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Estimating forage seed requirements to close ruminant feed gaps in Africa

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Abstract
Aspirations for ruminant production and contributions to countries' development goals are often not met primarily owing to inadequate livestock feeds and feeding. While ruminant process roughages to desirable products including meat, milk and manure; good quality roughages underpin the performance of the animals. In ten selected African countries in the current study including Malawi, South Sudan, Sudan, Zambia, Zimbabwe, Somali, Mozambique, Mali, Senegal and Nigeria clearly shows feeding gaps to the tune of > 82 million tons on dry matter per year. As the human population in the continent continues to grow, contributions from ruminant agriculture to nutritious foods and household incomes will intensify. To match the demand, the cultivation of good quality forages will become more inevitable, and one of the major bottlenecks is accessing good quality forage seeds by forage producers. As ruminants require both forage grasses and legumes to provide energy and crude protein, we selected two grasses and two legumes with potential to provide the desired ruminant nutrients when cultivated and fed. These include *Megathyrsus maximus* and *Urochloa* (grasses) and *Vigna unguiculata* and *Lablab purpureus* (legumes). Estimations indicate the countries will require 13,698 tonnes of forage seeds to bridge the forage cultivation that meets dry matter deficit. Therefore, it will be prudent for the countries to actively seek forage cultivation to sustain ruminant productivity for human food and development.
Keywords: forage seed, grasses, legumes, ruminants

Introduction
Ruminant livestock production plays a crucial role in the livelihoods of millions of people across Africa (Balehegn et al., 2021). Animals such as cattle, goats, and sheep are a primary source of income and employment for rural households. These animals provide meat, milk, hides, and wool, which are essential for household consumption and local trade. In many communities, livestock also serves as a form of savings and insurance, helping families cope with economic shocks or climatic hardships (Gwaka & Dubihlela, 2020). Milk and meat from ruminants are rich in protein and micronutrients, essential for the health and development of children and adults alike. These animals often serve as a steady food source even during periods of drought or crop failure, making them critical in sustaining diets year-round. Additionally, ruminant farming is integrated with crop production, as manure is used to fertilize fields, improving soil fertility and agricultural productivity.

Material and Methods
We selected ten countries (Malawi, South Sudan, Sudan, Zambia, Zimbabwe, Somali, Mozambique, Mali, Senegal & Nigeria) that have not been appraised on forage seed requirements. Further, we reviewed the latest ruminant populations and standardized to Tropical Livestock Units (TLU) and used to estimate annual dry matter requirement.

Concurrently, we reviewed for the dry matter (%) shortage in the countries which facilitated estimating total dry matter shortage. Quantified dry matter shortage was converted to potential forage seed requirement using forage grass and legumes as described by Burkart and Mwendia, (2024).

Results and Discussion

Ruminant dry matter deficits varied greatly (Table 1) across the study countries like Tropical Livestock Units (TLUs) and percentage dry matter shortfall. Subsequently, estimated cultivated forage deficits were in the order Nigeria > Sudan > Mali > South Sudan > Zambia ≈ Somali > Zimbabwe > Senegal > Malawi > Mozambique.

Table 1. Selected African countries ruminant populations and corresponding dry matter feed demand and deficits

Country	Ruminant population heads	Tropical livestock units (TLU)	Dry matter Deficit %	Annual feed demand (dry matter t y^{-1})	Annual feed deficit (dry matter t y^{-1})	Annual cultivated forage deficit (dry matter t y^{-1})	Reference
Malawi	13,437,198	2,519,181	31	6,902,525	2,139,783	494,290	(World Bank Group, 2021)
South Sudan	36,200,000	10,640,000	33.36	29,161,600	9,700,000	2,240,700	(Rahimi et al., 2022)
Sudan	105,600,000	24,070,000	24	64,989,000	15,597,360	3,602,990	(FAO, 2020)(ICPALD, 2022)
Zambia	9,160,000	3,735,056	29.14	10,234,754	8,500,000	1,963,500	(Mulenga et al., 2020)
Zimbabwe	10,479,385	6,006,923	24.96	16,464,953	4,110,988	949,638	(FAO 2024)
Somalia	56,900,000	18,625,000	15.27	51,060,250	7,800,000	1,801,800	(FAO, 2015)
Mozambique	2,400,000	2,390,000	24.89	6,548,600	1,630,000	376,530	(CIAT & World Bank, 2017)
Mali	48,000,000	19,450,000	23.33	53,347,000	12,430,000	2,871,330	(World Bank, 2023)
Senegal	11,700,000	3,870,000	24.97	10,603,800	2,648,531	611,811	(Eeswaran et al., 2022)
Nigeria	158,200,000	34,600,000	25	94,404,000	23,601,000	5,451,831	(FAO, 2020)

The amount of forage seeds combined for *Megathyrsus maximus*, *Urochloa*, *Vigna unguiculata* and *Lablab purpureus* forage species (Table 2) that would be required to meet the prevailing dry matter deficit is ≈ 13698 tonnes

Table 2. Estimated forage seed requirement from *Megathyrsus maximus*, *Urochloa*, *Vigna unguiculata* and *Lablab purpureus* forage species required to bridge dry matter deficit in selected Africa countries.

Country	*Megathyrsus maximus* (e.g. Mombasa)	*Urochloa* e.g Hybrid Cayman	*Vigna unguiculata*	*Lablab purpureus* (Lablab)	Total
Malawi	25.95	81.41	123.57	123.57	354.51
South Sudan	117.98	370.13	561.81	561.81	1611.73
Sudan	189.16	593.43	900.75	900.75	2584.09
Zambia	36.17	113.47	172.23	172.23	494.11
Zimbabwe	49.84	156.36	237.33	237.33	680.86
Somali	94.56	296.65	450.27	450.27	1291.75
Mozambique	19.77	62.01	94.13	94.13	270.04
Mali	150.94	473.53	718.75	718.75	2061.96

Senegal	32.11	100.74	152.91	152.91	438.67
Nigeria	286.22	897.95	1362.96	1362.96	3910.09
Total	1002.69	3145.69	4774.71	4774.71	13697.80

Given that the dry matter feed gap across the countries occurs having considered all available dry matter, it is logical to consider addressing the deficit from cultivated forages. Cultivated forages have been used successfully for increased ruminant productivity (Dey et al., 2022). With increasing demand for animal source foods (Juan et al., 2024), ruminant included especially for African countries, cultivated forages will most likely increase, to fill the shortages. This is more so given the governments' intentions to see increased ruminant productivity that address multiple benefits including provision of nutrient dense foods, livelihoods, more contribution to Gross Domestic Product and employment especially for the youths. Ruminant enteric methane production contributes to the undesirable increase of greenhouse gas emissions associated with global warming. Use of nutritive and productive forages form part of the solution, as quality forages reduce the methane emission intensity per unit product(Loza et al., 2021). While there are many reasons for low forage cultivation in most countries including lack of knowledge & skills, competing land allocation with food crops, limited or lack of forage seeds and planting materials, the latter has been cited as a key limitation where forage producers, especially those with commercial orientation are unable to access seeds. Overreliance on native and naturals forages and crops residues as has continued to be the case may not offer adequate nutrients required for meat and milk production. Looking at the example here of pooled forage seed requirements (13,698 tonnes) has the potential for business cases especially by the private sector which warrants exploring.

Conclusions and Outlook

In conclusion, among the countries considered, none is sufficient with dry matter required by the ruminants and cultivated forages would be key in filling the gap, which in turn means forage seeds would be required to support production and grow the sector.

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