Sensor technology for soil testing – to provide fertilizer recommendations for small holder farmers in Myanmar

Helping Farmers grow better crops

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The Objective

Supporting farmers and distributors to make better fertilizer decisions using local customized information

Supporting crop economics

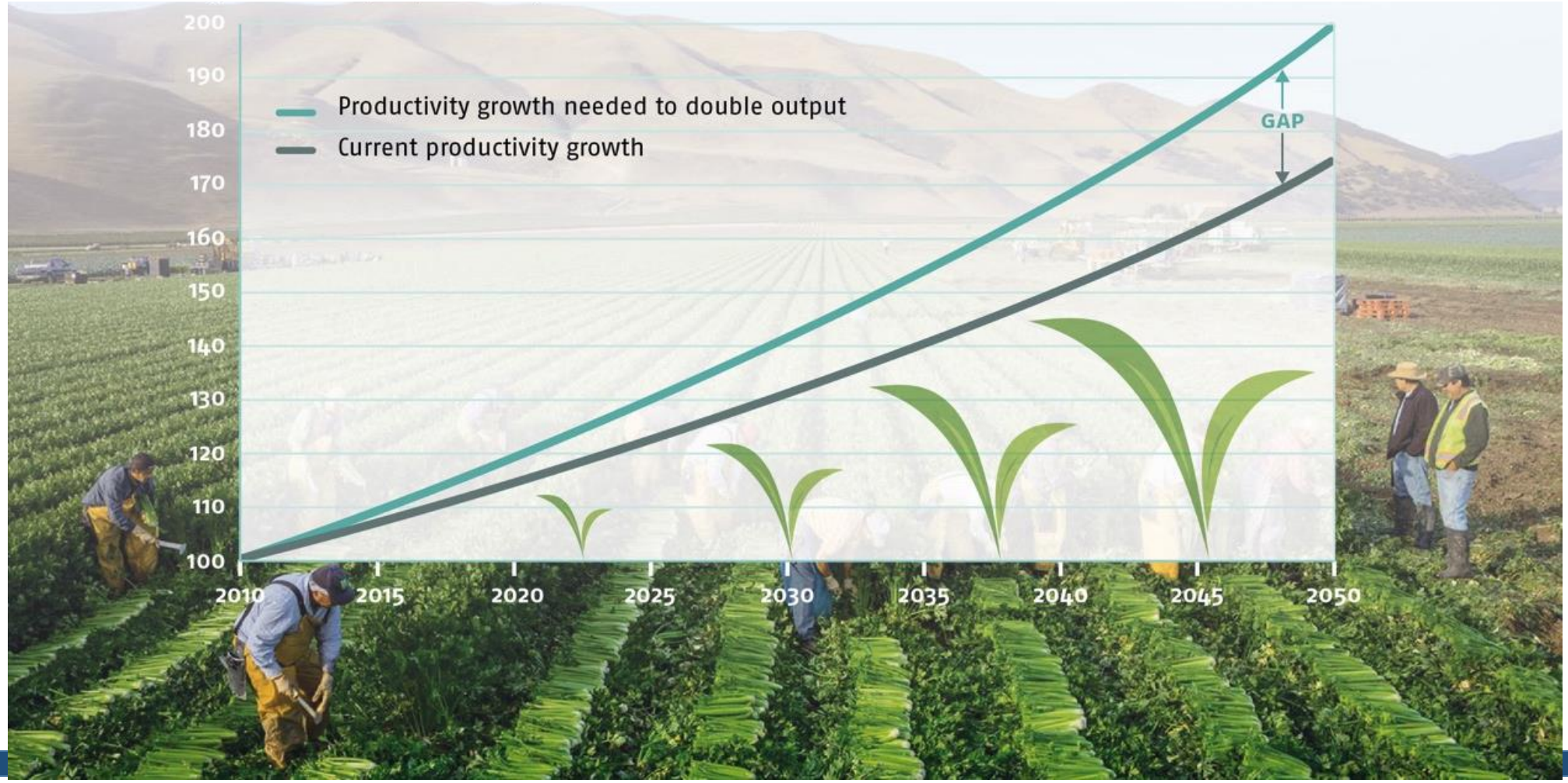
Inputs

With advanced technology - helping farmers grow better crops

- Better yields
- Better quality
- Improved return on investment

Increasing gap between expected & required food production

Agricultural output 2010 = 100



Sustainable – Productive Agriculture

4R Principles of Nutrient Stewardship

RIGHT SOURCE

Matches Fertilizer Type to Crop Needs

RIGHT RATE

Matches Amount of Fertilizer to Crop Needs

RIGHT TIME

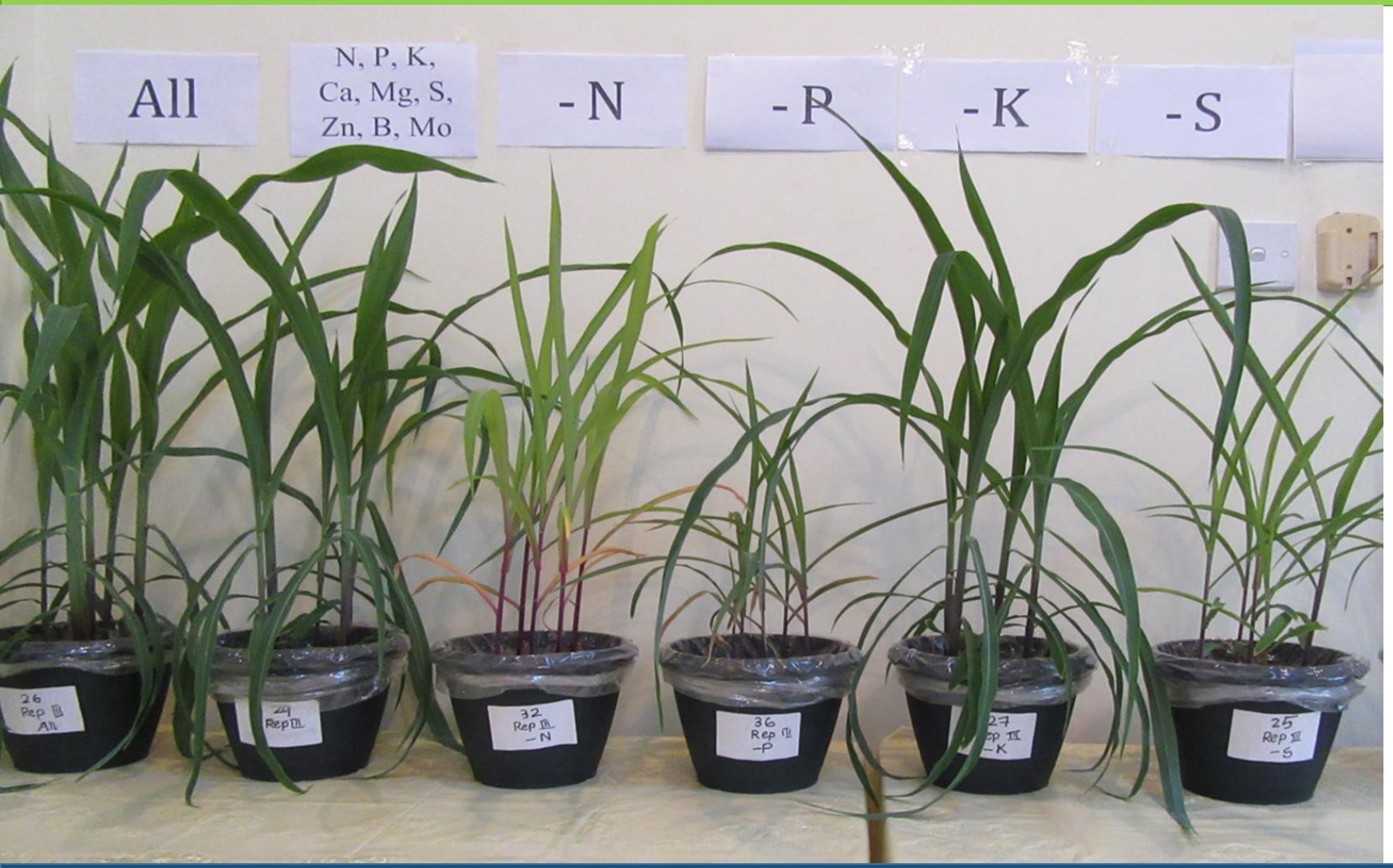
Matches Nutrients Available When Crops Need Them

RIGHT PLACE

Keeps Nutrients Where Crops Can Use Them

How good is my soil? What Fertilizer should I apply?

Pot Trials- to check soil fertilizer requirements



- Simple process
- Time consuming & slow to get results
- Limited accuracy
- Operator variations

Wet laboratory analysis

- Expensive equipment
- Skillful trained operators
- Time consuming process
- Expensive

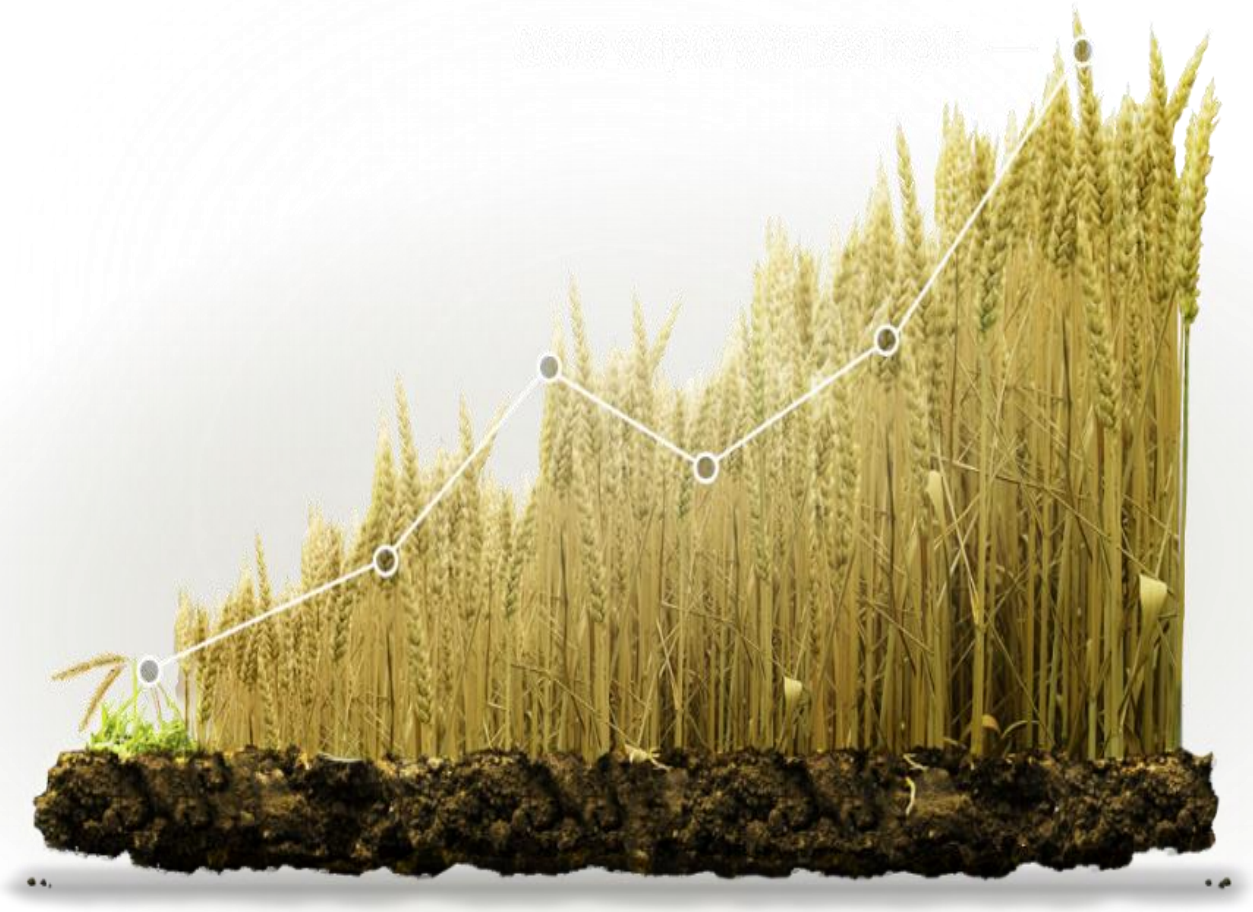
What are some of the common problems faced by MM farmers?

Remote locations

Limited knowledge

Numerous small fields

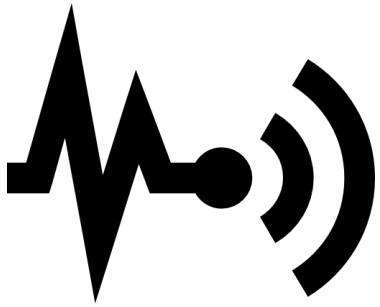
What does scanner technology enable?



- Fast, affordable & reliable soil information
- Ability to test soils even in remote areas
- Access to Soil Testing for millions of farmers

The service and the technology behind it

Cloud management

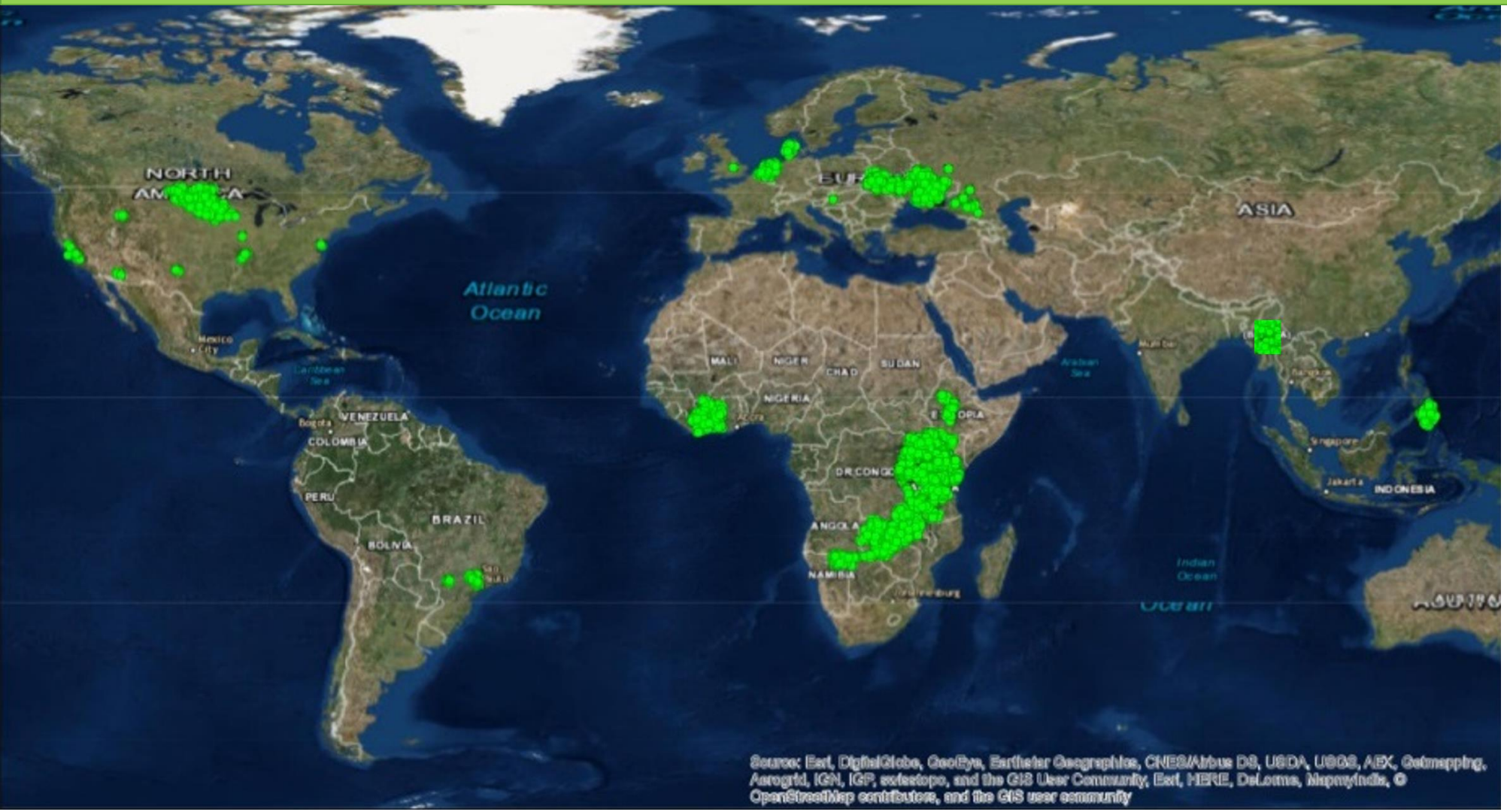


Innovative sensor technology
NIR, MIR, XRF

Intelligent learning Soilcares
Global Dbase

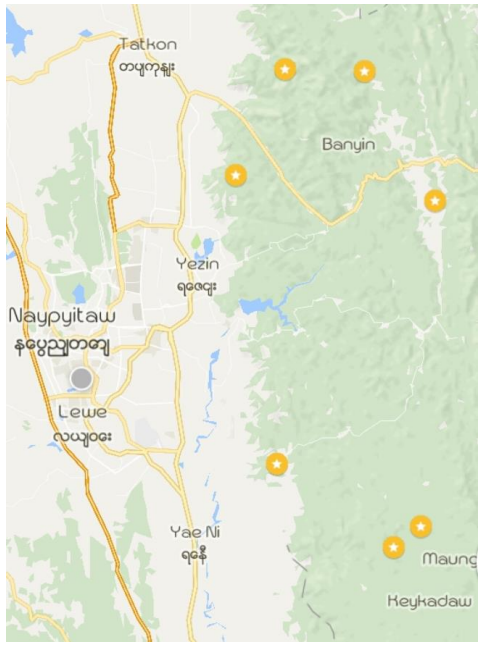
Expert knowledge on crops &
fertilizer recommendations

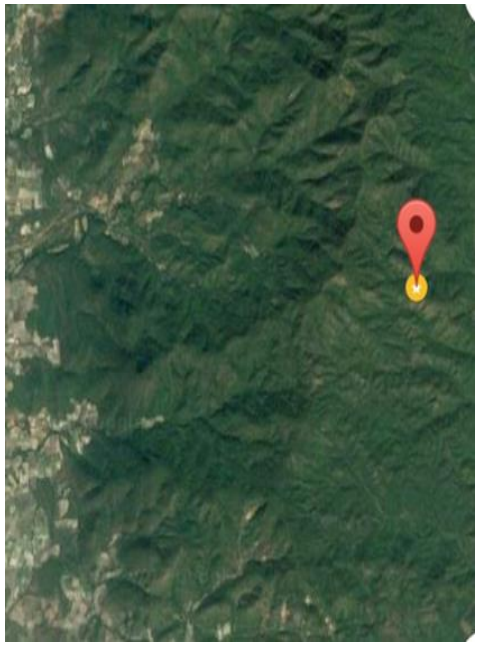
The “Golden Standard” sampling locations Worldwide

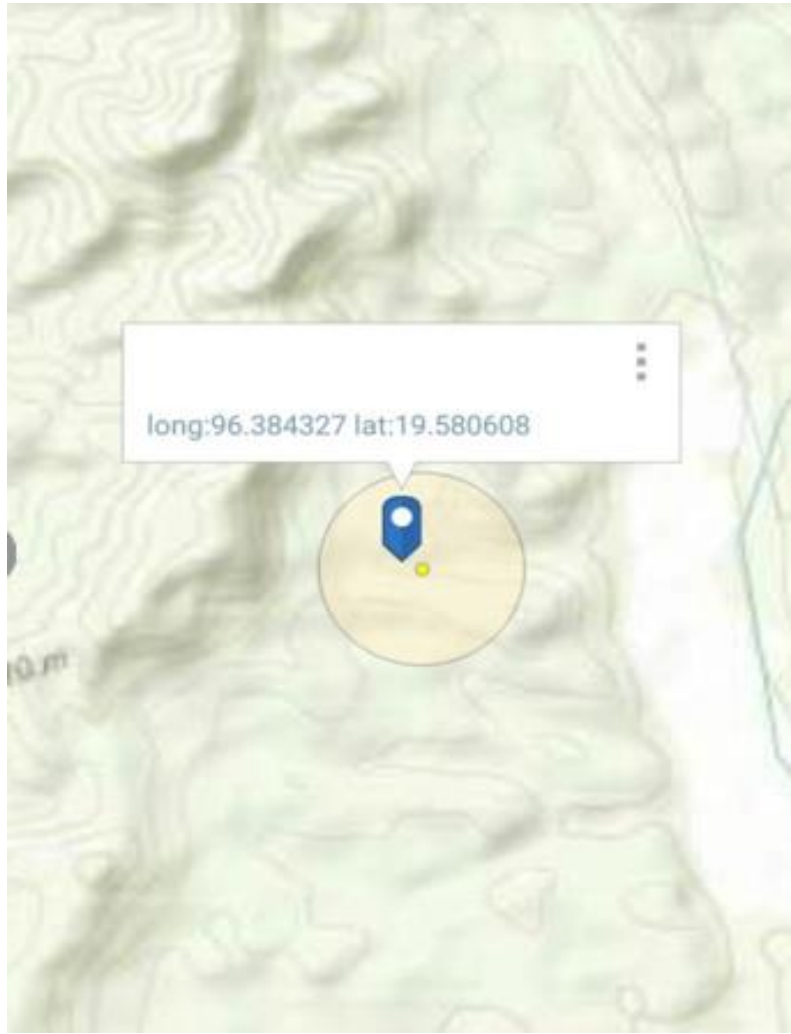


The real intelligence is in the database and the algorithms

Carefully selected “Golden Standard” sampling locations







Site selection based on a long procedure of statistical calculations.

Building the “Gold Standard” database

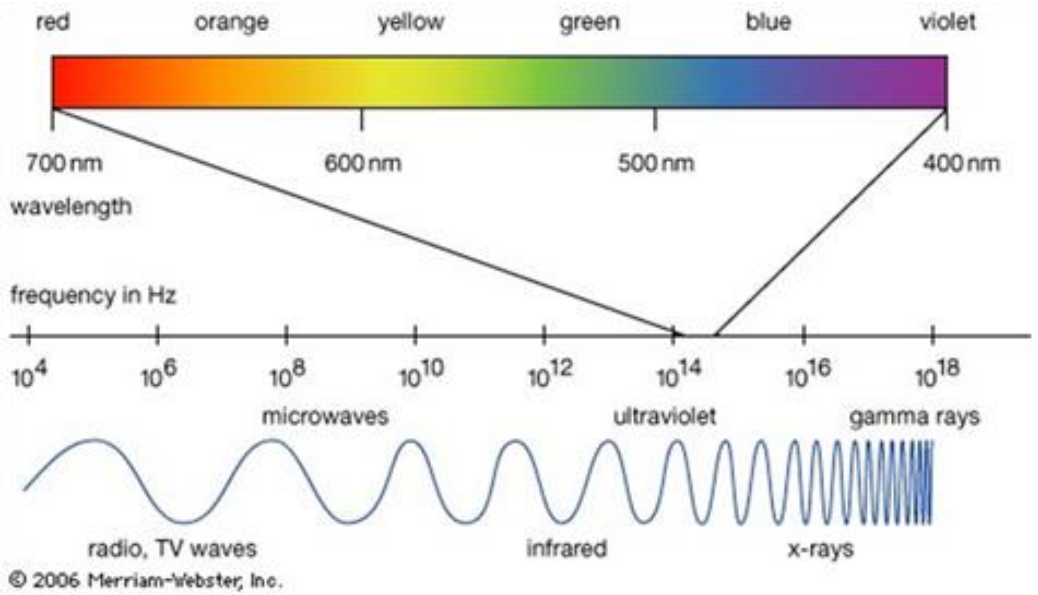
Storing thousands of soil samples from all over the world

Analysis of samples in wet-chemistry lab in exact same standardised way

Analysing the samples with NIR, MIR and X-ray, to make comparisons possible

Doing calculations using big data to obtain parameters & recommendations

Testing soil using sensor spectral technology



Different soils: what can you recognise?

Which one has the highest organic matter?

Which one is the clay soil?

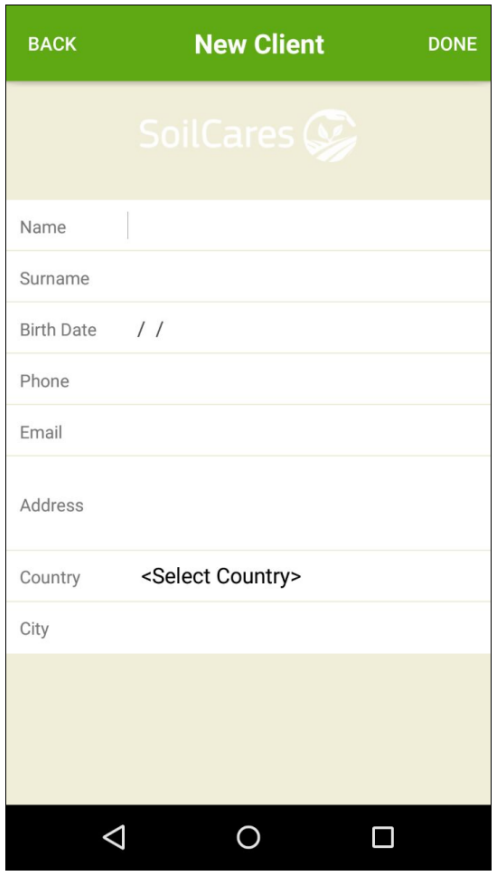
Which one has the highest clay content?

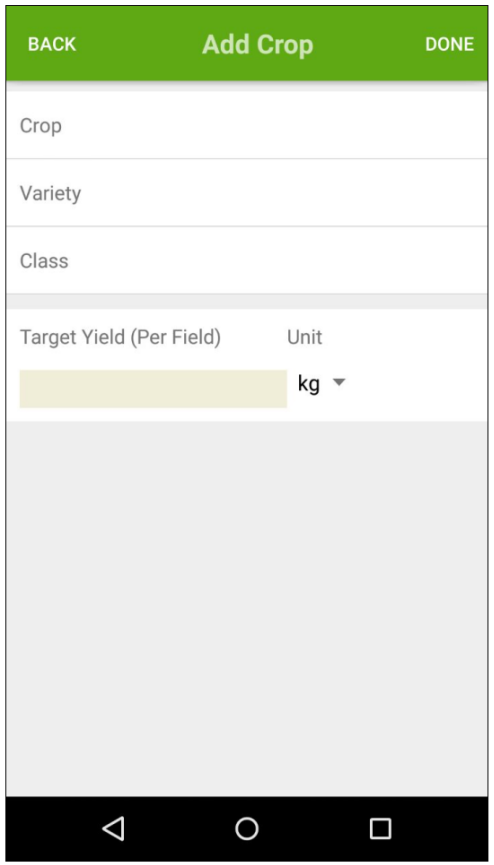
Your own Sensor technology

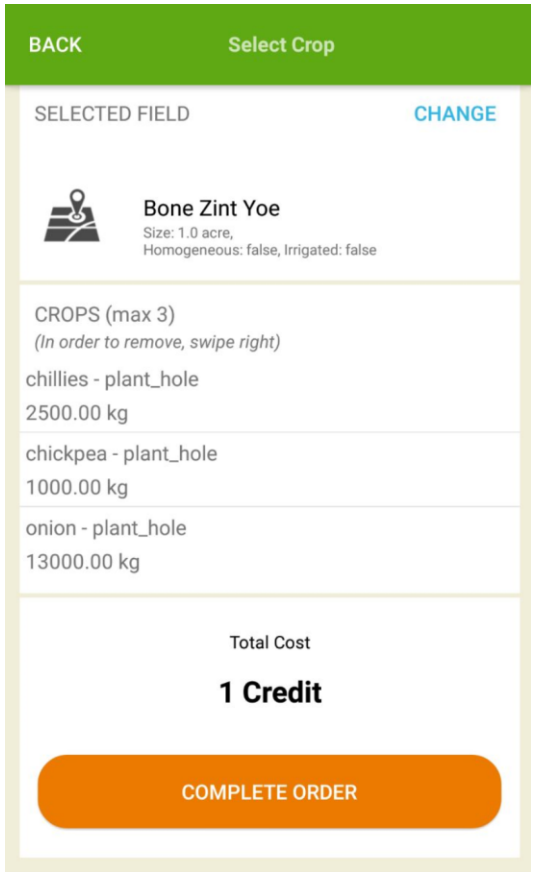
Your eyes – sensors of visible light

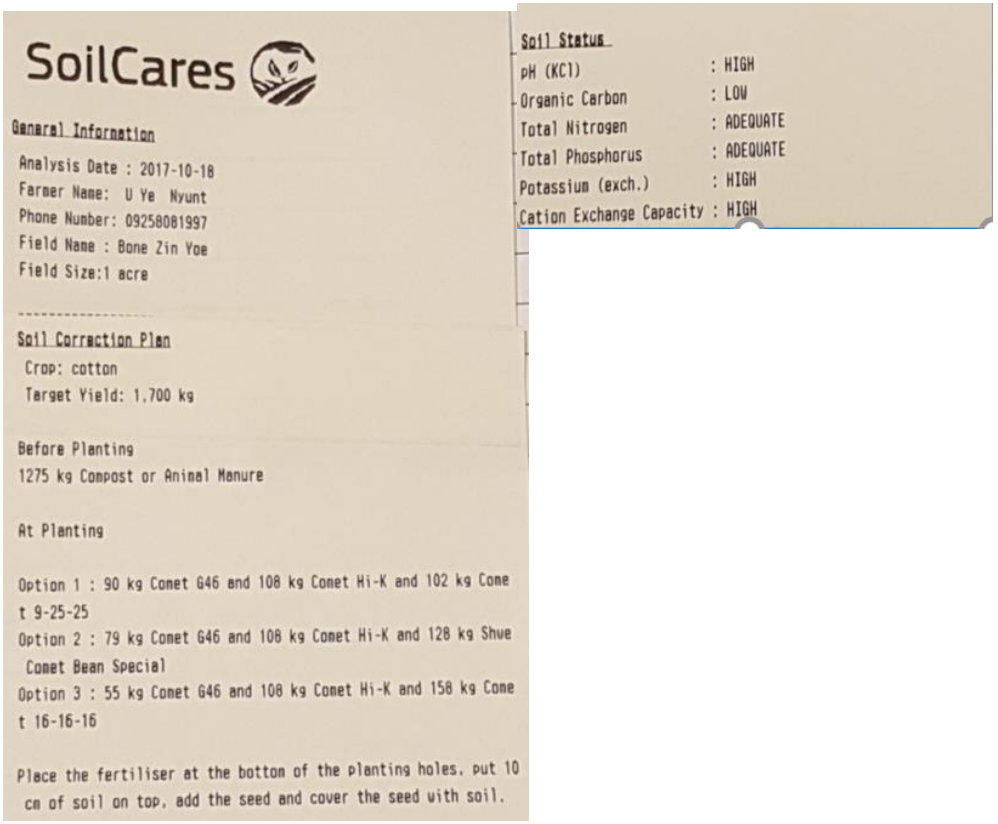
Your brain - a calibration set

Customized input for each sample- customized output








SoilCares

General Information

Analysis Date : 2017-10-18
Farmer Name: U Ye Nyunt
Phone Number: 09258081997
Field Name : Bone Zin Yoe
Field Size:1 acre

Soil Correction Plan

Crop: cotton
Target Yield: 1,700 kg

Before Planting
1275 kg Compost or Animal Manure

At Planting

Option 1 : 90 kg Comet G46 and 108 kg Comet Hi-K and 102 kg Comet 9-25-25
Option 2 : 79 kg Comet G46 and 108 kg Comet Hi-K and 128 kg Shue Comet Bean Special
Option 3 : 55 kg Comet G46 and 108 kg Comet Hi-K and 158 kg Comet 16-16-16

Place the fertiliser at the bottom of the planting holes, put 10 cm of soil on top, add the seed and cover the seed with soil.

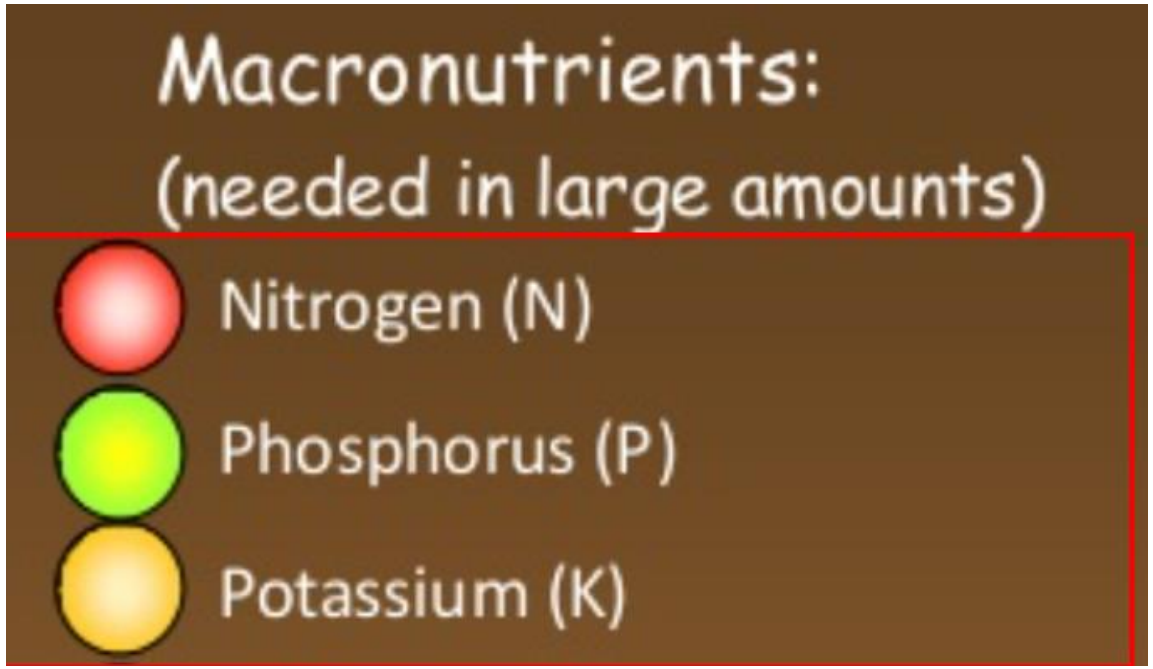
Soil Status

pH (KCl)	: HIGH
Organic Carbon	: LOW
Total Nitrogen	: ADEQUATE
Total Phosphorus	: ADEQUATE
Potassium (exch.)	: HIGH
Cation Exchange Capacity	: HIGH

SoilCares mobile Scanner

- Mobile
- Light weight
- Fast: < 20 minutes procedure
- Near Infrared spectrometer (NIR sensor)
- Accurate recommendations

Plant nutrients – macro nutrients



Also

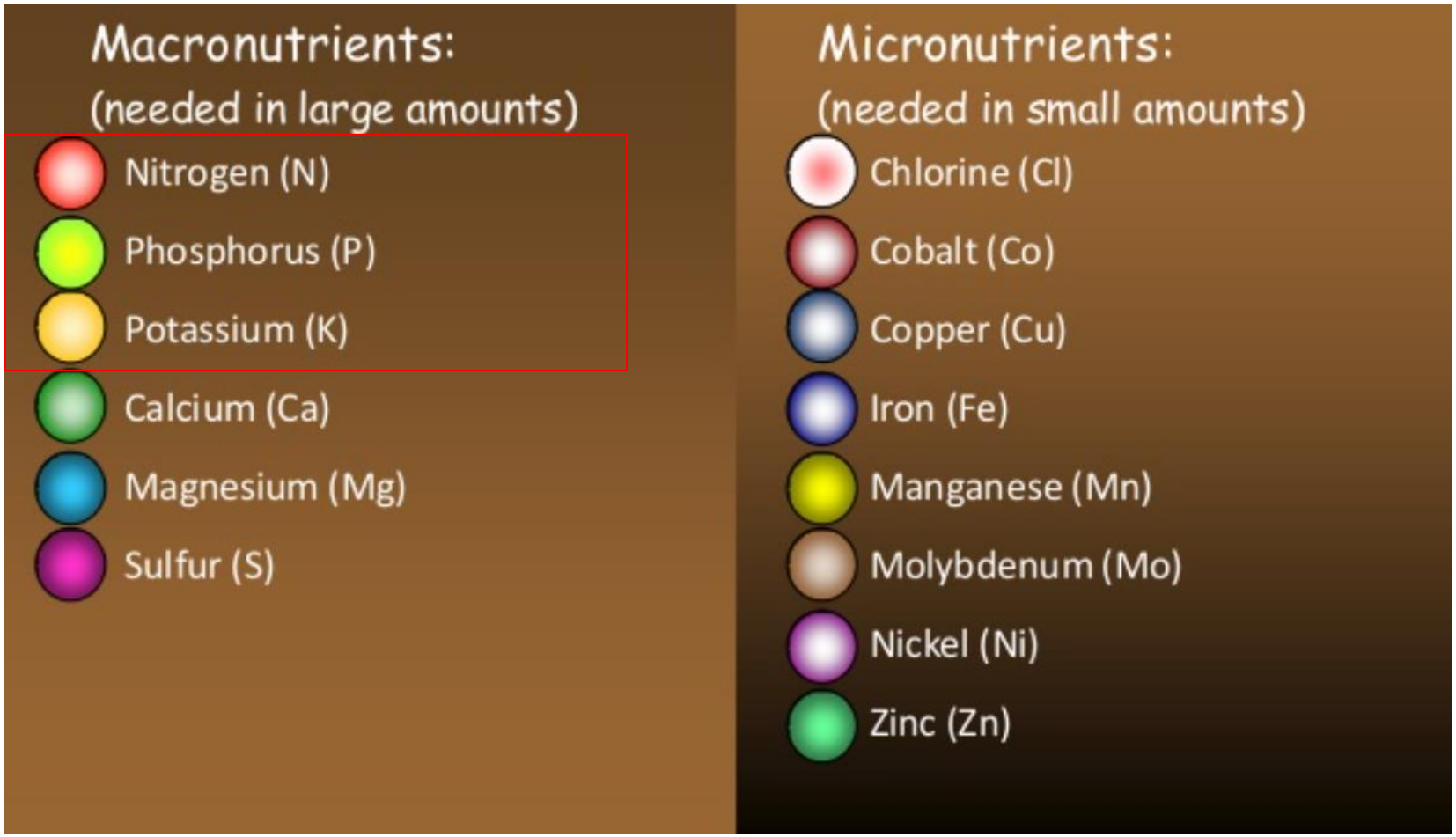
- pH
- Organic matter
- CEC

SoilCares Lab-in-a-Box (LIAB)

The most complete, fast, affordable and reliable solution

- Quick and reliable soil status
- On-site complete laboratory
- Easily integrated data
- Little lab experience needed
- Comprehensive analysis

Plant nutrients – plant food



The SoilCares Lab-in-a-Box: Example of a report

Soil Status

Parameter	Unit	Analysis Re sult	Range Low	Range High	Low	Ade quate	High
pH value	pH Value	4.7	4.90	6.40	■		
Organic Carbon	g/kg	27.4	17.00	50.00		■	
Total Nitrogen	g/kg	1.2	1.00	2.00		■	
Total Phosphorus	g/kg	0.1	0.20	0.60	■		
Potassium (exch.)	mmol+/kg	10.3	1.50	3.00			■
Calcium (exch.)	mmol+/kg	55.1	15.00	25.00			■
Magnesium (exch.)	mmol+/kg	28.8	4.50	10.00			■
Zinc (M3)	mg/kg	13.4	2.50	4.00			■
Copper (M3)	mg/kg	0.1	1.00	2.00	■		
CEC	mmol+/kg	120.6	75.00	200.00		■	

Soil Status

Analysis Result

Ranges

Low – Adequate - High Status

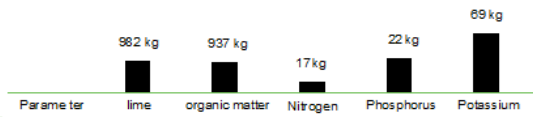
pH (KCl)
Zinc (Mehlich 3) (mg/kg)
Aluminium (exch.)(%)
Boron (exch.)(mmol-kg)
Boron (mehlich 3) (mg/kg)
Lime (g/kg)
Total Zinc (g/kg)
Total Copper (mg/kg)
Electrical conductivity (dS/m)
Total phosphorus (g/kg)

Potassium (exch.) (mmol+/kg)
Total Sulphur (g/kg)
Calcium (exch.) (mmol+/kg)
Magnesium (exch.) (mmol+/kg)
CEC (mmol+/kg)
Copper (Mehlich 3) (mg/kg)
Organic matter (g/kg)
Iron (Mehlich 3) (mg/kg)
Potassium (Mehlich 3) (mg/kg)
Magnesium (Mehlich 3) (mg/kg)

Manganese (M3) (mg/kg)
Molybdenum (mg/kg)
Sodium (exch.)(mmol+/kg)
Phosphate (Mehlich 3) (mg/kg)
Clay (%)
Sand (%)
Silt (%)

The SoilCares Lab-in-a-Box: Example of a report

Actual Nutrient Need (in kg)



Soil Correction Plan

	ACTIVITIES	INSTRUCTIONS	BEST OPTION	ALTERNATIVE 1	ALTERNATIVE 2
1	——		1000 kg agricultural lime		
2	—— Before Planting		937 kg compost or animal manure		
3	Start of the season	Apply the fertilizer at the start of the season. Put it at the bottom of the planting holes, put 10 cm of soil on top, add the planting material and cover it with soil. For adult plants you dig a furrow close to the crop. Place the fertilizer in the furrow (be careful that it does not touch the plants) and cover the fertilizer with soil.	207 kg MOP and 134 kg Mavuno planting	203 kg MOP and 94 kg Rock phosphate and 102 kg 17-17-17	65 kg CAN and 94 kg TSP and 231 kg MOP
4	After 1st harvest	Topdress after the first harvest.	41 kg calmax and 49 kg Mavuno topdressing	41 kg calmax and 41 kg SA and 41 kg 25-5-5-5S	53 kg CAN
5	After 2nd harvest	Topdress after the first harvest.	41 kg calmax and 49 kg Mavuno topdressing	41 kg calmax and 41 kg SA and 41 kg 25-5-5-5S	53 kg CAN
6	After 3th harvest	Topdress after the first harvest.	41 kg calmax and 49 kg Mavuno topdressing	41 kg calmax and 41 kg SA and 41 kg 25-5-5-5S	53 kg CAN

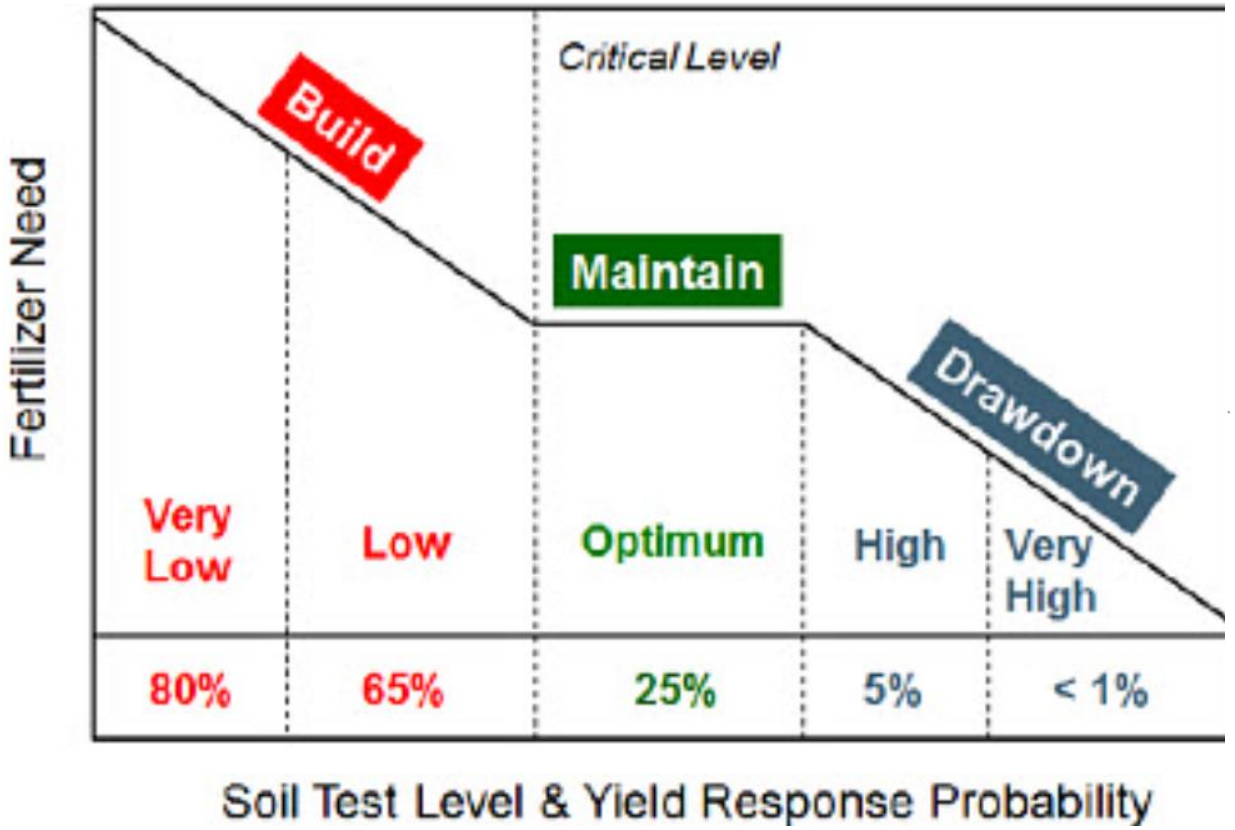
Actual Nutrient Need

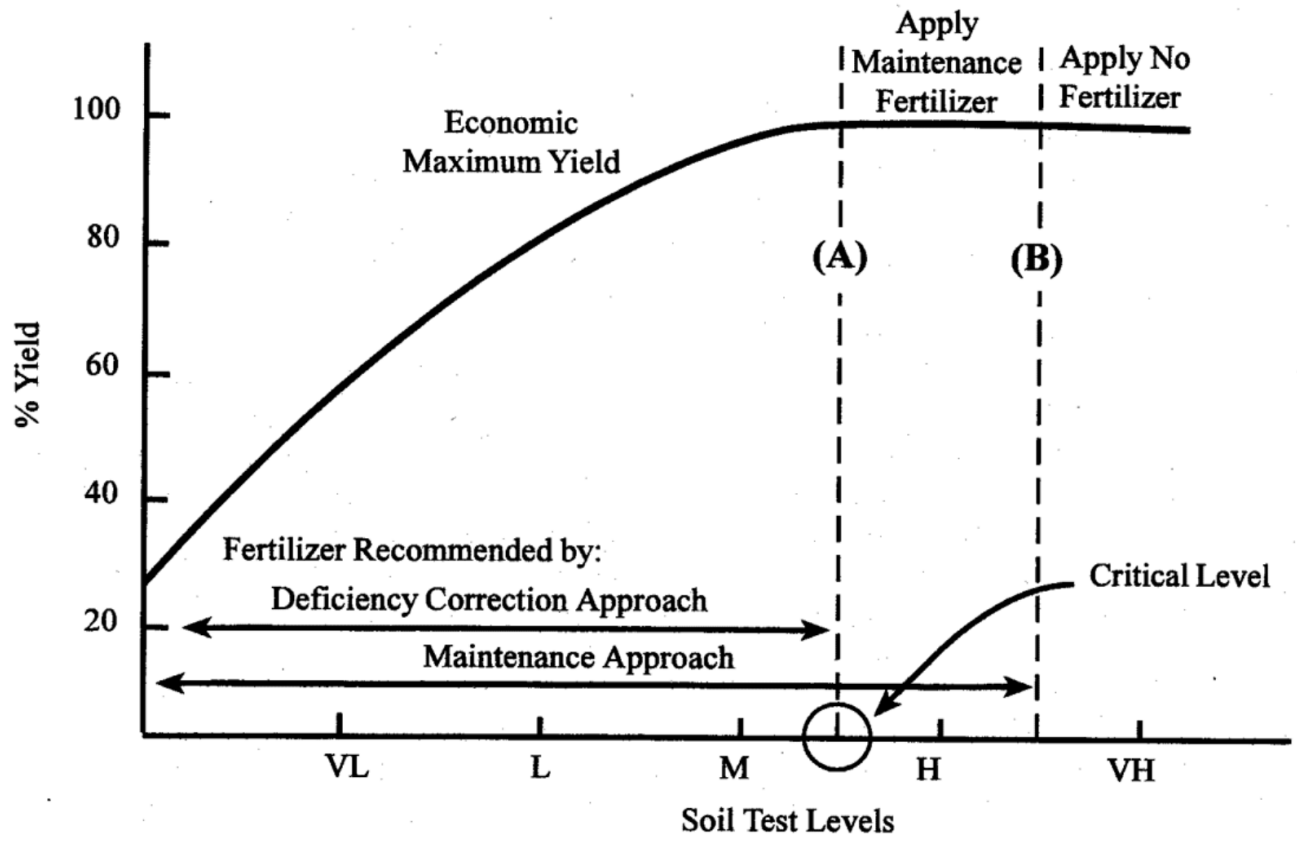
Soil Correction Plan

Fertilizer recommendations

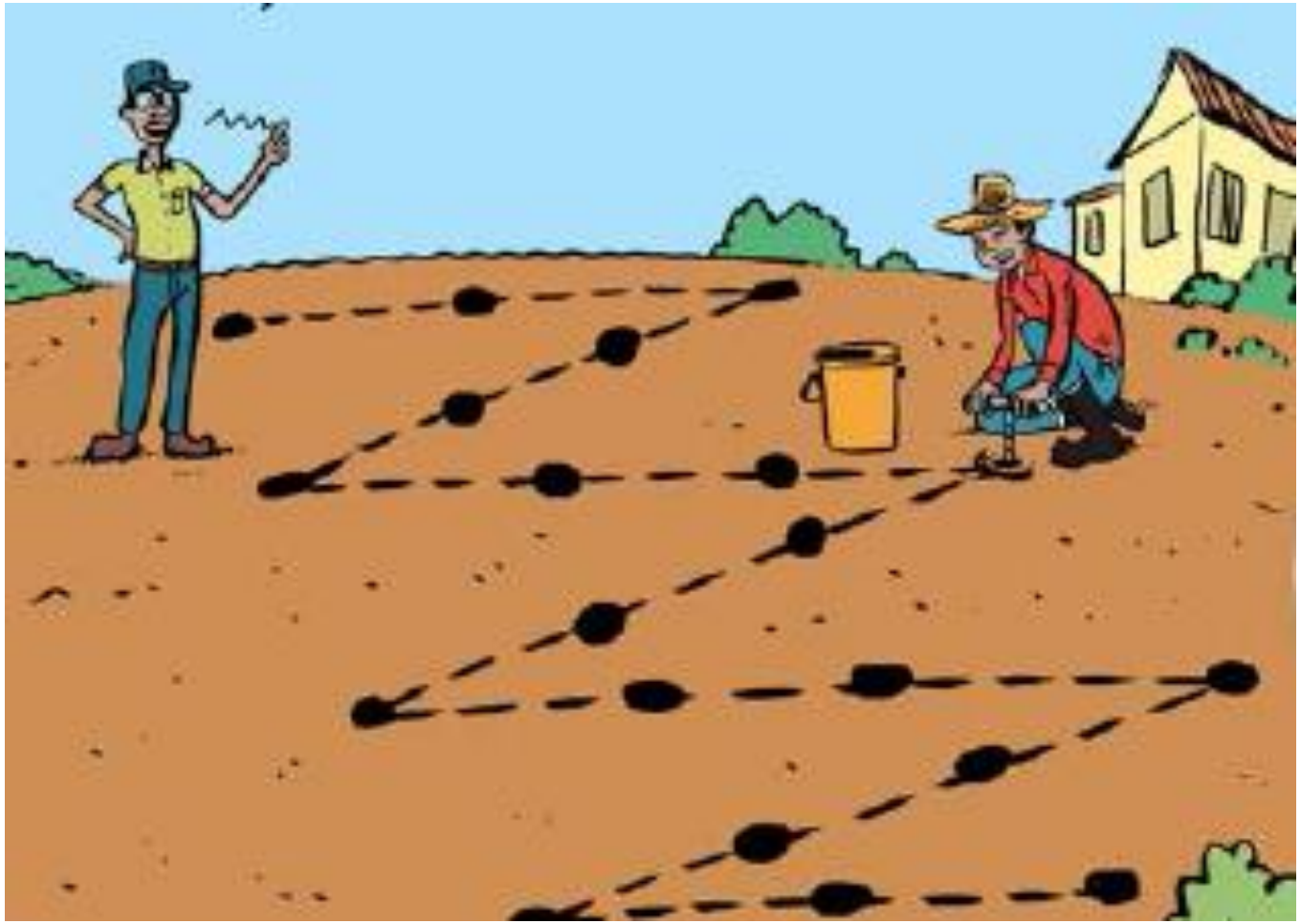
Application instructions

Calculating the right fertilizer application rate





Random sample taking



Very important to have a representative soil sample

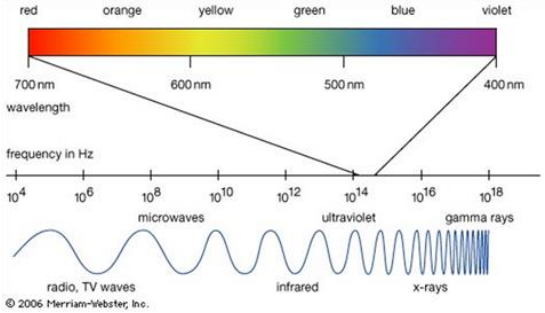
What influences the quality of soil analysis?

	Wet Chemistry	Lab-in-a-box	Scanner
Sample quality	✓	✓ ✓ ✓	✓ ✓
Number of samples	✓	✓ ✓ ✓	✓ ✓
Standardization	✓	✓ ✓ ✓	✓ ✓
Analitical quality	✓ ✓ ✓	✓ ✓	✓

Table: Qualitative scoring of different elements of accuracy of the prediction for different determination methods. ✓ = low score, ✓ ✓ = medium score, ✓ ✓ ✓ = high score.

Scanner Technology in Summary

1. Sensor technology to convert soil spectra into soil data
2. Transmission through internet and blue-tooth
3. Evaluation in global algorithm
4. Fertiliser recommendations using farmer specific data and customized app.



- Enabling millions of farmers to get affordable soil information and customised fertilizer recommendations

Thank you!