

TOBACCO RESEARCH INSTITUTE OF TANZANIA (TORITA)



"Site-Specific Fertilizer General Recommendations for Sustainable Tobacco Production in Tanzania: Aligning Research with National Targets 2025/26 and Agenda 10/30"

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TORITA Fertilizer Initiatives and the Need for Revised Blends

Executive Summary

Since its establishment in 2000, the Tobacco Research Institute of Tanzania (TORITA) has played a pivotal role in guiding fertilizer use for tobacco production. One of its earliest and most influential initiatives was the recommendation of a basal fertilizer blend of NPK (10:18:24) enriched with 0.5% MgO, 3% CaO, 7% S, and 0.012% B, complemented by a top dressing of Calcium Ammonium Nitrate (CAN 27%) fortified with 1.7% MgO, 3% CaO, and 3% S. This package has been the standard across the tobacco-growing regions for nearly twenty-five years, supporting consistent yields and leaf quality.

In 2022-2024, TORITA coordinated a quick and simple soil sampling and analysis from the tobacco zones (Tabora, Urambo, Sikonge, Kahama, Chunya, and Serengeti) to reassess the sustainability of this long-standing fertilizer practice. Results revealed critical nutrient deficiencies: *Macronutrients*: Very low nitrogen (N) and organic carbon across sites; very low potassium (K) in Kahama and Chunya despite high CEC; and localized phosphorus (P) surpluses where P-application exceeded crop demand. *Secondary nutrients* include magnesium (Mg), which is consistently very low; sulfur (S), which is adequate under current blends; and calcium (Ca), which varies but is often low to medium, except in Kahama. *Micronutrients*: Acute zinc (Zn) and boron (B) deficiencies across all zones; copper (Cu) adequate to high; iron (Fe) and manganese (Mn) sufficient.

These findings demonstrate that while the TORITA fertilizer blends from the past helped stabilize production for two decades, they no longer match the evolving fertility profile of Tanzania's tobacco soils. Continued use of the same blanket formula risks yield stagnation and declining leaf quality. To align with the Ruling Party Manifesto target of 200,000 MT of tobacco by 2025/26 and the Agenda 10/30 vision for agricultural transformation, TORITA is spearheading the development of site-specific fertilizer blends. The new approach emphasizes (a) balancing nutrients by reducing excess phosphorus and prioritizing nitrogen and potassium supply in line with tobacco demand. (b) Correcting secondary nutrient gaps, especially magnesium and calcium, to support leaf structure and curing quality. (c) Introducing micronutrient enrichment, particularly zinc and boron, either through customized basal fertilizers or foliar programs. (d) Improving soil health through organic matter management, lime application for acid soils, and sustainable nutrient recycling.

By adopting adaptive fertilizer recommendations rooted in soil diagnostics, TORITA seeks to unlock higher yields, safeguard tobacco quality, and ensure sustainable productivity. This renewed fertilizer strategy is therefore central to realizing the dual national objectives of achieving the 200,000 MT tobacco milestone and contributing to Tanzania's broader Agenda 10/30 for inclusive agricultural growth.

1. SOIL FERTILITY STATUS AND RATINGS IN TANZANIA TOBACCO ZONES

Descriptive parameter	Unit	Field Sites (0 – 30 cm soil depth)											Rating
		Tabora	Rating	Urambo	Rating	Sikonge	Rating	Kahama	Rating	Chunya	Rating	Serengeti	
Soil pH	pH (1:2.5) in H ₂ O	5.49	Strongly acid	5.87	Medium acid	5.89	Medium acid	6.50	Neutral	6.18	Neutral	5.46	Strongly acid
P.S.D	% Clay	6.96		12.12		11.5		14.48		12.48			
	% Silt	4.64		2.92		3.48		3.28		3.28			
	% Sand	88.4		84.96		85.04		82.24		84.24			
Texture Class	Texture Class	Sand		Sandy loam		Loamy sand		Sandy loam		Loamy sand			
Exchangeable Bases (Cmolkg ⁻¹)	Ca ²⁺	0.10	Very low	0.40	Low	1.29	Medium	2.73	High	1.56	Medium	0.90	Medium
	Mg ²⁺	0.24	Low	0.26	Low	0.29	Low	0.20	Low	0.07	Very low	0.19	Very low
	K ⁺	0.29	Medium	0.25	Medium	0.53	High	0.42	Medium	0.01	Very low	0.04	Very low
	Na ⁺	0.10	Low	0.01	Very low	0.02	Very low						
Cation Exch Capacity	CEC (Cmol kg ⁻¹)	2.60	Very low	3.20	Very low	4.40	Very low	29.14	High	25.72	High		
Micro	B (mgkg ⁻¹)	0.3	Low	0.32	Low	0.34	Low	0.01	Very low	0.01	Very low	0.01	Very low
	Cu (mgkg ⁻¹)	0.14	Medium	0.26	Adequate	0.21	Adequate	2.0	Very high	0.37	High		
	Fe (mgkg ⁻¹)	12.95	Adequate	13.32	Adequate	14.54	Adequate	41.08	High	55.30	High	36.38	Adequate
	Mn (mgkg ⁻¹)	11.90	Adequate	24.07	Adequate	24.32	Adequate	72.75	High	72.12	High	5.64	Adequate
	Zn (mgkg ⁻¹)	0.11	Very low	0.37	Very low	0.47	Very low	0.79	Very low	0.50	Very low	0.65	Very low
Macro	Ext P (mgkg ⁻¹)	53.39	High	44.41	High	43.48	High	11.9	Medium	10.4	Medium	5.00	Low
	Ext S (mgkg ⁻¹)	8.09	Medium	8.19	Medium	9.12	Medium	24.3	High	20.5	High	27.2	High
	Total N (%)	0.04	Very low	0.04	Very low	0.05	Very low	0.02	Very low	0.02	Very low	0.11	Low
Organic carbon	OC (%)	0.16	Very low	0.25	Very low	0.36	Very low	0.21	Very low	0.18	Very low	2.52	Medium

Source: TORITA 2025: Compiled soil laboratory results from TORITA Lab (2022), TARI Selian (2023) & Soil Lab at SUA (2024)

2. Ranking of site zones (from the lowest to the highest yield potential expected)

i. Tabora (Lowest)

Constraints:

- Strongly acidic (pH 5.49).
- Very sandy (88.4% sand, sand texture).
- Very low CEC (2.6 cmol/kg) result in poor nutrient retention.
- Very low Ca, very low N, very low OC.
- Low B, very low Zn.

Implication: Severe nutrient and water-holding limitations may result to lowest yield potential.

ii. Urambo

Constraints:

- Moderately acidic (pH 5.87).
- Sandy loam but still low CEC (3.2 cmol/kg).
- Ca low, Mg low, K medium.
- Low B, very low Zn, very low N & OC.

Implication: Slightly better than Tabora due to better pH and texture, but still fertility-limited.

iii. Sikonge

Constraints:

- Medium acid (pH 5.89).
- Loamy sand, slightly better texture than Urambo.
- CEC still very low (4.4).
- Ca medium, K high (better base fertility).
- B low, Zn very low, N & OC very low.

Implication: Some fertility advantage (higher K and Ca than Urambo), but still limited by low OM, N, B, Zn.

iv. Serengeti

Advantages:

- Strongly acid (pH 5.46) but manageable for tobacco.
- Medium OC (2.52%) – much better than other regions.
- Total N low (0.11%), better than all others.

Constraints:

- Very low Ca (0.9), very low K (0.04).
- Low B, very low Zn.

Implication: Higher organic matter & N support better crop growth, but low bases (Ca, K, B, Zn) limit yield.

v. Chunya

Advantages:

- Neutral pH (6.18).

- Loamy sand, high CEC (25.7).
- Ca medium (1.56), Cu high, Fe & Mn high.

Constraints:

- Very low K, Mg, B, Zn.
- Very low N & OC.

Implication: High CEC + neutral pH support good growth if nutrients are supplied, may lead to high yield potential with fertilization.

vi. Kahama (Highest)

Advantages:

- Neutral pH (6.5).
- Sandy loam, high CEC (29.1).
- High Ca (2.73), medium K (0.42), high Fe & Mn.

Constraints:

- Very low Mg, very low B, very low Zn.
- Very low N & OC.

Implication: Best natural fertility base for tobacco among sites; highest yield potential if micronutrients are corrected.

3. Main problems relative to the soil tests results and typical tobacco needs

- ❖ Nitrogen is deficient across the sites
- ❖ Potassium shortfall (K): Recommended tobacco K_2O removal/requirement is high, reference (<https://www.ipipotash.org/publications/>) cite total K_2O needs ranging from 220 to 240 kg K_2O/ha for full production. The basal (10:18:24) at practical basal rates supplies relatively little K_2O (120 kg/ha) compared with the crop need. So additional K (SOP preferred) is needed, especially critical for Chunya and Serengeti, where exchangeable K is very low (0.01 and 0.04 cmol/kg).
- ❖ Phosphorus oversupply at some sites: Several of your sites (Tabora, Urambo, Sikonge) already test high in available P. Applying a high-P basal everywhere is wasteful and risks environmental loss; on high-P soils, P can be reduced through basal P. (Vann M. et al. (2023) in (2023 Flue-Cured Tobacco Guide) also visited [website](https://www.coresta.org/sites/default/files/technical_documents/main/NCSU-Nutrient-Management.pdf?) (https://www.coresta.org/sites/default/files/technical_documents/main/NCSU-Nutrient-Management.pdf?))
- ❖ Micronutrients missing (Zn, B): In general the Tanzania tobacco soils are very low Zn across sites and low/very low B in several sites. The basal product's B at 0.012% is too low to correct field deficiencies; Zn is not included. These must be corrected (foliar + small soil additions).
- ❖ Acid soils & Ca: Tabora and Serengeti are strongly acidic, lime is required before expecting the best response to applied fertilizer. Basal CaO content in fertilizer is helpful but not a substitute for liming acidic soils.
- ❖ Sandy, very low CEC fields: Tabora, Urambo, Sikonge lose nutrients quickly, they need split applications, use of more frequent small top-dressings, and organic matter improvements.

4. Recommendation for the future proposed NPK blend to each zone subject to agronomical research

- i. Kahama (Best natural base; neutral pH, high CEC)
 - Issue: Maintain moderate N for quality, supply full K requirement, correct Zn & B.
 - Basal (at/just before transplant): NPK 12:20:20 inclusive with Zn and B.
 - Comments: Because Kahama has high CEC application of larger fertilizer at once; neutral pH means micronutrients will be available once Zn and B applied.
- ii. Chunya (High CEC, neutral; but very low exchangeable K)
 - Similar comment to Kahama. Lime not required (pH near neutral).
- iii. Serengeti (Higher OC & N than most; but very low K and slightly acidic)
 - Issue: good OC but very low K and low Ca; pH 5.46 (acidic).
 - Lime: Required, application of lime (CaCO_3) to correct soil pH in order to improve Ca and availability.
 - Basal: NPK 10:10:30 (raise K).
 - Comment: Because OC is higher, nutrient retention is better, K must be supplied.
- iv. Sikonge (Very sandy loam, low CEC, medium acid, P high, K adequate)
 - Issue: low CEC hence causing leaching of nutrients, need to avoid P as is high.
 - Basal: NPK 12:6:30
 - Topdress CAN: apply in splits top-dresses rather than a single dose.
 - Organic matter: apply compost/green manure to increase OC and CEC.
- v. Urambo (Sandy loam, low CEC, soil P high)
 - Same principle as Sikonge:
- vi. Tabora (Worst: very sandy, very low CEC, strongly acidic, low Ca & OC)
 - Priority actions: Lime CaCO_3 to raise pH build organic matter.
 - Basal: Avoid high-P basal (soil P already high). Use a low-P NPK 10:6:24
 - Micronutrients: Correct Zn and B
 - Organic matter: Add compost over seasons to raise OC and improve CEC.

5. Conclusion:

Liming for Tabora & Serengeti is strongly recommended. Apply agricultural lime (CaCO_3) at pre-transplanting for the increase of Ca, to raise soil pH and improve micronutrient balance. Important for timing and splitting fertilizer applications for sandy soils. A detailed soil survey for soil sampling in the future is required to come up with strong recommendations covering all tobacco growing areas.

Approved by;



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