutrient status affect potential yield ceilings.

Use: Ideal for dry-season fodder reserves, silage, or cut-and-carry systems.

Key Limitation: High nutrient demand requires periodic manure or NPK supplementation to maintain top yield.

Comparative Analysis (Relative to Napier)

M. Mombasa (*Megathyrsus maximus* cv. Mombasa) – 16% of Napier

Lower yield but strong forage quality potential.

Performance could improve with higher fertility or irrigation.

Interpretation: Functions best as a complementary species to Napier in integrated forage-livestock systems.

M. Mun River (*Megathyrsus maximus* cv. Mun River) – 28% of Napier

Comparable to Camello in mean yield but more consistent.

Good regrowth potential, making it suitable for sustained production.

Interpretation: Strong secondary forage choice; can complement Napier in cut-and-carry systems for feed diversity.

U. Camello (*Urochloa brizantha* cv. Camello) – 28% of Napier

Exhibited balanced productivity and regrowth.

Yields between 1.3–8.7 t DM/ha show moderate persistence but moderate sensitivity to cutting interval.

Interpretation: Performs well where Napier cannot persist due to drought; lower yield compensated by stability and feed quality.

U. Cayman (*Urochloa* hybrid) – 23% of Napier

Moderate producer with minimal year-to-year variation.

Adapted to stress-prone or low-input environments.

Interpretation: A reliable stabilizer in mixed pastures, offering resilience where Napier's water or nutrient needs cannot be met.

U. Cobra (*Brachiaria* hybrid) – 38% of Napier

Second-highest *Brachiaria* performer.

Yields peaked at 10.7 t DM/ha but were inconsistent across replicates.

Responds well to good fertility, making it suitable for semi-intensive forage or pelleted feed systems.

Interpretation: With improved fertilization, Cobra could approach 50–60% of Napier's yield potential.

U. Mestizo (*Urochloa* hybrid) – 12% of Napier

Lowest yielding among all grasses.

Likely constrained by poor persistence or nutrient exhaustion.

Interpretation: Suitable primarily for soil conservation or short-term feed systems.

U. Okapi (*Urochloa* hybrid) – 19% of Napier

Modest yield levels and noticeable inter-replicate variation.

Likely affected by uneven stand establishment.

Interpretation: Better suited for supplementary forage production rather than as a mainstay species.

Regrowth Analysis: 2023–2024 vs 2024–2025

This section combines regrowth data for *Urochloa* hybrids (Cobra, Camello, Cayman, Mestizo, Okapi), cultivars (Basilisk, Marandu) and *Megathyrsus* cultivars (Maasai, Mombasa, Mun River) across two seasons (2023–2024 and 2024–2025). Mean regrowth percentages per variety were computed across four blocks for each year. Persistence is interpreted from the latest season (2024–2025) as: High ($\geq 80\%$), Moderate (40–79.9%), Low ($< 40\%$).

Table 2. Mean Regrowth by Variety

Variety	2023–2024 (%)	2024–2025 (%)	Change (%)	Persistence (2024–2025)
M Maasai	100.00 ^g	92.72 ^{fg}	-7.28	High persistence
M Mombasa	36.30 ^{abcd}	23.85 ^{abcd}	-12.45	Low persistence
M Mun River	60.07 ^{cdefg}	21.83 ^{abc}	-38.24	Low persistence
U Basilisk	11.10 ^{ab}	4.55 ^a	-6.55	Low persistence
U Camello	96.28 ^g	87.30 ^{efg}	-8.98	High persistence
U Cayman	43.92 ^{abcd}	25.77 ^{abcd}	-18.15	Low persistence
U Cobra	55.23 ^{cdef}	55.52 ^{cdef}	+0.29	Moderate persistence
U Marandu	20.95 ^{abc}	12.80 ^{ab}	-8.15	Low persistence
U Mestizo	55.86 ^{cdef}	63.95 ^{defg}	+8.09	Moderate persistence
U Okapi	49.17 ^{bcde}	41.97 ^{abcd}	-7.21	Moderate persistence

Values with different superscripts are significantly different ($P < 0.05$)

Observations

Megathyrsus maximus cv Maasai

Highest and most stable persistence: maintained ~92.7% regrowth in 2024–2025 (from 100%), indicating strong longevity under repeated cutting.

Megathyrsus maximus cv Mombasa

Decline from ~36% to ~23.9%; indicates sensitivity to repeated cutting or declining soil moisture/fertility.

Megathyrsus maximus cv Mun River

Marked decline ($\approx -38.24\%$) to ~21.8%; likely sensitive to cumulative stress or requires extended recovery intervals.

Urochloa decumbens cv. Basilisk

Lowest persistence ($\approx 4.55\%$); not suited to repeated cutting regimes under current conditions.

Urochloa hybrid Camello

High persistence: slight decline (-9%) but still ~87% in 2024–2025; resilient stand with excellent recovery after defoliation.

Urochloa hybrid Cayman

Low–moderate persistence (computed in source data); management uniformity may reduce variability.

Urochloa hybrid Cobra

Moderate persistence and stable ($\approx +0.29\%$ change); robustness across seasons with balanced survival under stress.

Urochloa brizantha cv. Marandu

Low persistence in 2024–2025; sharp decline in one block (3.33%) points to stress sensitivity.

Urochloa hybrid Mestizo

Improving trend (+8.1%) to ~64% in 2024–2025; suggests better adaptation or management in second season.

Urochloa hybrid Okapi

Moderate persistence but declined (~–7.2%); may benefit from longer rest periods or fertility boosts.

Conclusions

- Napier grass recorded the highest mean yield (15.2 t DM/ha), confirming its role as the benchmark species for biomass production. However, the high nutrient demand requires sustained fertility inputs to maintain biomass production.
- Among *Urochloa* hybrids, Cobra (38%) and Camello (28%) were the strongest performers relative to Napier. Yield inconsistency among some hybrids was high due to uneven stand establishment and cumulative cutting stress.
- *Megathyrsus maximus* cv Mun River (28%) showed stable biomass production, while Mombasa (16%) displayed lower yield but potential quality advantages.
- Regrowth analysis identified *Megathyrsus maximus* cv Maasai and *Urochloa* hybrid Camello as highly persistent, while M. Mun River, M. Mombasa, U. Marandu, and U. Basilisk showed low persistence under repeated cutting.

Next Steps

- Conduct nutrient response trials to determine fertilisation thresholds for high-performing but nutrient-demanding species.
- Integrate high-persistence species (e.g. M. Maasai, U Camello) into mixed forage systems to stabilise biomass supply.
- Test extended cutting intervals and rotational harvesting for stress-sensitive cultivars.
- Link biomass yield and persistence data to livestock feeding trials and biomass flow analyses.
- Prepare a peer-reviewed manuscript on forage productivity and persistence under semi-arid conditions.

Lessons Learnt and Implications

The results confirm that biomass yield alone is insufficient as a selection criterion for forage systems. While Napier delivers superior biomass, its high nutrient demand necessitates complementary species with greater persistence and stress tolerance. *Brachiaria* hybrids such as Camello and Cobra offer balanced yield persistence trade-offs, while *Panicum* cultivars contribute to feed diversity but require careful management. These findings underscore the importance of forage diversification and management intensity matching to sustain feed availability and reduce pressure on natural grazing lands.

This comparative biomass and regrowth dataset provides strong empirical evidence to guide climate-smart forage system design in northern Ghana and similar agro-ecologies. The integration of yield and persistence metrics strengthens recommendations for fodder banks, cut-and-carry systems, and dry-season feed strategies within smallholder crop–livestock systems.

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Photos

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The CGIAR Sustainable Farming Science Program will address key challenges in agrifood systems by fostering efficient production of nutritious foods and safeguarding the environment to create fair employment opportunities, as we simultaneously tackle climate change, soil degradation, pests, diseases, and desertification.



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