Taking Maize Agronomy to Scale in Africa (TAMASA)

Planning Meeting, 14-17 March 2016, Arusha, Tanzania

Compiled by Peter Craufurd and Rahel Assefa (CIMMYT)

Executive Summary

The second planning meeting, including a field trip and a partner meeting, was held in Arusha with approximately 45 participants. There was a core TAMASA partner meeting (30 participants) and field trip 14-16 March with participants from Ethiopia, Nigeria and Tanzania, as well as representatives from AfSIS, Leuven, Reading, Wageningen, Michigan and One Acre Fund.

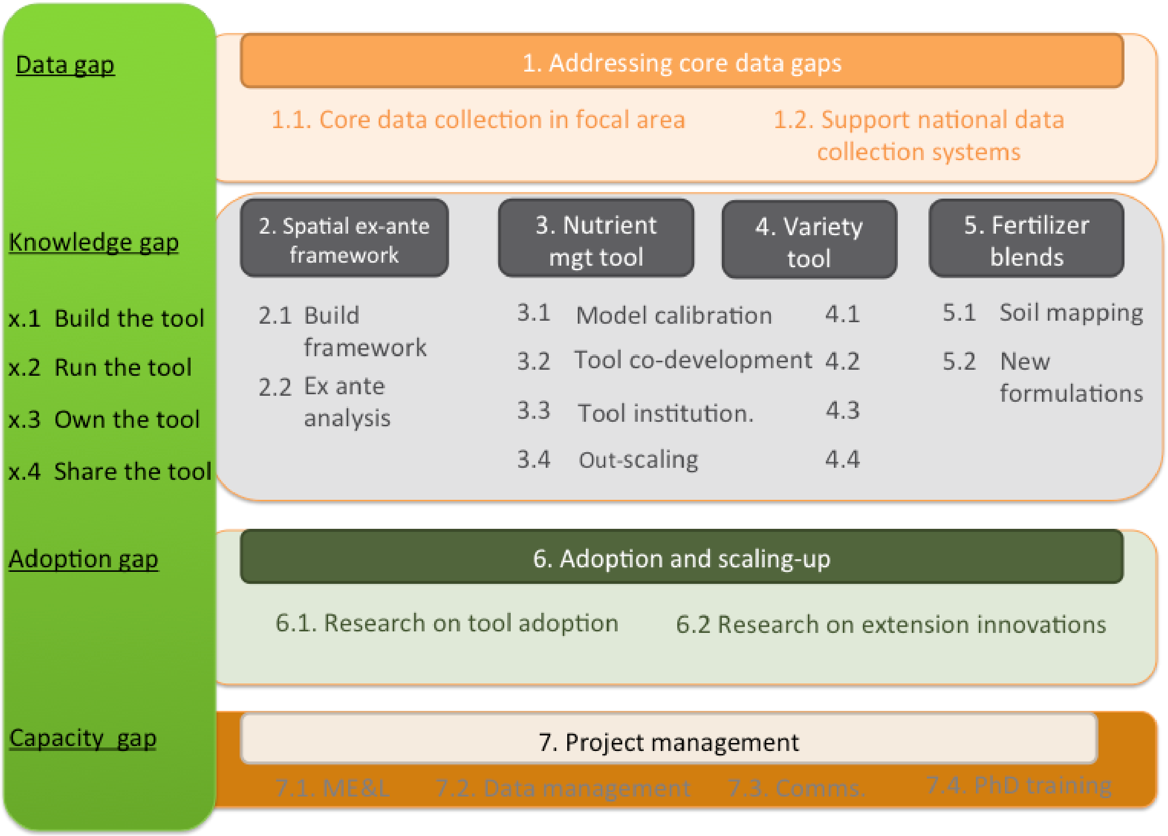
The objectives of the meeting were to: review and present key results from Year 1; review existing and new SOPs for each Workstream (WS); present and approve work plans for each WS & country for Year 2; review any data quality & process/method issues; increase partnerships in Tanzania; identify research opportunities under TAMASA.

The meeting started with an overview of the spatial sampling strategy and how the agronomy, yield and household (HH) data were to be integrated thorough the use of 10 x 10 km sampling cells. Country work plans for Year 2 were then presented along with key questions to be agreed on Standard Operating Procedures (SOPs). Thereafter sessions were held on each Workstream, focusing on the experiences gained in Year 1 and proposals for Year 2. Presentations by One Acre Fund and STARS in WCA were also made, along with three presentations on the TAMASA supported PhD programs. The field trip was to Keratu, about two hours away, where participants visited two of the nutrient omission trials and an Africa Rising fertility trial. The revised Workstreams are given below.

In all three countries 10 x 10 km sampling cells will be the basis of the spatial analysis of the Area of Interest (AOI). All TAMASA implemented activities will be in these cells, i.e. the household, agronomy and yield panel surveys, and the nutrient management and variety tool validation. This is to maximize integration by linking different data streams in the same locations; this also helps increase logistical efficiency. Partners who co-develop and use the tools that are developed will scale these out, predominately but not exclusively in the AOI. Standard SOPs will be used throughout and implemented via ODK to aid rapid data sharing. The more significant changes from 2015 plans were to expand and integrate the household, agronomy and yield panel to about 750 households in each country, and to focus earlier in the tool development process on institutionalisation.

The partner meeting on the 17th included 15 participants from government extension, NGOs, research and the private sector in Tanzania to showcase TAMASA and AfSIS products and to initiate discussions on institutionalisation. Nutrient management attracted the greatest interest among participants.

The layout of the report is arranged by the meeting Agenda.



Key discussion points

Project

- Revised country work plans for 2016 are available from DropBox (https://www.dropbox.com/home/TAMASA/Country%20Workplans%20for%202016)
- Institutionalisation is a key objective and more time and resource needs to be devoted to this process, which has started. The model of all functions being done by country institutions may not be the right one for some products, i.e. a central institute maybe be needed for databases and analytics
- The role of an enlarged household survey that forms the basis of experimentation in future years was discussed and agreed. This is quite a lot of additional work and it was suggested that this should be done through one single visit (for data collection in the upcoming season, with cost-benefit analysis of multiple visits to be assessed for subsequent seasons)
- PhDs still need to be more integrated into the main TAMASA work plan.

Workstream 1

- Overall strategy was agreed by all and cells have been identified in all three countries
- Revisit the question of analyzing representativeness using box plots and other bivariate measures, as well as propensity scores for representativeness in multivariate space (as opposed to AUC)
- Consider whether the selection of cells and farms/HHs should be hypothesis based and not random
- Further develop the UAV SOP using AfSIS, STARS and CIMMYT experience. Need to consider

image processing now and not later. A small group met to discuss these issues further on day 2

- Develop a HH 'lite' version for partners to use with yield measurements
- Jordan will provide training in each country on the HH instrument, which has been co-developed with MSU, AfricaRising, and WUR inputs.
- Agronomy instrument should be designed for a single visit and include NDVI or other measures of 'growth' where possible

Workstream 2

- Ex-ante spatial framework. In progress; discussion was focused on data gaps and the price modeling

Workstream 3

- Nutrient management. A lot of discussion and a small group met on the question of target yield and treatments for Year 2 on day 2
- Designs and treatments were agreed for validation in Year 2.
- Discussions on institutionalisation have started with BUK in Nigeria and Mlingano in TZ. In Ethiopia institutionalisation is still under discussion with partners but Ethiosis is the logical partner rather than EIAR or MOANR

Workstream 4

- Variety tool experiments are in progress in TZ and planned for ET and NG.
- Discussion of why just phenology and not yield and whether data collection and experiments could be simplified.
- Henri to conduct training in NG and ET on the SOP
- Plans for institutionalisation include IAR in Nigeria, EIAR in Ethiopia and TOSCI in Tanzania

Workstream 5

- Fertilizer formulation. OCP-funded soil sampling in progress in NG.
- Upto four formulations are expected to be tested in Year 2 once soil analysis is completed (in progress)

Workstream 6

- HH survey will be the basis of experimentation in Year 3. A small group met to look at the instrument and process.

Workstream 7

- New project manager Rahel Assefa will assume leadership of several project areas, including communications (including a web-site) and ME&L, as well as budgets and reporting
- For data management the proposed portal (Geonode) and other procedures were discussed. The need to follow the data SOP for uploading and processing ODK-data was re-emphasized.

Workshop Agenda

Day 1, Monday, March 14, 2016

Monday 14			**Time**
0800-0830	Registration	C. Mukundi	
0830-0900	Welcome & Meeting Objectives	P. Craufurd	30
Session 1	Overarching sampling strategy & yield data		
0900-1000	Gridded sampling strategy & integration yield, agronomy & HH panels	P. Craufurd, J. Adewopo, J. Chamberlin	60
1000-1045	*Tea/Coffee Break/Photo Session*	C. Mukundi (photo)	45
Session 2	Draft Country Workplans		
1045-1115	Tanzania	K. Masuki	30
1115-1145	Nigeria	I. Mohammad	30
1145-1215	Ethiopia	T. Balemi	30
1215-1230	Discussion		15
1230-1400	Lunch	C. Mukundi	90
Session 3	Nutrient Expert WS3		
1400-1430	Innovations in agronomy at scale: lessons from One Acre Fund	D. Guerena	30
1430-1510	Year 1 results & plans & protocols for validating/ testing recommendation	S. Zingore & J. Rurinda	40
1510-1530	Plans for tool co-development & institutionalisation	S. Zingore, J. Rurinda & J. Andersson	20
1530-1600	*Tea/Coffee Break*	C. Mukundi	
Session 4	PhD programs WS7		
1600-1620	Leuven	J. Diels	20
1620-1640	Wageningen	T. Schut	20
1640-1700	Reading	E. Black	20
1700-1730	Discussion & close		30

Day 2, Tuesday 15 March

Session 5	Variety tool WS4		
0830-0910	Plans & protocols for calibration	H. Tonnang	40
0910-0930	Plans for tool co-development & institutionalisation	H. Tonnang & J. Andersson	20
0930-1000	Use of UAVS: STARS in WCA	T. Schut	30
1000-1030	*Tea/Coffee Break*	C. Mukundi	30
Session 6	Household panel, agronomy & yield survey & ex-ante framework		
1030-1100	Household panel & data protocol	J. Chamberlin & M. Jaleta	30
1100-1130	Yield & agronomy panel & data	P. Craufurd	30

	protocol		
1130-1200	Ex-Ante Framework	J. Chamberlin	30
1200-1230	Institutionalization	P. Craufurd & J. Andersson	30
1230-1400	Lunch	C. Mukundi	90
Session 7			
1400-1445	Data management	H. Tonnang, J. Adewopo	45
1445-1530	Project management, communications, M&E	P. Craufurd & R. Assefa	45
1530-1600	*Tea/Coffee Break*	C. Mukundi	
1600-1730	Space for workplans, protocols etc.	WS leaders & all	90
1730-1800	Wrap up & next steps	P. Craufurd	30
1830-2030	TAMASA Dinner	K. Masuki/ C. Mukundi	120

Day3, Wednesday 16 March

0830-1700	Field Trip	K. Masuki	

Day 4, Thursday 17 March

0830-0900	Registration	C. Mukundi	30
0900-0930	Introduction & objectives	P. Craufurd & M. Walsh	30
0930-1015	Brief introduction to products from AfSIS & TAMASA	6 x 5 min (2 slides max)	45
1015-1100	*Tea/Coffee Break & organization next session*		
1100-1145	World café Round 1		45
1145-1230	World café Round 2		45
1230-1300	Feedback from groups	3 mins each	30
1300-1400	Lunch & departure		
1400-1700	Free for other meetings		

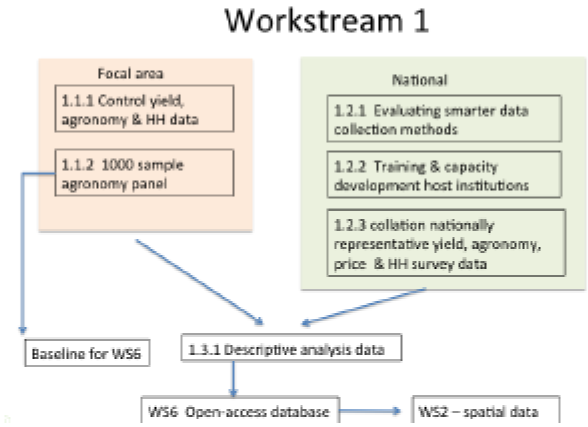
Overarching sampling strategy & yield data

Gridded sampling strategy & integration yield, agronomy & HH panels

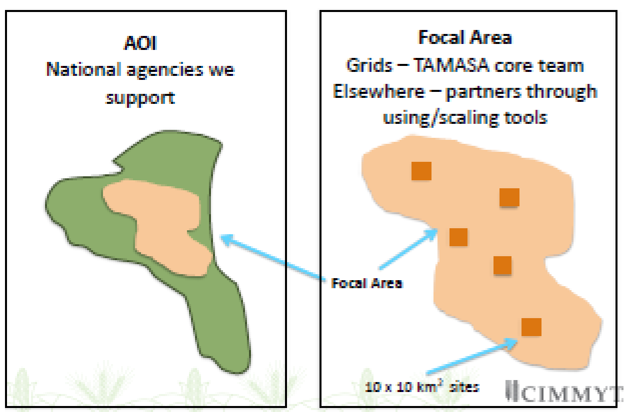
Workstream 1

Aim

- To capture and understand spatial and temporal variability in soil, climate and agronomic practices and relations with yield (and HH characteristics) in farmers' maize fields
- To pilot innovative and non-destructive data collection methods that can support agronomy at scale
- To support national agencies collecting yield and other agronomic data with training and awareness of new tools and methods



Who is responsible for collecting agronomy & yield data?



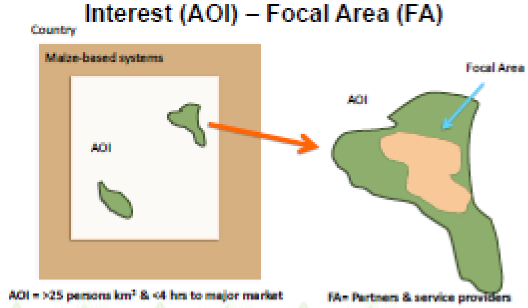
Integration of agronomy, yield, soil & HH data panels

Why integrate?

- Maximise value & efficiency from our & partner activities in Focal Area (& AOI)
- Core data that we collect in all countries & fields; cross-country comparisons
- Contributes to high resolution spatial data on soil, agronomy, yield & HH in Focal Areas

TAMASA sampling frame

Country – Maize-based systems – Area of Interest (AOI) – Focal Area (FA)



Draft Country Workplans

Tanzania Workplan

RF code	Activity	Milestone/indicators	Who is responsible?	Where to be done?	When to be done
WS1	Reduced knowledge gap on spatial and temporal variation in agronomy and productivity				
1.1.1	Collate control data from WS1, 3, 4 & 6	Identify 1000 farms by April and 1000 control yield data observations collected in SHZ & NZ by September	Ken, Arnold and Lameck	Southern Highlands zone (500 farms) and Northern zone (500 farms)	September 2016
1.1.2	Panel survey	Identify 1000 panel survey farms by April and data collected on the farms by September	Ken, Arnold and Lameck	Southern Highlands zone (500 farms) and Northern zone (500 farms)	September 2016
1.1.3	Descriptive analysis	Report summarizing Year 1 data by December	Ken, Arnold and Lameck		December 2016
1.1.4	Open access database	Baseline yield, soil, NOT and VT data incorporated into database by August	Ken	Baseline yield data (173), soil data, NOT (390); VT data for 10 sites	August 2016
1.1.5	Training in using Ebees	Metrisys conducts a 3 day training in Arusha by May	Ken	Arusha, 5 participants	May 2016
	Protocols for processing UAV data developed & training	SOPs developed and users training conducted by June	Peter, Henri, Julius	Arusha, 6 participants	June 2016
	3-5 UAV flights in selected grids	UAV data processed & added to database by December	Ken	SHZ (...grids) and NZ (...grids)	December 2016
1.1.6	Meeting with national agencies collecting yield data	Host institution identified by March	Ken, Jens, Peter, Jairos and Henri	Arusha, 3 institutions identified	March 2016
	Roadmap for capacity development and hosting	MOU for support & capacity development signed by May	Ken		May 2016
	Training & support for 2016 data collection	Training given; staff for mentoring or MSc identified by August	Ken,		August 2016

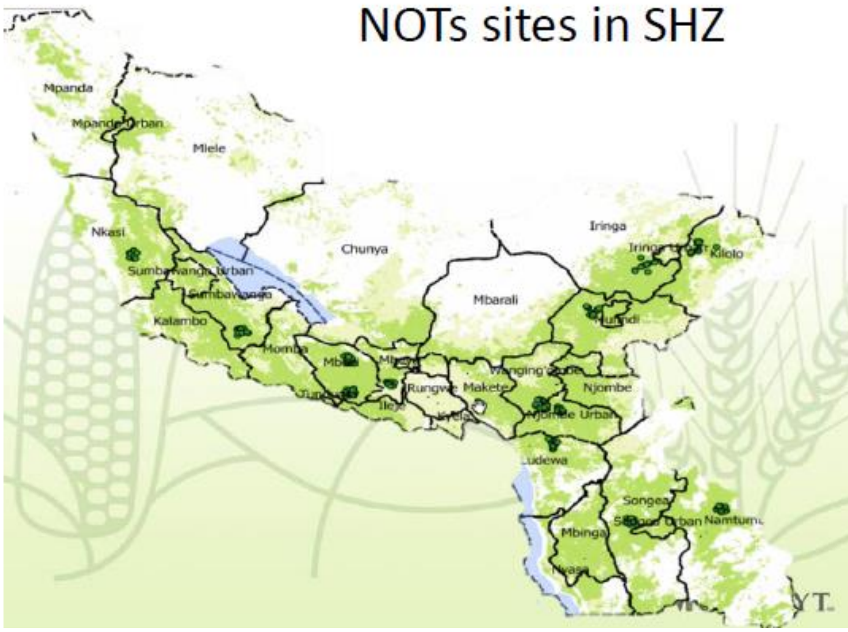
RF code	Activity	Milestone/indicators.	Who is responsible?	Where to be done?	When to be done
WS3	Nutrient management tool available				
1.3.1	Meeting with users for co-development	Partners' meeting held in Arusha by March	Ken, Peter, Shamie	Arusha; about 57 participants expected	March 2016
	Tool(s) developed	Interfaces built by IPNI for users by September	Shamie, Jairos, Ken	Nairobi, Arusha	September 2016
1.3.2	NE validation experiments in AOI	390 experiments established in SHZ and some part of NZ by December	Jairos, Ken	Southern Highlands zone (195 trials) and Northern zone (195 trials)	December 2016
	NE updated and V1 of tool produced				2017
1.3.3.	V1 tool evaluated by users	Users evaluation of the NE Tool conducted in SHZ by December 2016 and in NZ by March 2017	Ken, Arnold and Lameck and Jairos	Southern Highlands zone (... users) and Northern zone (... users)	December 2016 (SHZ) and March 2017 (NZ)
1.3.4	Meeting with national agencies to host tool	Partners' and users' meeting held in Arusha by March	Ken, Peter, Jairos	Arusha; about 27 Partners and users	March 2016
	Roadmap for capacity development and hosting	MOU for support & capacity development signed by May	Ken	Arusha	May 2016
	Training & support for hosting	DRD staff to operate NE tool identified and training by August	Jairos, Ken	Arusha, 6 participants	August 2016
1.3.5	Meeting to raise awareness of Tool	NE Tool awareness raised in a Arusha meeting by March	Peter, Jairos, Ken	Arusha; about 27 Partners and users	March 2016

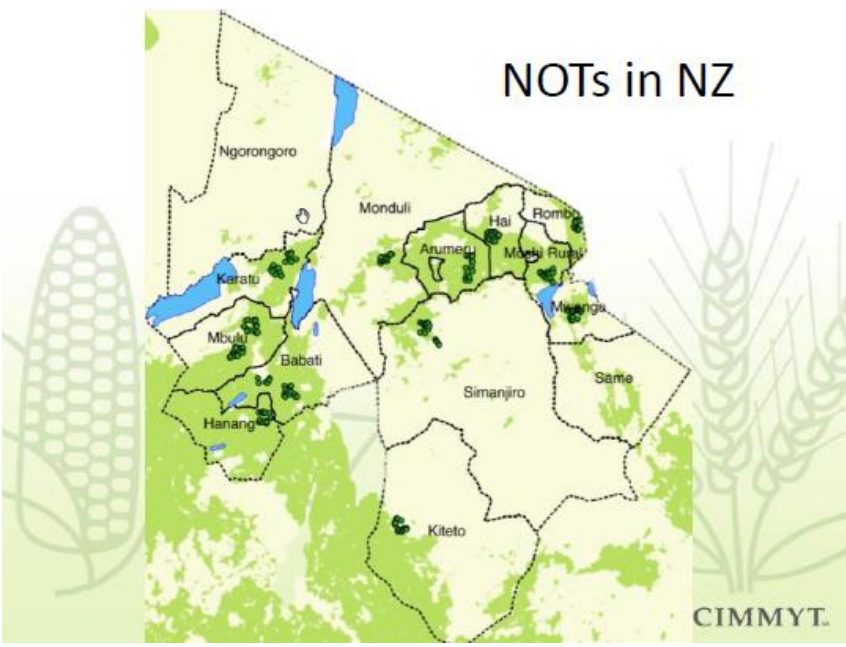
RF code	Activity	Milestone/indicators.	Who is responsible?	Where to be done?	When to be done
WS4	Variety options tool available				
1.4.1	Tool co-development (V0= model; V1 = desktop software; Vt=API	VT trials conducted and data available by August	Henri, Ken	Southern Highlands zone (5 trials) and Northern zone (5 trials) each with 36 variety entries	August 2016
1.4.2	Validation of prediction	Validation trials established by December 2016 in SHZ and March 2017 in NZ	Ken, Arnold and Lameck	Southern Highlands zone (...trials) and Northen zone (.... trials) each with..... variety entries	December 2016 (SHZ) and March 2017 (NZ)
1.4.3	Evaluate tool design	Users evaluation of the VT conducted in SHZ by December 2016 and in NZ by March 2017	Ken, Arnold and Lameck and Henri	Southern Highlands zone and Northern zone	December 2016 (SHZ) and March 2017 (NZ)
1.4.4	Meeting with national agencies to discuss institutionalization of the tool	TOSCI staff to operate VT identified and training by August	Ken, Peter, Henri	Arusha; TOSCI representative	August 2016
1.4.5	Meeting to raise awareness of tool	Tool awareness raised in a Arusha meeting by March	Henri, Ken	Arusha; about 57 participants expected	March 2016

RF code	Activity	Milestone/indicators.	Who is responsible?	Where to be done?	When to be done
WS6	Evidence of use of impact evaluation results by service providers				
1.6.1	Findings from impact assessment of tools	1 working paper evaluating the costs and benefits of NE tool recommendations in TZ by November	Jordan, Ken	Addis ababa/Arusha	November 2016
1.6.2	Findings from impact assessment of complementary innovations	1 working paper describing RCT work on packaging innovations and seed spacing in TZ by December	Jordan, Ken	Addis ababa/Arusha	December 2016
1.7.1	Postgraduate (Phd and MSc) training completed for host country nationals	2 new MSC students enrolled from DRD enrolled in TZ, 2 research papers developed by December	Ken, Arnold and Lameck	Sokoine University of Agriculture, 1 agronomist and 1 socio-economist, one from each zone (SHZ and NZ)	December 2016
1.7.2	Technical training of research and extension staff in the use and application of TAMASA tools and SOPs	At least 4 on-demand training from core and new partners in GIS, ODK and SOPs in TZ by October	Ken, Henri, Jordan, Shamie	SHZ and NZ, two trainings each zone	October 2016
1.8.1	Timely reporting	Revisions to Narrative and RF by Feb; Annual Reports by November	Ken	Arusha	November 2016
1.8.2	Annual Planning meetings	Annual planning meeting held in Arusha by March	Ken	Arusha; about 57 participants expected	March 2016
1.8.3	Annual ME&L Report	Conduct country based ME&L quaterly (March, June, September and December)	Ken	Southern Highlands zone and Northern zone	December 2016
1.8.4	Effective communication	TAMASA and tools awareness meeting to reach partners & users by March; Six WS-based knowledge sharing products developed in TZ by September	Ken	Southern Highlands zone and Northern zone, at least reach 3 partners in each zone	March 2016 and September 2016

RF code	Activity	1	2	3	4	5	6	7	8	9	10	11	12
1.1.1	Collate control data from WS1, 3, 4 & 6	X	X	X	X	X	X	X	X	X			
1.1.2	Panel survey				X	X	X	X	X	X			
1.1.3	Descriptive analysis						X	X	X	X	X	X	X
1.1.4	Open access database			X	X	X	X	X	X				
1.1.5	Training in using Ebees				X	X							
	Protocols for processing UAV data developed & training					X	X						
	3-5 UAV flights in selected grids											X	X
1.1.6	Meeting with national agencies collecting yield data			X									
	Roadmap for capacity development and hosting				X	X							
	Training & support for 2016 data collection						X	X	X				
1.3.1	Meeting with users for co-development			X									
	Tool(s) developed				X	X	X	X	X	X			
1.3.2	NE validation experiments in AOI										X	X	X
	NE updated and V1 of tool produced												
1.3.3	V1 tool evaluated by users										X	X	X
1.3.4	Meeting with national agencies to host tool			X									
	Roadmap for capacity development and hosting				X	X							
	Training & support for hosting						X	X	X				
1.3.5	Meeting to raise awareness of Tool			X									
1.4.1	Tool co-development (V0= model; V1 = desktop software; Vt=API	X	X	X	X	X	X	X	X				
1.4.2	Validation of prediction											X	X
1.4.3	Evaluate tool design						X	X	X	X			
1.4.4	Meeting with national agencies to discuss institutionalisation of the tool			X									
1.4.5	Meeting to raise awareness of tool			X									
1.5.1	Digital soil mapping												
1.5.2	Nutrient response of new formulations determined												
1.6.1	Findings from impact assessment of tools									X	X	X	
1.6.2	Findings from impact assessment of complementary innovations										X	X	X
1.7.1	Postgraduate (PhD and MSc) training completed for host country nationals												
1.7.2	Technical training of research and extension staff in the use and application of TAMASA tools and SOPs		X		X						X		
1.8.1	Timely reporting		X									X	
1.8.2	Annual Planning meetings			X							X		
1.8.3	Annual ME&L Report			X			X			X			X
1.8.4	Effective communication					X				X			

RF code	Activity	Estimated cost	ARIs	Total
1.1.1	Collate control data from WS1,3, 4 & 6	2,500	22,936	25,436
1.1.2	Panel survey	2,500	22,936	25,436
1.1.3	Descriptive analysis	200	92	292
1.1.4	Open access database	500	0	500
1.1.5	Training in using Ebees	2,000	0	2,000
	Protocols for processing UAV data developed & training	0	0	0
	3-5 UAV flights in selected grids	500	0	500
1.1.6	Meeting with national agencies collecting yield data	0	0	0
	Roadmap for capacity development and hosting	1,000	0	1,000
	Training & support for 2016 data collection	3,000	0	3,000
1.3.1	Meeting with users for co-development	0	0	0
	Tool(s) developed	0	0	0
1.3.2	NE validation experiments in AOI	2,000	10,321	12,321
	NE updated and V1 of tool produced	0	0	0
1.3.3.	V1 tool evaluated by users	1,000	10,321	11,321
1.3.4	Meeting with national agencies to host tool	0	0	0
	Roadmap for capacity development and hosting	1,000	0	1,000
	Training & support for hosting	3,000	0	3,000
1.3.5	Meeting to raise awareness of Tool	0	0	0
1.4.1	Tool co-development (V0= model; V1 = desktop software; Vt=API	1,500	11,468	12,968
1.4.2	Validation of prediction	1,500	11,468	12,968
1.4.3	Evaluate tool design	1,500	10,321	11,821
1.4.4	Meeting with national agencies to discuss institutionalization of the tool	3,000	0	3,000
1.4.5	Meeting to raise awareness of tool	0	0	0
1.6.1	Findings from impact assessment of tools	500	0	500
1.6.2	Findings from impact assessment of complementary innovations	500	0	500
1.7.1	Postgraduate (PhD and MSc) training completed for host country nationals	13,390	550	13,940
1.7.2	Technical training of research and extension staff in the use and application of TAMASA tools and SOPs	6,000	0	6,000
1.8.1	Timely reporting	200	0	200
1.8.2	Annual Planning meetings	300	0	300
1.8.3	Annual ME&L Report	200	0	200
1.8.4	Effective communication	500	0	500
	Total	48,290	100,413	148,703


NOTs sites in SHZ
Mpanda
Mlele
Nkasi
Chunya
Iringa
Mbarali
Kalambo
Njombe
Ludewa
Songea
Mbinga


NOTs in NZ
Ngorongoro
Monduli
Hai
Karatu
Mbulu
Babati
Simanjiro
Same
Hanang
Kiteto
CIMMYT

Nigeria Workplan

Achievements in 2015

1. Establishment of good partnerships with stakeholders for the co-development of maize enhancement tools:
   - fertilizer recommendation tool,
   - variety tool, and
   - fertilizer blending tool for industry

2. Capacity development of project support staff
   - Training in Data collection with GPS and ODK for proper conduct of field surveys and trials

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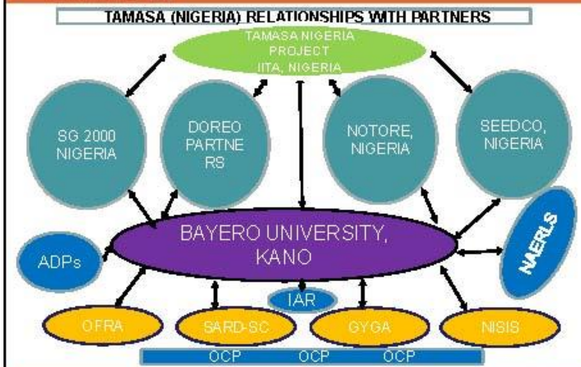

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Achievements in 2015....

3. Building partnership for geospatial and weather data acquisition with ICRISAT, NASRDA, NiMET.

4. Ninety five NOTs were conducted across Kaduna, Kano and Kano States in Nigeria.

5. Panel and baseline surveys conducted

6. Data Management – Repositories created data management TAMASA to serve the three focal countries.

7. Training in KUT, Leuven, Belgium
   - 3 PhD candidates from the Bayero University, Kano
   - One candidate from ABU, Zaria

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Challenges

- Late onset of rains in the 2015 season
- Late training on ODK
- Accessing farmers during baseline survey
- Some panel survey farmers harvested their fields before the harvest stage data collection
- Access to existing data from Partners
- The window to measure yield was short; some points/farms are harvested before survey team located them
- Access to weather data
- Sending completed baseline ODK forms to the server

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2016 UPDATE

1. Data Management

- Baseline data comprising farmer and field characteristics, maize grain yield records and soil information captured using ODK were uploaded on to the TAMASA server.
- Panel survey data also uploaded on to the TAMASA server.

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2. Soil and Tissue Samples Analysis

- NOT soil samples have been analysed.
- leaf samples analysis at advanced stage of completion.
- NOT grain and Stover samples; grinding has been completed; to be delivered to Ibadan for analysis

3. Building synergy with national systems on data collection.

- **NAERLS has agreed to partner with TAMASA in the quality data collection.**
- **It requires training on use of ODK, soil sampling, etc.**

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2016 TAMASA WORKPLAN

Workstream 1: Reduced knowledge gap on spatial and temporal variation in agronomy and productivity

Activity	Milestones	Who is responsible?	Location of activities, numbers of trails or farmers, etc.	When will activity be done &/or completed?
1.1.1 Collate control data from WS1, 3, 4 & 6	Baseline: 500 georeferenced agronomic data, NOT: Data for validation of NE; Data for calibration of VT, from the FAs	IITA/BUK	AOI: Kano (NOT 30, VT 2 trials), Kaduna (NOT 40, VT 2), Katsina (NOT 30) Detail of Val. Of VT in Adnan's work	June - December
1.1.2 Panel survey	100 farms surveyed and yield and soil data collected	BUK/IITA	AOI: Kano (20), Kaduna (40), Katsina (40);	May - December
1.1.3 Descriptive analysis	To understand the trend of response	BUK/IITA	BUK	December, 2016

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2016 TAMASA WORKPLAN

Workstream 1: Reduced knowledge gap on spatial and temporal variation in agronomy and productivity

Activity	Milestones	Who is responsible?	Location of activities, numbers of trails or farmers, etc.	When will activity be done &/or completed?
1.1.5 Open access database	A central database of soil and yield, calibration and validation trials made available.	IITA/BUK	IITA	Through out the year
Training in using Ebees	Some IITA/BUK staff trained in operating Ebees for data collection	IITA	IITA	April

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2016 TAMASA WORKPLAN

Workstream 1: Reduced knowledge gap on spatial and temporal variation in agronomy and productivity

Activity	Milestones	Who is responsible?	Location of activities, numbers of trails or farmers, etc.	When will activity be done &/or completed?
Protocols for processing UAV data developed & training	SOPs developed for data collection process	IITA, Julius	IITA	April - June
3-5 UAV flights in selected grids	High resolution data obtained using UAV.	IITA/BUK	AOI	June - July
1.1.6 Meeting with national agencies for collecting yield data	Signing of agreements with partners (NAERLS) on data collection and training on improved practices done.	IITA	IITA	March - June

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2016 TAMASA WORKPLAN

Workstream 1: Reduced knowledge gap on spatial and temporal variation in agronomy and productivity

Activity	Milestones	Who is responsible?	Location of activities, numbers of trails or farmers, etc.	When will activity be done &/or completed?
1.1.7 Roadmap for capacity dev't and hosting	Comprehensive plan for national partners to host tools available	IITA/BUK	IITA	April - May
1.1.8 Training & support for 2016 data collection	Quality data collection by EAs and Technical staff	IITA/BUK	BUK	March - June

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2016 TAMASA WORKPLAN

Workstream 2: Use of spatial ex-ante analysis to guide investments

Activity	Milestones	Who is responsible?	Location of activities, numbers of trails or farmers, etc.	When will activity be done &/or completed?
1.2.1 Spatialising QUEFTS	Core algorithm components coded; input data prepared	Jordan/IPNI	IITA	?
1.2.2. Spatial price modelling	Price data assembled; surfaces generated and validated	Jordan	AOI	?
1.2.3 Yield mapping	Georeferenced yield data assembled; surfaces generated and validated	Jordan	?	?

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2016 TAMASA WORKPLAN

Workstream 3: Nutrient management tool available

Activity	Milestones	Who is responsible?	Location of activities, numbers of trails or farmers, etc.	When will activity be done &/or completed?
1.3.1 Meeting with users for co-development	users will be well carried along	IITA/IPNI	IITA	March - May
Tool(s) developed	NE tools available for users	IITA/BUK/IPNI/ADPs/NOTORE/DOREO/SG 2000/NAERLS/IAR	IITA	Feb - Sept
1.3.2 NE validation expts in AOI	NE FR gives higher yields than FFP in @ least 75% of the cases.	IITA/BUK	AOI	May - December
Collection of feedback on NE from users	Feedback collected from users	IPNI, IITA, BUK	AOI	November - December

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IITA | CGIAR 2016 TAMASA WORKPLAN

Workstream 3: Nutrient management tool available

Activity	Milestones	Who is responsible?	Location of activities, numbers of trails or farmers, etc.	When will activity be done &/or completed?
NE updated and V2 of tool produced	field testing of NE recommendation and feedback from stakeholders	IPNI	IPNI	December
1.3.3 V1 tool evaluated by users	NE V1 validated.	IPNI, BUK, IITA and other partners	ACI	December
1.3.4 Meeting with national agencies to host tool	Potential host identified	IITA	IITA	March - May

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IITA | CGIAR 2016 TAMASA WORKPLAN

Workstream 3: Nutrient management tool available

Activity	Milestones	Who is responsible?	Location of activities, numbers of trails or farmers, etc.	When will activity be done &/or completed?
Roadmap for capacity dev't and hosting	Capacity of national partners to host tools enhanced	IITA	IITA	March - July
Training & support for hosting	Buiding the capacity of host institute	IITA/IPNI	IITA	March - August
1.3.5 Meeting to raise awareness of Tool	Tool Scaled out	IITA/IPNI	IITA	Feb - May

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IITA CGIAR

2016 TAMASA WORKPLAN

Workstream 4: Variety tool available

Activity	Milestones	Who is responsible?	Location of activities, numbers of trails or farmers, etc.	When will activity be done &/or completed?
1.4.1 Tool co-development (V0)	V0 of the tool developed	Henri	IITA	March - July
1.4.2 Calibration of Variety tool	Calibration trials established in some locations within the AOI	BUK and IITA	AOI	March – June
1.4.3 Evaluate tool design	VT V1 evaluated.	Partners, IITA, BUK, IAR	AOI	July - November
1.4.4 Institutionalization tool	Stakeholders meeting with potential host institution(s) in June; hosting & capacity dev't agreements signed by Sept., 2016.	IITA, BUK, Henri	IAR or IITA	August -December

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IITA CGIAR

4. NE Training Workshop, IITA Kano, Nigeria

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Ethiopia Workplan

Activities	Activity duration	Milestones	Responsible persons	Locations	Completion period	budget
WS1	Reduced knowledge gap on spatial and temporal variation in agronomy and productivity					
1.1.1 Collate control yield data from WS1,3, 4 & 6	May-Nov. 2016	1000 farmers field in focal areas will be identified by June, 2016 and georeferenced control yield data will be collected	EIAR: Gebreyes and other EIAR staff CIMMYT: Tesfaye & Mesfin	Jimma, Bako, Melkasa and Bahirdar areas	Will be completed in November/December, 2016	Plan to merge
1.1.2 Panel survey	May-Nov. 2016	1000 panel survey farms in focal areas identified by June, 2016 and socio economic & control yield data will be collected	EIAR: Gebreyes and other EIAR staff, CIMMYT: Tesfaye Jordan, Moti & Mesfin , Alemu	Jimma, Bako, Melkassa and Bahirdar areas	Nov./Dec., 2016	50,000

Activities	Activity duration	Milestones	Responsible persons	Locations	Completion period	budget
WS1 cont'd	Reduced knowledge gap on spatial and temporal variation in agronomy and productivity					
1.1.3 Descriptive analysis	Dec. 2016 & beyond	Data cleaned and descriptive analysis of collected data done and figures generated and report written by Jan/Feb, 2017	Tesfaye, Jordan, Moti, Mesfin and Gebreyes	desk top work	Feb., 2017	1,000
1.1.4 Open access database	Dec.2016 & Beyond	Yield and soil data base from Surveys, validation experiments made available from Nov./Dec.2016 onwards	Henri & Julius	desk top work	December, 2016-February, 2017	No budget required (?)
1.1.6 (a) Meeting with national agencies collecting yield data	August, 2016	MoU signed between CSA, EIAR, CIMMYT for HH and yield data collection	Country project coordinator	Respective EIAR and CSA offices	August, 2016	6,000

Activities	Activity duration	Milestones	Responsible persons	Locations	Completion period	budget
WS1 cont'd	Reduced knowledge gap on spatial and temporal variation in agronomy and productivity					
1.1.6 (b) Roadmap for capacity dev't and hosting	August, 2016	Agreement and all facilitation work for capacity development for data collection met by Sept., 2016	Country project coordinator	at CSA and EIAR head quarter offices	August, 20	No budget
1.1.6 (c)Training & support for 2016 data collection	Sept., 2016	EIAR and CSA staff trained on quality yield data collection at regional level	Country project coordinator, Mesfin	At each CSA regional offices and EIAR head office	Sept., 2016	10,000

Activities	Activity duration	Milestones	Responsible persons	Locations	Completion period	budget
WS2	Use of spatial ex-ante analysis to guide investments					
1.2.1.Spatialising QUEFTS		Model written in R that takes gridded input and output for QUEFTS/NE model	Jordan	Addis Ababa (desktop), 1 model	Jun-16	No budget req.
1.2.2. Spatial price modelling		Set of gridded price surfaces for fertilizer, labor and maize grain	Jordan	Addis Ababa (desktop), 3 surfaces	Sep-16	"
1.2.3.Yield mapping		Set of gridded estimates of actual yield levels	Jordan	Addis Ababa (desktop), 1 surface	Dec-16	"
1.2.4.Scenario analysis: targeting of technologies		Report summarizing, analysis of NE tool targeting	Jordan	Addis Ababa (desktop), 1 report	Dec-16	No budget req.
1.2.5 Scenario analysis: ex ante impact of investments		Report summarizing, analysis of NE tool impacts	Jordan	Addis Ababa (desktop), 1 report	Dec-16	"

Activities	Activity duration	Milestones	Responsible persons	Locations	Completion period	budget
1.2.6 Scenario analysis: return on investment analysis		Report summarizing analysis of returns to investment in establishing and administering NE tool	Jordan	Addis Ababa (desktop), 1 report	Dec-16	"

Activities	Activity duration	Milestones	Responsible persons	Locations	Completion period	budget
WS3	Nutrient management tool available					
1.3.1 Tool (s) developed	March, 2016	V1 version of Nutrient Expert tools developed and Variety tool calibrated	IPNI	Nairobi	April, 2016	?
1.3.2 NE validation expts in AOI (50 trials)	April-Nov., 2016	50 NE validation experiments established in four FA	EIAR: Gebreyes and other EIAR staff CIMMYT: Tesfaye & Mesfin	Bako and Jimma areas	Nov., 2016	25,000
1.3.3 V1 NE evaluated by users	August, 2016	Validation experiments evaluated	EIAR: Gebreyes and other EIAR staff CIMMYT: Tesfaye & Mesfin	Bako, Jimma areas	August, 2016	5,000 (?)
Calibration of NE in new FA + in selected Previous farms	April-Nov., 2016	NE tool calibrated for new FA + previous data confirmed	EIAR: Gebreyes and other EIAR staff CIMMYT: Tesfaye & Mesfin	Melkasa areas + Bako, Jimma	Nov/Dec2016	25,000

Activities	Activity duration	Milestones	Responsible persons	Locations	Completion period	budget
WS3 cont'd	Nutrient management tool available					
1.3.4 (a) Meeting with national agencies to host tool	March, 2016	meeting organized with national partners to host the tool	Country Project coordinator	Addis Ababa	March, 2016	7,000
1.3.4 (b) Roadmap for capacity dev't and hosting	July, 2016	MoU signed between CIMMYT & EIAR ATA (?)	Country project coordinator, IPNI, ATA, EIAR	Addis Ababa	July, 2016	No budget req.
1.3.4 (c) Training & support for hosting NE tool	Dec., 2016	EIAR & ATA staff trained on NE tool	Country project coordinator, IPNI, EIAR, ATA (?)	Addis Ababa	Dec., 2016	5,000
1.3.5 Meeting to raise awareness of Tool	March, 2016	Awareness creation meeting organized for users	Country project coordinator	Addis Ababa	March, 2016	see above budget for institutionalization

Activities	Activity duration	Milestones	Responsible persons	Locations	Completion period	budget
WS4	Variety tool available					
1. 4.1 Tool co-development (V0)	Feb., 2016	V0 of the tool developed	Henri	Desktop/Nairobi	March, 2016	?
1.4.2 Calibration of Variety tool	May-Nov., 2016	calibration expts established in each of the three focal areas	EIAR: Gebreyes and other EIAR staff CIMMYT: Tesfaye & Mesfin	Bako, Jimma Melkasa areas	Nov./Dec., 2016	25,000
1.4.3 Evaluate tool design					To be evaluated in 2017	
1.4.4 Institutionalizing the tool		Partners meeting held to institutionalize the tool	Country project coordinator, EIAR, Jens Andersson	Addis Ababa	March., 2016	See budget for NE tool
1.4.5 Out scaling of the tool					In the year 2017	

Activities	Activity duration	Milestones	Responsible persons	Locations	Completion period	budget
WS7	Increased capacity in national institutes (countries)					
1.7.1 Postgraduate (PhD and MSc) training completed for host country nationals	April-Dec., 2016	2 MSC students from EIAR in ET & 2 PhD students get their thesis work/field experiments started	Students, country coordinator, advisors	Tepi/Jimma, Bako and other locations	Dec., 2016 & beyond	16,000
1.7.2 Technical training of research and extension staff in the use and application of TAMASA tools and SOPs	Dec., 2016 & beyond	10 EIAR and 10 MoA extension staff trained on the use of NE tools	Country coordinator, IPNI	Addis Ababa	Dec., 2016 and beyond	10,000

Core Activities-2016	Total est. Budget	EIAR	CIMMYT
1. Panel survey (1.1.2)	50,000	40,000	10,000
2. Descriptive analysis (1.1.3)	1,000	1,000	-
2. Engage national institutes in data collection (agreement) (1.1.6)	6,000		6,000
3. Training & support for 2016 data collection (1.1.6)	10,000	5,000	5,000
4. Ex-ante analysis to guide investment (WS2)	-	-	-
5. Meeting with partners for NE & V tools intro & Institutionalization (1.3.1) (1.3.4) (1.3.5)	18,000	-	7,000
6. NE validation exps in AOI (1.3.2)	25,000	20,000	5,000
7. NE calibration at new FA + **selected previous farms**	25,000	20,000	5,000
8. Variety Calibration experiments (1.4.2)	25,000	20,000	5,000
9. V1 tools evaluation by users (1.3.3) (1.4.3)	5,000	-	5,000
10.Training & support for hosting (1.3.4)	5,000	-	5,000
11. Postgraduate Students Research (Phd and MSc) (1.7.1)	16,000	-	16,000
12 Technical training of research and extension staff in the use and application of TAMASA tools and SOPs (1.7.2)	10,000	-	10,000
Total	**185,000**	**106,000**	**79,000**

Code activities-2016	EIAR	CIMMYT	Total
Panel survey	40,000	10,000	50,000
Descrptive analysis	1,000		1,000
Meeting with national agencies collecting yield data		6,000	6,000
Training & support for 2016 data collection	5,000	5,000	10,000
Meeting with users for co-development & institutionalization		7,000	7,000
NE validation expts in AOI	20,000	5,000	25,000
NE calibration expts in new FA	20,000	5,000	25,000
V1 tools evaluated by users		5,000	5,000
Training & support for hosting		5,000	5,000
Calibration of NE tool prediction	20,000	5,000	25,000
Postgraduate (PhD and MSc) research at host country		16,000	16,000
Technical training of research and extension staff in the use and application of TAMASA tools and SOPs		10,000	10,000
	106,000	**79,000**	**185,000**

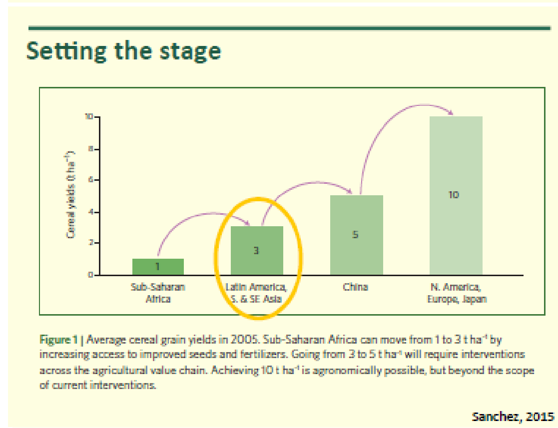
CIMMYT-TAMASA Budget-2016-Ethiopia	Budget amount
CIMMYT support for field trials	15,900
Transport, vehicle use & maintenance	10,000
MSc research support costs	13,390
Workshops & training for partners & tool users	18,000
Local in-country travel Ethiopia	6,180
Total-operational	**63,470**

Budget difference

79,000-63,470=15,500 ??

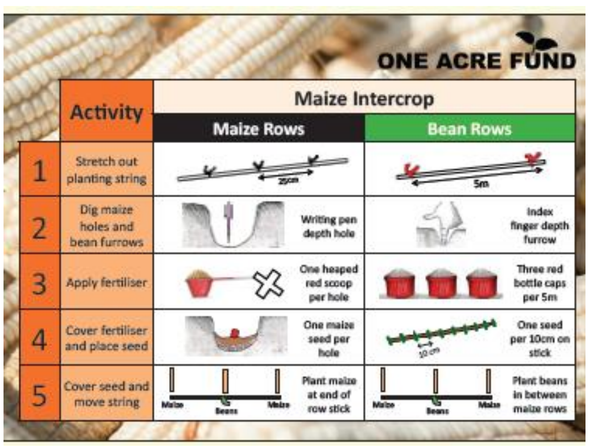
Nutrient Expert WS3

Innovations in agronomy at scale: lessons from One Acre Fund



How?
FINANCING
DISTRIBUTION
TRAINING
Maize agronomy
• Seed choice
• Fertilizer choice
• Land prep
• Planting timing
• Planting spacing
• Fertilizer timing
• Fertilizer placement
• Weeding
• Pest and disease management

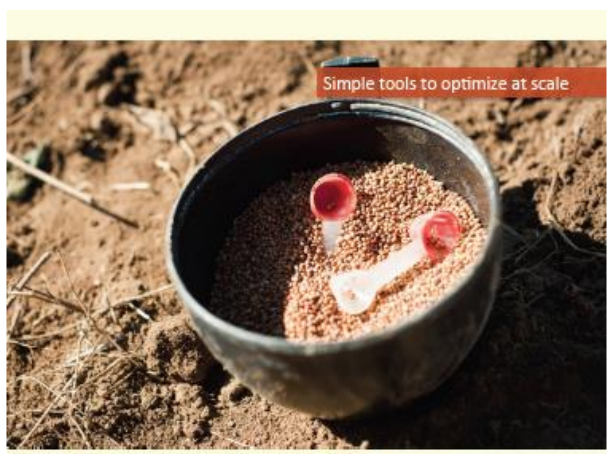
Scalable impact
FINANCING
DISTRIBUTION
TRAINING
MARKET FACILITATION
1 field officer
provides service bundle
to 200 smallholder farmers
reaching 1,000 people



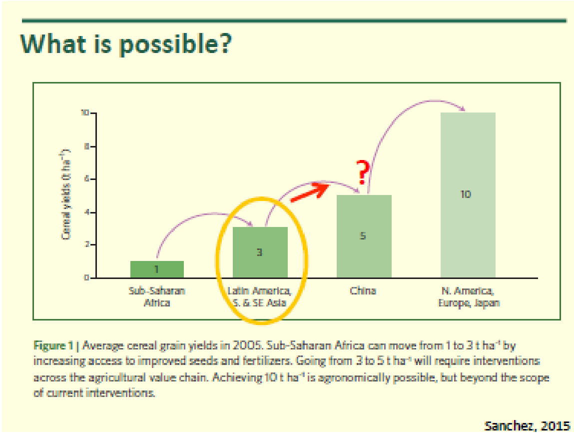
ONE ACRE FUND
Activity
Maize Intercrop
Maize Rows
Bean Rows
1
Stretch out planting string
25cm
5m
2
Dig maize holes and bean furrows
Writing pen depth hole
Index finger depth furrow
3
Apply fertiliser
One heaped red scoop per hole
Three red bottle caps per 5m
4
Cover fertiliser and place seed
One maize seed per hole
10 cm
One seed per 10cm on stick
5
Cover seed and move string
Maize
Beans
Maize
Plant maize at end of row stick
Plant beans in between maize rows

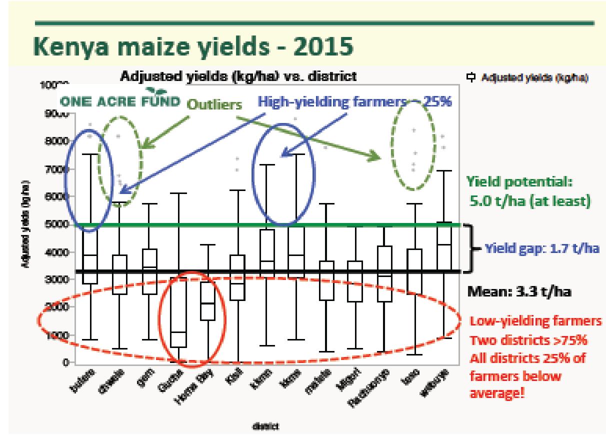
High-contact trainings

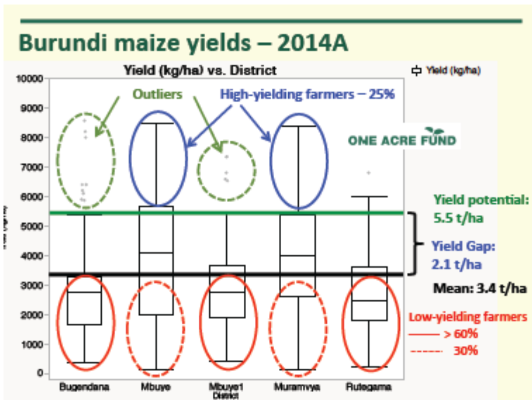
Simple tools to optimize at scale

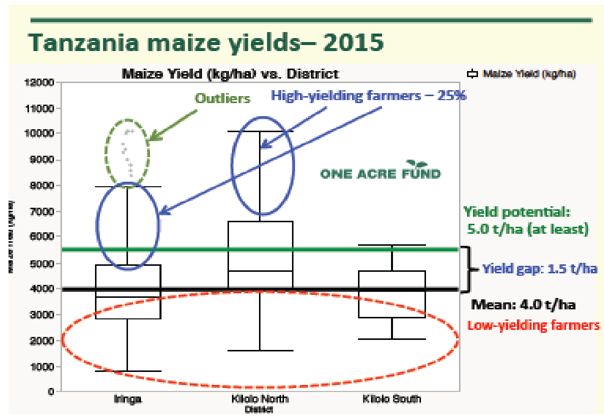


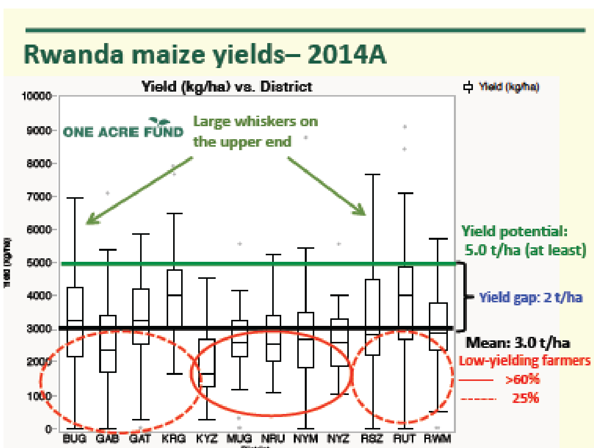
Simple tools to optimize at scale

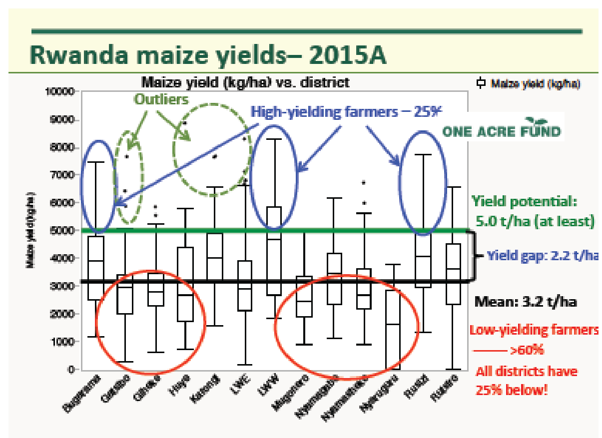

What is possible?
Cereal yields (t ha⁻¹)
Sub-Saharan Africa
Latin America, S. & SE Asia
China
N. America, Europe, Japan
1
3
5
10
?
Figure 1 | Average cereal grain yields in 2005. Sub-Saharan Africa can move from 1 to 3 t ha⁻¹ by increasing access to improved seeds and fertilizers. Going from 3 to 5 t ha⁻¹ will require interventions across the agricultural value chain. Achieving 10 t ha⁻¹ is agronomically possible, but beyond the scope of current interventions.
Sanchez, 2015

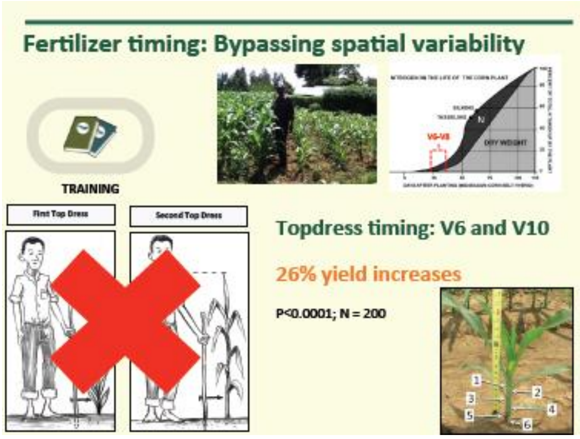

Kenya maize yields - 2015
Adjusted yields (kg/ha) vs. district
ONE ACRE FUND
Outliers
High-yielding farmers – 25%
Yield potential: 5.0 t/ha (at least)
Yield gap: 1.7 t/ha
Mean: 3.3 t/ha
Low-yielding farmers
Two districts >75%
All districts 25% of farmers below average!
district

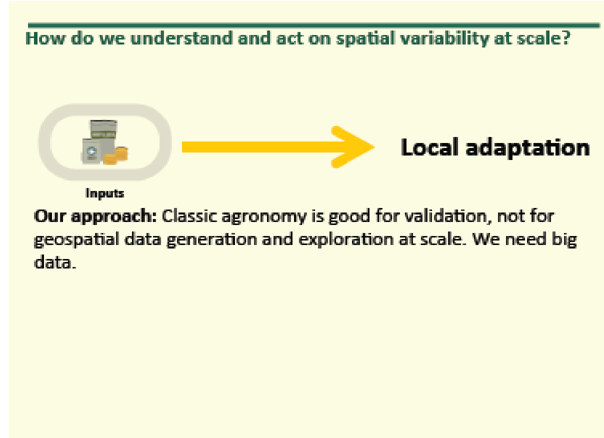

Burundi maize yields – 2014A
Yield (kg/ha) vs. District
Outliers
High-yielding farmers – 25%
ONE ACRE FUND
Yield potential: 5.5 t/ha
Yield Gap: 2.1 t/ha
Mean: 3.4 t/ha
Low-yielding farmers
> 60%
30%
Bugendana
Mbuye
Mbuye1
Muramvya
Rutegama

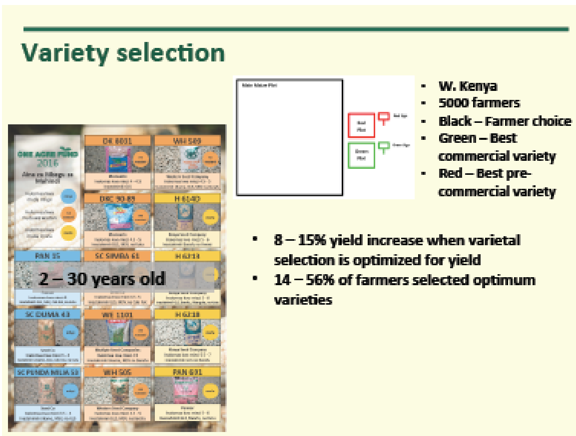

Tanzania maize yields– 2015
Maize Yield (kg/ha) vs. District
Outliers
High-yielding farmers – 25%
ONE ACRE FUND
Yield potential: 5.0 t/ha (at least)
Yield gap: 1.5 t/ha
Mean: 4.0 t/ha
Low-yielding farmers
Iringa
Kilolo North
Kilolo South
District

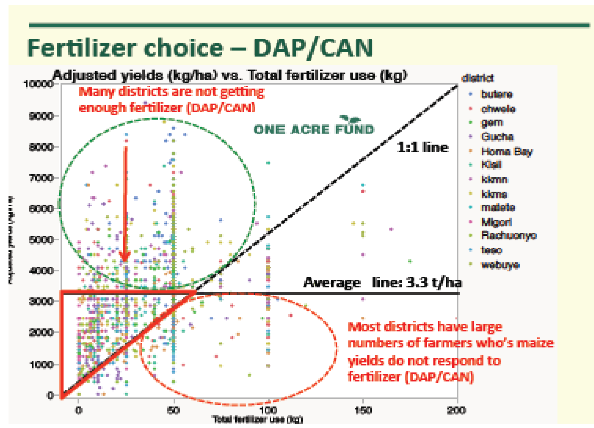

Rwanda maize yields– 2014A
Yield (kg/ha) vs. District
ONE ACRE FUND
Large whiskers on the upper end
Yield potential: 5.0 t/ha (at least)
Yield gap: 2 t/ha
Mean: 3.0 t/ha
Low-yielding farmers
>60%
25%
BUG
GAB
GAT
KRG
KYZ
MUG
NRU
NYM
NYZ
RSZ
RUT
RWM
District

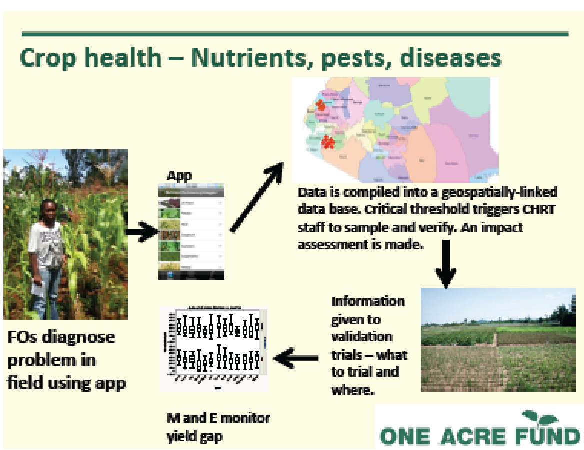

Rwanda maize yields– 2015A
Maize yield (kg/ha) vs. district
Outliers
High-yielding farmers – 25%
ONE ACRE FUND
Yield potential: 5.0 t/ha (at least)
Yield gap: 2.2 t/ha
Mean: 3.2 t/ha
Low-yielding farmers
>60%
All districts have 25% below!
district

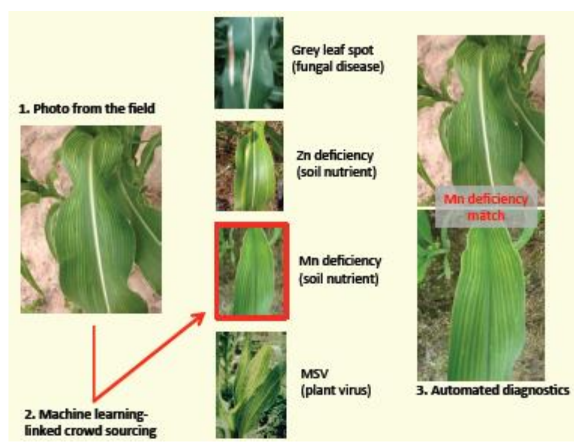

Fertilizer timing: Bypassing spatial variability
TRAINING
First Top Dress
Second Top Dress
Topdress timing: V6 and V10
26% yield increases
P<0.0001; N = 200

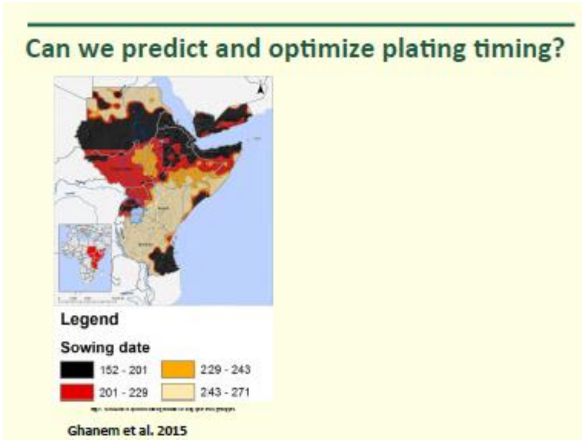

How do we understand and act on spatial variability at scale?
Inputs
Local adaptation
Our approach: Classic agronomy is good for validation, not for geospatial data generation and exploration at scale. We need big data.

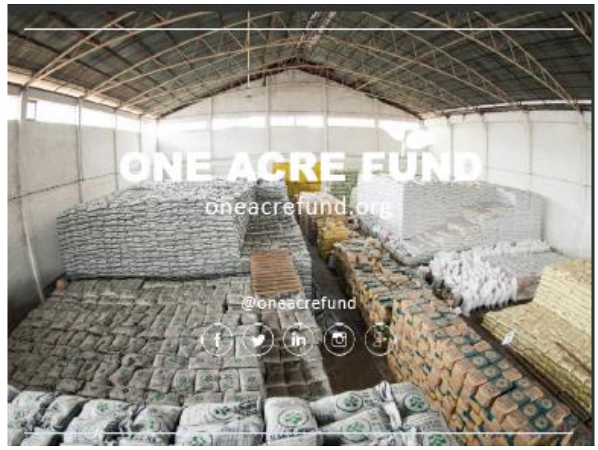

Variety selection
2 – 30 years old
W. Kenya
5000 farmers
Black – Farmer choice
Green – Best commercial variety
Red – Best pre-commercial variety
8 – 15% yield increase when varietal selection is optimized for yield
14 – 56% of farmers selected optimum varieties


Fertilizer choice – DAP/CAN
Adjusted yields (kg/ha) vs. Total fertilizer use (kg)
Many districts are not getting enough fertilizer (DAP/CAN)
ONE ACRE FUND
1:1 line
Average line: 3.3 t/ha
Most districts have large numbers of farmers who's maize yields do not respond to fertilizer (DAP/CAN)
Total fertilizer use (kg)
district
butere
chwele
gem
Gucha
Homa Bay
Kisii
kkmn
kkms
malete
Migori
Rachuonyo
teso
webuye


Crop health – Nutrients, pests, diseases
App
Data is compiled into a geospatially-linked data base. Critical threshold triggers CHRT staff to sample and verify. An impact assessment is made.
FOs diagnose problem in field using app
Information given to validation trials – what to trial and where.
M and E monitor yield gap
ONE ACRE FUND


1. Photo from the field
Grey leaf spot (fungal disease)
Zn deficiency (soil nutrient)
Mn deficiency (soil nutrient)
MSV (plant virus)
Mn deficiency match
2. Machine learning-linked crowd sourcing
3. Automated diagnostics


Can we predict and optimize plating timing?
Legend
Sowing date
152 - 201
229 - 243
201 - 229
243 - 271
Ghanem et al. 2015


ONE ACRE FUND
oneacrefund.org
@oneacrefund

Year 1 results & plans & protocols for validating/ testing recommendation

Use Case Need, Objectives and Outputs

- Nutrient management challenges for maize production intensification
  - Low fertilizer use
  - Inappropriate and blanket fertilizer recommendations
- Suitability of maize fertilizer recommendations is affected by complex variability is soil fertility, climate and socio-economic factors at various scales.
- The lack of site-specific fertilizer recommendations and tools to deliver them to farmers is a major challenge for maize production intensification.
  - ➔ Site-specific Nutrient Management decision support tools prioritized by strategic partners

Use Case Need, Objectives and Outputs

- Overall goals:
  - Co-develop demand-driven, rapid and cost-effective methods and tools for providing farmers with site-specific fertilizer recommendations that will increase yield and profit of farmers; demand creation with service providers.
- Primary clients
  - Extension services provider partners
    - Public extension systems
    - Developmental organizations
    - Private sectors (e.g. fertilizer industry)

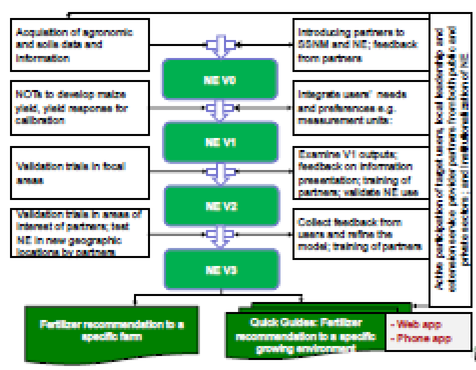
Use Case Need, Objectives and Outputs

Main Outputs

- Nutrient Expert (and associated tools) for maize decision support tool for use by extension systems to develop and promote farm-specific nutrient management recommendation.
- Nutrient Expert extension formats for use by partners in taking site-specific fertilizer recommendations to scale.

Use Case Outputs: Nutrient Expert

NE co-development process



Use Case Main Activities (YR-1)

Activity	Nigeria	Output
Nutrient omission trial protocols	Develop and agreed on guidelines and protocols for the implementation of on-farm maize nutrient omission trials	Std protocols developed
Nutrient omission trials	Establishment of multi-location nutrient omission trials in all three countries	Trials completed in NG and ET. On-going in TZ Soil and plant sample analysis in progress
Partner engagement	Identification and engagement of primary service provider partners (tool users and tool hosts) to establish needs and demands for site-specific nutrient management recommendations considering scale and capacity	Completed
	Introduce to partners the principles of SSNM and NE decision support tool; and received feedback on the use of NE	On-going
	Site information for the development of NE V0 provided by services provider partners	Completed
Nutrient Expert Calibration	Algorithm and decision rules based on the QUEFTS model adapted to Nigeria and Ethiopia	On-going

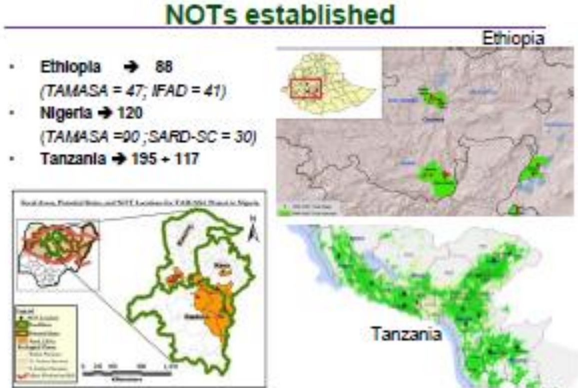
Nutrient Omission Trials

Objectives of Nutrient Omission trials

- To gain understanding of the local maize production system and the influence of farm socio-economic and soil fertility variability, and historical and current management practices on maize yields
- To develop maize yield, yield response and nutrient uptake datasets for parameterization of *NE* algorithms to develop SSNM practices under variable soil fertility and climatic conditions in TAMASA project pilot sites

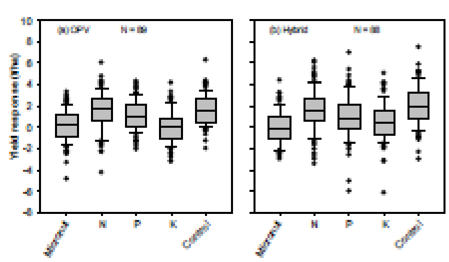
NOTs established

- **Ethiopia** → **88** *(TAMASA = 47; IFAD = 41)*
- **Nigeria** → **120** *(TAMASA =90 ;SARD-SC = 30)*
- **Tanzania** → **195 + 117**



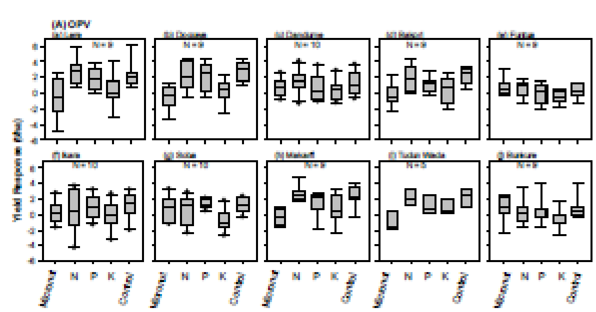
NOTs results - Nigeria

- N & P are the nutrients most limiting yield in Nigeria



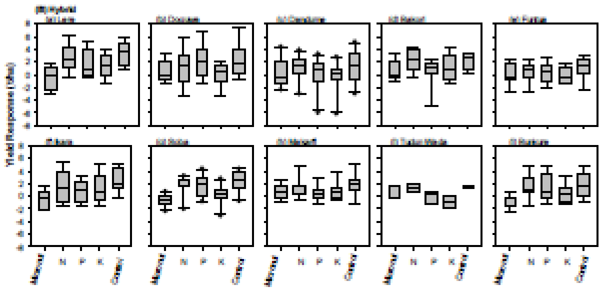
NOTs results - Nigeria

- Maize response to nutrient varies from location to location
- Dandume, Funtua, Bunkure responded to micro-nutrients



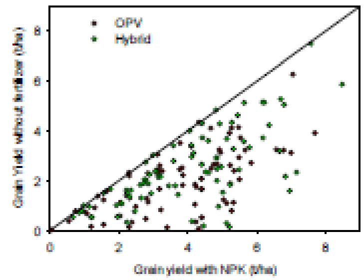
NOTs results - Nigeria

- Maize response to nutrient varies from location to location



NOTs results - Nigeria

- The relationship between yield in omission plot and yield with NPK in maize.



NOTs results - Ethiopia

- Nitrogen is the nutrient most limiting yield in both Bako and Gobu sayo
- K & P are also important in Gobu sayo
- Yield was depressed when micro-nutrients were applied

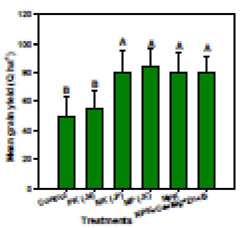


Figure 1: Mean grain yield of maize on responsive soil at Bako tibe district, West shoa zone (N=12)

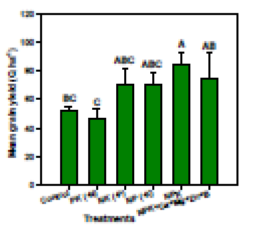


Figure: Mean grain yield of maize on responsive soil at Gobu sayo district, West shoa zone (N=8)

NOTs results - Ethiopia

- No yield response to each nutrient in some areas

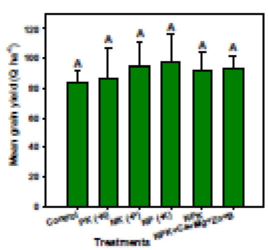


Figure: Mean grain yield of maize on non-responsive soil at Bako tibe district, West shoa zone (N=4)

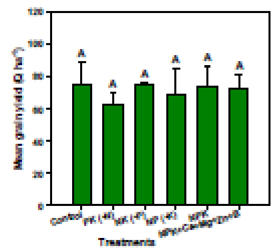


Figure: Mean grain yield of maize on non-responsive soil at Gobu sayo district, West shoa zone (N=4)

NOTs results - Ethiopia

- Nitrogen was the nutrient most limiting yield in both Omonada and Kersa districts.

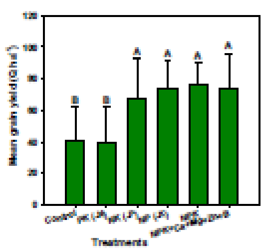


Figure: Mean grain yield of maize on responsive soil at Omonada district, Jimma zone (N=13)

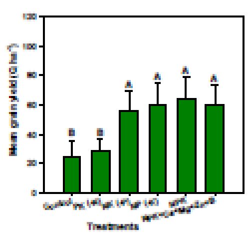


Figure: Mean grain yield of maize on responsive soil at Kersa district, Jimma zone (N=8)

NOTs results - Ethiopia

- Yield response to nutrients in Bako, Gobu sayo. Kersa and Omonada districts in Ethiopia.

Districts	Yield response (q/ha) due additional nutrients			
	N	P	K	Secondary & micro
Bako Tibe	24.6	-0.2	-3.9	-0.2
Gobu sayo	37.2	13.3	13.6	-9.5
Kersa	34.9	7.2	2.8	-2.9
Omonada	35.8	8.5	1.7	-2.7

Engaging partners on the use of NE

Engaging partners on the use of NE

- NE workshops in Nigeria and Ethiopia conducted:
  - ✓orient extension partners on the scope and use of NE in the development of site-specific nutrient management and fertilizer recommendations
  - ✓evaluate the use of NE for different for extension partners, and identify partners' specific needs and demands for its effective use in specific intervention areas
  - ✓develop action plans for the co-development of NE and other related applications

TAMASA Primary partners in Nigeria

- Managed to engage TAMASA primary partners.
- Nigeria
  - ✓NE users: SG 2000; NOTORE; DOREO partners; ADA
  - ✓NE host institution: BUK
- Ethiopia
  - ✓NE users: MOANR; SG 2000; GIZ
  - ✓NE host institution: EIAR – Land, Water Resource Research directorate

Feedback on the use of NE from Nigeria

- The value of NE
  - ✓NE is highly efficient and easy to understand and operate
  - ✓NE will solve the issue of blanket nutrient application as it provides estimate of fertilizer recommendations for specific sites
  - ✓NE will help to forecast economic returns and expected yield
- Suggestions for improvement
  - ✓Questions are too many in the procedures/steps if possible be reduced
  - ✓NE should be made to be operative with other applications such as mobile smart phones for portability
  - ✓NE should meet the need of other crops such as cowpea because most farmers are rotating maize with legumes
  - ✓There is need to include all the states in Nigeria

Feedback on the use of NE from Ethiopia

- The value of NE
  - ✓Enabling to give site specific fertilizer recommendation
  - ✓Calculation of the economic benefits from the fertilizer input
  - ✓It is in harmony with fertilizer recommendation strategy of the country (Ethiosis data could be used)
- Suggestions for improvement
  - ✓Quantification of the inherent soil fertility is missing (eg. pH, OM, Av.P and Exch.K, trace elements)—only limited on color and soil texture
  - ✓Source OM (composts has to be included)
  - ✓Other crops should be included
  - ✓Lime requirement as option for yield improvement

Key message – NE workshops

- The partners have demonstrated their willingness and commitment to participate in the co-development of the NE
- Partners especially in Nigeria have noted that NE will also help them to provide efficient and effective services to farmers and hence build a strong relationship with their clients

Lessons Learnt

- Partners' needs depend on country as influenced by country's current development of fertilizer recommendations.
- Feedback from partners depends on the nature of the participants and the existing extension system:
  - extension agents versus researchers with great influence on extension agents.
- One-on-one engagement with primary partners is critical for building trust between TAMASA and its core partners
- Understanding the current development of fertilizer recommendations and existing extension system in each country is important for identifying entry points to streamline the NE decision support tool in the existing programs

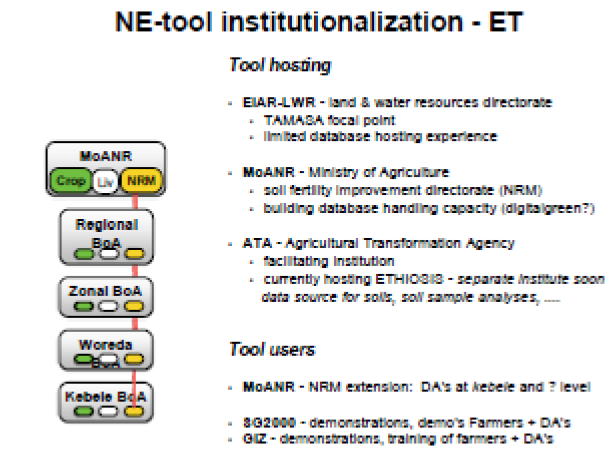
IPNI

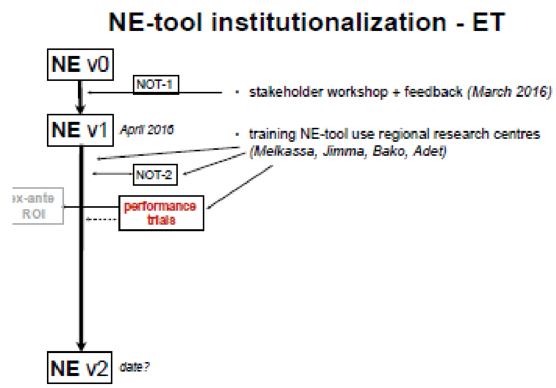
NOTs for the 2016 season

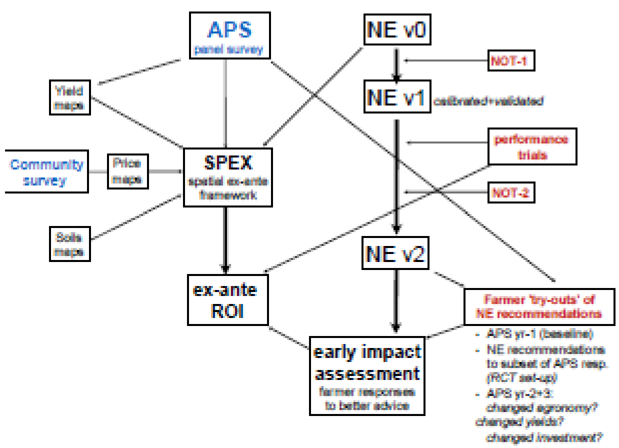
- Out of the total trials established in the first season about 50% will be repeated on the same experimental sites in the second season in each of the three countries.
- The set of sites to be selected are decided based on cluster analysis to select sites that are representative of categories of growing conditions, treatment effect and yield response.
  - ✓Ethiopia – 40
  - ✓Nigeria – 60
  - ✓Tanzania – 100

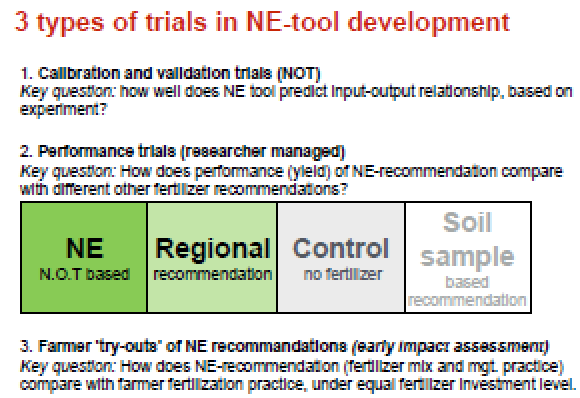
IPNI

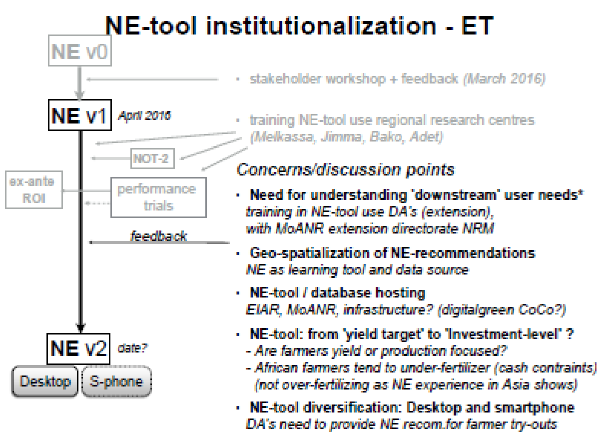
Plans for tool co-development & institutionalisation

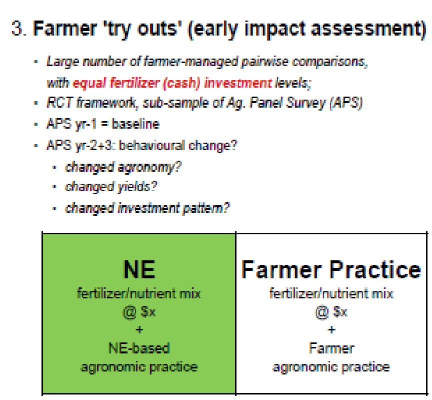












NE-tool institutionalization - ET

Planning

- **Engaging 'downstream' NE-tool users**
  - *training in NE-tool use DA's (extension) for feedback*
  - *For NE recommendations to APS survey yr.2*
- **Geo-spatialization of NE-tool + recommendations**
  NE as learning tool and data source (output file storage, retrievable)
- **NE-tool / database hosting**
  EIAR, MoANR, ETHIOSIS?, Infrastructure? (digitalgreen CoCo?)
  Training in database mgt.

  Development of smartphone app (operational after APS 1)

Variety-tool institutionalization - ET

Tool hosting

- National Variety Release Committee (NVRC)
- Standing committee, chair prof. Firew Shikeb (Melkassa
- Secretariat in MoANR (crop directorate)
- **EIAR-crop** - crop directorate
  - limited database hosting experience
- **MoANR** - Ministry of Agriculture
  - Crop directorate (NRM)
  - building database handling capacity (digitalgreen?)
- **ATA** - Agricultural Transformation Agency
  - facilitating institution

Tool users

- **MoANR** - crop extension: DA's at *kebele* and ? level
- ....

PhD programs WS7

PhD Program in Nigeria

PhD programmes in Nigeria in collaboration with KU Leuven

Jan Diels

- Nutrient imbalances (related to NOT trials): BELLO MUHAMMAD SHEHU (Supervisors Roel Merckx, Miet Maertens, Jan Diels)
- Matching maize varieties to different soils and agro-climatic conditions: ADNAN AMINU ADNAN (Supervisors Jan Diels, Roel Merckx, Miet Maertens)
- Ex-ante and ex-post socioeconomic evaluation of the nutrient expert tool: OYINBO OYAKHILOMEN (Supervisors Miet Maertens, Jan Diels, Roel Merckx)

KU LEUVEN 1

Study Areas

KU LEUVEN

OPTIMIZING PRODUCTIVITY OF MAIZE IN THE NIGERIAN SAVANNA AGRO-ECOLOGICAL ZONE: INFLUENCE OF NUTRIENT LIMITATIONS AND IMBALANCES

BELLO MUHAMMAD SHEHU

Objectives

- ✓ Evaluation of nutrient responses: fertility status, nutrient supply, nutrient use efficiency and yield response to nutrient application.
- ✓ Establishment of nutrient norms, critical and optimal ranges.
- ✓ Diagnosis of nutritional limitations and imbalances.
- ✓ Modelling of site-specific nutrient requirements.

KU LEUVEN 3

Study Area

Country	State	LGA
Nigeria	Kaduna	Lere*, Soba*, Ikara*, Makarfi*
Nigeria	Katsina	Funtua*, Dandume*, Bakori#
Nigeria	Kano	Doguwa*, Tudun Wada*, Bunkure#

* Northern Guinea Savanna, # Sudan Savanna

Activity 1: On-Farm Nutrient Omission Trials (NOT)

- Farmers: 10 farms will be randomly selected from each LGA (10*6=60)
- Treatments: Two set of trials will be conducted in each location (one with OPV and the other with a hybrid variety). The treatments consists of: no fertilizer (control), PK, NK, NP, NPK and NPK+S+Ca+Zn+Mg+B.
- Duration: Two years (2015 and 2016 rainy seasons)
- Soil Sampling and Analysis: Particle size distribution, pH, OC and all essential plant nutrients.
- Plant Tissue Sampling and Analysis: All essential plant nutrients in the ear leaf, grain and the stover.

KU LEUVEN 4

Activity 2: Modelling of Site Specific Nutrient Requirement

Calibration of QUEFTS model

- Data from NOT will be used to calibrate QUEFTS model where: fertilizer recovery, indigenous nutrient supply/relations with soil chemical properties, maximum accumulation Validation of QUEFTS Model

Validation of QUEFTS Model

- Experimental sites: Six fields from NOT sites selected (2 from Sudan Savanna and 4 from Northern Guinea Savanna).
- Treatment: zero fertilizer (control) plus three nutrient recommendations obtained from QUEFTS by setting the yield at 80%, 60% and 40% of the potential yield.
- Experimental Design: a randomized complete design (RCBD) will be used with three replications.
- Duration: Two years (2016 and 2017 rainy seasons)

KU LEUVEN 5

MATCHING MAIZE VARIETIES TO DIFFERENT SOILS AND AGRO-CLIMATIC CONDITIONS OF NORTHERN GUINEA AND SUDAN SAVANNAS OF NIGERIA USING SIMULATION MODELS

ADNAN AMINU ADNAN

Objectives

- ✓ Estimate cultivar coefficients of maize varieties produced in Sudan Savanna (SS) and Northern Guinea Savanna (NGS) of Nigeria
- ✓ Evaluate the sequential approach method of generating cultivar coefficients with CERES-maize by using data generated via field measurements and data from yield evaluation trials
- ✓ Evaluate the effect of varying planting densities of maize across SS and NGS of Nigeria and validation of CERES-Maize Model for the ability to predict planting density of maize
- ✓ Develop variety suitability maps to be used as decision-support tools for maize varietal selection across the SS and NGS of Nigeria.

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Estimation of Cultivar Coefficients (Calibration)

From field calibration trials

Four trials (1 in each of 4 locations) conducted first in the dry season under full irrigation and then repeated in the wet season using supplementary irrigation when necessary in 2016.

SN	Location	Zone
1.	Research Farm, Bayero University Kano	SS
2.	Irrigation Station, Audu Bako College of Agriculture, Dambatta	SS
3.	Institute for Agricultural Research, Ahmadu Bello University, Zaria	NGS
4.	Kaduna Agricultural Development Agency (KADP) Irrigation Research Station, Saminaka	NGS

Yield Evaluation Trials

Data from evaluation trials by breeders across multiple seasons and locations will be collected. Data must be from at least 5 years and 5 locations for each variety, under proper management, and details of soil analysis and weather records must be available.

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On-Farm Validation Trials

- Number of Villages: 10 in 6 LGAs = 60 Villages
- 10 early and extra early varieties in the SS and 10 intermediate and late varieties in the NGS

LGA	State	Zone	Sites
Bunkure	Kano	SS*	10
Garun-Mallam	Kano	SS	10
Kura	Kano	SS	10
Doguwa	Kano	NGS	10
Lere	Kaduna	NGS	10
Ikara	Kaduna	NGS	10

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Factors

- Varieties = 10 per (AEZ) } Main Effects
- Sowing Density = 3 } Main Effects
- LGAs = 3 per AEZ
- Farmer Class = 5

Number of Farmers/Site

- No. of farmers per class = 2
- No. of farmers per LGA = 10
- Total No. of Farmers/AEZ = 30 (3 LGAs x 10 farmers)

Experimental Design

- Fractional factorial design with farmers serving as blocks accommodating 10 treatment combinations

Observations

- Grain yield, Biomass at tasseling and harvest, harvest index

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Next steps ….

Weather data: Gridded data from NASA vs. MarkSim vs weather station data

Scenario analysis with CERES-MAIZE: 30 years of daily weather data * soil properties * varieties * sowing density

Summarize data in **suitability maps:** what are most suitable varieties and densities?

10

KU LEUVEN

Agricultural Intensification through Nutrient Expert Decision Support Tools: Evidence from Maize-Based Systems of Nigeria

OYINBO OYAKHILOMEN

General Objective

✓ The general objective of this research is to undertake an ex-ante and ex-post socioeconomic evaluation of key stakeholders (farmers and extension agents) in the uptake and scaling up of NE tools in Nigeria.

Specific objectives

✓ To determine farmer's preferences for extension advice from NE decision support tools, heterogeneity and willingness to adopt NE tool recommendations

✓ To determine extension agents' preferences for NE decision support tools, heterogeneity and willingness to adopt NE tools

✓ To determine heterogeneous impact of famers' exposure to NE-based fertilizer recommendations on fertilizer use, complementary inputs, yield and income

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Study area

- Northern Guinea Savanna- Kaduna State
- Local government areas with TAMASA activities (NOTs)

Sampling

- 2 Local government areas (Lere and Makarfi), 4 Districts, 45 villages
- Villages should have no project on fertilizer recommendation such as OFRA
- 450 farmers', 150 village extension agents

Data collection

- Data will be collected from both farmers' and extension agents
- Choice cards, structured questionnaire and FGD will be used to elicit data
- Researcher and trained enumerators will carry out the data collection

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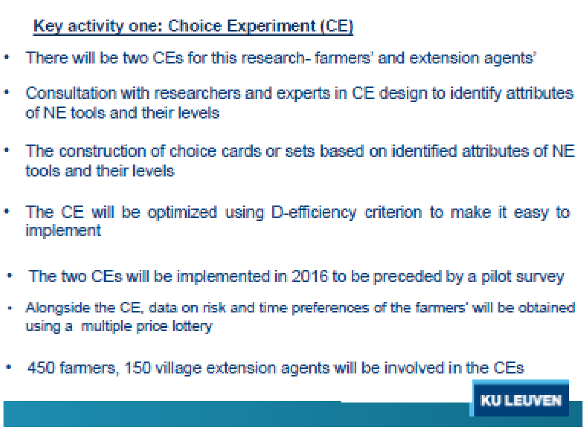
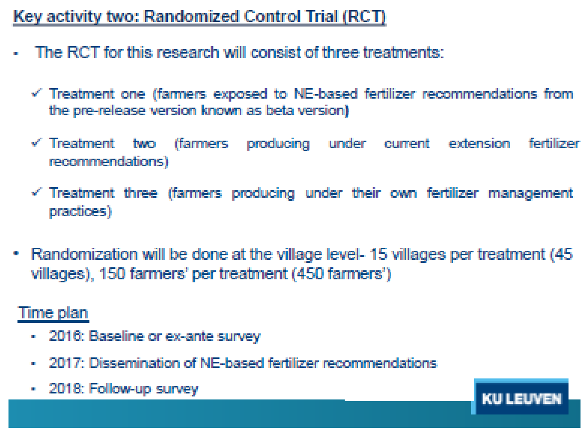
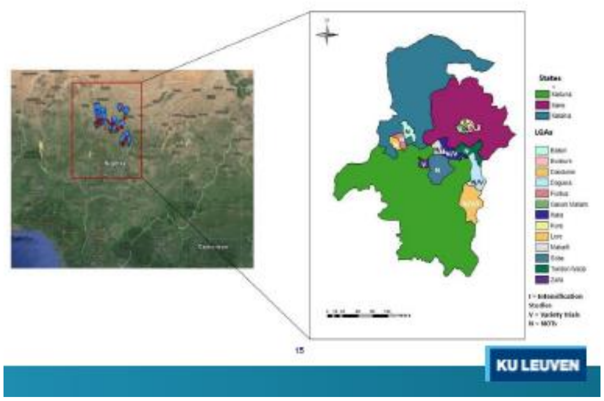
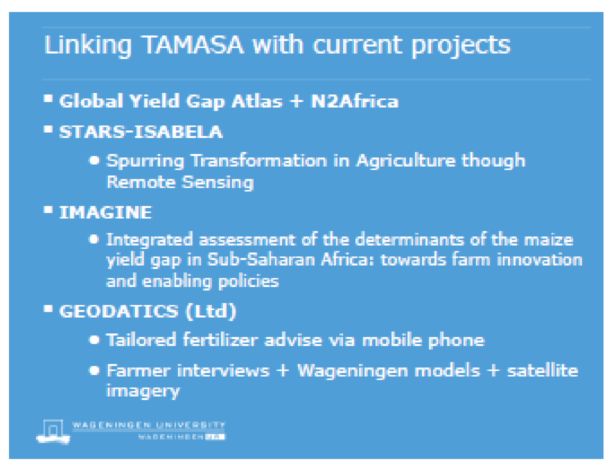


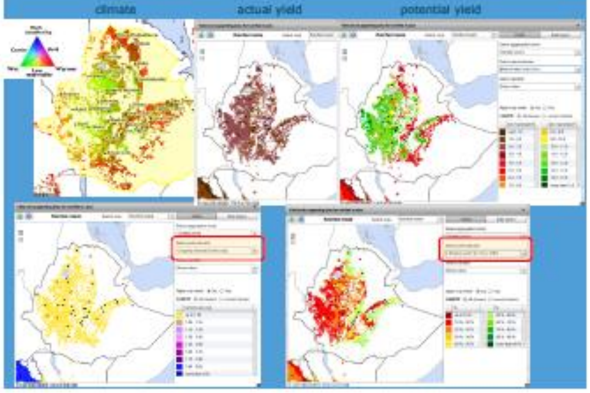




Wageningen University



GYGA: Ethiopia

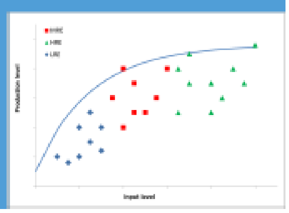


Selected PhD students

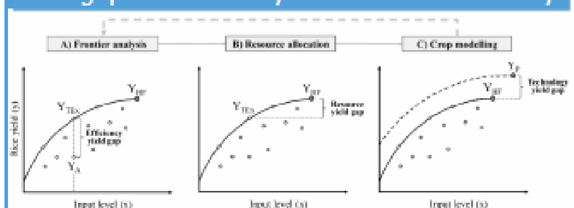
- Ethiopia
- Tanzania

Maize yield gaps
An integrated assessment

- Major hypothesis
  - Yield gaps are related to poverty and farmer endowments
  - Farmer endowment determine crop management and technology adoption
  - Bio-economic modelling can predict impact of technology on food security and poverty



Yield gaps: inefficiency vs resource deficiency



Y_{BF}, Y_{TEx} and Y_A are abbreviations for best farmer's yield, technical efficient yield at a specific input level and actual yield of each individual farm. Y_p is the climatic potential yield quantified using crop growth models.

Vasco Silva et al., 2015.
5[th] International Symposium for Farming Systems Design, Montpellier, France

Calculated potential*	Gap 1		
	Best practice yield	Gap 2	
		Economic ceiling yield (given current markets and institutions)	Gap 3
			Actual farmer yield
Modelled	Farm and plot level observations		

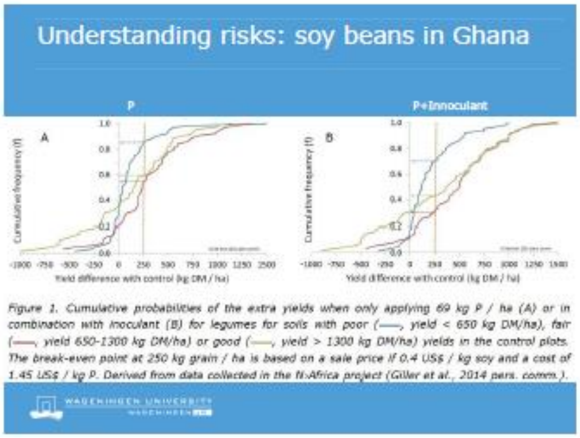
*water-limited yield potential in case of rainfed systems

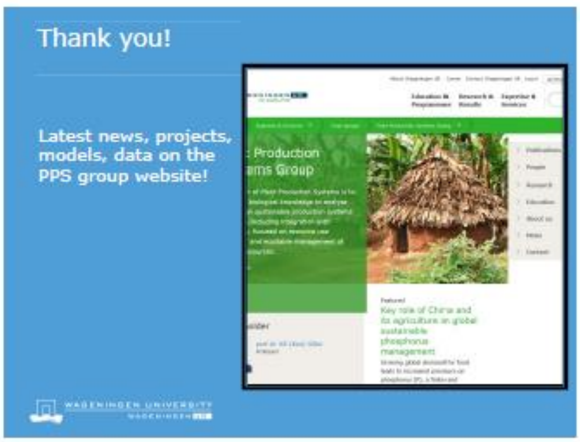
Mitigating yield gaps
Exploration and re-design

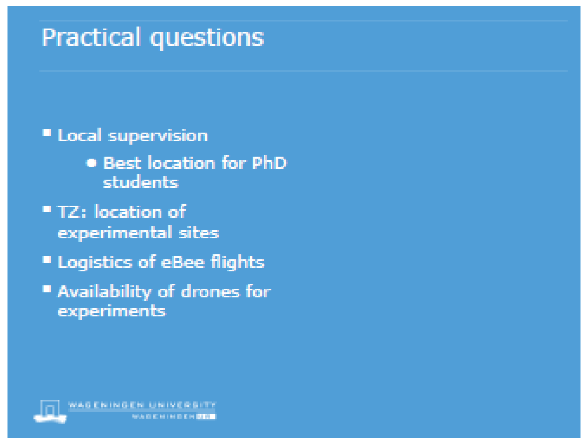
- Hypothesis
  - Participatory co-design with farmers using farming system models provides realistic intervention options
  - Best interventions are specific for EDs and farming systems
  - Experiments and demonstration allows upscaling to EDs.

Spatial variability
Reducing technological risks

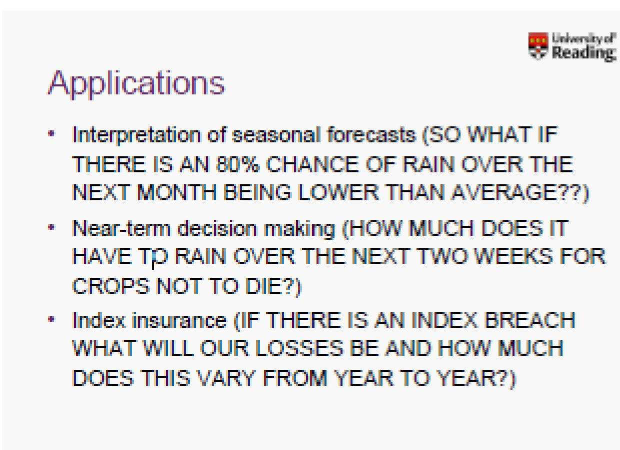
- Hypothesis:
  - Nutrient response curves vary between and within fields
  - Spatial variability of fields affect nutrient response curves
  - Knowledge of spatial variation in crops assist in improved NUE

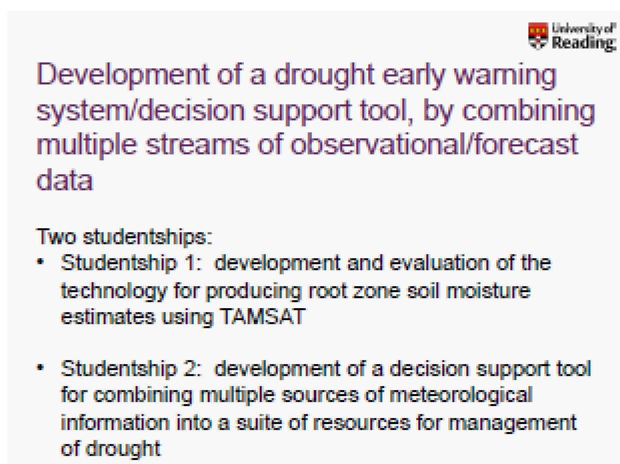






University of Reading



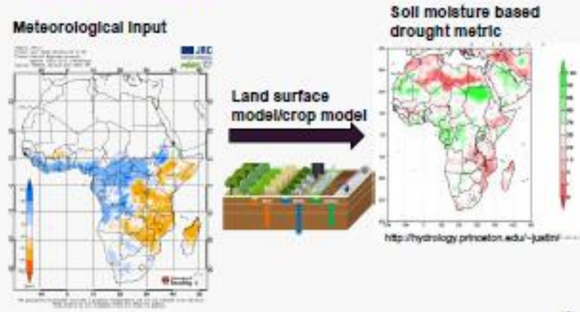


Development of a drought early warning system/decision support tool, by combining multiple streams of observational/forecast data

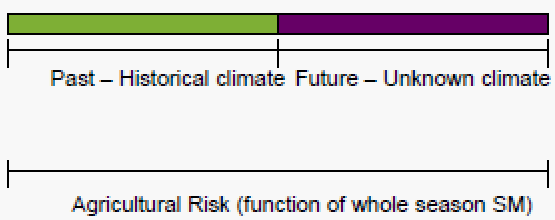
Two studentships:

- Studentship 1: Amsalework Ejigu – Ethiopian national, who is a mathematician and Lecturer on AIMS (African Institute of Mathematical Sciences) programme. Supervised by Tristan Quaife and Amos Lawless
- Studentship 2: Dagmawi Asfaw – Ethiopian national, who has an agronomical background and lecturing experience. Supervised by me and Ross Maidment

Current methods of providing drought early warning: snapshots and forecasts



New methods: whole season risk: www.droughtforecast.org



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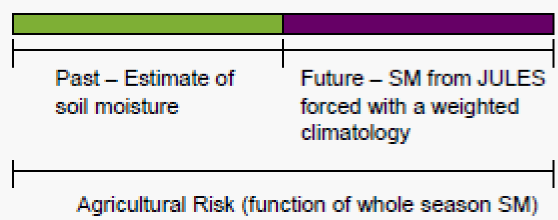
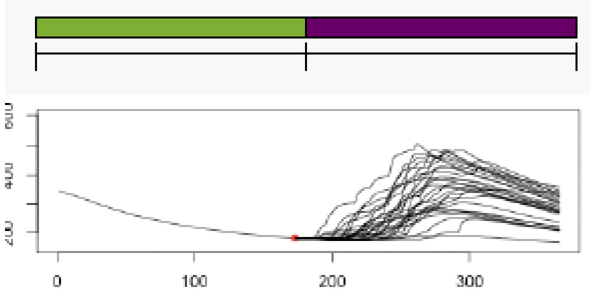
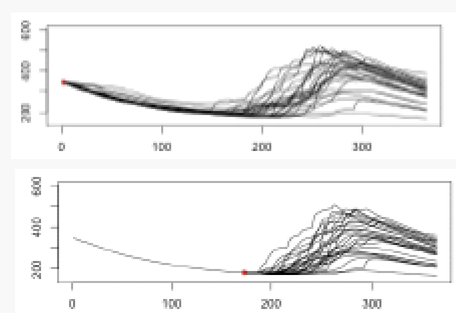


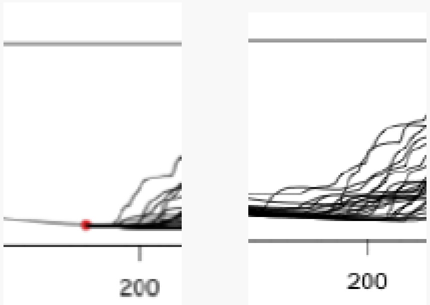
New methods: whole season risk: www.droughtforecast.org



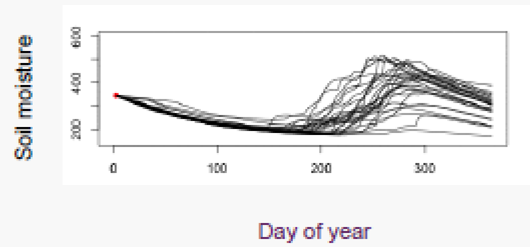
The condition of the land surface affects near-term soil moisture



The condition of the land surface affects near-term soil moisture

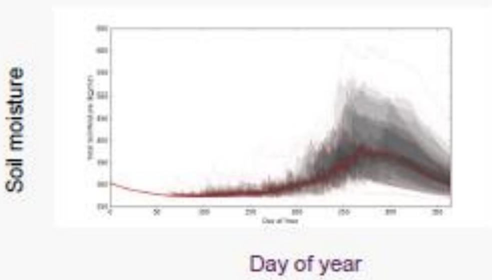


Seasonal evolution of soil moisture

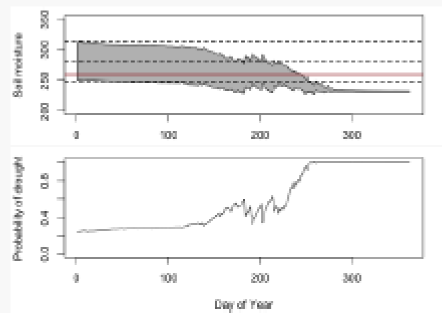


Red dot is the present day. The soil moisture before the present day is the seasonal evolution to that point (modelled with JULES) and the soil moisture onwards are projections (modelled with JULES).

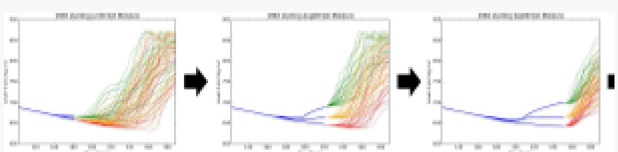
Seasonal evolution of soil moisture



Seasonal evolution of drought risk (Dagmawi's project)

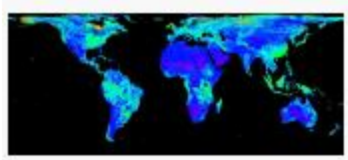


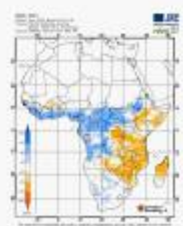
Knowledge of soil moisture is the key



Forecasts are based on a range of possible precipitation scenarios. **Uncertainties in soil moisture significantly increase the ensemble spread**

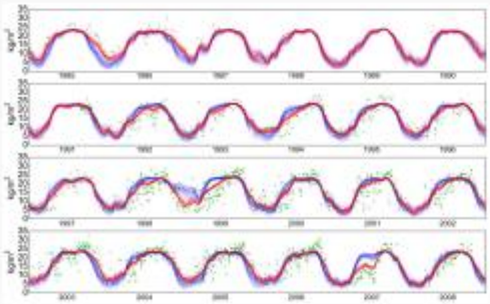
Knowledge of soil moisture is the key



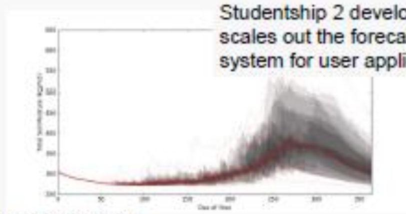


Soil moisture can be constrained using SMAP and TAMSAT within a JULES-based data assimilation system

Experimental data assimilation (Amsale's project)



Bringing the projects together



Studentship 2 develops and scales out the forecasting system for user applications

Studentship 1 constrains soil moisture for forecast initialization

TAMASA programme suggests pilot studies and provide validation and feedback on usefulness

Applications

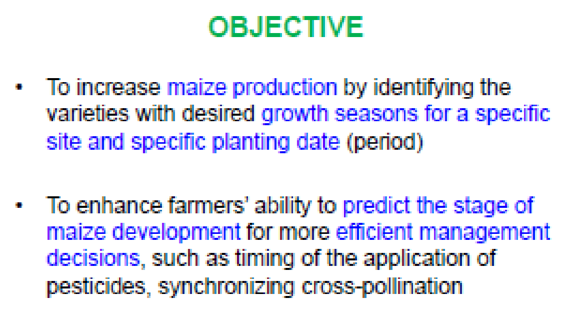
- Interpretation of seasonal forecasts (SO WHAT IF THERE IS AN 80% CHANCE OF RAIN OVER THE NEXT MONTH BEING LOWER THAN AVERAGE??)
- Near-term decision making (HOW MUCH DOES IT HAVE TO RAIN OVER THE NEXT TWO WEEKS FOR CROPS NOT TO DIE?)
- Index insurance (IF THERE IS AN INDEX BREACH WHAT WILL OUR LOSSES BE AND HOW MUCH DOES THIS VARY FROM YEAR TO YEAR?)

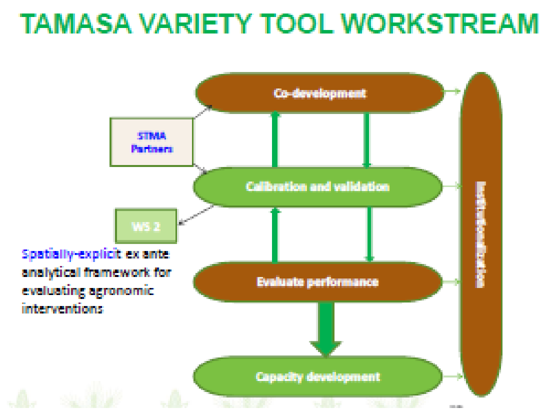
Next steps

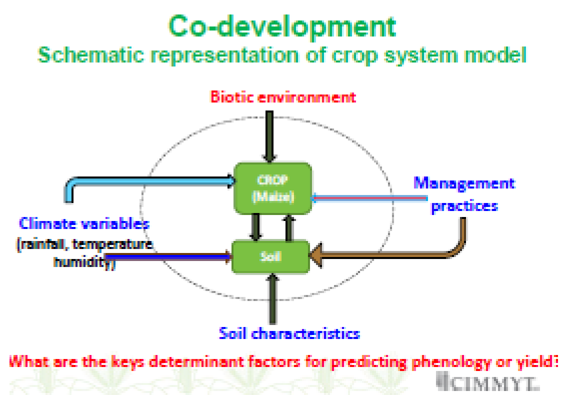
- Continue to run the pilot operational system for Ghana and (soon) for Zambia. ADDITIONAL CASE STUDIES?? (TAMSAT group + Dagmawi)
- Metrics of drought risk IDEAS FROM TAMASA PARTNERS? We can look at most quantities.
- Start to look at SMAP data for the DA (Amsale)
- Scaling out using satellite-based rainfall: TAMSAT, ARC, CHIRPS… (Dagmawi)
- Incorporation of seasonal forecasts. The technology is there but method is naïve. (Dagmawi)

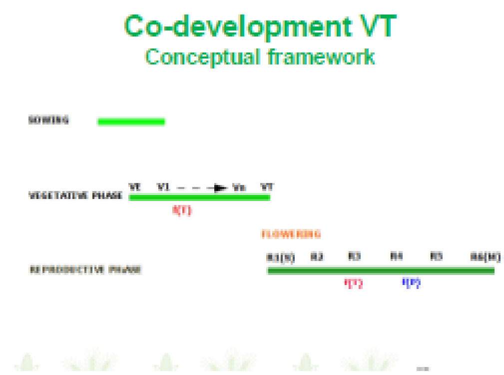
Variety tool WS4

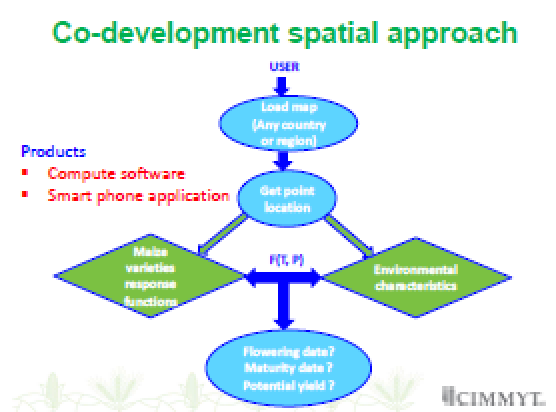
Plans & protocols for calibration

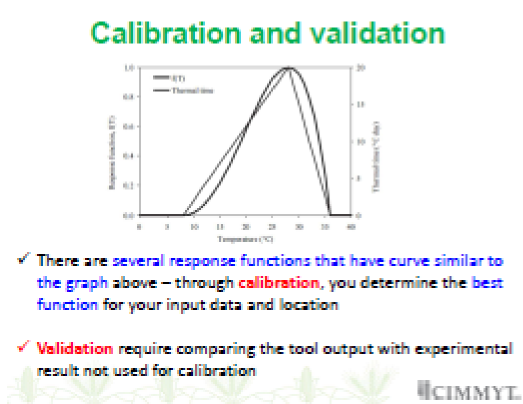












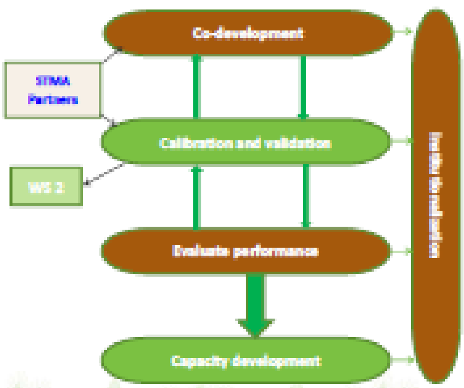
Evaluation tool performance

✓ The tool is used to provide recommendations in a location in advanced and then data collection is conducted to evaluate the level of the prediction accuracy of the tool

Capacity to use the tool

✓ Training people on how to use the tool and produce output and how to interpret the output to provide recommendations

Institutionalization



Keys Discussion points?

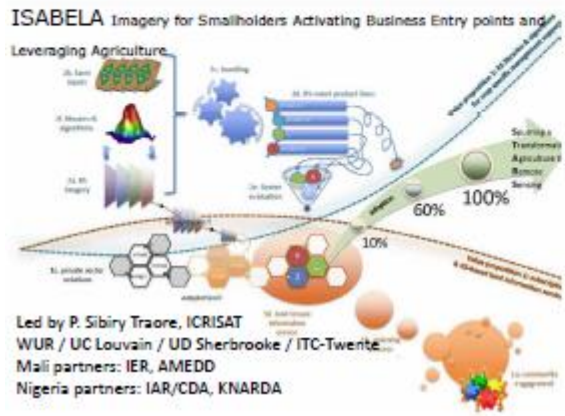
- What are the key determinant factors to use for predicting maize phenology? and yield?
- If rainfall is to be considered as important factor do we have means and time to calibrate and validate the tool using different rainfall response functions?
- What factors shall we considered under ideal conditions?

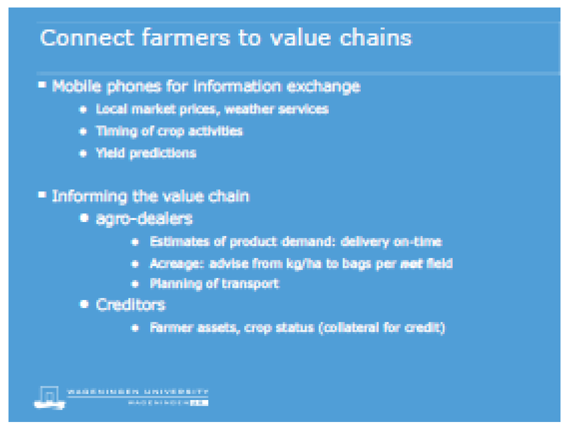
Keys Discussion points?

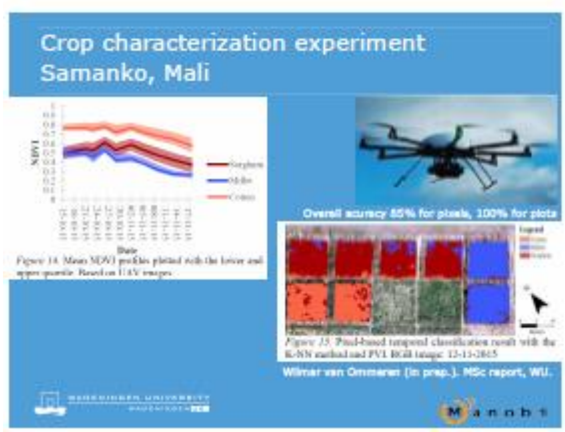
- Which institution is willing to joint TAMASA team for the co-development of the tool?
- What else do you like the tool to do? It is a must to include yield prediction?
- How will you want the tool to be presented? It is in form of desktop software? or smart phone app? or both?
- Who are the potential users of the tools

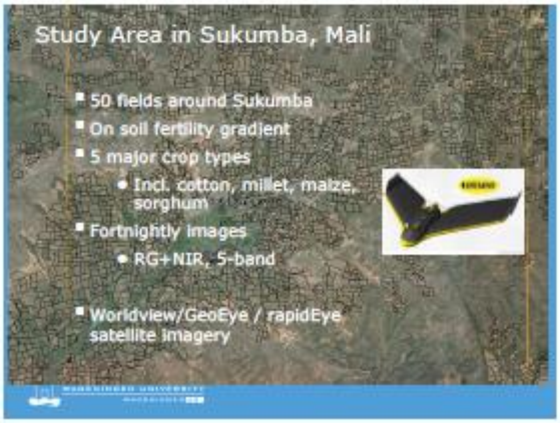
CIMMYT.

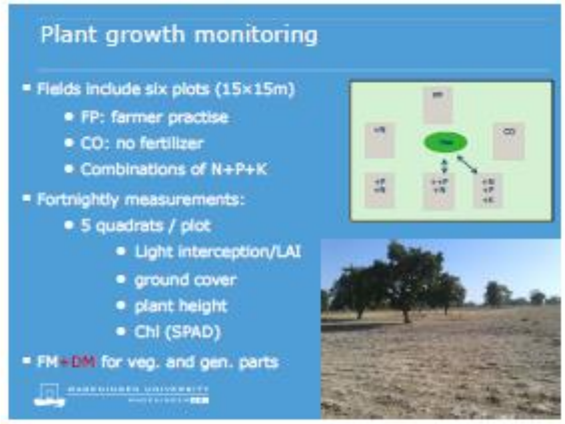
Use of UAVS: STARS in WCA



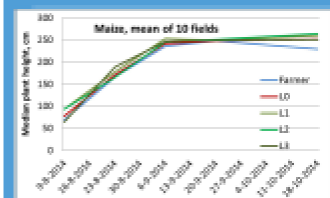








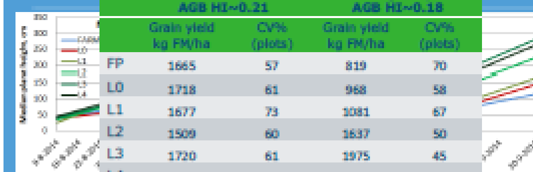
Maize growth and development



	Grain yield kg FM/ha	CV% plots
FP	4415	45
L0	5176	41
L1	5936	38
L2	5964	35
L3	6863	27

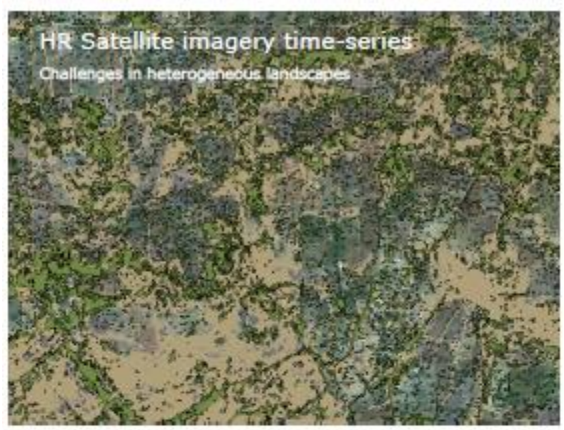
	NPK (kg/ha) 15-15-15	Urea (kg/ha) 46-0-0	DAP (kg/ha) 18-46-0
Farmer Practise			
L0	100	0/150	-
L1	-	0/150	100/0
L2	200/0	0/300	-
L3	-	0/300	200/0

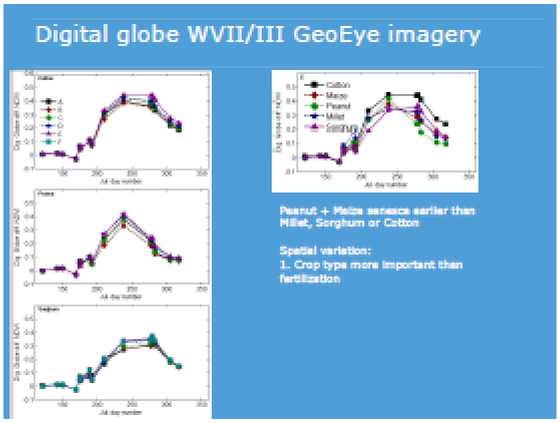
Millet/Sorghum growth

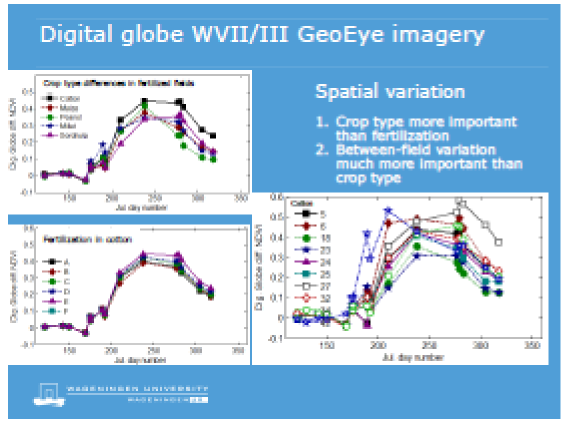


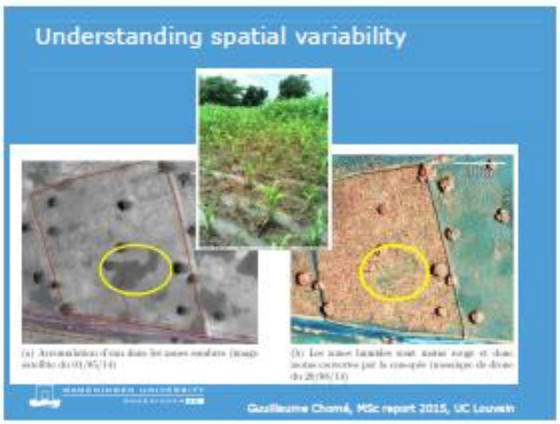
	Millet, AGB HI~0.21		Sorghum, AGB HI~0.18	
	Grain yield kg FM/ha	CV% (plots)	Grain yield kg FM/ha	CV% (plots)
FP	1665	57	819	70
L0	1718	61	968	58
L1	1677	73	1081	67
L2	1509	60	1637	50
L3	1720	61	1975	45
L4	1830	63	1822	54

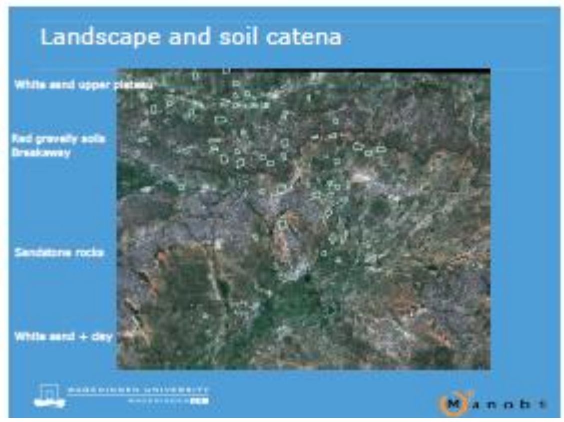
	NPK (kg/ha) 15-15-15	Urea (kg/ha) 46-0-0	DAP (kg/ha) 18-46-0
Farmer Practise			
L0	-	-	-
L1	-	0/50	-
L2	-	0/50	75/0
L3	-	0/50	150/0
L4	150/0	0/50	

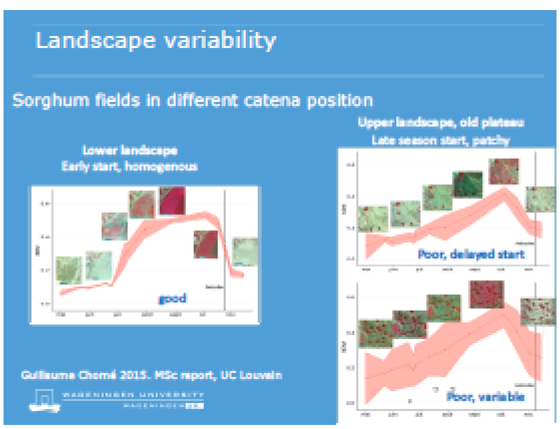


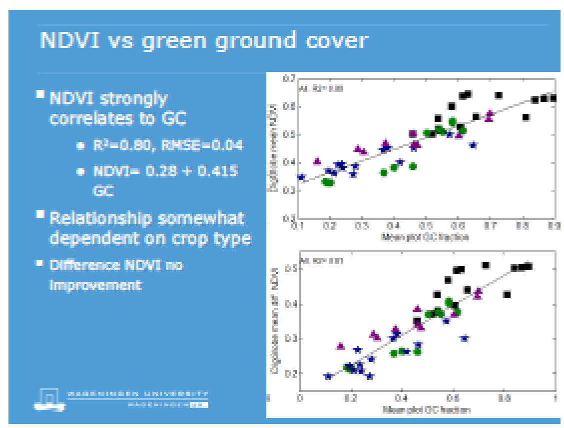

Digital globe WVII/III GeoEye imagery
Peanut + Maize senesce earlier than Millet, Sorghum or Cotton
Spatial variation:
1. Crop type more important than fertilization

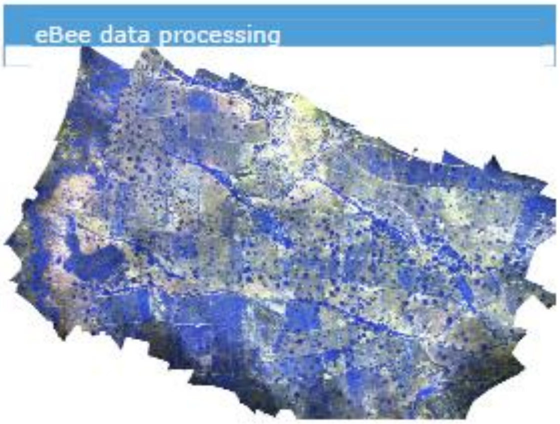

Digital globe WVII/III GeoEye imagery
Spatial variation
1. Crop type more important than fertilization
2. Between-field variation much more important than crop type
Crop type differences in fertilized fields
Fertilization in cotton
Jul. day number


Understanding spatial variability
Guillaume Chomé, MSc report 2015, UC Louvain

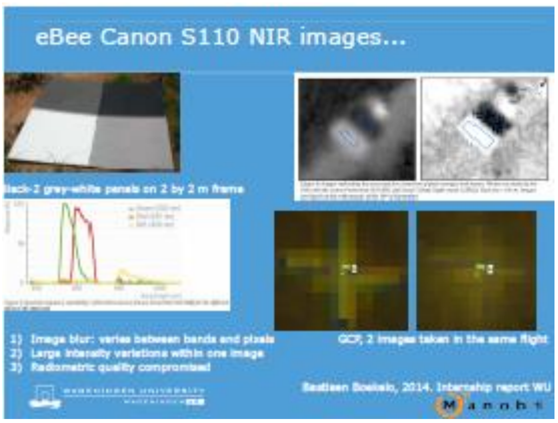

Landscape and soil catena
White sand upper plateau
Red gravelly soils
Breakaway
Sandstone rocks
White sand + clay

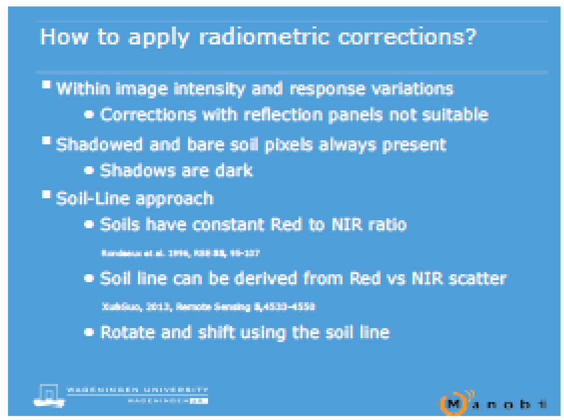

Landscape variability
Sorghum fields in different catena position
Lower landscape
Early start, homogenous
good
Upper landscape, old plateau
Late season start, patchy
Poor, delayed start
Poor, variable
Guillaume Chomé 2015. MSc report, UC Louvain

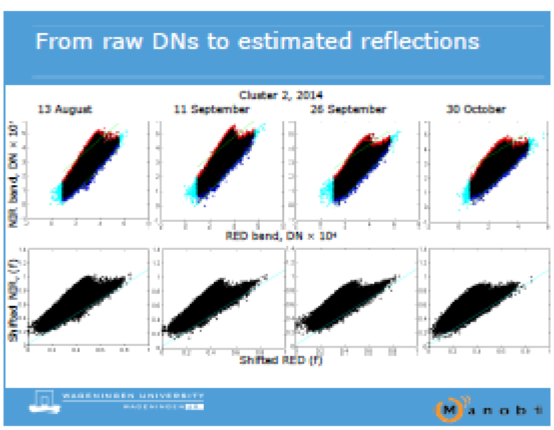

NDVI vs green ground cover
NDVI strongly correlates to GC
R²=0.80, RMSE=0.04
NDVI= 0.28 + 0.415 GC
Relationship somewhat dependent on crop type
Difference NDVI no improvement
Mean plot GC fraction


eBee data processing


Ground Control
5-6 needed per flight for normal GPS
Maintenance is required....
Figure 2: Ground control points (GCPs). Left: GCP painted on bedrock. Right: GCP painted on constructed concrete cross.
Bastiaan Boelalo, 2014. Internship report WU
WAGENINGEN UNIVERSITY


eBee Canon S110 NIR images...
Black-2 grey-white panels on 2 by 2 m frame
1) Image blur: varies between bands and pixels
2) Large intensity variations within one image
3) Radiometric quality compromised
GCP, 2 images taken in the same flight
Bastiaan Boelalo, 2014. Internship report WU
WAGENINGEN UNIVERSITY


How to apply radiometric corrections?
Within image intensity and response variations
Corrections with reflection panels not suitable
Shadowed and bare soil pixels always present
Shadows are dark
Soil-Line approach
Soils have constant Red to NIR ratio
Rondeaux et al. 1996, RSE 55, 95-107
Soil line can be derived from Red vs NIR scatter
XubGuo, 2013, Remote Sensing 5,4533-4550
Rotate and shift using the soil line
WAGENINGEN UNIVERSITY


From raw DNs to estimated reflections
Cluster 2, 2014
13 August
11 September
26 September
30 October
NIR band, DN × 10⁴
RED band, DN × 10⁴
Shifted NIR (f)
Shifted RED (f)
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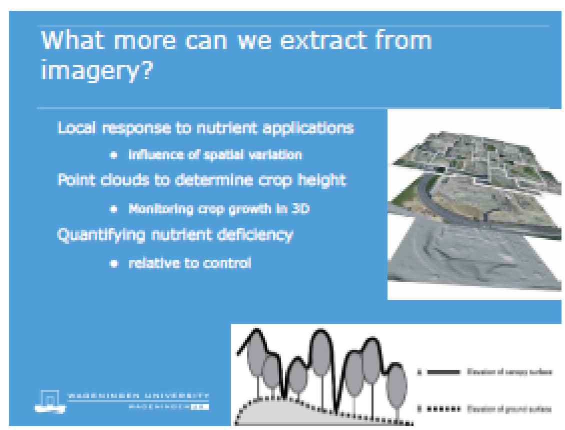
What more can we extract from imagery?
Local response to nutrient applications
Influence of spatial variation
Point clouds to determine crop height
Monitoring crop growth in 3D
Quantifying nutrient deficiency
relative to control
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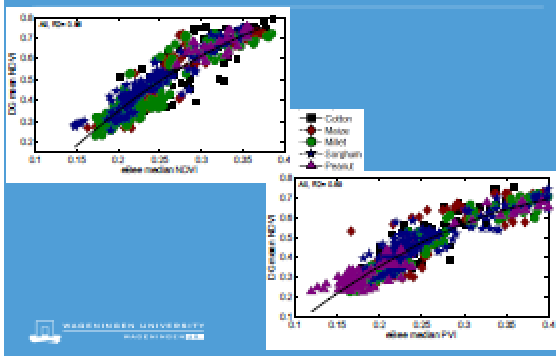
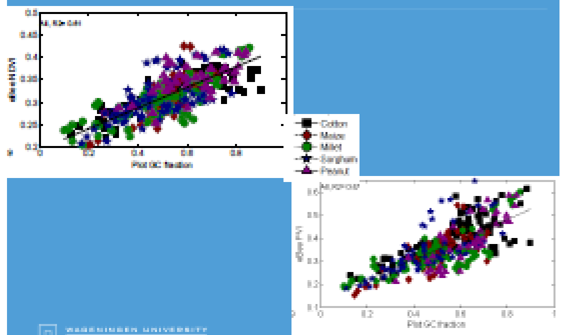
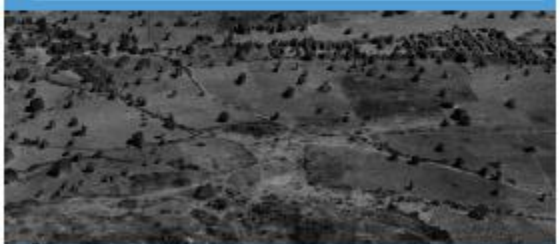
Satellite and eBee Veg. Indices



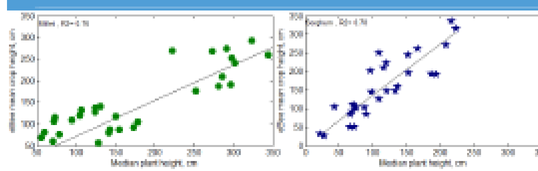
Plot ground cover vs eBee PVI & NDVI



Crop height from eBee
DSM difference with December



Crop height from eBee
DSM difference with DSM @ 21 December



- DSM crop height (provisional results)
  - Extensive manual point cloud "cleaning" (Agisoft Photoscan)
  - Crop specific relationships

What else?
Mapping *Messor Galla* harvester ant nests

Bastiaan Boekelo, 2014. Internship report WU

Frédéric de Schaetzen 2016. Internship report, WU

Crop type differences

- NDVI/PVI strongly relates to ground cover
  - DG-image (r^2=0.81) and eBee (r^2=0.61)
- Between field variation larger than within-field
  - Manag.>>Crop type>>Nutrient response
  - Sowing time, weeding
- Crops differ in VI response within landscape strata
- Crop height can be accurately measured with eBee
  - RMSE of 45 cm, sufficient to differentiate crops
  - [Cotton + peanuts] vs [maize + millet + sorghum]
  - Only accurate when sufficient GCP and careful processing!

Key lessons

- Ground control is essential
- eBee S110 NIR camera is not the best!
- Max 200 ha (~40 minutes) flight for battery life
- Standard DG satellite ortho's are 2-3 m (!!) off
- Very large variation in yields at plot scale (15*15 m), >50%CV
  - Science: requires many replicates for significant effects
  - Strata has major effect on growth curves
  - Crop type classification can only work within strata
- What is farmer yield? Production divided by which area?

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Thank you!

ISABELA team

P.S. Traore, K.A. Ajeigbe (ICRISAT)

D Annerose (Manobi), M Djire (GERSDA)

K. Goita (Rsala/UDS), B. Sogoba (AMEDD), K.B. Traore (IER)

P. Defourny, X. Blaes (UCL)

I. Schmitt-Olabisi (MSU)

A.G.T. Schut (WUR), R Zurita-Milla (ITC)

Z-A Mainassara (CIMMYT)

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Household panel, agronomy & yield survey & ex-ante framework

Agronomic Panel Survey

Objective

- Review and agree on a common set of SOPs for farm household survey, soil & yield data collection
- Starting this year, these data collection activities are integrated within the agronomic panel survey (APS)

Purpose of the APS

- Describe spatial/temporal patterns in maize yields and agronomic practices
- Understand the contribution of agronomic practices and other management decisions on yields
  - after controlling for soil, terrain and weather conditions
- Measure costs of inputs at the farm gate and thereby measure profitability of maize production
- Baseline for measuring impacts of selected interventions
  - randomly distributed as "treatments" to the surveyed sample

Sampling farm households

- Within 10km² grids, we randomly select farm households for inclusion in the Agronomic Panel Survey sample
- Aiming at 600-800 households per country
  - Tanzania: 30 households in 26 grids = 780 households
  - Ethiopia: 50 households in 12 grids = 600 households
  - Nigeria: ?
- Sampling strategy varies by country:
  - Tanzania: utilize 1km² sub-grids used by AfSIS; do quick listing exercises within
  - Ethiopia: do listing exercises in sub-villages within 10km² grids
  - Nigeria: ?

Data collection partnerships

- Tanzania
  - Sustainable Intensification Lab (MSU, SUA) will co-finance data collection and analysis, using a mutually agreed instrument
  - Enumerators from SUA
  - Supervision from TAMASA, MSU, others?
- Ethiopia
  - Data collection through EAIR & CSA
  - Collaboration with IMAGINE project (supplemental data collection)
- Nigeria
  - ?

Agronomic panel survey components

- Household questionnaire
- Community questionnaire
- Soil sampling on focus plot ("largest maize plot")
- Crop cuts on focus plot ("largest maize plot")
- Complementary data from UAV sensors (Tza, Nga only)

Agronomic panel survey timing

- 2016
  - Harvest period only
  - Questionnaires, crop cuts, soil samples
- 2017
  - Pre-planting, mid-season, harvest
  - Questionnaires (divided), crop cuts (harvest), (soil samples?)
- 2018
  - Pre-planting, mid-season, harvest
  - Questionnaires (divided), crop cuts (harvest), (soil samples?)

APS panel definition

- Panel observations are farms & (with caveats) plots
  - Allows observation of dynamics
  - Allows econometric controls for time-invariant factors
- Plot-panel complicated by:
  - Changes in boundary
  - Changes in composition (e.g. if no longer maize)
- Possibly responses:
  - Drop observation (treat as attrition)
  - Replacement (lose panel, but aids pooled cross-sectional analysis)
  - Expand observations

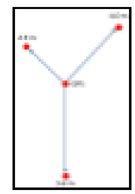
Questionnaire components

- Household composition
- Farm overview, plot roster
- Current season production (plot-level, farmer info)
- Previous season crop output & use (crop-level, farmer recall)
- Livestock production (current season)
- Non-farm income (current season)
- Assets (current season start)
- Innovation, nutrition, risk aversion
- Main plot details (+ soils + crop cuts)

Questions on survey instrument

- Tradeoffs between length & detail/quality
  - What can/should be cut? (added?)
- Two versions of questionnaire?
  - Standard version for us; "light" version for partners… what components?

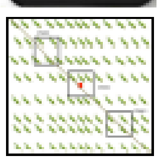
Soil SOP



- See 'baseline soil & yield survey_v2'
- All three countries & some partners used the SOP, ODK, QR codes successfully
- Training is straightforward
- Are any modifications needed?

Proposal is to use this SOP without any changes

Yield SOP



- Measure field area, yield & no. stands
- Ask farmer about variety and whether fertilizer was applied
- *Any problems & improvements?*

Questions
- No. reps
- Questions for the farmer
  - Sowing date
  - Sex of the farmer
  - Amount & type of fertilizer (nb units)
  - No. weedings
  - Other?

Agronomy SOP

Purpose
- Common set of observations in all experiments or partner fields
- Observations should be quantitative, non-destructive & explanatory

Current SOP (four parts)
- HH information & characteristics
- Vegetative stage
- Flowering stage
- Harvest stage

Farmer & field characteristics

Farmer characteristics	Field characteristics
Age	Previous crop
Sex	Soil type (inspection)
Farm size (ha)	Soil depth (farmer knowledge)
Assets (transport, equipment, house etc)	Slope Distance to house
Family size (adults & children)	Field size (by GPS)
Livestock (no & type)	Collect soil sample

Questions

- Include farmer & field characteristics in HH SOP?
- Do we need a 'lite' version for non-panel data or for partners?

Vegetative & flowering stage

Questions	Direct observation
System (mono, intercrop, relay, rotation)	Stand count (no per quadrat)
Variety	Weeds & Residue present (% ground cover)
Land preparation method (plough, harrow; ridges, flat, beds, min. tillage)	Pest & disease present (% stands)
Planting method (dibble stick, hoe lines, machine)	Greenseeker/SPAD readings?

Nutrient management

	Type	Rate	Timing	Placement
Organic				
Inorganic				

Vegetative & flowering stage

- Proposal is to have a single within season visit, towards flowering

Questions

- What data to drop?
- What data to add?
- Use more digital imagery & post-processing for NDVI, stand counts etc: Greenseeker, photographs, UAVs

Notes from Meeting

Session 1: Gridded sampling (WS1, Peter, Julius, Jordan)

- Nigeria – maize-area was for OCP. TAMASA partners work slightly outside this
- AUC – 0.5 = random, i.e. can't distinguish foreground from background. Is this correct? Yes it should be 0.5. High figures indicate bias in this process. Nb – for using AUC to test prediction it should be a high correlation. Therefore need to revise the analysis.
- Representative of soils but not other factors – HH. But?
- Or choose drivers, i.e. soil fertility, market, HH?
- Low sampling density is the issue?
- So within 1 km grids can do more stratified sampling of other factors

Action:

- Grid is method to manage logistics. So *n*= what we can fund and then test to make these as representative as possible. AfSIS to help with stats.
- Within grids we can look at stratification. Is this needed and a hypothesis based selection?
- Better not to use AUC as this is a random process. Julius to talk to JC on this.

Workplans

- Note that there is institutionalisation & tool development and this is more important as an outcome than previously
- Robert – maybe you need a central institute to hold some database and analytical functions? Not possible to do this via national systems. Good thought.

Tanzania

- Meteorological data? Soils data? Soil moisture data? All useful for others, esp. PhDs
- AfSIS has UAV SOPs – Julius to follow up and adapt where possible.
- Budget for TZ – need to see this

Nigeria

- Panel will need revising from 100 to 500
- Role of NAERLS? Agreed to work with TAMASA. Any data from now or historic? Not known: do surveys with estimates from farmers. Not measured.
- BUK for NE institutionalisation
- IAR for variety institutionalisation
- Use of UAVs – important. More after Tom tomorrow.
- Tool development – need more feedback from users.
- Budget?

Ethiopia

- Need to look at budget

One Acre Fund – David Guerena

- Agronomy many aspects
- Scale critical to reach 100k to millions
- 3 t/ha possible with access seed and fertilizer
- 1 supervisor for 200 farmers (1000 pax with family)
- lot of geospatial variability – how to avoid this?
- e.g. Fertilizer timing – growth stage timing
- for geospatial variability – e.g. contextual inputs, local adaptation
- variety selection – give farmers a crop catalogue. 15% yield advantage with best variety
- innovation in monitoring plant health, nutrition, disease, pest
- planting dates – telling farmers optimum times

NE – Shamie, Jairos, Jens

- 50% NOTs to be repeated in 2016 at same site. Why 50%?
- Sites selected on yield response. So ET 40; NG 60
- Need to look at data and decide on this – based on response/quality. Can be done for NG but not ET.

- Need also to see how representative locations were as well. This needs to be repeated and maybe new trials established.
- If NOTs were not representative then can we do validation? Yes we need for practical reasons and validation can contribute to more data and yield response (but not nutrient response). Julius to do test and select new sites from that point.
- Enough data to make a first version that can be used for validation.
- Validation –have some trials with partners – this is tool development rather than validation
- Treatments: control (zero fertilization); NE fertilizer recommendation (max yield or?); blanket/regional; soil-based recommendations
- Plus rapid farm survey for NE
- Suggest Jairos feeds back on treatments Tuesday; and consider survey as part of Panel? (or lite instrument).
- Treatments – recommendation based on target yield. Need small group to discuss this.

Jens

- Maybe MOANR better than EIAR and hosting. Limited hosting experience in both. Really should be Ethiosis
- Need more feedback from lower end users;
- Calibration/validation (NOT); performance on-farm (researcher managed); farmer try-outs
- Is yield target the way to do this? Better to do via investment level (because most farmers do not have enough seed or fertilizer so have to make the comparison)
- Need smart phone to reach large numbers to test.

PhDs

Need to share proposals.

Leuven - Jan

- Nutrient imbalances; NOTs, tissue analysis
- Varieties; 20 cvs varying in maturity; CERES-maize; planting density; variety suitability maps
- Ex-ante/ex-post of NE
- Students not all in same location but will work together
- *What are outcomes?*
- *Why do choice and RCT?*
- *Integration?*

Wageningen – Tom

- GYGA, STARS, IMAGINE, Geodatics (tailored fertilizer advice); many cross-fertilization responses
- Yield gaps – Bancha
- DEED and scaling via ED for technology – Workneh
- Spatial variability – Elias. *More needed on spatial (field to km^2)*
- Farmer decisions in relation to risk - Violeth

Reading – Emily

- Soil moisture system SMAP and TAMSAT
- DSS on rainfall advice
- www.droughtforecast.org

- Link to TAMASA with forecasts at our sites and validation data
- Can produce drought risk and drive crop models

Variety tool – Henri

- Question – why not measure more parameters for modeling yield? Only phenology for this tool – not fully understood
- Could use simpler models with phenology to predict yield; consider this later. Yes, use statistical approaches or some simple data like interception/NDVI
- Overdesigned for phenology perhaps – multiple inputs

STARS – Tom

- Management >crop type>nutrient. Between field variation>within field
- NDVI/ Plant veg height correlates with ground cover
- Lot of post processing needed for PVI
- Ground control essential; max area 200ha or 40 mins
- Very large variation yield at plot scale – 15 x 15m – many reps needed
- Good for growth data

Agronomy Panel Survey

- Still to be decided in Nigeria; but more spatial, more *n* and more socio-economic
- Socio-economic only once; agronomy in the season
- Maybe more on technology adoption (and reduce some other parts)
- Maybe need a 'lite' version for greater spatial and *n*; yes but what to include
- Where not maize – take a soil sample but not crop cut; use a new maize field
- Get inputs for 'lite' version; hiring in/out labour; training, networks external income, maize income vs farm income
- NDVI and digital analysis; very important how to process images
- Fertilizer amount – issues with this question
- Have group with Jordan PM on the survey
- Who is responsible in Nigeria?

Data management – Henri

- NETCDF – standard for gridded data
- Should have common interests with other projects and have common platforms
- Dataverse and CG data standards; Henri to lead for SIP

General

- Rahel introduction
- Communication strategy; get inputs on what and how, what is needed on website etc
- Sharing documents on Sharepoint
- M&E – use CIMMYT templates and develop this with coordinators
- Publication strategy
- Future meeting and cross-regional visits
- Support to training VT and HH surveys
- Four groups: NE, HH, UAV, PQC/PhDs

Robert comments

- Will request written
- Send annual reports etc

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Partner Meeting

Discussion on Nutrient Expert

The meeting was facilitated by Dr J. Rurinda and Dr J. Andersson

(1) **Participants feedback, Nutrient Expert introduction session**

- The partners indicated that the NE is going to be useful in Tanzania as it takes into account many characteristics for improving crop production.
- NE should not only focus on cereal crops (maize, rice and wheat) but also on other crops so that the tool is useful in many regions. There are many different crops grown in Tanzania. Is/will NE (be) developed for other crops?
- Incorporate soils data explicitly. What are the soils parameters used to develop the model?
- Incorporate rainfall data explicitly
- When experts use the tool, is there also a simplified version for farmers?
- Does the tool consider information on existing recommendations on the use of nutrients?
- NOT location choice could build on local expertise to take into account emerging nutrient deficiencies.
- Consider NOT's on ferrosols, those soils are tropical spoils which produce much maize, but many have specific problems such as copper deficiency;

For workplan:

- Consultation with agronomists in the country is needed to share experiences.
- Development of a dissemination and institutionalization strategies.
- Strategies to upscale the NE involvement in institutions to take up the tool, like commercially oriented farmers.

(2) Meeting on institutionalization Nutrient Expert tool with potential tool hosts

Present:

- Dr. Kajiru – DRD (Dept. of research & development)
- Dr. Mkangwa – Mlingano research institute, Tanga
- Dr. Joel Melyo, AfSIS
- TAMASA: Jairos, Peter, Kenneth, Henri, Jens

Mlingano, Tanga (Director, Dr. Makwanga)

- Mandated to conduct soils research in TZ (has national soils lab for soil/fertilizer/plant/water sample analyses to serve CGIAR, and NARS); soil survey and land info. research; GIS lab; fertilizer use research.
- Has 15 scientists on soils research (most MSc, 1-2 diploma level, rest PhD), focusing on sisal, maize, beans, rice and cassava. Where present, they work crop boards (no crop board for maize).
- Mlingano is not responsible for **fertilizer recommendations**. These are staple food based, build on crop response, soils and rainfall and economic data adjusted for different sites. First recommendations date back to 1980s, then 1994, and these were recently revised. Aim is to make them more locally specific. Focus is on N, P and (recently) K and micro-nutrients.

TanSIS project, in Selian ARI, Arusha (Dr. Joel Melyo)

- 7 months old project focused on soil fertility appraisal, through new methods (AfSIS). 12 districts are done. Uses 4 labs (Mlingano, Ukilogumu in Mwanza, Uyole-Mbeya, Selian, Arusha), and SUA when more funds come available. The project does not have its own staff but it assigns the tasks to key research centers.
- Aims is to develop soil characteristic maps: pH, Sodium, SOC, P, K, and micro-nutrients and also identify soil fertility problematic areas.
- Database is currently in the cloud, (AfSIS), but the Ministry may have other ideas;

DRD, Dar es Salaam (Director, Dr. Kajiru)

- Responsible for research coordination among 16 institutions in 7 agro-ecological zones of TZ. Each zone has a head institution. Three directorates: (1) Crop Research / (2) Socio-economics and farming systems research / (3) special program research (which used to be NRM). The latter program encompasses soil fertility, land resources evaluation, agro-forestry, irrigation and mechanization. 1, 2, 3 are in all institutions but focus differs.
- Crop directorate has 4 departments: 1) Crop promotion, 2) Extension Services, 3) Plant health, and 4) …? Promotion and extension services are relevant for TAMASA, as they are responsible for technology dissemination. **Yet, there is also an extension dept. a director for extension in MoA**.
- **Extension is thus part of DRD, MoA, but local-level extension workers are employed by the ministry of local government**. There are generally 20-30 extension workers per district, but there is often not an extension in a village. At wards level they are usually there.

Discussion

- Agric. sector programme, phase 2 (starts in July): needs to be informed of TAMASA
- Capacity building concerns: Soil scientists: 5 in Uyole, 3 at Selian, but half of them will retire in 2017. 20 PhD and 40 MSc are currently being trained, availability is an issue.
- Need to present TAMASA to ministerial mgt. team in DSM.
- There is is already an MoU between CIMMYT and MoA, so additional MoU (with DRD) may not be needed
- Strong need for capacity building – training.

To be incorporated in 2016 workplan of TAMASA (Dr K. Masuki)

- Present TAMASA to ministerial mgt. team (IMPORTANT!) – May? Zingore in TZ 16 May?)
- Present TAMASA to agric. sector programme (When? In July?)

- Training in NE tool use [phone app] (by Jairos; Jens present?) to local-level extension workers and ARI researchers in TAMASA FA's. Timing (June?) + participants to be planned with DRD+Mlingano in meeting. Training programme for PhD and MSc level researchers (tool hosting, database analytics) needs to be specified.

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References to additional documents
Home - Dropbox