

Towards more sustainable small holder farmer livelihoods by using infrared spectroscopy for soil analytical advisory services

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Kenyan small holder farmers

- Decrease in soil fertility and crop yields
- Acidification and low organic matter content
- Farmers lack knowledge on sustainable management practices
- Challenges farmers face:
 - Small fields
 - high fertilizer prices/distribution costs
 - scarce financial resources
 - lack of market access

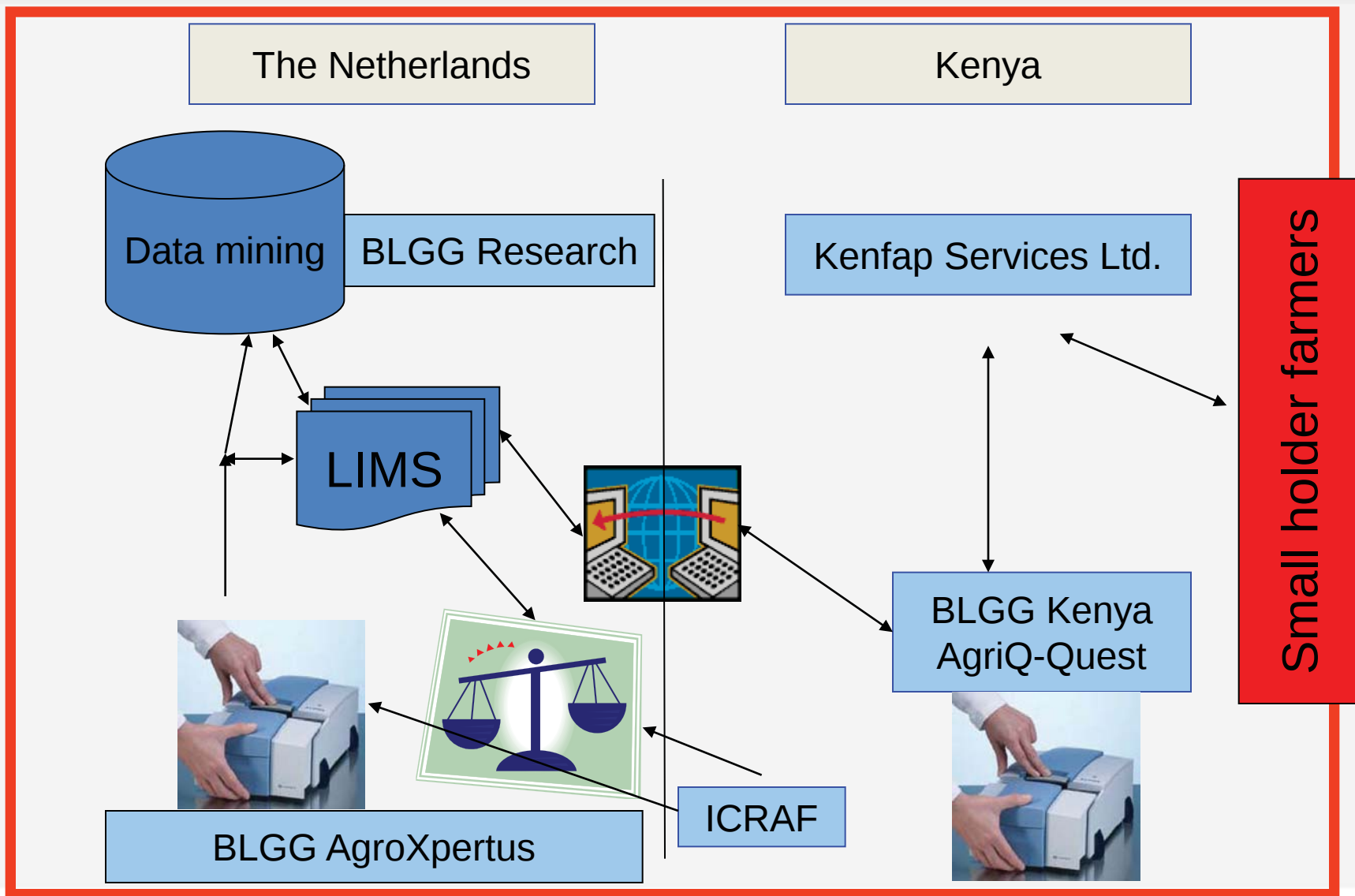


Project background

- In 2011 BLGG Kenya won a competition
 - Innovation – mid-infrared analysis of soils and compost
 - Research into business (RIB)
 - funded by the African Economic Challenge fund (AECF)
 - 50% own investments
 - about 25% subsidy and 25% loan
- Partners from research and business work together
- 6 years project (year 1-3 research)



How is the service organized?



Research question 1: spectral calibrations

Soil spectral database from ICRAF:

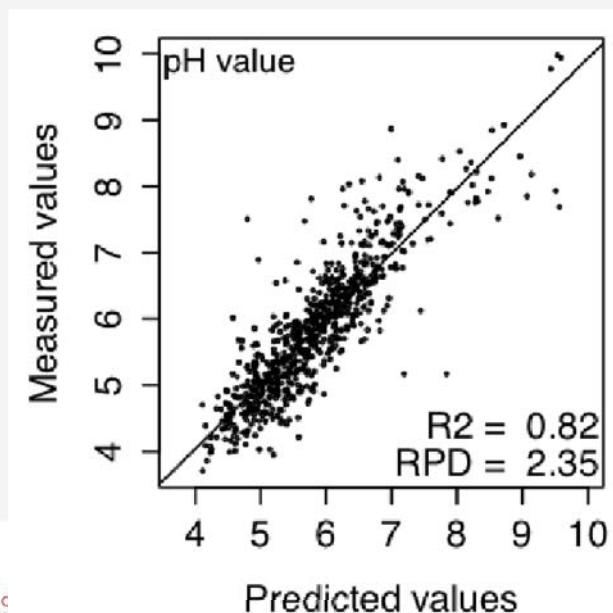
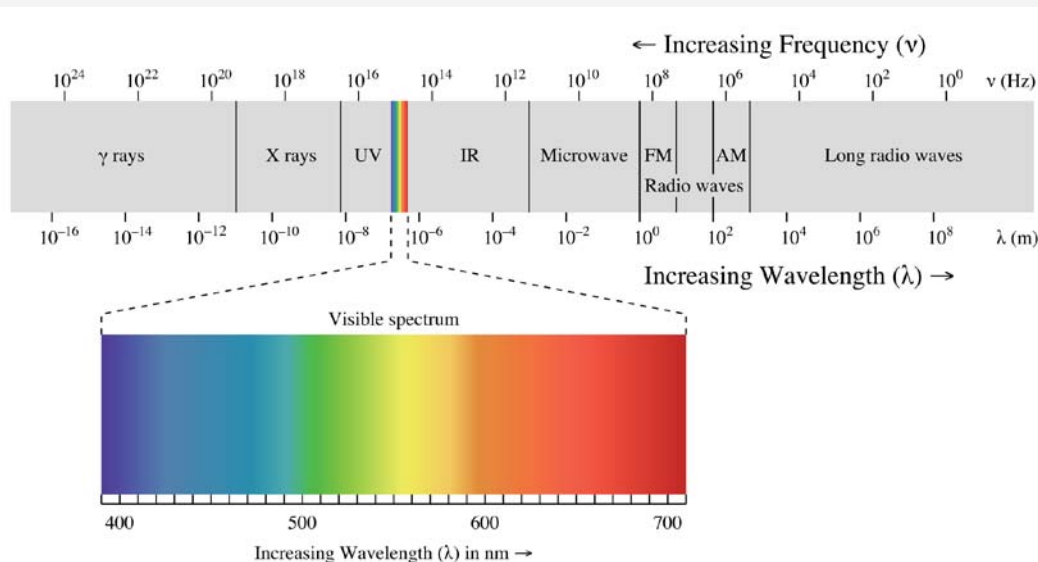
- about 2000 samples per soil property (mid-infrared spectra+reference data)

Compost spectral data base:

- The first 800 samples used for spectral modeling

How is the data base used?

- Conversion of soil wet-chemical analytical data to BLGG wet-chemical analytical data
- Spectral outliers are analysed wet-chemically and added to the model
- An ongoing validation is done to monitor quality of predictions



Research question 2: Fertilization advice

Input into the advice module:

- Soil and compost mid-infrared (MIR) analysis
- GPS location field
- QUEFTS model (a system for QUantitative Evaluation of the Fertility of Tropical Soils; Janssen et al. 1990)
- Crop nutrient equivalent (Janssen 2011)
- Types of fertilizers available, their prices and transport costs
- Packing of advised fertilizer in 5 kg steps
- Farmer's investment limit
- Farmer's historic yields
- Potential crop sales prices

Research question 2: Fertilization advice

General information

Sample	Field name: sha01	Soil texture (FAO): Medium	Name compost heap: -	Date sample taking: 12-03-2012	Sample taken by: KE02
Field/Order	Field size: 0.5 acre	sample number: 955106	Date recommendation made: 27-04-2012	BLGG Kenya client number: 8357544	

Analytical results

Soil analytical results	Unit	Value	no info	very low	low	good	very high
pH (acidity of the soil)		5.6	☐	☒	☐	☐	☐
SOC (soil organic carbon)	%	2.8	☐	☒	☐	☐	☐
Nt (Total Nitrogen)	mg/kg	2199	☐	☒	☐	☐	☐
Ca (exch. Calcium)	mmol+/kg	260	☐	☒	☐	☐	☐
Mg (exch. Magnesium)	mmol+/kg	70.7	☐	☒	☐	☐	☐
K (exch. Potassium)	mmol+/kg	6.1	☐	☒	☐	☐	☐
P (total Phosphorus)	mmol P/kg	13.5	☒	☐	☐	☐	☐
Clay	%	20	☒	☐	☐	☐	☐
Sand	%	42	☒	☐	☐	☐	☐

Compost analytical results	Unit	Value	no info	very low	low	good	very high
Ct (total carbon)	g/kg	-	☒	☐	☐	☐	☐
Ash (soil in the compost)	g/kg	-	☒	☐	☐	☐	☐
N (nitrogen)	g/kg	-	☒	☐	☐	☐	☐
P (Phosphorous)	g/kg	-	☒	☐	☐	☐	☐
K (Potassium)	g/kg	-	☒	☐	☐	☐	☐
ADL (lignin)	g/kg	-	☒	☐	☐	☐	☐
ADF (lignocellulose)	g/kg	-	☒	☐	☐	☐	☐
Volume compost heap	m ³	-	☒	☐	☐	☐	☐
Weight compost heap	t	-	☒	☐	☐	☐	☐



Research question 2: Fertilization advice

Recommendation

	Function	Name	number 50 kg bags/acre	number 50 kg bags/field
Lime	increasing pH	Calmax	7	<u>4</u>

- Lime needs to be applied by spreading uniformly before rain and planting (wear gloves and a dust mask)
- Lime must be mixed thoroughly with the soil directly after application to allow soil reaction – e.g. by harrowing or ploughing

	Function	Name	(1 bucket=20 L) buckets/ acre	buckets/field	volume/field m ³
Compost	increase soil fertility	own compost	-	-	-

- The organic carbon level in your soil is sufficient. However, compost is still advised to reduce fertilizer costs and to prevent plant diseases and pests
- Compost needs to be applied by spreading uniformly before planting (do not mix beforehand with lime)
- Compost must be mixed thoroughly with the soil (this can be done together with the lime incorporation)

	Function	Name	when	kg/acre	kg/field
Fertilizer	add nutrients	<u>17-17-17</u>	at planting	75	<u>40</u>
	add nutrients	urea	top dressing	15	<u>10</u>

- After applying compost and lime, put the fertilizer that is advised to be given "at planting" time into the planting hole
- Put a bit of soil on top, add the seed and cover the seed with soil
- When plant is about 6-7 weeks old make the top-dressing with urea (do this only if the crop is healthy [no pests or diseases], you did weeding and sufficient rain has fallen to grow a good crop)

General advice

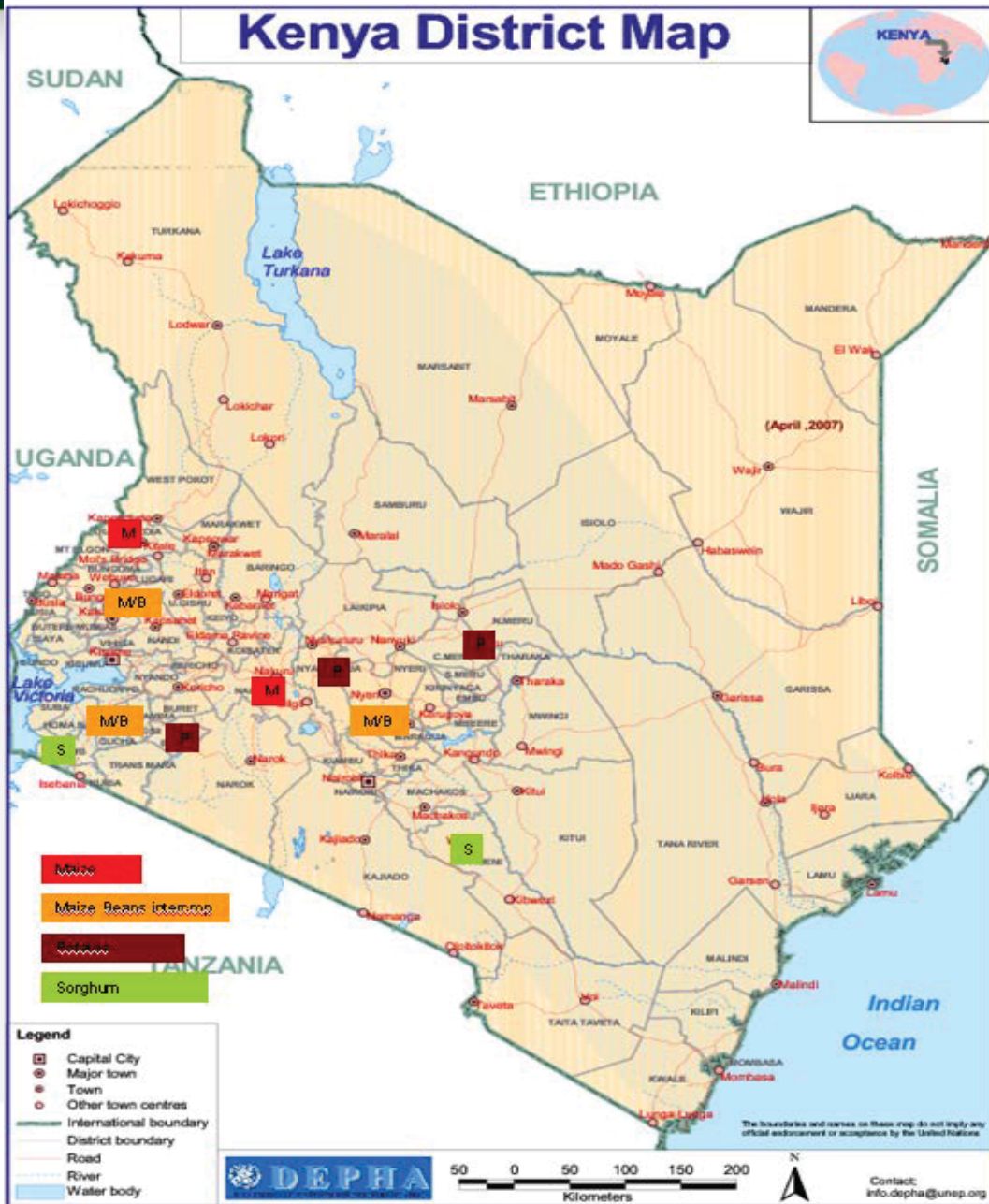
- Use improved/certified seeds
- Carry out sufficient weeding – otherwise you fertilize the weeds and not your crop
- Make continuously compost (every 2 weeks) to have sufficient volume for your field
- In case you experienced problems with Striga do the following
 - choose resistant varieties of maize
 - weed the Striga plant before it produces seed
 - increase nitrogen fertilization – this suppresses Striga



Research question 2: starting a QUEFTS network

- Administrated web-based platform
- Aims:
 - Creating network of people working with the same tool
 - Gathering experiences of model robustness
 - Extending this tool to new regions/crops
 - Using joint forces to develop new research questions/write proposals as a group
- Contact:
 - www.blgg-research.nl, Wageningen, The Netherlands

Research question 3: On-farm field trials



- 10 on-farm field trials in 2012/13
- Maize/potatoes/sorghum
- Comparison of results of usual farmer's practice and results following the advice
- Full economic comparison
- Farmer's days to show and convince farmers to ask for the service
- We invite researcher to participate in these field trials

Looking forward to the discussions!

