

Cost-effective and appropriate soil fertility and plant nutrition technologies



Lead Scientist:

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In this key result area, several achievements have been recorded during SAPs I, II and III. Two consultancy reports submitted in 2005 had revealed lack of coherent soil fertility database. Following this observation, soil fertility evaluation was carried out in 5 coffee growing zones and district reports submitted, which include ISFM recommendations down to ward level. Review and compilation of ISFM packages continued, and a new coffee yield model was developed. The model, called SAFERNAC, was tested with soils of Hai and Lushoto and found to work well (Figure 1). It is now under preliminary validation with the countrywide soil data, to be followed by field trials.

A screenhouse experiment was done to test the nutrient (NPK) release potential of various organic substrates (Figure 2) in two contrasting soils (Nitisols of Lyamungu, Hai District, and Acrisols of Yoghoi, Lushoto District). Organic substrates tested were in three categories: farmyard manure, coffee farm by-products (pulp, husks and droppings from a common leguminous shade tree, *Albizzia maranguensis*) and green manure plants (*Mucuna pruriens*, *Lupinus albus*, *Canavalia ensiformis* and *Crotalaria ochroleuca*). The green manure plants proved to be the best sources of NPK, followed by *Albizzia*. Pulp, husks and manure did not differ significantly (Figure 3). Partial ISFM recommendations involving the test organics were outlined for organic and conventional farmers in Hai and Lushoto.

Priority research area for SAP IV, most of which are brought forward from SAP III, include the following:

- Research on lime requirement for the acid coffee soils
- Response function of different levels of NPK fertilizers on new varieties
- Assessing the benefits of tonic application of micronutrients
- Nutritional potential of coffee by-products and other farm substrates
- Continue with soil fertility survey to fill database gaps Southern Highlands.

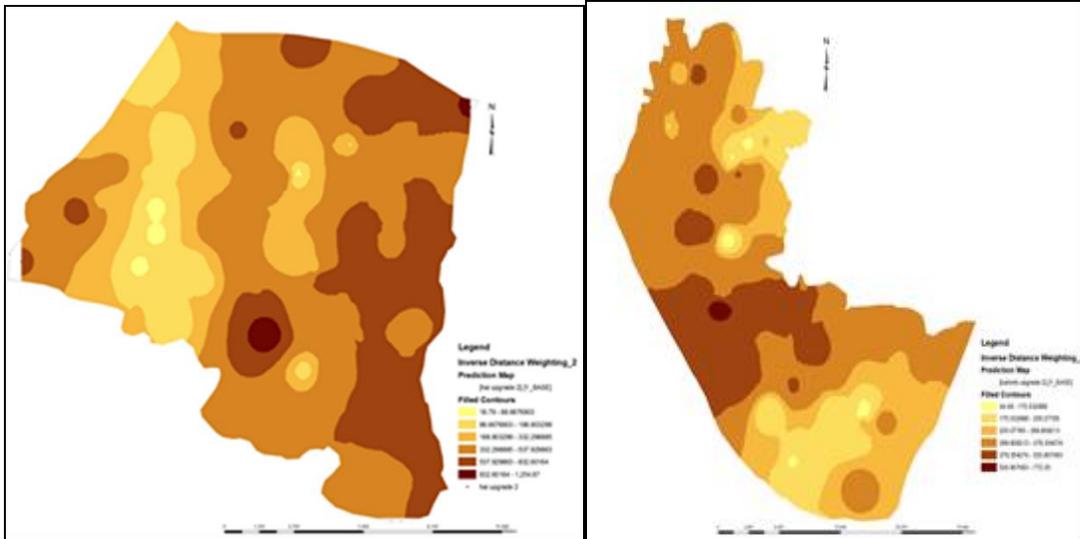


Figure 1: Estimated yield of parchment coffee with SAFERNAC model, Hai (left) and Lushoto (right)



Figure 2: Crotalaria and Canavalia green manure plants (left), setting the screenhouse experiment (right)

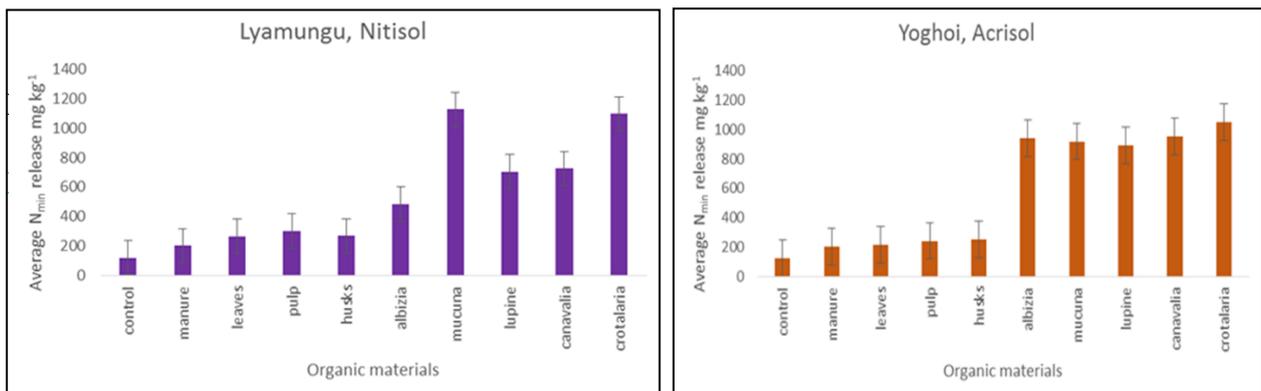


Figure 3: The Nitrogen release potential of different organic substrates

Soil Fertility Laboratory



The TaCRI Soil Fertility Laboratory is located at Lyamungu Headquarters, Hai District, Tanzania. It was built in 2007 and inaugurated in February, 2008. Its objective has been to provide coffee stakeholders with reliable and sustainable analytical services for soils, water and plant tissues. The goal is to enable farmers (growing coffee and other crops) to make scientifically informed decisions regarding the appropriate types and rates of fertilizer and other soil amendments to apply in their farms. Generally, the role of the laboratory is to:

1. Analyze samples from farmers, groups of farmers, cooperatives and various NGOs involved with coffee.
2. Analyze samples from farmers, groups of farmers, cooperatives and various NGOs which are not involved with coffee on commercial basis.
3. Interpret the soil analytical data and provide recommendations on appropriate and sustainable soil fertility management for coffee and other crops.
4. Backstop farmers' fields on request for in-situ diagnosis of nutritional disorders and suggest intervention measures.

ACHIEVEMENTS SINCE INCEPTION

1. Following the campaign "Know your farm" initiated in 2006, the number of samples received from farmers has been increasing year after year (Figure 1, left).
2. We have been interpreting the data according to the internationally set standards and providing expert advice on the requirement, type and dosage of fertilizers to apply; and we have maintained customer trust throughout.
3. We have been visiting farmers' fields upon request for in-situ diagnosis and training on soil fertility management (Figure 1 right).
4. We have provided analytical services to a total of six PhD students, four of whom have graduated and two are in their final touches.

The laboratory is sufficiently equipped to perform the following analyses:

1. The levels of acidity or alkalinity (pH)
2. Salinity (EC)
3. Cation exchange capacity (CEC)
4. Organic carbon (OC)
5. Total, ammonium & nitrate N
6. Available P
7. Exchangeable bases— Ca, Mg, K, Na

- 8. Extractable S
- 9. Boron
- 10. Micronutrients (Fe, Mn, Cu, Zn, Mo)
- 11. Texture
- 12. Structure, bulk density and porosity

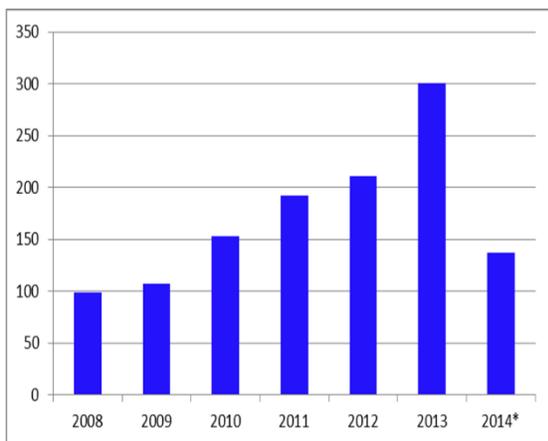


Figure 1: Number of client samples analyzed (left), ISFM training Aviv Songea (right)

ANALYTICAL CHARGES:

Analysis is costly, as it involves chemical reagents that are imported and are quite expensive. Also wear and tear of equipment should be considered. We have established the following tables for routine and complete soil analysis.

1. Price list for routine soil analysis for fertility assessment.

Parameter	pH	Ca	K	Mg	Na	CEC	%OC	%N	P	Text	EC
Price Tshs	2000	1500	1500	1500	1500	4000	2000	2000	2000	2000	1500

Total = 21500 TZS per sample

2. Price list for complete soil analysis for fertility assessment.

Parameter	pH	Ca	K	Mg	Na	CEC	%OC	%N	P	Text	EC
Price Tshs	2000	1500	1500	1500	1500	4000	2000	2000	2000	2000	1500
	Cu	Fe	Zn	Mn	S	B	Al				
	1500	1500	1500	1500	2000	2000	2000				

Total = 33500 TZ per sample

These are nominal charges as compared to other fully commercial laboratories – they could be about twice as much. Charges for coffee stakeholders have been subsidized even further, and they are required to pay just 10,000 TZS per sample (this however, will likely be revised upwards by the TaCRI Board of Directors in the near future) for routine analysis. In case a coffee farmer needs complete analysis, we charge the 10,000/- for the parameters that constitute routine analysis and all additional parameters are charged individually. Analyses for other crops are charged individually, at the rate of 22,000 TZS per sample (routine analysis) and 34,000 TZS per sample (complete analysis).