



EXCELLENCE IN AGRONOMY
ADAPT INTENSIFY GROW

Data-driven Advisories

AgWise for potato in Rwanda

The AgWise Development Team 2023

AgWise overview

Data analytics framework to develop **tailored agronomic recommendations**

Joint effort across centers & experts

Enriched by diverse expertise, experiences

Co-development

High level of partner engagement is encouraged

Continual learning

AKILIMO, NextGen, EDACAP, GAYA, ...

Legacy + current data

Carob, partners (IFDC, OAF, Kilimo, CoW...)

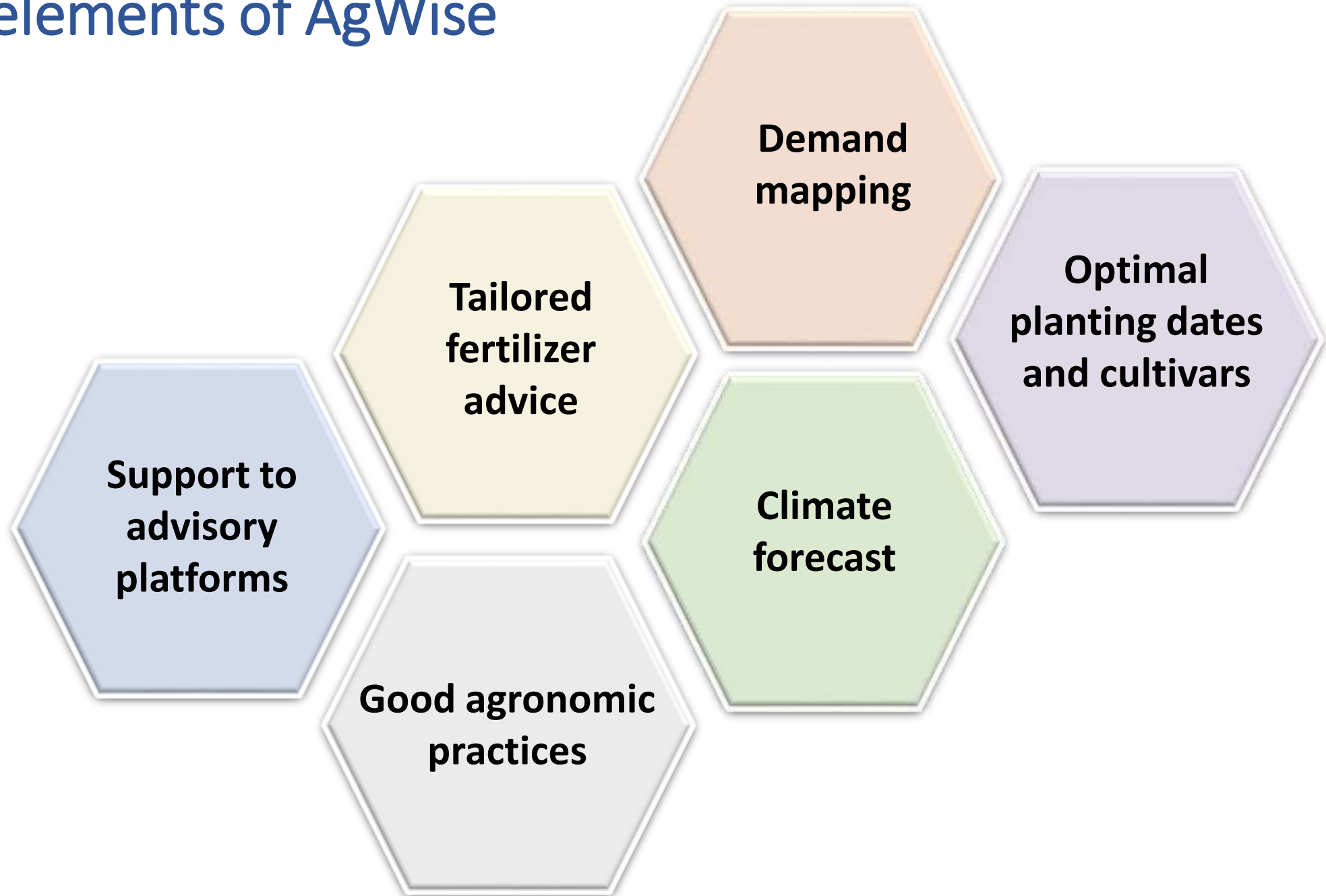
Modular design

Advance & maintain independently, adds flexibility, adoptability

Target crops

Maize, rice, wheat, potato, soybean, cassava

Key elements of AgWise



Generalized AgWise workflow



Improving the current blanket fertilizer advice for potato in Rwanda



Purpose:

Improve the current blanket recommendation to increase potato production at agroecology level

Requirements:

- Compatible with the national fertilizer subsidy program
- Consider commonly available fertilizer formulations
- Increase return on fertilizer investment



Rwanda potato: Data sources used for the current functionality

On-farm
fertilizer
response



On-farm fertilizer experiments for major potato growing areas in Rwanda over several seasons and nutrient rates

Digital soil
information



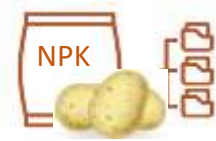
Open-access gridded soil information to predict soil nutrient supply capacity using machine learning algorithms, trained using on-farm fertilizer trial data

Topography
indexes and
agroecology
map



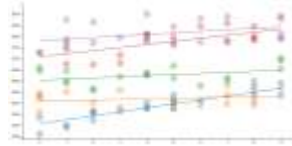
Elevation and derived variables, agroecology maps and marshlands identifiers

Rwanda potato: AgWise workflow



Assemble data

Compile, standardize data from several sources



Extract structural variation

Reduce residual error to increase signal to noise ratio



Assess soil nutrient supply (INS)

Estimate INS from yield response



Predict yield and yield responses

Use INS to predict yield; evaluate variable importance



Compare alternative approaches

Evaluate process-based vs empirical approach



Map INS for target area

Model INS as soil property response, topography, season, reference yield, AEZ



Calculate fertilizer recommendation

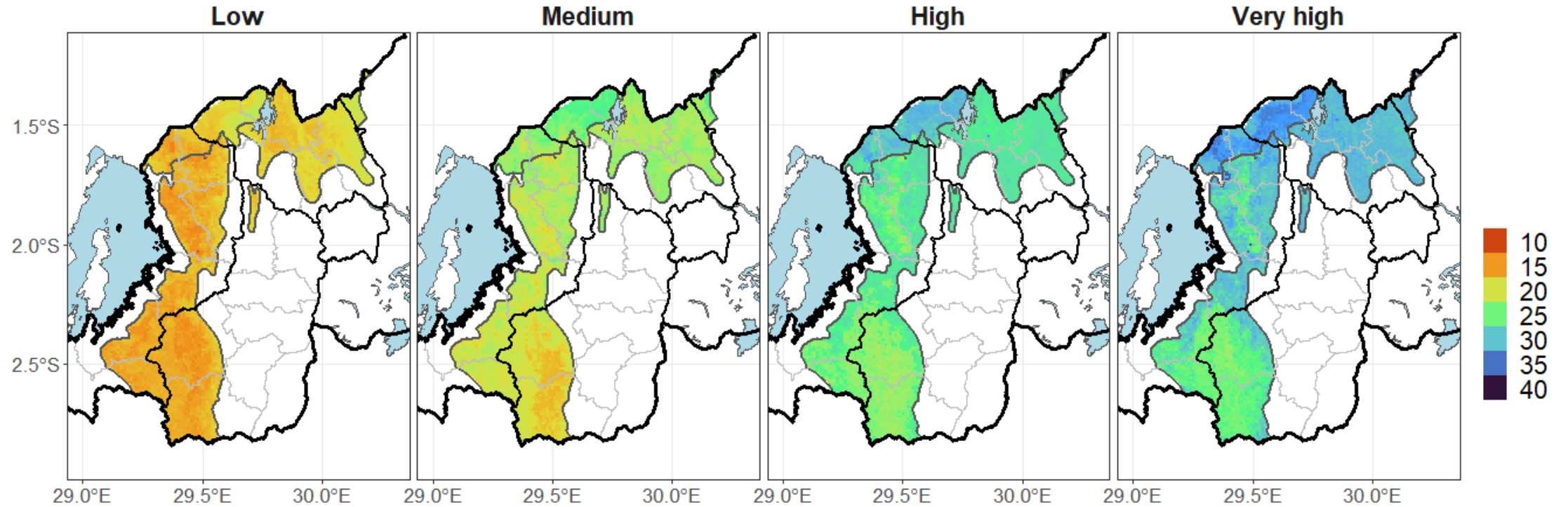
For target yields, by agroecology



Support field validation

Define fertilizer packages, support data management, analytics

Rwanda potato: Yield map



Predicted yield with the current blanket recommendation (300 kg ha⁻¹ NPK 17:17:17)

The different facets represent different reference yield classes accounting for poor vs responsive soils

Rwanda potato: Fertilizer requirements for the selected scenarios

Simplify to bags per ha (1 bag = 50 kg)

AEZ	Ref. yield	Same yield as current recommendation (kg ha-1)			Same yield as current recommendation (bags)		
		DAP	NPK 17:17:17	Urea	DAP	NPK 17:17:17	Urea
Birunga	High	50	59	78	1	1	2
Buberuka highlands	High	46	49	85	1	1	2
Congo-Nile watershed divide	Medium	50	54	95	1	1	2
AEZ	Ref. yield	20% above current recommendation (kg ha-1)			20% above current recommendation (bags)		
		DAP	NPK 17:17:17	Urea	DAP	NPK 17:17:17	Urea
Birunga	High	100	96	145	2	2	3
Buberuka highlands	High	98	84	145	2	2	3
Congo-Nile watershed divide	Medium	112	99	170	2	2	3

For each of the 3 agro-ecologies the most common reference yield class is used

- Birunga and Buberuka highlands 48 t/ha and Congo-Nile watershed divide 36 t/ha

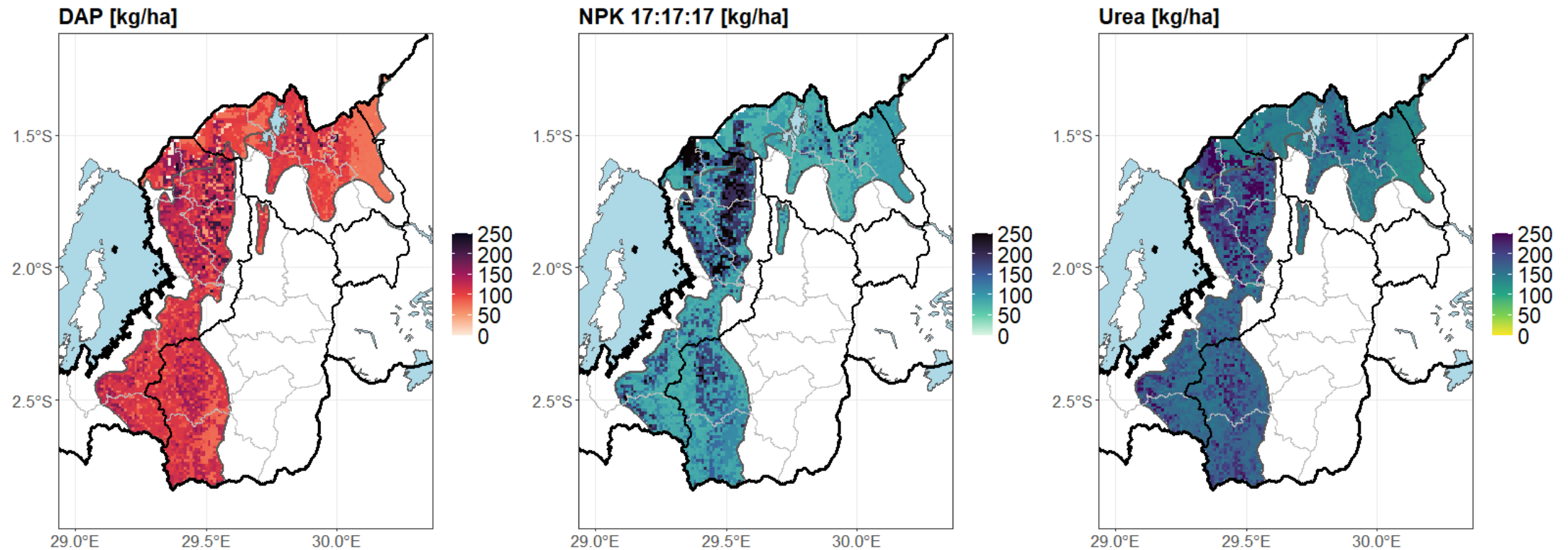
Yields obtained with the current blanket recommendation can be obtained with 30% less fertilizer

- 6 bags/ha replaced by 4 bags/ha (1 bag of NPK 17:17:17, 1 bag of DAP and 2 bags of urea)
- Farmers in Rwanda pay similar prices for fertilizers so capital for fertilizer purchase is also reduced by 30%

20% yield increase over current blanket achieved through 2 bags NPK17:17:17, 2 bags DAP, 3 bags urea ha-1

- Prices for the 3 fertilizers is similar, so using 1 extra bag of fertilizer over 6 bags of blanket recommendation translates to about 16% increase in fertilizer investment for 20% yield increase

Rwanda potato: Fertilizer requirements for 20% yield increase

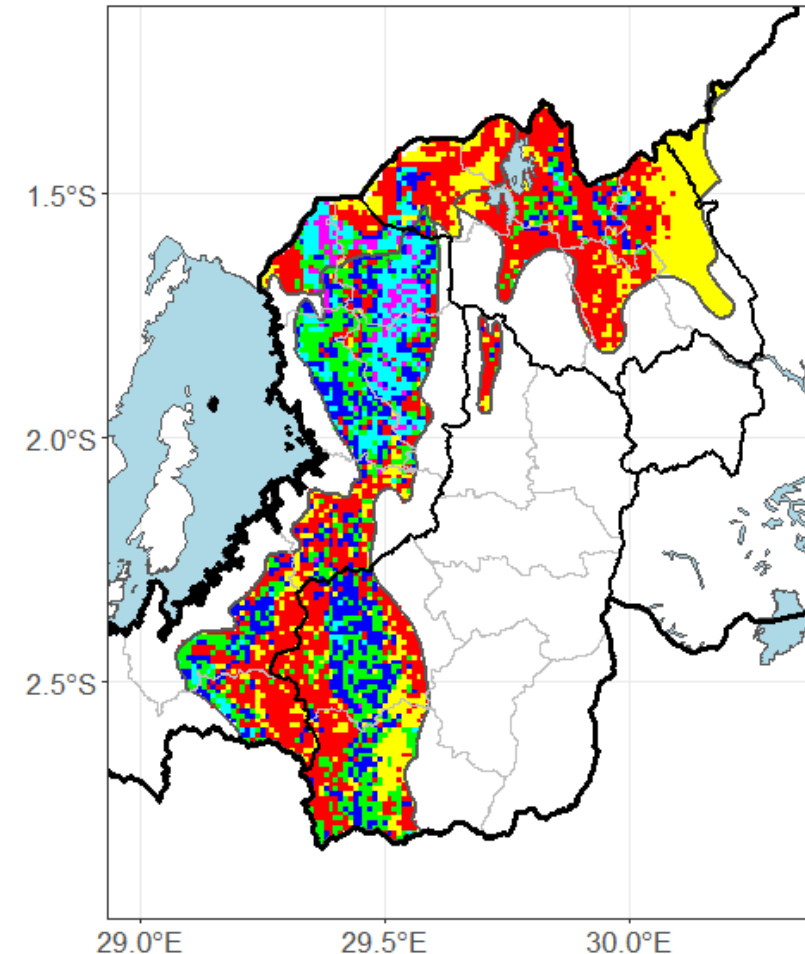
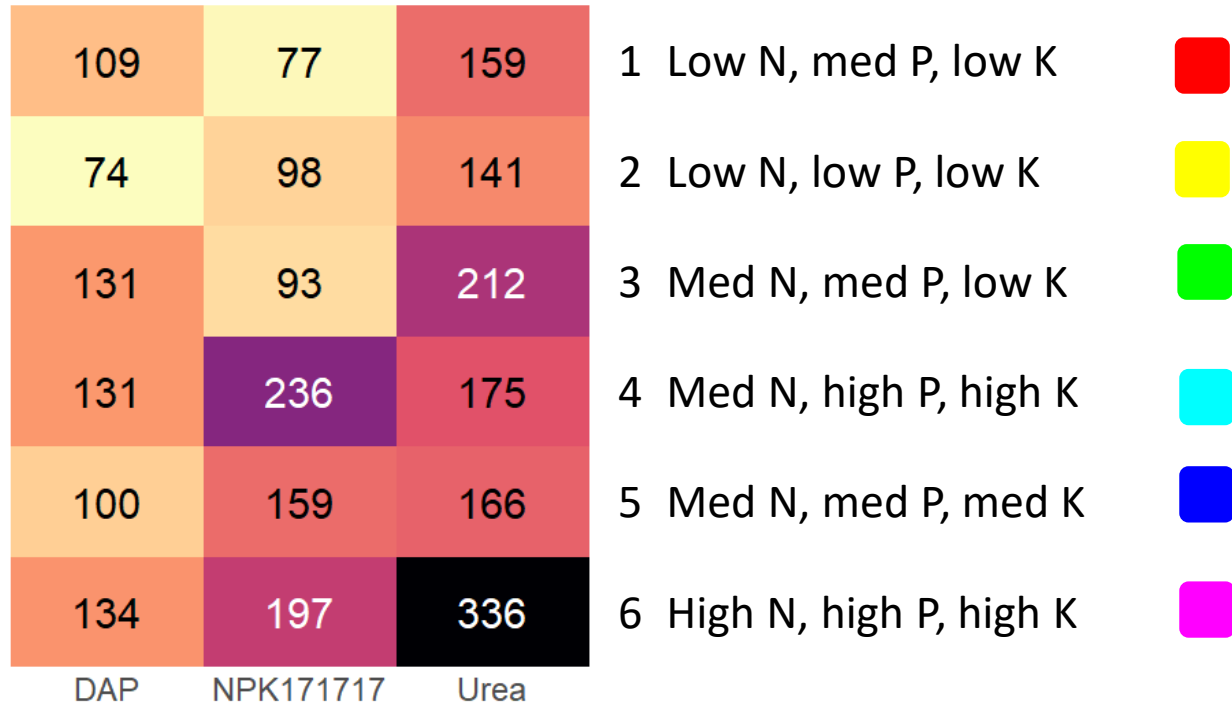


Fertilizer rates for a 20% yield increase vary spatially due to variation in INS, implying:

- Possibility of further tailoring fertilizer rates
- Allocating higher fertilizer rates for more responsive soils
- Addressing specific nutrient deficiencies by varying rates of individual fertilizers
- Achieving higher agronomic efficiencies and higher return on investment

Rwanda potato: Site-specific recommendations for 20% yield increase

Six fertilizer packages (colour coded) are formulated* - capturing 76% of the variation in fertilizer requirements

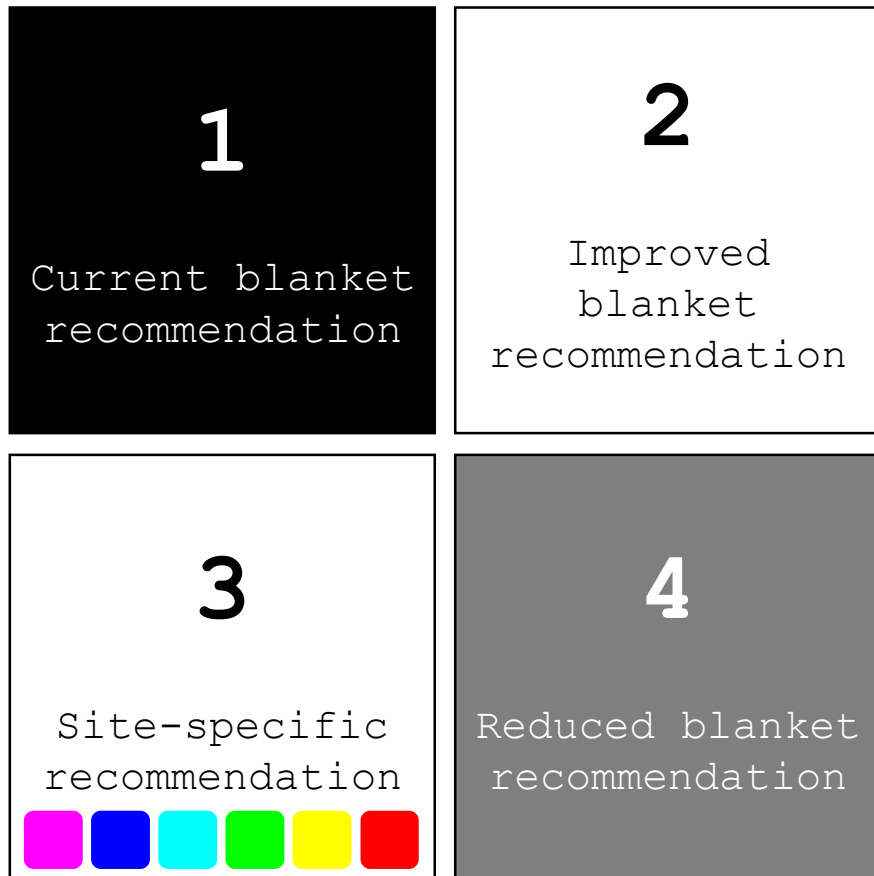


* using K-medoid clustering

Rwanda potato: Validating these recommendations

Suggested treatment structure for the validation exercises:

4 plot design



3 plot design



The **improved recommendation to achieve the same yield as blanket has fertilizer rates lower than what farmers are currently using**, hence suggest to drop it and conduct a 3-plot validation

AgWise – A cross-CGIAR team effort

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