ISRIC
World Soil Information

Extrapolation of fertilizer nutrient recommendations for major food crops in West Africa

A proof of concept (with dataset)

Draft

Project report 2018

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Project report for IFDC Accra, USAID - West Africa Fertilizer Program

ISRIC - World Soil Information
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This is a draft version of a full project report and does not have the formal status of an ISRIC Report because it has not been subjected to internal review for approval.

It is proposed to condense this full project report into a brief report.

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Summary

Site-specific fertilizer recommendations for major food crops in West Africa have been updated and mapped by ISRIC in collaboration with the International Fertilizer Development Center (IFDC) and experts from the NARs of Benin, Burkina Faso and Ghana. The project served as a proof of concept and was carried out within the context of the USAID - West Africa Fertilizer Program which was implemented over five years in collaboration with the Economic Community of West African States (ECOWAS). A tiered approach was developed which makes use of the Africa SoilGrids (soil property maps at a resolution of 250 m) including maps of macro, meso and micro nutrients produced using soil analytical data selected and standardised from near 70,000 sample locations and maps of rootable depth. In the first tier, QUEFTS was parameterised from literature and later using georeferenced fertilizer trial data compiled from three countries and used to calculate and map the soil nutrient supply- and crop nutrient uptake- and use efficiencies as well as the corresponding fertilizer recommendations targeting spatially variable attainable yield levels, obtained from available maps, for millet, sorghum, maize, rice and cassava. These first tier maps were validated with fertilizer recommendations as reported, and newly produced, from the fertilizer trial data and were added to regional covariates in the second tier to model and map the fertilizer recommendations using machine learning. The site-specific fertilizer recommendations were spatially aggregated for three countries according to agro-ecological zones and these aggregates were expressed by probability distributions to quantify the uncertainty of the recommendation and of obtaining the targeted crop responses. Herewith this uncertainty is made a function of mainly the spatial variability of soil nutrient contents. However, the trial data show that this uncertainty, and response in general, is predominantly determined by the spatial and temporal variability of the nutrient gap (deficiency) as governed by water supply. This latter variability is insuffiently well reflected in the maps used for defining the target yields and is emperically not well modelled with QUEFTS. The framework is therefore preferably further improved by spatio-temporal modelling of the nutrient gap. The proof of concept provides an operational framework for progressive and collaborative updating and upscaling of fertilizer recommendations across the region, adding value to additional adequate soil-crop-response data, using techniques based on both agronomic and artificial intelligence.

1. Introduction

Improving fertilizer recommendations for increased return from fertilizer investments and optimized crop response to fertilizer has been a major area of investigation of IFDC. Since 2008, IFDC through its Natural Resource Management (NRM) Program has partnered with national agricultural research services to undertake research, development and extensive on-farm trials in various agroecosystems in West Africa to develop site specific fertilizer recommendations for crops. Validation trials have been conducted in many countries (Benin (maize, cassava), Burkina (rice, maize and sorghum) Ghana (maize, cocoa and cassava) and Togo (maize and cassava). However, these fertilizer recommendation data remain scattered and most of them need final statistical analysis before they can be fully utilized and/or up-scaled.

As part of its efforts to improve fertilizer use and efficiency in West Africa, and following the recent adoption of fertilizer recommendations by ECOWAS, IFDC has taken technical lead with key partner institutions and experts to build on previous and current fertilizer recommendations for various crops and countries in West Africa for wider uptake by public policy makers and fertilizer industry actors.

To achieve this objective, IFDC, through its West Africa Fertilizer Program (USAID WAFP) and Cotton Partnership Program (USAID C4CP), has setup a regional team of experts led by a scientific and technical committee (see composition below) that facilitate a regional workshop on fertilizer recommendations from June 14-16, 2016 in Lomé, Togo. The workshop was attended by 114 participants, mainly soil scientists from research institutions and universities across the sub-region, representatives of key regional organizations/entities in charge of soil fertilizer management, and representatives of private sector from West Africa and beyond, representatives of donor community, representatives of West African farmers' organizations as well as key international institutions specialized in soil and plant data gathering and extrapolation. The objective of the workshop was to review past and current fertilizer recommendations, select an extrapolation methodology and develop a way forward for regional upscaling of updated fertilizer recommendations in West Africa.

Major results include:

- Updated fertilizer recommendations for major agro ecological zones in Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali, Niger, Nigeria, Senegal and Togo for Cassava, Maize, Rice, Sorghum, Cocoa, Oil Palm, tomato, legumes presented (not yet made available);
- Extrapolation tools selected for upscaling updated fertilizer recommendations to targeted agro ecological zones in West Africa;
- Linkages between private sector (importers, blenders) and public sector (NARS/Universities) established to ensure appropriate fertilizer blending/testing of new formulations across West Africa as a result of updated fertilizer recommendations;
- Way forward for upscaling updated fertilizer formulations developed;
- Political will from key stakeholders (ECOWAS, Member States, technical institutions, donors, and private sector) to work together towards improved enabling policy/regulatory environment for private sector investment in agricultural sector in West Africa reiterated.

ISRIC – World Soil Information was invited to propose an extrapolation methodology and subsequently to implement the methodology as a proof of concept for the way forward for regional upscaling of updated fertilizer recommendations in West Africa. This report reports about the approach applied and the results obtained in this project.

1.1. Objective

General: Produce proof of concept for upscaling of site-specific fertilizer recommendations for major crops in the ECOWAS region
Specific: Extrapolate NPK recommendations for pilot crops (sorghum, maize and irrigated rice and possibly pearl millet and cassava) from limited point data to maps for pilot countries (Benin, Burkina Faso and Ghana).

The activities and deliverables are listed in the Terms of Reference as given in annex 1.

2. Methods and materials

The overall approach, including specific activities, is formulated in the Terms of Reference as given in annex 1. The original workplan is given in annex 2. Basically, the approach implies the compilation of NPK recommendations, as derived from fertilizer trial data, geo-referenced at point locations, and reported by the various NARs, and the modelling of those recommendations relative to environmental covariate data in order to extrapolate them in the form of maps. We adopted a tiered approach to do the modelling and extrapolation, with the methods and materials within each Tier depending on the availability, and the timing thereof, of either fertilizer recommendations and/or the underlying fertilizer trial data at point locations, or FeRWAM data (Fertilizer Recommendations for West Africa Map), following suggestions of the scientific and technical committee (STC). This tiered approach deviates from the original ToR's.

- Tier 1 was developed and implemented on the basis of yet unavailable recommendations and unavailable fertilizer trial data. Crop- and site-specific NPK recommendations were calculated and mapped using a tailored made version of the QUEFTS model with input data which were derived from publicly available gridded maps of soil and attainable yields and crop parameters derived from literature. The basis of calculating the NPK recommendations was the crop and site-specific nutrient gap between crop nutrient requirements (demand) at target yield and soil nutrient availability (supply).
- Tier 2 was developed and implemented on the basis of yet unavailable recommendations and makes use of georeferenced fertilizer trial data which were compiled under a common standard and made available by IFDC for the purpose of this project. The data were used where possible to adjust the crop parameters needed for QUEFTS. With the adjusted parameters and using QUEFTS we calculated the crop yields for each trial in response to the reported NPK treatments and compared the calculations with the measurements. Following this validation at point locations we applied QUEFTS onto the gridded input maps and calculated gridded output maps of crop- and site-specific NPK recommendations together with the corresponding yields when fertilized accordingly and when unfertilized.
- Tier 3 was developed and implemented on the basis of georeferenced fertilizer recommendations which were reported from the fertilizer trial data and made available by IFDC for the purpose of this project. These reported recommendations were used, where possible, to validate the recommendations as calculated at point locations in Tier 2. Moreover, these fertilizer recommendations, as reported from the trials, were modelled relative to spatial covariate data, with the maps resulting from Tier 2 added to the covariates, and extrapolated using machine learning. The resulting maps of the extrapolated fertilizer recommendations were validated and inputted to QUEFTS to calculate and map the associated yields when fertilized accordingly.

For Tier 2 and 3, the gridded maps of the site-specific results per crop were aggregated (clustered) per country according to globally coherent agro-ecological zones (AEZ). The mean recommendation is given for each cluster together with the full frequency distribution of recommendations calculated within that cluster (the median ± 1 and ± 2 standard deviations and the minimum and maximum recommendation) and of the associated target yields, yield gaps, and soil nutrient supplies. These aggregated results can be compared with the recommendations compiled in FeRWAM for each cluster.

Following a validation session with the STC, the target yield levels as well as a few model parameters have been adjusted and fine tuned to the farming conditions prevailing in West Africa and the results for Tiers 2 and 3 have been produced again.

2.1. Compile fertilizer recommendations to be extrapolated and associated fertilizer trial data (activity 1 & deliverable)

Required to extrapolate fertilizer recommendations are data on fertilizer recommendations which are georeferenced and available. While these data were compiled, preparations were made to enable the production of maps of fertilizer recommendations either with (Tier 3) or without (Tier 2 & 1) using those data on fertilizer recommendations. Additionally, the preparations enabled the production of maps of fertilizer recommendations either with (Tier 2) or without (Tier 1) using fertilizer trial data.

2.1.1. Compile georeferenced crop- and site-specific fertilizer recommendations (at xy-point locations) and related fertilizer trial data, as made readily available by IFDC (activity 1A & deliverable)

Fertilizer trial data were georeferenced and compiled for each of the three countries and interpreted to formulate derived fertilizer recommendations. For this purpose, a common template was prepared and three consultants from three countries were involved to prepare and compile trial data from various datasets into the common template and to interpret and formulate fertilizer recommendations from these trial data. These data have been made available to the project and the applicability of the data has been reviewed. Added to these data were trial data compiled by the OFRA project. Annex 3 lists the datasets that were included in the ToR's but it is unknown if and which of these datasets have been shared and included in the compilation.

The template was prepared by ISRIC as a suggestion to facilitate the compilation under a common standard, including guidelines for standardisation (e.g. each trial, repetition and treatment requires a consistent identifier and a consistent reference to the data source (lineage), metadata to describe the experimental conditions (crop, crop variety, location, year, type of trial (omission trial, validation trial, on farm trial, on station trial, etc.), coordinates of the geolocation expressed in decimal degrees, information about the management applied including the use of additional fertilizers (manure, micro-nutrients, etc.), soil data using adequate and explicit units of expression (e.g. g/kg, g/100g), the fertilizer treatments expressed in elemental form (kg/ha of N, P and K instead of e.g. NO3, P2O5, K2O), the treatments including the control treatments (0,0,0 kg/ha), yield and biomass dry matter (instead of yield and straw fresh matter), elemental N, P and K contents in g/100g tissue dry matter) and last but not least the recommendation interpreted from the trial together with the associated measured yield.

2.1.2. Review applicability of the compiled fertilizer recommendations and the related fertilizer trial data (activity 1B)

The applicability of the data, for the purposes of this study, was reviewed. The purposes include:

a. Parameterization of the QUEFTS model (Tier 2)
b. Modelling of the measured response data using QUEFTS (Tier 2)
c. Modelling of the measured response data using machine learning (Tier 2)
d. Modelling of the reported recommendations using QUEFTS (Tier 3)
e. Modelling of the reported recommendations using machine learning (Tier 3)
f. Validation of the model results (of Tier 1, 2 & 3)

The following three paragraphs describe specific activities as originally formulated in the ToR's and considering the fertilizer recommendations. Note that these activities could start only after the fertilizer recommendations, and the fertilizer trial data, had been made available to the project and are therewith by definition part of Tier 3.

2.1.2.1 Evaluate the fertilizer recommendations, based on the fertilizer trials data (at xy-point locations and incl. soil data) as made readily available by IFDC (activity 2); Tier 3

The fertilizer recommendations as reported by the consultants for each crop were evaluated relative to the crop response data as measured for the fertilizer treatments of all trials combined. Additionally, and in fact out of scope of this study, recommendations derived from few selected trials were evaluated separately. It was tried to reconstruct the recommendations from the measured data, both statistically and through modelling, for which the consultants were asked to explicitly describe the basis and the approach used for interpretation. The consultants were also asked to all apply a single uniform basis for the interpretation of the data and the formulation of the recommendations.

The basis for a site-specific recommendation could be e.g.:

1. NPK rates corresponding with the highest yield, measured in the trial or a number of trials or read from the response curve fitted through the trial data
2. NPK rates corresponding with a specified target yield, as measured in the trial or a number of trials or as read from the response curve fitted through the trial data
3. NPK rates corresponding with the nutrient uptake at a specified (target) yield, also called balanced fertilization, as measured in the trial or a number of trials or as read from the response curve fitted through the trial data
4. NPK rates corresponding with the highest efficiency (yield / rate), measured in the trial or a number of trials or read from the response curve fitted through the trial data, for N, P and/or K
5. NPK rates corresponding with the highest cost-efficiency (benefit / cost), calculated from as measured in the trial or a number of trials or from as read from the response curve fitted through the trial data, for NPK
6. NPK rates corresponding with the highest net financial benefit (benefit minus cost)), calculated from as measured in the trial or a number of trials or from as read from the response curve fitted through the trial data, for NPK
7. NPK rates corresponding with the highest likeliness (lowest risk) for each year obtaining yield response and net financial benefit, calculated from as measured in the trial or a number of trials during a number of years or from as read from the multi-year response curves fitted through the trial data, for NPK.

2.1.2.2. Fine-tune the evaluation and crop parameterization, for modelling, together with IFDC agronomist (activity 3); Tier 3 & 2

This activity focused on fine-tuning of the crop parameterisations for use with QUEFTS in Tier 2. The evaluation of recommendations was not fine-tuned because the recommendations had not been made available according to a single coherent basis which impeded the evaluation. Instead, and in fact out of scope of this study, alternative recommendations were generated from the trial data using a uniform single basis for each of the five crops. These recommendations have been added to the modelling and extrapolations in Tier 3. For this purpose we used basis number 4 (NPK rates corresponding with the highest efficiency (yield / rate), measured in the trial for N, P and K) with an approach including:

- Assess the agronomic fertilizer use efficiency (kg yield / kg rates of N, P and K) for each treatment
- Assess the 67% percentile of the agronomic fertilizer use efficiencies assessed for each nutrient per trial
- Select those treatments (N, P and K) from the trials with an agronomic fertilizer use efficiency exceeding the percentile
- Recommend N, P and K rates calculated as the average of the selected N, P and K treatments.

2.1.2.3. Model the fertilizer recommendations based on the fertilizer trials data (at xy point locations), using QUEFTS and attainable target yield data, and validate results (activity 4); Tier 3 & 2

See 2.1.2.1 for this activity where the recommendations have been evaluated. In Tier 2 we used QUEFTS and attainable target yield data to calculate crop yields for the various treatments applied in the various trials and to calculate fertilizer recommendations for reaching the target yields. These calculations were done at point locations and the input data at those points (soil data and attainable yield data) were read from gridded maps. The results were validated by comparing the calculated yields for each of the crops with the corresponding yields measured at the similar location. This comparison was done per crop considering all trials, including all treatments, together as well as by considering selected trials separately. The fertilizer recommendations calculated at the trial locations were validated in Tier 3 by comparing the calculated- with the reported recommendations.

Selected were few trials which include data on measured nutrient uptake. For these trials, we used QUEFTS and attainable target yield data to not only calculate yield responses to fertilizer treatments but to also model and calculate the underlying nutrient uptake and use efficiencies which explain yield response.

2.2. Produce extrapolated covariate maps required to extrapolate fertilizer recommendations (activity 5 & deliverable)

Spatial covariate data (maps) were obtained from various sources. Few were produced for the purpose of this study including 1) attainable yield and yield gap estimates, 2) crop variety, management parameters and weather and 3) soil including QUEFTS variables (pH, organic carbon, exchangeable K and available P) and rootable depth. The covariate maps represent the spatial variability of environmental conditions which explain the variability of crop response to fertilizer nutrients. The maps are used either as input data for running the QUEFTS model, to calculate and map site-specific fertilizer recommendations, in Tier 1 and 2 or as spatial covariates indeed to model and extrapolate georeferenced fertilizer recommendations using machine learning in Tier 3. For a more detailed description of the maps prepared and used as covariate and as input for QUEFTS, including attainable yield and soil variables, see paragraph 2.3.

2.2.1. Yield, attainable yield and yield gap estimates

Yield and yield gap estimates are calculated and mapped using QUEFTS as described in paragraph 2.3. Yield and yield gap estimates were also modelled and mapped using machine learning. The yields measured in the trials (Tier 2) have been extrapolated using machine learning including the measured control yields, the measured maximum yields and the measured yields corresponding with the recommendation as newly derived from the trial data. Moreover, we extrapolated the water-limited attainable yield levels as well as the control yield levels as reported for point locations by the Global Yield Gap Atlas (GYGA) project.

The map with the extrapolated control yields has been deducted from the selected map with attainable yields to produce the map with yield gap estimates. We tried several ways to produce and select maps for attainable yield and decided to use existing maps as made available by the FAO-GAEZ portal (Fisher et al., 2012)). How the maps of attainable yield have been produced and selected is described in paragraph 2.3.

2.2.2. Crop variety, management parameters and weather

New covariate maps have not been produced for variety and management nor for weather. These three parameters are captured indirectly and summarized through maps of agro-ecological zones (zones of length of growing period). Moreover, stacks of covariate maps on weather and climate related data are available and used as listed in the project folder \IFDC_upscale\0_InputData \0_Covariates.

2.2.3. Soil

ISRIC produced gridded maps of soil properties for sub Saharan Africa (SSA) within the context of the Africa Soil Information Service (AfSIS) project (Hengl et al., 2015; Leenaars et al., 2015; 2018) and, for soil nutrients, in collaboration with AfSIS upon the demand of the Plan Bureau for the Environment (PBL) of the Dutch government (Hengl et al., 2017). How the maps of soil properties have been used is described in paragraph 2.3.

Figure 1 gives an example soil property map illustrating the predicted spatial distribution of the total nitrogen content in the upper 30 cm of soil.

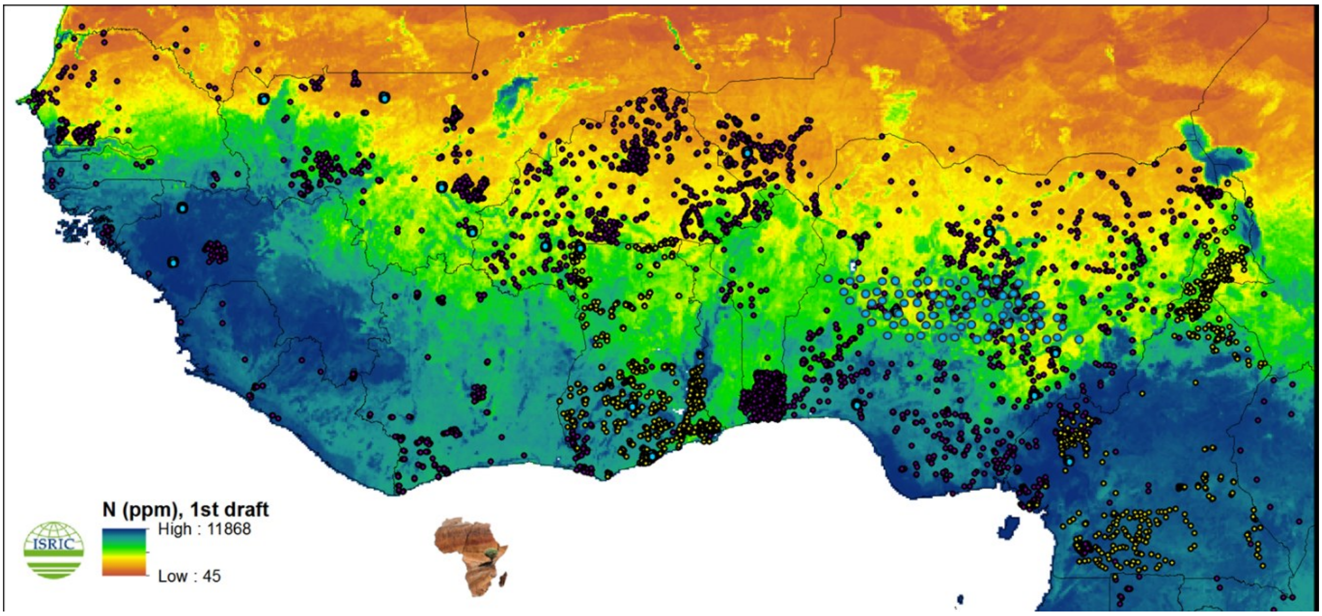


Figure 1. Example of a (draft version of a) soil property map at 250 m resolution: total nitrogen content (mg/kg).

2.3. Extrapolate fertilizer recommendations and validate extrapolation results (activity 6 & deliverable)

As mentioned before, fertilizer recommendations are mapped in 3 Tiers whereby only the 3rd Tier makes use of available data on fertilizer recommendations. Fertilizer recommendations are created in Tier 1 and Tier 2 using soil-crop-response models.

2.3.1. Tier 1, QUEFTS to calculate and map fertilizer recommendations

QUEFTS (Quantitative Evaluation of the Fertility of Tropical Soils) was developed by Janssen et al. (1990) to calculate the availability of NPK from the soil, the uptake of NPK by the crop and the corresponding crop yield. In the same year, Janssen and Guiking (1990) published about the use of QUEFTS to model the response of crop to fertilizers. Since, the model has been used and parameterised for various crops in various circumstances. Few of the rules have been reconsidered and suggestions for improvement have been made such as by Sattari et al. (2014). We implemented QUEFTS in R using the rules of Janssen combined with the suggestions of Sattari. This QUEFTS-R version reads the input data from external data sources, including data from tables and data from maps (also see paragraph 2.2). The programming of QUEFTS in R was tested in collaboration with colleagues from Wageningen University and Research centre through running a scenario in QUEFTS-R as well as in an older version of QUEFTS programmed in Fortran.

2.3.1.1. QUEFTS input data: soil property maps

For the purpose of this study, QUEFTS-R reads the soil data from the Africa SoilGrids (a collection of gridded soil property maps) which we prepared for the ECOWAS region at a resolution of 1 km^2. The maps are available at the ISRIC ftp server and summarized in Table 1.

Table 1. Maps of soil properties used as input to QUEFTS-R

Input to QUEFTS-R ABC	Map	Source map	Conversion
Soil pH H_2O	pH	pHH2O_M_agg30cm_AF_1km.tif [1]	[* 1/10]
Soil organic carbon (g/kg)	Corg	OC_M_agg30cm_AF_1km.tif [2]	[* 1]
Soil total nitrogen (g/kg)	Norg	N_M_agg30cm_AF_1km.tif [2]	[* 1/1000]
Soil available phosphorus (mg/kg)	Pavail	P_M_agg30cm_AF_1km.tif [2]	[* see below]
Soil total phosphorus (mg/kg)	Ptot	P.T_M_agg30cm_AF_1km.tif [2]	[* 1]
Soil exchangeable potassium (mmolc/kg)	Kexch	K_M_agg30cm_AF_1km.tif [2]	[* 0.03]
Soil temperature (°C)	Tmprtr	Calculated as the mean of long term average day and night temperatures [3]	
Additional input to QUEFTS-R ABC			
Soil coarse fragments (m^3/100 m^3)	CRFVOL	CRFVOL_M_agg30cm_AF_1km.tif [4]	[* 1]
Soil bulk density (kg/dm^3)	BD	BLD_M_agg30cm_AF_1km.tif [4]	[* 1/1000]
Soil root zone depth (cm)	ERZD	ERZD [4]	[* 1]
Soil root zone water holding capacity (mm)	RZPAWHC	RZ-PAWHC [4]	[* 1]

1. Hengl et al., 2015
2. Hengl et al., 2017
3. ftp://africagrids.net/1000m/MYD11A2/LST_day/Average/ & ftp://africagrids.net/1000m/MYD11A2/LST_night/Average/
4. Leenaars et al., 2015; 2018 (derived from Hengl et al., 2015)

The map of soil available P (in ppm) represents data according to P-Olsen (ppm) which were converted from the source map which represents data according to P-Mehlich 3 (in pp100m). The conversions are given here below and were based on rules derived from data presented by Sawyer (Iowa State University) and as suggested by de Pater (2015). The data presented by Sawyer are visualised in Figure 2**Error! Reference source not found.**.

If pH < 6.5,
then Polsen (ppm) = 0.55 * P-m3 (pp/100m) / 100
else if pH < 7.3,
then Polsen (ppm) = 0.50 * P-m3 (pp/100m) / 100
else
Polsen (ppm) = 0.45 * P-m3 (pp/100m) / 100

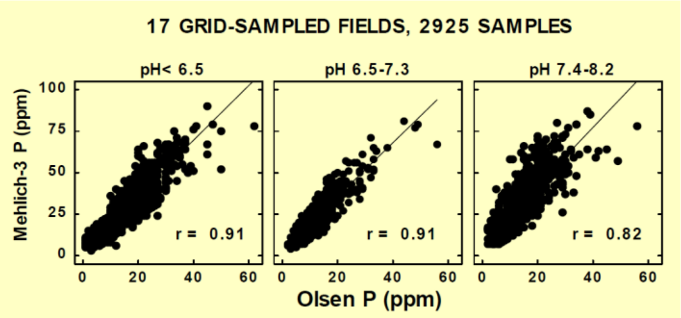


Figure 2. Relationships between soil P contents measured according to Olsen and according to Mehlich-3, differentiated according to soil pH (Sawyer)

The map of soil exchangeable K represents data (in mmolc/kg) measured according to K-NH4Ac which were converted from the source map which represents data for extractable K (in ppm) measured according to K-Mehlich 3. The conversions are given here below and were based on rules derived from data presented by Sawyer (Iowa State University) and as suggested by de Pater (2015). The data presented by Sawyer are visualised in Figure 3.

If pH < 7.3
then K-exch (ppm) = [K-m3 (ppm) – 14.5] / 0.825
and K-exch (mmolc/kg) = [[K-m3 (ppm) – 14.5] / 0.825] / 39 = [K-m3 (ppm) – 14.5] / 32.2
= -0.45 + 0.031 * K-m3
else
then K-exch (ppm) = [K-m3 (ppm) – 21] / 0.73
and K-exch (mmolc/kg) = [[K-m3 (ppm) – 21] / 0.73] / 39 = [K-m3 (ppm) – 21] / 28.5
= -0.738 + 0.035 * K-m3

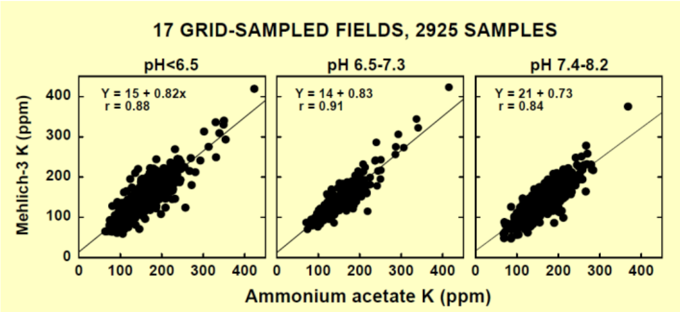


Figure 3. Relationships between soil K contents measured according to NH4Ac and according to Mehlich-3, differentiated according to soil pH (Sawyer)

Soil nutrient availabilities (supply) are a fraction of the soil nutrient contents and were calculated (as nutrient supplies in kg/ha) using QUEFTS from the input data on relative soil nutrient contents (organic carbon and total nitrogen, available and total phosphorus and exchangeable potassium), pH and temperature. The resulting values were reduced according to the volumetric coarse fragment contents and the total soil nutrient contents (kg/ha) were calculated using the map of bulk density. Maps of the soil root zone depth and the soil root zone plant-available water holding capacity were added (as deliverable) and were tested for downscaling of attainable yield data according to Guilpart et al. (2017) and subsequent use with QUEFTS.

2.3.1.2. QUEFTS Input data: attainable yield maps

We added a module to QUEFTS-R which reads attainable yield data from gridded maps. The attainable yield data were used as a reference to define target yields for which the corresponding nutrient requirements were calculated prior to calculating fertilizer recommendations.

We tested and applied several approaches to produce maps of attainable yield, including:
- Extrapolation of water-limited yield data, at point locations, available from the GYGA project portal for the pilot crops except cassava (www.yieldgap.org).
- Extrapolation of the maximum yields measured in each trial, at point locations (Tier 2)
- Download of maps with attainable yield data, available from the GAEZ portal of IIASA/FAO (http://gaez.fao.org)

All maps have been tested for being used as input to QUEFTS. The maps available at the GAEZ portal proved the most coherent and were selected for further use. See Table 2 for the list of maps. How these maps have been produced is described by Fisher et al. (2012). The attainable yield data are valid for three management regimes; low, intermediate and high. We selected the maps for the intermediate management level which are visualized in Figure 4.

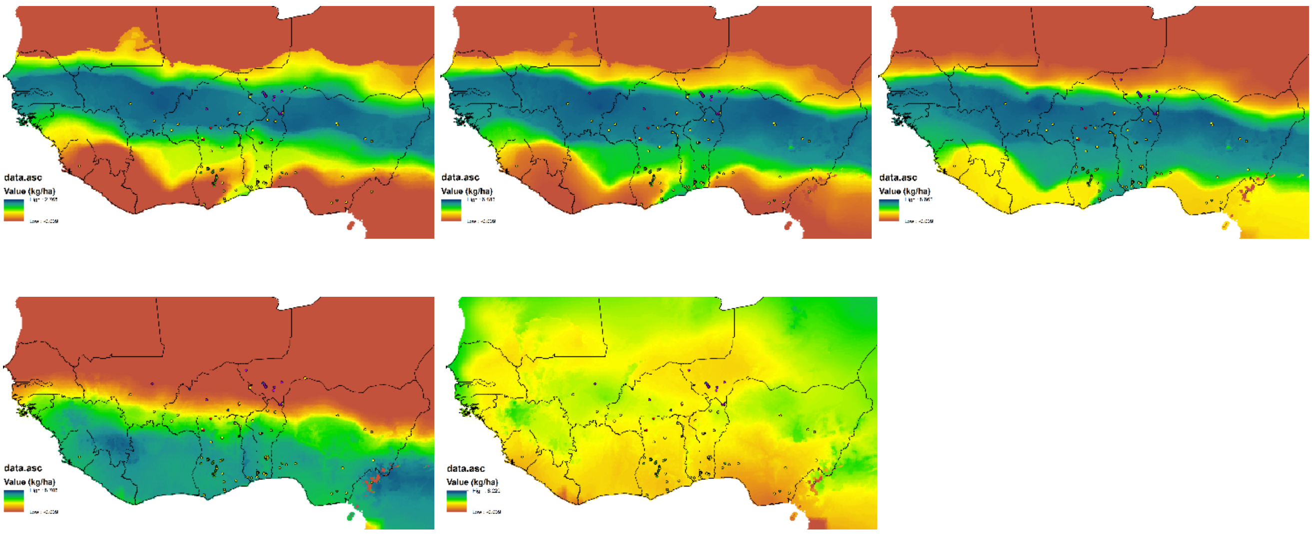


Figure 4. Maps of attainable yield (at intermediate management level) for a) millet, b) sorghum, c) maize, d) cassava, e) rice.

Table 2. Maps of attainable yield used as input to QUEFTS-R

Input to QUEFTS-R ABC	Map	Source map	Conversion
Attainable yield (kg/ha)	ymaxCassava	Cassave_rainfed_intermed_baseline/data.asc	[* 1000]
Attainable yield (kg/ha)	ymaxMaize	Maize_rainfed_intermed_baseline/data.asc	[* 1000]
Attainable yield (kg/ha)	ymaxMillet	Millet_rainfed_intermed_baseline/data.asc	[* 1000]
Attainable yield (kg/ha)	ymaxRice	Rice_irrigated_intermed_baseline/data.asc	[* 1000]
Attainable yield (kg/ha)	ymaxSorghum	Sorghum_rainfed_intermed_baseline/data.asc	[* 1000]

The maps of attainable yield, selected from the GAEZ portal, have been produced without adequate consideration of the spatial variability of the root zone plant-available water holding capacity of the soil. Consequently, those maps lack granularity. It was out of scope of this study to simulate water-limited yield potentials using adequate soil maps as input data. Instead we developed efforts to make the maps of attainable yield more granular by using the rule suggested by Guilpart et al. (2017) which reduces attainable yield from 100% to 60% as a function of the rootable depth decreasing from 150 cm to 50 cm. Figure 5 illustrates this rule, including our extrapolation reducing attainable yield further from 60% to 0% as a function of the rootable depth decreasing further from 50 cm to 0 cm. These efforts should be considered a test because they were implemented only near the end of the study following the production of yet validated results.

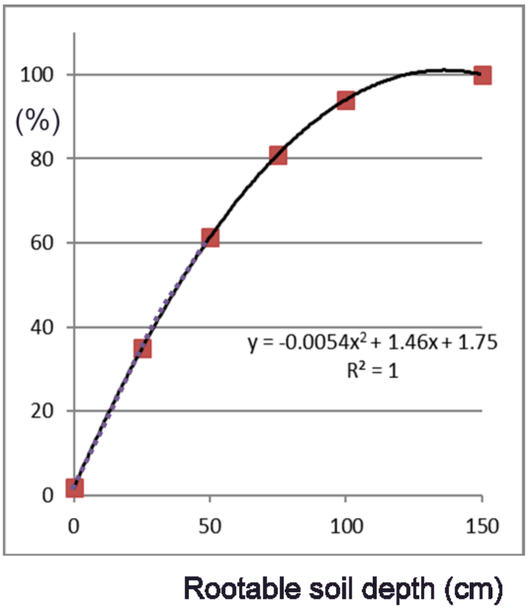


Figure 5. Rootable soil depth reducing attainable yield as a fraction of the attainable yield depicted on the GAEZ maps.

2.3.1.3. QUEFTS input data: crop parameters

Crop parameters for maize, millet, rice and sorghum were taken from literature with special reference to West Africa (van Duivenbooden, 1992) and for cassava from Ezui et al. (2012). The maize default parameters were taken from Janssen et al. (1990) to test the model performance. See Table 3.

Table 3. Crop parameter settings defined for use in Tier 1

LUT	CROP	aN	aP	aK	dN	dP	dK	rN	rP	rK	rfNmed	rfPmed	rfKmed
1	MilletT1	15	108	9	45	350	22	5	0.4	2	0.33	0.14	0.34
2	SorghumT1	19	124	15	80	500	42	5	0.4	2	0.33	0.14	0.34
3	MaizeT1	24	130	27.7	70	600	86	5	0.4	2	0.34	0.13	0.33
4	RiceT1	36	155	18	80	850	86	5	0.4	2	0.4	0.1	0.28
5	CassavaT1	53	305	46	132	585	181	5	0.4	2	0.35	0.13	0.32
6	MaizeDefault	30	200	30	70	600	120	5	0.4	2	0.5	0.1	0.5

aNPK ratio of yield over nutrient uptake (kg yield / kg NPK uptake) at accumulated nutrient concentrations
dNPK ratio of yield over nutrient uptake (kg yield / kg NPK uptake) at diluted nutrient concentrations
rNPK residual nutrient uptake at zero yield (kg NPK/ha)
rfNPKmed median of fertilizer recovery fractions (ratio of nutrient uptake over fertilizer nutrient applied (kg NPK uptake / kg NPK applied)

Additional crop parameter settings are presented in Table 4, including harvest index (HI) and the minimum and maximum recovery fractions (rfNPKmin, rfNPKmax). Ypot is defined to maximize yield calculations to the yield potential. Ytargetratio is defined to set a spatially variable target yield as a ratio of the spatially variable attainable yield.

Table 4. Additional crop parameter settings defined for use in Tier 1.

LUT	CROP	HI	ytargetratio	ypot	rfNmax	rfPmax	rfKmax	rfNmin	rfPmin	rfKmin
1	MilletT1	0.22	0.8	6000	0.51	0.2	0.46	0.22	0.09	0.25
2	SorghumT1	0.2	0.8	11000	0.51	0.2	0.46	0.22	0.09	0.25
3	MaizeT1	0.41	0.8	14000	0.46	0.18	0.5	0.21	0.02	0.17
4	RiceT1	0.43	0.8	13000	0.52	0.16	0.53	0.24	0.05	0.19
5	CassavaT1	0.505	0.8	15000	0.50	0.19	0.49	0.22	0.06	0.22
6	MaizeDefault	0.45	0.8	14000	0.5	0.1	0.5	0.5	0.1	0.5

2.3.1.4. Calculation of soil and fertilizer nutrient use efficiencies (QUEFTS AC)

Yields were calculated using QUEFTS, the maps of input data and the crop parameters. Near all steps in the calculation procedure were outputted in the forms of maps (or in the form of tables when calculating the measured trial data in Tier2). These steps are based on the so-called quadrants of de Wit (1953) as illustrated in Figure 6a and slightly adapted by Janssen et al. (1990), without the word 'grids', as illustrated in Figure 6b. De Wit did not consider the conversion of soil nutrient content to soil nutrient availability (supply), as QUEFTS does, but did consider the base uptake (by unfertilized crop). QUEFTS primarily considers soil nutrients and calculates the amount of soil nutrients available for uptake (supply) as a fraction of the measured soil nutrient content. The uptake efficiencies are calculated in a next step defining actual uptake, followed by a calculation of the physiological use efficiencies defining actual yield. The physiological use efficiencies when nutrients are fully diluted or fully accumulated are predefined crop parameters determining the maximum and minimum efficiencies (see Table 3). Adding to the soil nutrients are the fertilizer nutrients. Predefined as a crop parameter, and fixed, is the fraction of fertilizer nutrients which is available for uptake (supply) which is in QUEFTS also referred to as the reference (maximum) recovery fraction. The uptake efficiency calculated in the next step thus considers both soil and fertilizer nutrients and determines the true fertilizer nutrient recovery fraction.

Note that QUEFTS-R calculates fertilized yields in two stages including a first stage (A) calculating the unfertilized control yield and the second stage (C) calculating the fertilized yield. The fertilizer rates are read either from an external table, in case of the trial data, or an external grid, in case of the recommendations extrapolated in Tier 3. The fertilizer rates can also correspond to the recommendations calculated by QUEFTS-R in an intermittent stage (B) between stages A and C in Tier 1 and 2, as explained in section 2.3.1.5.

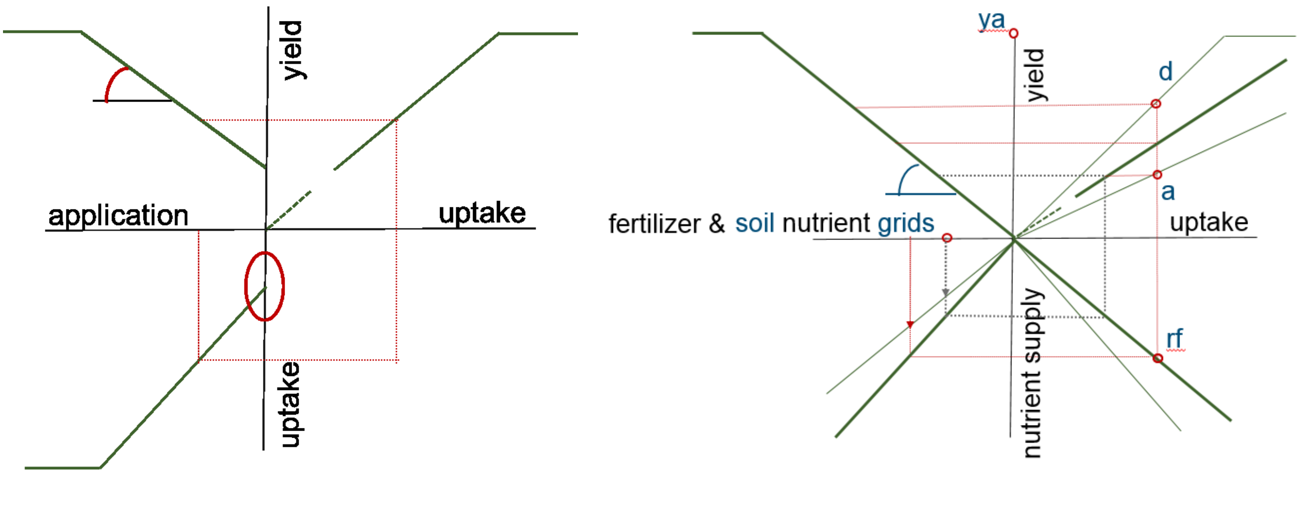


Figure 6. Schematic illustration of a). crop response to fertilizer nutrient application, simplified according to de Wit (1953) and b). crop response to both soil nutrients and fertilizer nutrients, simplified according to Janssen et al. (1990), indicating attainable yield (ya), physiologic use efficiency at diluted (d) and accumulated (a) nutrient concentrations and the nutrient recovery fraction (rf).

Calculated and outputted for each crop, in two stages (A and C), are the following:

N soil content
P soil content
K soil content
1N = soil release efficiency (soil supply / content)
1P = soil release efficiency (soil supply / content)
1K = soil release efficiency (soil supply / content)
1Nf = fertilizer release efficiency (fertilizer supply / content); this is normally combined with 2
1Pf = fertilizer release efficiency (fertilizer supply / content) ; this is normally combined with 2
1Kf = fertilizer release efficiency (fertilizer supply / content) ; this is normally combined with 2
N supply
P supply
K supply
N supply from soil
P supply from soil
K supply from soil
N supply from fertilizer
P supply from fertilizer
K supply from fertilizer
2N = base uptake efficiency (recovery fraction of soil supply)
2P = base uptake efficiency (recovery fraction of soil supply)
2K = base uptake efficiency (recovery fraction of soil supply)
2Nf = uptake efficiency (recovery fraction of fertilizer supply)
2Pf = uptake efficiency (recovery fraction of fertilizer supply)
2Kf = uptake efficiency (recovery fraction of fertilizer supply)
N uptake
P uptake
K uptake
N uptake from soil (base uptake)
P uptake from soil (base uptake)
K uptake from soil (base uptake)
N uptake from fertilizer
P uptake from fertilizer
K uptake from fertilizer
3N = physiologic use efficiency of base nutrient uptake
3P = physiologic use efficiency of base nutrient uptake
3K = physiologic use efficiency of base nutrient uptake
3Nf = physiologic use efficiency of fertilizer nutrient uptake
3Pf = physiologic use efficiency of fertilizer nutrient uptake
3Kf = physiologic use efficiency of fertilizer nutrient uptake
Yield unfertilized
Yield fertilized

2.3.1.5. Calculation of fertilizer recommendations (QUEFTS ABC)

We added a module (B) to QUEFTS-R which calculates fertilizer recommendations on the basis of the nutrient requirements of target yields, defined as a fraction of the attainable yield data read from gridded maps, relative to the nutrient supplies by the soil, as calculated in the former paragraph by QUEFTS. The nutrient gap between these demands and supplies defines the amount of fertilizer nutrients which need to be taken up and, considering the predefined maximum reference fertilizer nutrient uptake efficiencies (recovery fractions), the amount of fertilizer nutrients to be applied (the fertilizer recommendations). See Figure 7.

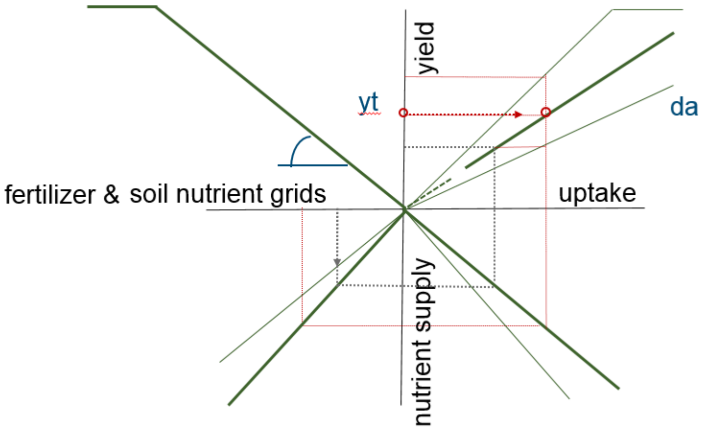


Figure 7. Schematic illustration of crop response to both soil nutrients and fertilizer nutrients and the fertilizer nutrient recommendation calculated in this study from the target yield (yt)

Prior to validation, the target yields were defined at 80% of the attainable yield for all crops throughout the area of interest. The nutrient requirements at those target yields were defined on the basis of the crop parameters a, d and r which define the physiological use efficiencies at diluted and accumulated nutrient concentrations (minimal and maximal yield over uptake efficiencies) and the residual uptake required for yield formation starting to take place. Defined was:

$$\text{Nutrient requirement} = (\text{Target yield} / (d - ((d - a)/3))) + r$$

Note that we targeted an efficiency within the range between a and d, and not the initial highest efficiency (d), because we aimed to assess balanced N, P and K requirements. We targeted a use efficiency which was one third of the range less efficient than the highest (initial) efficiency and one sixth more efficient than the median efficiency. This efficiency corresponds more or less with the efficiency as conventionally calculated by QUEFTS, which is based on the corresponding uptakes and using a 2nd order equation, exceeding the median efficiency. In reality though, the efficiency at the calculated uptake (and thus the corresponding yield) can be higher as well as lower as the targeted efficiency (and targeted yield), depending on the actual circumstances such as rainfall, management, micronutrient deficiencies, etc., but most likely within the range as defined by the crop parameters a and d.

The recommendations calculated in module B were inputted as fertilizer rates in module C to calculate and verify the associated responses and yields. We expect the calculated fertilised yields to correspond more or less with the defined target yields. We also expect the uptake efficiencies to be near to the maximally defined reference uptake efficiencies because of the recommendations being balanced in terms of the ratios between N, P and K as defined by the crop requirements.

2.3.2. Tier 2, QUEFTS to calculate and map fertilizer recommendations parameterized with trial data

In Tier 2, measured trial data have been made available for use. See sections 2.1 and 2.2 for the data, the applicability of the data and the actual use of the data.

2.3.2.1. Pre validation

The QUEFTS-R ABC model as well as the input data (soil maps and maps of attainable yield) used in Tier 2 is similar to that used in Tier 1. The crop parameters were adjusted from the available fertilizer trial data where possible. Assessed from the data were the median as well as the minimum and maximum of the fertilizer nutrient uptake efficiencies (nutrient uptake when fertilized minus uptake when unfertilized relative to the fertilizer nutrient application rate) and the nutrient use efficiencies (yield relative to uptake at diluted and at accumulated concentrations). The minimum and maximum efficiencies were assessed at 2.5 and 97.5 percentiles, respectively. Moreover, the harvest indices (ratio of yield over biomass) were assessed for verification purposes. See Tables 5 and 6 for the adjusted parameter settings.

Table 5. Pre-validated crop parameter settings defined for use in Tier 2 (adjusted in bold)

LUT	CROP	aN	aP	aK	dN	dP	dK	rN	rP	rK	rfNmed	rfPmed	rfKmed
7	MilletT2	15	108	9	45	350	22	5	0.4	2	0.33	0.14	0.34
8	SorghumT2	19	124	15	80	500	42	5	0.4	2	0.33	0.14	0.34
9	MaizeT2	**25**	**45.8**	**25.3**	**63.8**	**386.1**	**83.4**	5	0.4	2	**0.34**	**0.21**	**0.67**
10	RiceT2	**54.9**	**132.9**	**47.3**	**127.2**	**505.9**	**153.1**	5	0.4	2	**0.23**	**0.13**	**0.43**
11	CassavaT2	53	305	46	132	585	181	5	0.4	2	0.35	0.13	0.32

Table 6. Additional pre-validated crop parameter settings defined for use in Tier 2 (adjusted in bold)

LUT	CROP	HI	ytargetratio	ypot	rfNmax	rfPmax	rfKmax	rfNmin	rfPmin	rfKmin
7	MilletT2	**0.2**	0.8	6000	0.51	0.2	0.46	0.22	0.09	0.25
8	SorghumT2	**0.25**	0.8	11000	0.51	0.2	0.46	0.22	0.09	0.25
9	MaizeT2	**0.38**	0.8	14000	**1.17**	**1.36**	**2.68**	**-0.14**	**-0.34**	**-0.71**
10	RiceT2	**0.4**	0.8	13000	**0.69**	**0.42**	**1.05**	**0.09**	**-0.43**	**0.02**
11	CassavaT2	**0.35**	0.8	15000	0.50	0.19	0.49	0.22	0.06	0.22

With these settings, QUEFTS-R ABC was applied to the trial point data to calculate the response to the fertilizer treatments as well as to calculate fertilizer recommendations at those point locations. The calculations are given in columns next to the corresponding measurements of response and the reported recommendations. Subsequently, QUEFTS-R ABC was applied to the gridded maps to calculate and map fertilizer recommendations and the corresponding crop responses. The maps are validated at the same point locations (thus using the same data).

2.3.2.2. Post validation

Following the validation meeting with the STC in June 2017, few changes were made before doing a final assessment. First, few rules in QUEFTS-R ABC were adjusted.

- The pH dependent correction factor which applies to calculating the availability (supply) of the soil nutrients was for P also applied for calculating the availability (supply) of fertilizer P. This implies that more fertilizer P is required at more acid soils to achieve a similar P uptake.
- The attainable yield data for cassava were multiplied by 2.5 to model fresh weight crop.
- The parameter defining the yield potential (ypot), maximizing the yield calculations, was lowered importantly for all crops. Herewith, diminishing returns (diminishing use efficiencies) are calculated at lower uptake rates.
- Instead of using the yield potential parameter for maximizing the yield calculations, the attainable yield data, read from maps, were used to maximize yield calculations.

The fertilizer recommendations are calculated for newly defined, lower, target yields at similar physiological use efficiency (d – ((d – a)/3)). These target yield levels were derived from the maximum target yields defined during the validation by the STC. Those maxima seemed very high and near to the attainable yield levels (while it was proposed to lower the target yields) and therefore it was decided to assess the nutrient requirements at those maximum target yields at the initial highest use efficiency (d) thus at fully diluted nutrient concentrations. Those nutrient requirements were subsequently translated to lower target yield levels at the usual, lower, use efficiencies thus at more accumulated concentrations and similar uptake. Applying these recommendations will ,in ‘normal conditions’, most likely result in a yield near to the conservative target yield but will, in ‘favorable conditions’, result in a yield near to the target yield as defined by the STC and near to, but not beyond, the attainable yield level. The crop parameters, defining the ratio of target yield relative to attainable yield, were adjusted accordingly.

- Table 7 indicates the maximum values given on the GAEZ maps for attainable yield, the only slightly lower initial target yields as suggested by the STC (a realistic target at diluted nutrient concentrations) and the corresponding target yields (a realistic target in ‘normal’ circumstances at in-range (d-((d-a)/3)) nutrient concentrations. Fraction indicates the latter target yield as a fraction of the maximum attainable yield. The fraction for millet was adapted to 0.65.

Table 7. Validated settings of the target yield as a fraction (ratio) of the maximum yield value in the region, depicted on the attainable yield map, defined based on the initial target yield (at d) suggested by the STC.

LUT	CROP	Max attainable yield	Initial target yield (at d)	Target yield (at (d-((d-a)/3)))	ytargetratio	adapt
7	MilletT2	3000	2500	1800	0.6	0.65
8	SorghumT2	6000	4500	3000	0.5	
9	MaizeT2	7500	5500	4125	0.55	
10	RiceT2	6500	6000	4550	0.7	
11	CassavaT2	20000	16000	12000	0.6	

- The crop parameter defining the median fertilizer nutrient recovery fraction (uptake efficiency), used for the calculations, was adjusted to increase the uptake efficiency (because of the N, P, K rates being balanced). We changed the parameter from the measured value at the 50 percentile (the median value) to the 60 percentile. For those crops lacking measured data on nutrient uptake, we changed the parameter from the default median to the median + 10% of the range between the minimal and maximal values. The impact of this change is that less fertilizer nutrients are recommended. See table 8.

Table 8. Validated crop parameter settings defined for use in Tier 2 (adjusted in bold)

LUT	CROP	aN	aP	aK	dN	dP	dK	rN	rP	rK	rfNmed	rfPmed	rfKmed
7	MilletT2	15	108	9	45	350	22	5	0.4	2	**0.33**	**0.14**	**0.34**
8	SorghumT2	19	124	15	80	500	42	5	0.4	2	**0.36**	**0.15**	**0.36**
9	MaizeT2	**25**	**45.8**	**25.3**	**63.8**	**386.1**	**83.4**	5	0.4	2	**0.4**	**0.26**	**0.82**
10	RiceT2	**54.9**	**132.9**	**47.3**	**127.2**	**505.9**	**153.1**	5	0.4	2	**0.34**	**0.19**	**0.49**
11	CassavaT2	53	305	46	132	585	181	5	0.4	2	**0.38**	**0.14**	**0.37**

Table 9. Additional validated crop parameter settings defined for use in Tier 2 (adjusted in bold)

LUT	CROP	HI	ytargetratio	ypot	rfNmax	rfPmax	rfKmax	rfNmin	rfPmin	rfKmin
7	MilletT2	**0.2**	**0.65**	**3000**	0.51	0.2	0.46	0.22	0.09	0.25
8	SorghumT2	**0.25**	**0.5**	**6500**	0.51	0.2	0.46	0.22	0.09	0.25
9	MaizeT2	**0.38**	**0.55**	**8000**	**1.17**	**1.36**	**2.68**	**-0.14**	**-0.34**	**-0.71**
10	RiceT2	**0.4**	**0.7**	**8500**	**0.69**	**0.42**	**1.05**	**0.09**	**-0.43**	**0.02**
11	CassavaT2	**0.35**	**0.6**	**22000**	0.50	0.19	0.49	0.22	0.06	0.22

With these settings, QUEFTS-R ABC was applied again first to the trial point data and then the gridded maps.

2.3.3. Tier 3, use of reported fertilizer recommendations to validate recommendations mapped in Tier 2 and to extrapolate using machine learning

2.3.3.1. Pre validation

In Tier 3, fertilizer recommendations have been made available for use. These reported recommendations, at point locations, have been used to validate, or to compare with, the recommendations as calculated and mapped at those point locations in Tier 2. Additionally, these recommendations have been used to extrapolate directly using an ensemble of machine learning techniques.

Added to the recommendations as reported from the trials are recommendations for each of the crops as newly derived from the trials according to as described in paragraph 2.2.1.2. Both the reported and the newly derived recommendations have been modelled using an ensemble of machine learning techniques and stacks of spatial covariate maps. Included with these covariate maps are the gridded output maps of Tier 2 including the recommendations as calculated using QUEFTS. We expect these Tier 2 maps to be relevant as 'enhanced' covariates for the modelling. Modelling by Random Forests implies a large number of rounds wherein a portion of the data, which changes every round, is included in the building of the model and the other portion of the data is set aside for independent validation of the model built in each round, to the point that a best-fit model, predicting with highest accuracy, is identified together with the associated covariates. This model is applied onto the associated covariates, which are available for the entire area of interest (ECOWAS region) to predict (extrapolate) the recommendations over the area.

The resulting maps of extrapolated fertilizer recommendations (those which were newly assessed for all five crops) were inputted to QUEFTS again to calculate the corresponding yield when fertilized accordingly.

2.3.3.2. Post validation

The gridded maps produced in Tier 2 using QUEFTS, validated thus using the latest settings, have been newly added to the covariates to newly model and extrapolate the point based fertilizer recommendations using machine learning.

2.4. Define generic crop- and site-specific fertilizer recommendations (activity 7 & deliverable)

The post-validation results of Tier 2 and 3 have been generalised from detailed gridded maps of N, P and K recommendations for crops in West Africa to aggregated polygon maps of NPK recommendations for crops in agro-ecological zones in Benin, Burkina Faso and Ghana. Each polygon represents a country-specific agro-ecological zone for which the average NPK recommendation is specified for each crop as well as the associated variance expressed by the minimum, maximum and median recommendation and the 1^{st}, 2^{nd} and 3^{rd} standard deviations, both positive and negative, from the median.

2.5. Discuss and validate findings with regional experts of the STC (activity 8 & deliverable)

As mentioned in sections 2.3.2 and 2.3.3, a validation meeting with the STC was held during which the approach and results were discussed. The target yield levels and few of the parameters settings were adjusted to better match with the agronomic practices and farmer's capabilities prevailing in the region.

2.6. Report about the findings of the proof of concept project including data, methods, results and conclusions (activity 9 & deliverable)

A draft version of the final report has been prepared and submitted to IFDC in June 2017. Upon the request of IFDC, a final version was produced and shared in October 2018.

2.7. Propose a pragmatic mechanism for collecting, sharing and processing of data required for all crops, AEZ's and countries targeted for further upscaling to the whole West African region (activity 10)

The mechanism for collecting, sharing and processing of data needs to be well designed and fully transparent in order to permit collaborators to contribute, adhering to defined standards, and to use the data coherently and quantitatively. It was out of scope of this study (not a deliverable) to work out and propose such a mechanism.

3. Results

The results are available in a project folder at the ISRIC ftp server (ftp://ftp.isric.org/) and are password protected. Login with ifdc as user and IFDCWAIFDCWA as password. Annex 13 provides the metadata, listing and describing the folders and file names stored on the ftp.

3.1. Compile fertilizer recommendations to be extrapolated and associated fertilizer trial data (activity 1 & deliverable)

The compilation of fertilizer recommendations, and the underlying fertilizer trial data, became available for further use in the second half of March 2017. The FeRWAM (GIS map of agro-ecological zones & tables of fertilizer recommendations) has not been made available except for a table of draft FeRWAM data which was made available after this study (June 2017). This draft FeRWAM table compiles mainly qualitative information from various countries about fertilizer recommendations for a number of crops in a number of country-defined agro-ecological zones and is still incomplete.

3.1.1. Compile georeferenced site and crop-specific fertilizer recommendations (at xy-point locations) and related fertilizer trial data, as made readily available by IFDC (activity 1 & deliverable)

The compilation of fertilizer trial data, and fertilizer recommendations, as compiled under a common standard data, is available in the project folder at the ISRIC ftp server (\IFDC_upscale\0_InputData\0_TrialData__Points\FertiliserTrialData.xlsx). The column headings in the table are described in the associated dictionary (PointsDictionary_FertilizerTrialData_Tier2.xlsx).

See Figure 8 for an illustration of part (two trials) of the compilation. Included are separate tables (tabs) for all data of all crops together, for the data per crop, for the data sources (lineage) and for a dictionary explaining the column headings used in the tables. The reported fertilizer NPK recommendations are given by fNR, fPR and fKR, respectively.

All trials report measured yield data, with the majority of the trials including control yields (at 0 kg NPK/ha), and the majority of trials also reports measured straw data. Only few trials for only maize and rice also report nutrient contents measured from the crop tissues (yieldable organs and straw). The columns with yControl, yResponse, yRec and yMx have been calculated à posteriori to underpin the evaluation of the trials and the recommendations derived and represent, for each repetition, the control yield when unfertilized, the yield response relative to that control yield, the measured yield corresponding with the reported fertilizer recommendation and the maximum yield measured in the repetition, respectively.

	A	B	C	D	E	G	H	AA	AB	AQ	AS	BC	BD	BE	BG	BI	BL	BM	BP	BR	BS	BT	BU	BV	BW	BX	BZ	CA	CB
1	FieldI	PlotID	TrialID	RepN	TrtNr	Partner	SourceID	XlonDD	YlatDD	Crop	Year	fertN	fertP	fertK	Straw	Yield	yControl	yRespon	yrec	ymx	NStraw	NYield	PStraw	PYield	KStraw	KYield	fNR	fPR	fKR
68	67	BJ02_3	BJ02	3	7	Aliou SAIDOU	0001	2.149083	6.730694	Maize	2011	69	30	40	5489	4193	2323	1870	2856	4193	1.017	1.248	0.134	0.347	1.441	0.627	80	30	25
69	68	BJ02_3	BJ02	3	8	Aliou SAIDOU	0001	2.149083	6.730694	Maize	2011	92	30	40	2864	1455	2323	-868	2856	4193	0.887	1.253	0.093	0.328	1.263	0.640	80	30	25
70	69	BJ02_3	BJ02	3	9	Aliou SAIDOU	0001	2.149083	6.730694	Maize	2011	69	15	25	4303	3209	2323	886	2856	4193	0.965	1.189	0.129	0.347	0.968	0.638	80	30	25
71	70	BJ02_3	BJ02	3	10	Aliou SAIDOU	0001	2.149083	6.730694	Maize	2011	46	15	25	3041	2366	2323	43	2856	4193	0.678	1.166	0.075	0.264	1.056	0.519	80	30	25
72	71	BJ02_4	BJ02	4	1	Aliou SAIDOU	0001	2.149083	6.730694	Maize	2011	0	0	0	2247	974	974	0	3359	3872	0.782	1.061	0.093	0.240	0.850	0.675	80	30	25
73	72	BJ02_4	BJ02	4	2	Aliou SAIDOU	0001	2.149083	6.730694	Maize	2011	44	15	17.5	4047	3809	974	2835	3359	3872	0.756	1.271	0.154	0.314	1.561	0.540	80	30	25
74	73	BJ02_4	BJ02	4	3	Aliou SAIDOU	0001	2.149083	6.730694	Maize	2011	80	30	40	4395	3451	974	2477	3359	3872	0.991	1.541	0.125	0.276	1.590	0.608	80	30	25
75	74	BJ02_4	BJ02	4	4	Aliou SAIDOU	0001	2.149083	6.730694	Maize	2011	80	15	40	4353	3287	974	2313	3359	3872	0.626	1.618	0.067	0.243	0.710	0.570	80	30	25
76	75	BJ02_4	BJ02	4	5	Aliou SAIDOU	0001	2.149083	6.730694	Maize	2011	80	30	25	4435	3359	974	2385	3359	3872	1.059	1.592	0.133	0.276	1.333	0.623	80	30	25
77	76	BJ02_4	BJ02	4	6	Aliou SAIDOU	0001	2.149083	6.730694	Maize	2011	80	30	0	4088	3142	974	2168	3359	3872	0.887	1.459	0.122	0.280	0.980	0.588	80	30	25
78	77	BJ02_4	BJ02	4	7	Aliou SAIDOU	0001	2.149083	6.730694	Maize	2011	69	30	40	4070	2398	974	1424	3359	3872	0.782	1.413	0.084	0.339	1.071	0.687	80	30	25
79	78	BJ02_4	BJ02	4	8	Aliou SAIDOU	0001	2.149083	6.730694	Maize	2011	92	30	40	4895	3872	974	2898	3359	3872	0.777	1.387	0.084	0.283	1.316	0.626	80	30	25
80	79	BJ02_4	BJ02	4	9	Aliou SAIDOU	0001	2.149083	6.730694	Maize	2011	69	15	25	2514	1183	974	209	3359	3872	0.688	1.464	0.087	0.359	1.242	0.701	80	30	25
81	80	BJ02_4	BJ02	4	10	Aliou SAIDOU	0001	2.149083	6.730694	Maize	2011	46	15	25	2798	1808	974	834	3359	3872	0.939	1.438	0.115	0.176	1.016	0.452	80	30	25
82	81	BJ03_1	BJ03	1	1	Aliou SAIDOU	0001	1.676194	6.753333	Maize	2011	0	0	0	2665	1470	1470	0	1857	4087	0.679	1.357	0.152	0.227	1.212	0.516	80	15	40
83	82	BJ03_1	BJ03	1	2	Aliou SAIDOU	0001	1.676194	6.753333	Maize	2011	44	15	17.5	2772	1565	1470	95	1857	4087	0.763	1.599	0.118	0.327	1.460	0.644	80	15	40
84	83	BJ03_1	BJ03	1	3	Aliou SAIDOU	0001	1.676194	6.753333	Maize	2011	80	30	40	3322	2692	1470	1222	1857	4087	0.965	1.526	0.159	0.315	1.332	0.625	80	15	40
85	84	BJ03_1	BJ03	1	4	Aliou SAIDOU	0001	1.676194	6.753333	Maize	2011	80	15	40	3103	1857	1470	387	1857	4087	0.906	1.410	0.196	0.284	1.903	0.619	80	15	40
86	85	BJ03_1	BJ03	1	5	Aliou SAIDOU	0001	1.676194	6.753333	Maize	2011	80	30	25	6024	4087	1470	2617	1857	4087	0.721	1.211	0.069	0.300	1.443	0.613	80	15	40
87	86	BJ03_1	BJ03	1	6	Aliou SAIDOU	0001	1.676194	6.753333	Maize	2011	80	30	0	3583	2280	1470	811	1857	4087	0.984	1.541	0.105	0.300	1.130	0.578	80	15	40
88	87	BJ03_1	BJ03	1	7	Aliou SAIDOU	0001	1.676194	6.753333	Maize	2011	69	30	40	3021	1784	1470	314	1857	4087	0.589	1.342	0.087	0.301	1.419	0.605	80	15	40
89	88	BJ03_1	BJ03	1	8	Aliou SAIDOU	0001	1.676194	6.753333	Maize	2011	92	30	40	3921	2579	1470	1109	1857	4087	0.804	1.512	0.060	0.280	1.151	0.609	80	15	40
90	89	BJ03_1	BJ03	1	9	Aliou SAIDOU	0001	1.676194	6.753333	Maize	2011	69	15	25	2862	1644	1470	174	1857	4087	0.813	1.420	0.088	0.280	1.636	0.576	80	15	40
91	90	BJ03_1	BJ03	1	10	Aliou SAIDOU	0001	1.676194	6.753333	Maize	2011	46	15	25	2147	1896	1470	426	1857	4087	0.487	1.570	0.046	0.270	0.986	0.523	80	15	40
92	91	BJ03_2	BJ03	2	1	Aliou SAIDOU	0001	1.676194	6.753333	Maize	2011	0	0	0	2470	1298	1298	0	2209	2748	0.862	1.289	0.080	0.272	1.312	0.575	80	15	40
93	92	BJ03_2	BJ03	2	2	Aliou SAIDOU	0001	1.676194	6.753333	Maize	2011	44	15	17.5	3649	2500	1298	1202	2209	2748	0.687	1.289	0.070	0.283	1.385	0.603	80	15	40
94	93	BJ03_2	BJ03	2	3	Aliou SAIDOU	0001	1.676194	6.753333	Maize	2011	80	30	40	3246	1983	1298	685	2209	2748	0.765	1.476	0.160	0.341	1.854	0.674	80	15	40
95	94	BJ03_2	BJ03	2	4	Aliou SAIDOU	0001	1.676194	6.753333	Maize	2011	80	15	40	3502	2209	1298	912	2209	2748	0.667	1.560	0.060	0.318	1.683	0.682	80	15	40
96	95	BJ03_2	BJ03	2	5	Aliou SAIDOU	0001	1.676194	6.753333	Maize	2011	80	30	25	4112	2748	1298	1450	2209	2748	1.023	1.575	0.105	0.344	1.715	0.648	80	15	40
97	96	BJ03_2	BJ03	2	6	Aliou SAIDOU	0001	1.676194	6.753333	Maize	2011	80	30	0	3190	1934	1298	636	2209	2748	0.911	1.403	0.091	0.261	1.178	0.535	80	15	40
98	97	BJ03_2	BJ03	2	7	Aliou SAIDOU	0001	1.676194	6.753333	Maize	2011	69	30	40	3974	2625	1298	1328	2209	2748	0.721	1.368	0.066	0.272	1.160	0.586	80	15	40

Trials / Dictionary / Source / Millet / Sorghum / Maize / Rice / Cassava

Figure 8. Illustration of part of the fertilizer trial data, and fertilizer recommendations (the 3 columns at the right hand side), compiled under a common standard

The total number of trials varied according to the crop and was somewhat limited except for maize. Also the spatial distribution of the trials was limited to only narrow ranges of environmentally variable conditions with the trials for each crop located in few agro-ecological zones only (see Figure 9 and Figure 10 a, b, c, d, e).

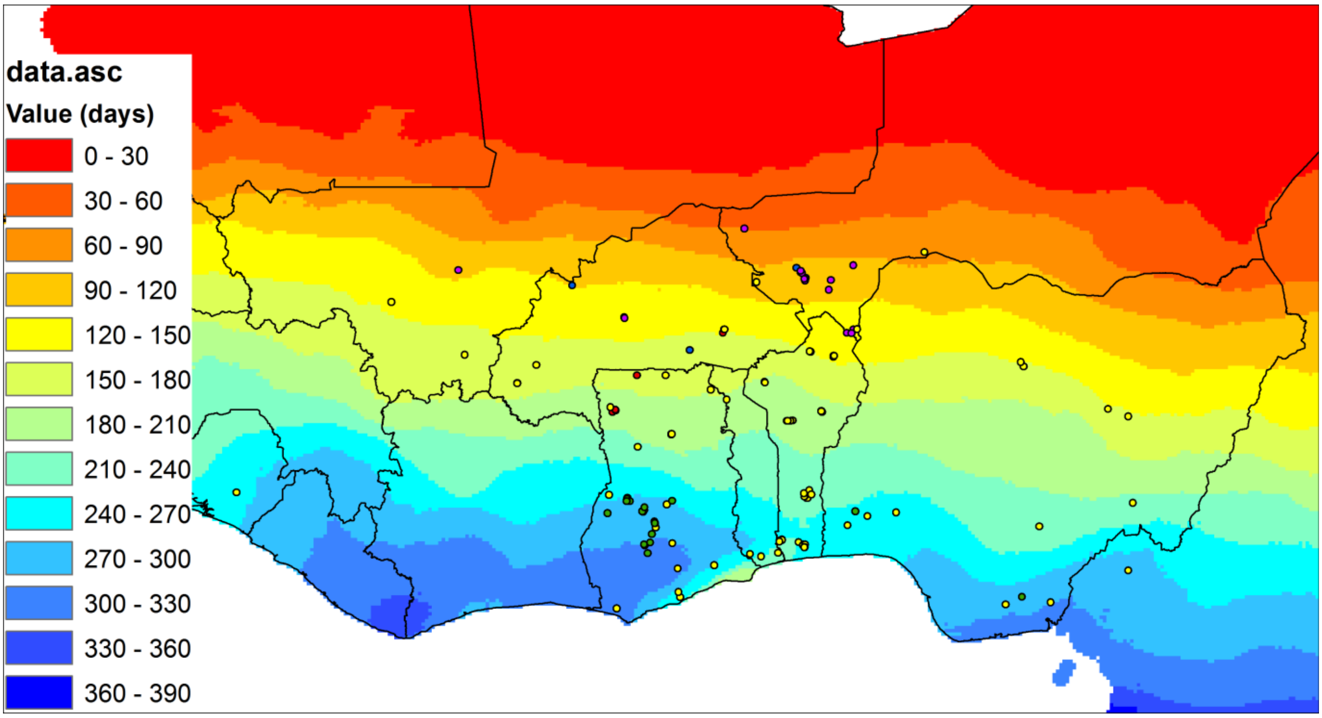


Figure 9. Overview of the fertilizer trial data and their locations (dots) within the various countries and agro-ecological zones (zones of length of growing period in days). The different colors of the dots indicate the different crops.

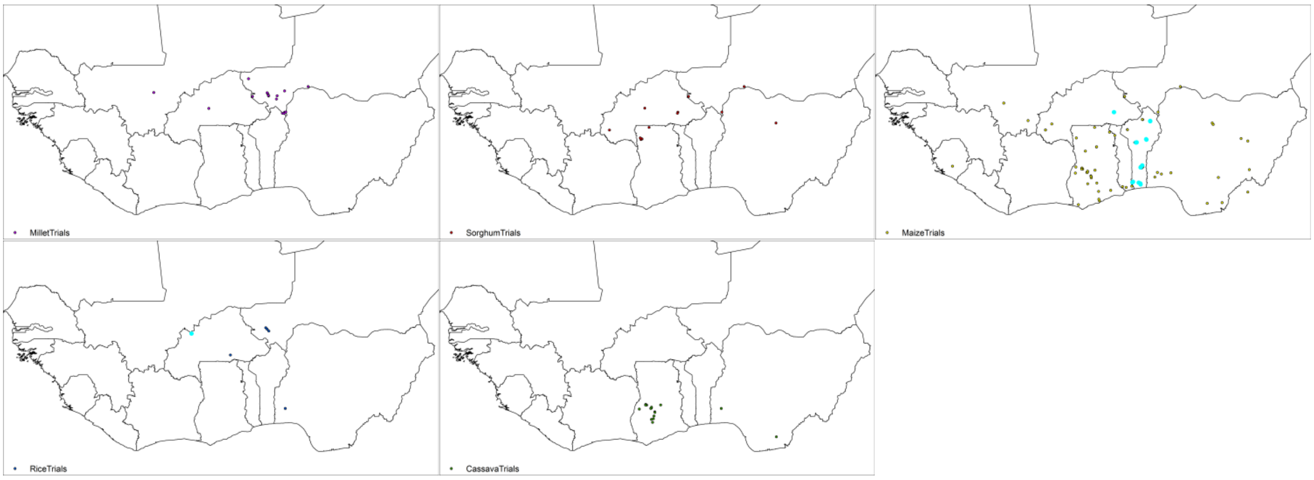


Figure 10. Maps of the fertilizer trials locations for a). millet, b). sorghum, c). maize, d). rice and e). cassava. The selected dots (in blue) indicate trials including data available on measured crop nutrient contents.

The nature of the trials was quite variable, as is summarized in Table 10. Summed for each crop is the number of trials compiled and made available by IFDC and compiled from OFRA data, the number of records (trials, repetitions and treatments), the number of trials including an explicit fertilizer recommendation, the number of reported recommendations, the number of trials with crop analytical data (nutrient contents), the number of different years of experimentation, the number of varieties considered, the number of different management regimes reported, the number of ways to report yields (dry matter of fresh matter), the number of agro-ecological zones covered by the trials (with the zones defined on national basis) and the number of countries where the trials have been conducted.

Table 10. Summary of the nature of the compiled fertilizer trial data

	Ifdc trials	Ofra trials	Records	RecTrials	**Recom's**	**Analysed**	Years	Varieties	Mgt	DM/FM	AEZs	Countries
Millet	**0**	63	480	0	**0**	**0**	17	3	9	1	3	3
Sorghum	**17**	14	491	12	**2**	**0**	13	9	16	1	5	4
Maize	**100**	112	3396	90	**27**	**16**	36	47	20	1	9	9
Cassava	**12**	12	463	3	**1**	**0**	8	5	4	2	3	2
Rice	**1**	6	108	1	**1**	**1**	6	5	18	1	3	3

The number of georeferenced fertilizer recommendations per crop is extremely limited and totally insufficient for extrapolation purposes for defining site specific (spatially variable) recommendations. No recommendation has been reported for millet, only one recommendation at one location for cassava and for rice and few recommendations, at two locations, for sorghum. Quite a large number of recommendations, at 26 locations, have been reported for maize. The recommendations are summarized in Table 11.

Table 11. Summary of the reported fertilizer recommendations

	BF	**N**	**P**	**K**
Millet	-	-	-	-
Sorghum	1	37	10	12
Maize	2	74 - 88	20 - 30	23 - 35
Cassava	-	-	-	-
Rice	1	119 - 136	24 - 32	40
	GH	**N**	**P**	**K**
Millet	-	-	-	-
Sorghum	1	90	6.6 - 9.8	0 – 17 - 25
Maize	20	30-60-90-120-135-160	0-6.6-9.8-13-26-39	0-8-10-17-25-59-60-75
Cassava	1	68	5.2	89.4
Rice	-	-	-	-
	BJ	**N**	**P**	**K**
Millet	-	-	-	-
Sorghum	-	-	-	-
Maize	4	80	15 – 22 - 30	20 – 25 – 30 - 40
Cassava	-	-	-	-
Rice	-	-	-	-

3.1.2. Review applicability of the compiled fertilizer recommendations and related fertilizer trial data (activity 1B)

The applicability of the trial data (Tier 2) and especially of the recommendations (Tier 3) proved somewhat limited due to the heterogeneous nature of the data and the recommendations as well as due to the limited quantities, limited spatial distribution and incompleteness of the data. Required for modelling, and extrapolation, are sufficient and complete data which are spatially well distributed covering the environmentally variable conditions over which the extrapolation needs to take place.

a. Parameterization of the QUEFTS model (Tier 2); crop parameters have been adjusted and used in Tier 2 for those crops with available measured data on crop nutrient contents (maize and rice). Those data were unavailable for millet, sorghum and cassava and those parameters have not been adjusted.
b. Modelling of the measured data using QUEFTS (Tier 2); crop yields in response to the fertilizer treatments have been calculated and compared with the measured data for each of the crops and for each of the trials including all fertilizer treatments. Also calculated but not supported by measured trial data were the underlying relationships including soil and fertilizer nutrient availability, soil and fertilizer nutrient uptake, and yield response to nutrient uptake.
c. Modelling of the measured data using machine learning (Tier 2); measured crop yields have been modelled and extrapolated using machine learning, separately for the measured control yields, the measured maximum yields and the measured yields at the newly derived fertilizer recommendation rates.

d. Modelling of the recommendations using QUEFTS (Tier 3); this proved not possible in a uniform manner for all crops and all trials. However, the parameter settings in Tier 2 (defining target yield and uptake efficiency) were fine-tuned such as to aim for calculating recommendations within the reported orders of magnitude.
e. Modelling of the recommendations using machine learning (Tier 3); recommendations were reported for sorghum, maize, rice and cassava, not for millet. Note though that machine learning requires so called big data while the number of recommendations (number of data points as well as the number of different recommendations) was extremely limited for each of these crops. Nevertheless, the recommendations have been modelled for solely proof of concept purposes.
    a. The spatial distribution of the trial-based recommendations is too narrow to support extrapolation by machine learning
    b. The quantity of the trial-based recommendations is too small to support extrapolation by machine learning
    c. The interpretative basis and nature of the trial-based recommendations is too heterogeneous to support extrapolation by machine learning
    d. The nature of the trials is too heterogeneous to support the formulation of trial-based recommendations
f. Validation of the modelled results (of Tier 1, 2 & 3); all model results were validated as far as the available data permitted and the errors quantified.

3.1.2.1. Evaluate the fertilizer recommendations, based on the fertilizer trials data (at xy-point locations and incl. soil data) as made readily available by IFDC (activity 2); Tier 3

The fertilizer recommendations formulated and reported based on the fertilizer trial data could not be reproduced in a consistent manner using the trial data. The consultants from each of the three countries applied a different basis each, based on different considerations, to do the interpretation and especially to formulate the recommendations. None of the consultants provided an explicitly worked out example of the approach applied, nor associated literature. This made the reported recommendations basically unsuitable for being used as a reference for modelling, unsuitable for being used to validate model outcomes and unsuitable for being extrapolated.

Generally, the recommendations do not show clear relationships with the measured trial data. More specifically, when considering trials one by one, clear relationships could be found for a number of trials. Note though that such analysis is out of scope of this study. Moreover, it is out of scope to interpret the trial data to the extent of formulating recommendations.

As a general impression, and not specifically referring to each or one of the crops, the recommendations as reported seem very invariable hardly showing any site-specificity. Also, the recommendations seem generally low for reaching target yields as communicated (not reported) but quite high for smallholder farmers to adopt and may prove to be financially inefficient. The recommendations include K whereas the trials hardly show response to K.

3.1.2.2. Fine-tune the evaluation and crop parameterization, for modelling, together with IFDC agronomist (activity 3); Tier 3 & 2

See Tier 2 for the crop parameterizations. The newly produced fertilizer recommendations, uniformly based on the highest agronomic fertilizer use efficiencies measured in the trials, are added to the data compilation (fNRec, fPRec and fKRec) for all trials. Generally, these newly produced recommendations are lower than those reported. The calculations as well as the results are available in the project folder (\IFDC_upscale\0_InputData\0_TrialData__Points\QUEFTS_FertiliserData_Tier2ToUse.xlsx).

3.1.2.3. Model the fertilizer recommendations, based on the fertilizer trials data (at xy point locations), using QUEFTS and attainable target yield data, and validate results (activity 4); Tier 3 & 2

The results for each trial modelled using QUEFTS are available at the ISRIC ftp server in the project folder \IFDC_upscale\
    \1_ResultsPreValidation\TIER1__Points_QUEFTS\ for each crop in a separate csv file.
    \1_ResultsPreValidation\TIER2__Points_QUEFTS\ for each crop in a separate csv file.
    \2_ResultsPostValidation\TIER2__Points_QUEFTS\ for each crop in a separate csv file.
The crop-specific csv files provide both measured trial data, including responses and recommendations, as yet provided in above section and calculated trial data. The column headings in the table are described in the associated dictionary (PointsDictionary_QUEFTS_FertilizerTrialData_Tier2.xlsx). The crop specific shape files read the input data from the input maps (at point locations).

Note that the results illustrated here in this paragraph were produced prior to the validation workshop, thus using pre-validated target yield levels and parameter settings. The fertilizer recommendations as calculated using QUEFTS do not coincide with the recommendations as reported from the trials. The reason could be the incoherent reporting of the recommendations, as stressed here above, and/or incorrect modelling with possibly inadequate assumptions and parameter settings.

Figure 11 illustrates the yields as modelled and calculated for millet in response to the fertilizer treatments relative to the yields as measured for millet in the fertilizer trials. Combining all data, for all trials of all years etc., results in an apparent poor relationship between modelled and measured results, hiding the relationships possibly valid for individual trials.

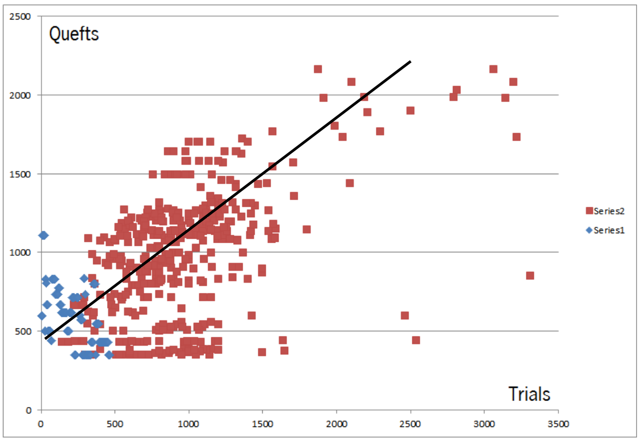


Figure 11. Pre-validated modelled yields (QUEFTS) relative to measured yields (Trials), for millet in both unfertilized (series 1; blue dots) and fertilized conditions (series 2; red dots), at point locations including all trials and all treatments

Figure 12 shows maize crop response to fertilizer treatments, as modelled and measured, only considering two selected trials (for maize). The modelled crop responses are within the ranges of the measured crop responses to N, P and K. The recommendations for N and P as modelled for the target yield at the trial locations are twice the recommendations as reported for the trials with the target yield also being twice the measured yield reported with the recommendation. The linearity suggests that the measurements as well as the reported recommendations are modelled rather well and that fine-tuning of the target yield levels and the model parameter settings will result in an adequate model fit and adequate recommendations. The recommendation for K as modelled differs very much from the recommendation for K as reported. Calculations suggest no response to K fertilizers which is confirmed by the measurements also showing no response. The reported recommendation though is 25 to 40 kg K/ha.

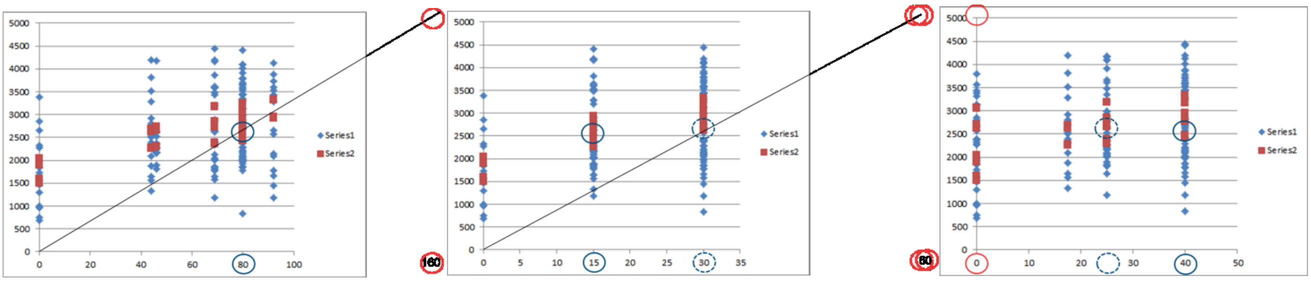


Figure 12. Pre-validated maize yield (Y axis; kg/ha) as measured (series 1; blue dots) and modelled in Tier 2 (series 2; red dots) in two selected trials in response to a). fertilizer N, b). fertilizer P and c). fertilizer K (x-axis; in kg/ha). The blue circles indicate the recommended fertilizer rate and the associated yield as reported and the red circles as calculated. The line indicates the linearity between the reported and the calculated recommendations, and yields, for N and P.

Quantitative accuracy assessments of the modelled crop responses to the various treatments, relative to the mesured crop responses, are preferably done for selected trials of comparable nature. Similarly for quantitative accuracy assessmens of the modelled fertilizer recommendations, relative to the reported fertilizer recommendations (and the newly derived recommendations). However, the latter accuracy assessments were done for all modeled recommendations relative to all reported recommendations as well as relative to all newly derived recommendations for all trial locations together and those validations are included in the validations of the gridded maps (see annex 6 for the validations).

3.2. Produce extrapolated covariate maps required to extrapolate fertilizer recommendations (activity 5 & deliverable)

The regional covariate maps compiled and used in Tier 3 in this study are listed in the file IFDC_Covariates_List_Final_adjusted.xlsx as given in the project folder (\IFDC_upscale\0_InputData\0_Covariates\) at the ISRIC ftp server. The covariate maps used in Tier 2 as input data for QUEFTS-R are available in \IFDC_upscale\0_InputData\0_InputData_QUEFTS\InputDataGrids4QUEFTS\.

3.2.1. Yield, attainable yield and yield gap estimates

The maps of yield estimates for West Africa extrapolated using machine learning are available at the ISRIC ftp server as well as the derived maps of yield gap estimates. Also given are the quantitative validation results and an overview of the relative importance, per model, of the various covariates.

Included in the project folder (\IFDC_upscale\0_InputData\0_TrialYieldData_Grids_Extrapolated) are:

\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Crop\
[YA (actual yield), YW (water-limited yield), YW_SD (water-limited yield minus standard deviation)]

\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Crop\
[ycontrol000 (measured control yield), ymx000 (measured maximum yield),
fRyld (calculated yield when fertilized according to the newly derived recommendation)]

\TIER2C_Grids_YieldGaps\Crop\

An example of yield estimates (kg/ha) extrapolated using an ensemble of machine learning algorithms is given in Figure 13. Shown are the extrapolation results for the attainable (water-limited) yield and the actual (water & nutrient-limited) yield for sorghum as at point locations by the GYGA project. The yield gap is the difference between the two maps.

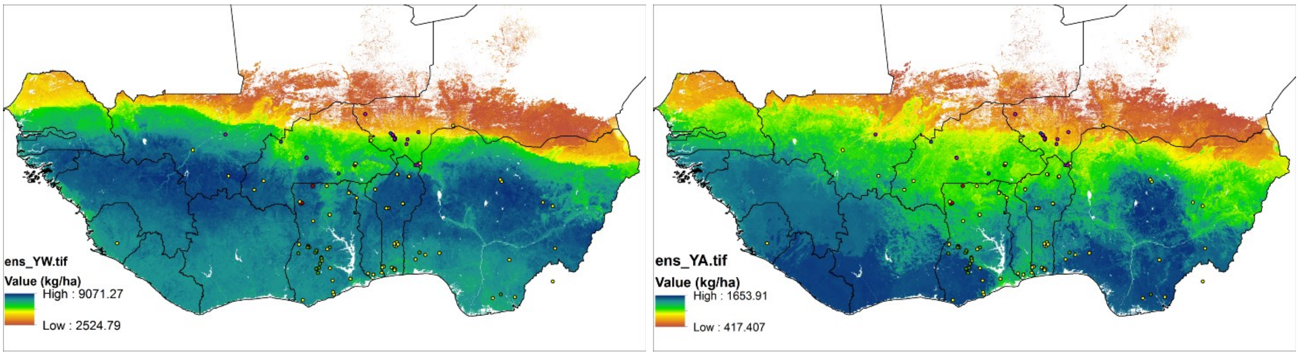


Figure 13. Yield levels (kg/ha) simulated at point locations by the GYGA project for soghum extrapolated by an ensemble of machine learning algorithms for a). water-limited yield and b). actual (water & nutrient-limited) yields

The validation results of the extrapolation, using machine learning, of the water-limited yield potentials simulated by the GYGA project are given in the project folder and summarized in Table 12 for four out of five crops.

Table 12. Validation of the extrapolation, using machine learning, of the water-limited yield potentials simulated by the GYGA project

CROP	RMSE	R^2
Millet	878	0.56
Sorghum	1073	0.71
Maize	2696	0.33
Rice	896	0.25
Cassava	-	-

The accuracy of the extrapolated maps seems quite reasonable. However, the major tendencies of the water-limited yields deviate considerably from the tendencies of the attainable yields depicted by the GAEZ maps of FAO. This deviation is mainly caused by the additional agro-climatic constraints considered and evaluated by the FAO, such as pests and diseases or defective yield formation, to downgrade the attainable yield levels. The rules are given by Fisher et al. (2012) and the resulting constraints for maize are visualised in Figure 14. It was decided to use the GAEZ maps of attainable yield instead of the GYGA maps of water-limited yield as input to define target yield. These maps are available in the project folder \IFDC_upscale\0_InputData\0_InputData_QUEFTS\InputDataGrids4QUEFTS.

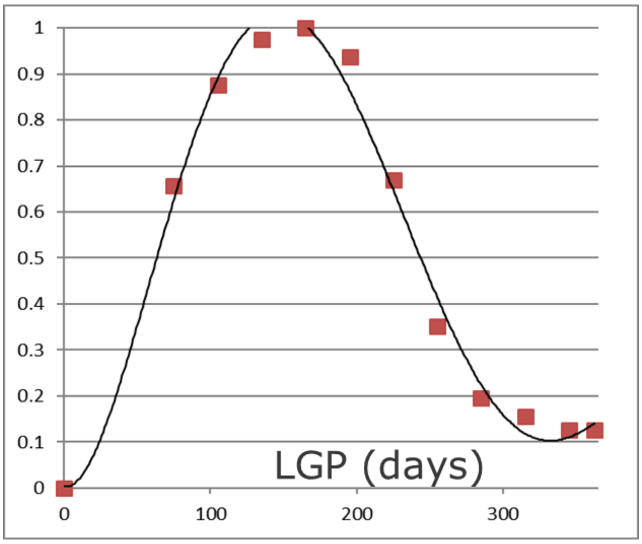


Figure 14. Impact of agro-climatic constraints on the attainable yield of maize, as evaluated by the GAEZ,

3.2.2. Crop variety, management parameters and weather

Covariate maps for variety, management and weather are captured indirectly and summarized through maps of agro-ecological zones (zones of length of growing period). The full stacks of covariate maps used, including those on weather and climate, are listed in the project folder.

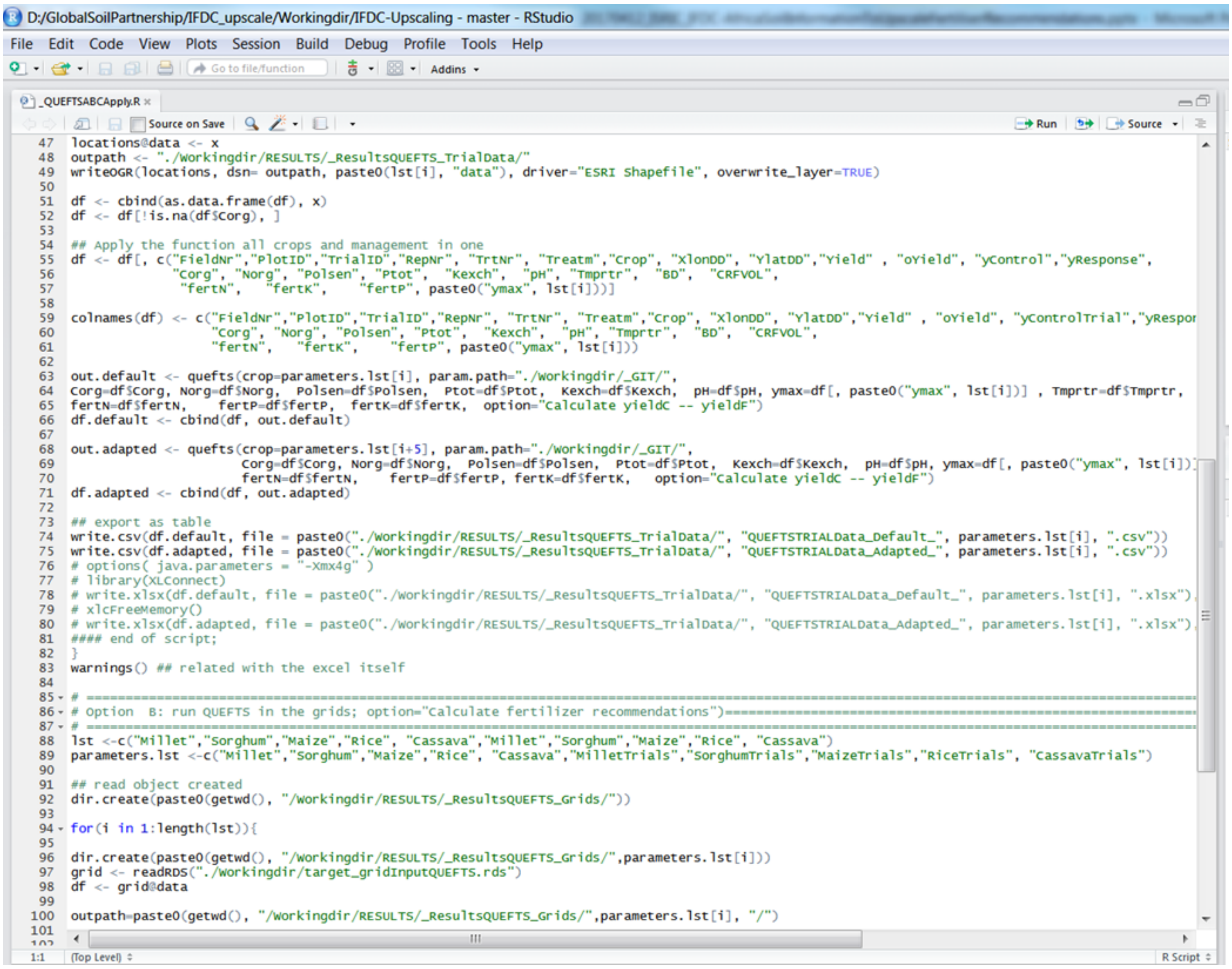
3.2.3. Soil

The soil property maps used in this study are included in the list of annex 13 and are available at the ISRIC ftp server in the project folder (\IFDC_upscale\0_InputData\0_InputData_QUEFTS\InputDataGrids4QUEFTS) .

3.3. Extrapolate fertilizer recommendations and validate extrapolation results (activity 6 & deliverable)

3.3.1. Tier 1, QUEFTS to calculate and map fertilizer recommendations

The QUEFTS model has been implemented in R as QUEFTS-R ABC, as is illustrated in Figure 15. The results of the model applied to the point locations of the fertilizer trials are available in the project folder \IFDC_upscale\1_ResultsPreValidation\TIER1__Points_QUEFTS\ in for each crop a separate csv file. The results of the model applied to the gridded input maps are available as gridded output maps in \IFDC_upscale\1_ResultsPreValidation\TIER1_Grids_QUEFTS\Crop\. The number of output maps (extrapolation results) produced for each crop is 57, including a map for each of the steps through the so-called quadrants modelled with QUEFTS-R ABC. The quantitative validation, or the accuracy assessed for a selected number of variables, is given by the file ValidationResults_07042017.xlsx in the project folder \IFDC_upscale\1_ResultsPreValidation\TIER1_Grids_QUEFTS\Validation\.



```r
locations@data <- x
outpath <- "./Workingdir/RESULTS/_ResultsQUEFTS_TrialData/"
writeOGR(locations, dsn= outpath, paste0(lst[i], "data"), driver="ESRI Shapefile", overwrite_layer=TRUE)

df <- cbind(as.data.frame(df), x)
df <- df[!is.na(df$Corg), ]

## Apply the function all crops and management in one
df <- df[, c("FieldNr","PlotID","TrialID","RepNr", "TrtNr", "Treatm","Crop", "XlonDD", "YlatDD","Yield" , "oYield", "yControl","yResponse",
             "Corg", "Norg", "Polsen", "Ptot",  "Kexch",  "pH", "Tmprtr",  "BD",  "CRFVOL",
              "fertN",   "fertK",    "fertP", paste0("ymax", lst[i]))]

colnames(df) <- c("FieldNr","PlotID","TrialID","RepNr", "TrtNr", "Treatm","Crop", "XlonDD", "YlatDD","Yield" , "oYield", "yControlTrial","yRespor
                  "Corg", "Norg", "Polsen", "Ptot",  "Kexch",  "pH", "Tmprtr",  "BD",  "CRFVOL",
                  "fertN",   "fertK",    "fertP", paste0("ymax", lst[i]))

out.default <- quefts(crop=parameters.lst[i], param.path="./Workingdir/_GIT/",
Corg=df$Corg, Norg=df$Norg,  Polsen=df$Polsen,  Ptot=df$Ptot,  Kexch=df$Kexch,  pH=df$pH, ymax=df[, paste0("ymax", lst[i])] , Tmprtr=df$Tmprtr,
fertN=df$fertN,    fertP=df$fertP,  fertK=df$fertK,  option="Calculate yieldC -- yieldF")
df.default <- cbind(df, out.default)

out.adapted <- quefts(crop=parameters.lst[i+5], param.path="./Workingdir/_GIT/",
                      Corg=df$Corg, Norg=df$Norg,  Polsen=df$Polsen,  Ptot=df$Ptot,  Kexch=df$Kexch,  pH=df$pH, ymax=df[, paste0("ymax", lst[i])
                      fertN=df$fertN,    fertP=df$fertP, fertK=df$fertK,   option="Calculate yieldC -- yieldF")
df.adapted <- cbind(df, out.adapted)

## export as table
write.csv(df.default, file = paste0("./Workingdir/RESULTS/_ResultsQUEFTS_TrialData/", "QUEFTSTRIALData_Default_", parameters.lst[i], ".csv"))
write.csv(df.adapted, file = paste0("./Workingdir/RESULTS/_ResultsQUEFTS_TrialData/", "QUEFTSTRIALData_Adapted_", parameters.lst[i], ".csv"))
# options( java.parameters = "-Xmx4g" )
# library(XLConnect)
# write.xlsx(df.default, file = paste0("./Workingdir/RESULTS/_ResultsQUEFTS_TrialData/", "QUEFTSTRIALData_Default_", parameters.lst[i], ".xlsx")
# xlcFreeMemory()
# write.xlsx(df.adapted, file = paste0("./Workingdir/RESULTS/_ResultsQUEFTS_TrialData/", "QUEFTSTRIALData_Adapted_", parameters.lst[i], ".xlsx")
#### end of script;
}
warnings() ## related with the excel itself

# ==========================================================================================================
# Option  B: run QUEFTS in the grids; option="Calculate fertilizer recommendations")=======================
# ==========================================================================================================
lst <-c("Millet","Sorghum","Maize","Rice", "Cassava","Millet","Sorghum","Maize","Rice", "Cassava")
parameters.lst <-c("Millet","Sorghum","Maize","Rice", "Cassava","MilletTrials","SorghumTrials","MaizeTrials","RiceTrials", "CassavaTrials")

## read object created
dir.create(paste0(getwd(), "/Workingdir/RESULTS/_ResultsQUEFTS_Grids/"))

for(i in 1:length(lst)){

dir.create(paste0(getwd(), "/Workingdir/RESULTS/_ResultsQUEFTS_Grids/",parameters.lst[i]))
grid <- readRDS("./Workingdir/target_gridInputQUEFTS.rds")
df <- grid@data

outpath=paste0(getwd(), "/Workingdir/RESULTS/_ResultsQUEFTS_Grids/",parameters.lst[i], "/")
```

Figure 15. Illustration of part of the implemented QUEFTSABC-R model

The implementation was tested as illustrated in Figure 16 where yields calculated using QUEFTS-R ABC were compared with the yields calculated using QUEFTS earlier implemented in Fortran for a scenario stretching from the Sahara to the coast. The degree of fit is near perfect, showing that the implementation was correct, but not fully similar apparently due to a minor difference in the parameter settings.

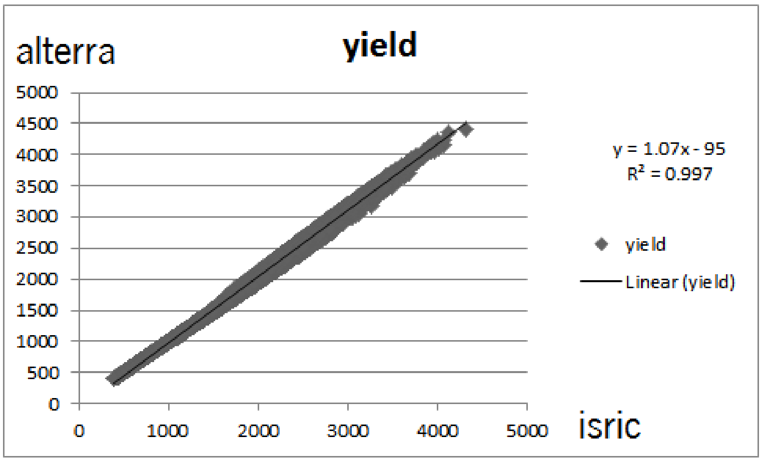


Figure 16. Yields calculated by ISRIC using QUEFTSABC-R compared with the yields calculated by Alterra using QUEFTS-Fortran

3.3.2. Tier 2, QUEFTS to calculate and map fertilizer recommendations parameterized with trial data

The results, both pre-validated and validated, of the QUEFTS-R ABC model applied to the point locations of the fertilizer trials are available in the project folder \IFDC_upscale\
\1_ResultsPreValidation\TIER2__Points_QUEFTS\ for each crop a separate csv file
\2_ResultsPostValidation\TIER2__Points_QUEFTS\ for each crop a separate csv file.

The results of the model applied to the gridded input maps are available as gridded output maps in the project folder \IFDC_upscale\
\1_ResultsPreValidation\TIER2_Grids_QUEFTS\CropTrials\
\2_ResultsPostValidation\TIER2_Grids_QUEFTS\CropT2\
The number of output maps produced for each crop is 62, including a map for each of the steps through the so-called quadrants modelled with QUEFTS-R ABC. The quantitative validation, or the accuracy assessed for a selected number of variables, is given by the file Tier2_GridsValidation.xlsx in the project folder \Y:\IFDC_upscale\2_ResultsPostValidation\TIER2_Grids_QUEFTS\Validation\.

3.3.2.1. Pre validation

The harvest index could be adjusted based on the trial data for each of the crops. The other crop parameters (nutrient uptake efficiencies [min, median, max] and nutrient use efficiencies [when diluted and when accumulated]) could be adjusted for only maize and rice. Data for the other crops were lacking. Table 13 shows the adjustments made for maize and rice, based on the trial data. Note the enormous decrease, from Tier 1 to Tier 2, of the P use efficiency of maize (aP and dP) and to a lesser extent for rice (dP). The physiological N and K use efficiencies remain near similar for maize and importantly improve for rice. The P and also K recovery fractions though improve for maize as well as rice both

The fertilizer P requirements, and thus the fertilizer P recommendations, in Tier 2 will be very high for maize relative to those for the other crops due to the relatively low P use efficiency.

Table 13. Crop parameters for maize and rice adjusted from Tier 1 (from literature) to Tier 2 (from the trial data).

LUT	CROP	aN	aP	aK	dN	dP	dK	rN	rP	rK	rfNmed	rfPmed	rfKmed
6	MaizeDefault	30	200	30	70	600	120				0.5	0.1	0.5)
3	MaizeT1	24	130	27.7	70	600	86				0.34	0.13	0.33
9	MaizeT2	25	45.8	25.3	63.8	386	83.4				0.34	0.21	0.67
4	RiceT1	36	155	18	80	850	86				0.4	0.1	0.28
10	RiceT2	54.9	133	47.3	127	506	153				0.23	0.13	0.43

Preceeding the modelling of the measured yield responses to fertilizer nutrients, and the associated fertilizer recommendations, as was visualized in Figure 12, we modelled the nutrient uptake in response to the fertilizer nutrient applications (the fertilizer treatments) using QUEFTS-R ABC and the adjusted crop parameters. Figure 17 visualizes the results (fertilizer nutrient uptake efficiencies) for two selected trials for maize. The measured uptakes show large ranges with masked but evident uptake efficiencies. The calculated uptakes show narrower ranges which fall within the measured ranges though, with the calculated P uptake efficiency being relatively high and the calculated K uptake effincy being relatively low compared to the measurements.

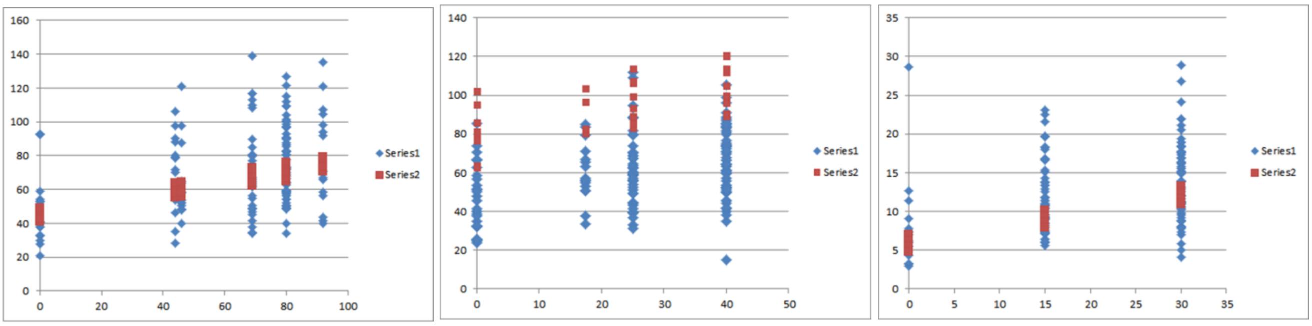


Figure 17. Nutrient uptake by maize (Y axis; kg/ha) in response to a). fertilizer N, b). fertilizer P and c). fertilizer K (x-axis; kg/ha) as measured (series 1; blue dots) and modelled (series 2; red dots) for two selected trials; visualising the soil- and fertilizer nutrient uptake efficiencies.

The measured effect of the nutrient uptakes on yield (physiological nutrient use efficiencies) was modelled using the adjusted parameters. The results for all fertilizer treatments, including the controls, of two selected trials for maize are visualised in Figure 18. Modelled use efficiencies are relatively high compared to the measurements for N and P and relatively low for K.

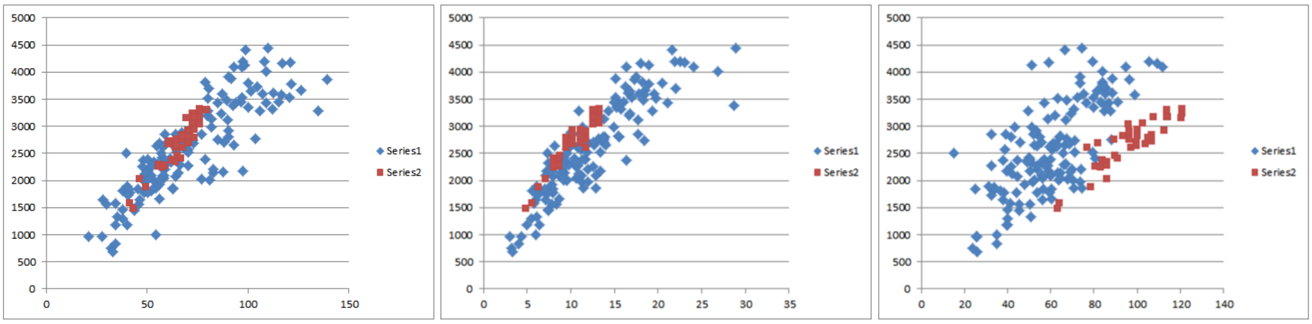


Figure 18. Yield of maize (Y axis; kg/ha) in response to a). N uptake, b). P uptake and c). K uptake (x-axis; kg/ha) as measured (series 1; blue dots) and modelled (series 2; red dots) for two selected trials; visualising the physiologic nutrient use efficiencies for all fertilizer treatments including the controls.

The measured and modelled physiological nutrient use efficiencies in unfertilized conditions are visualized in Figure 19. The measurements and calculations correspond well for P, less for N and least for K.

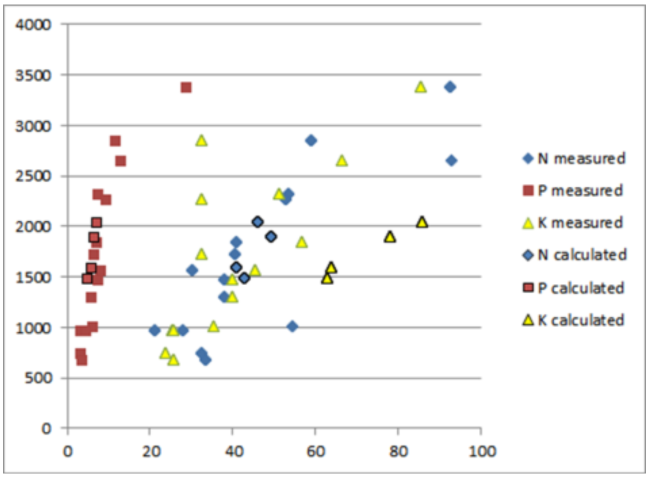
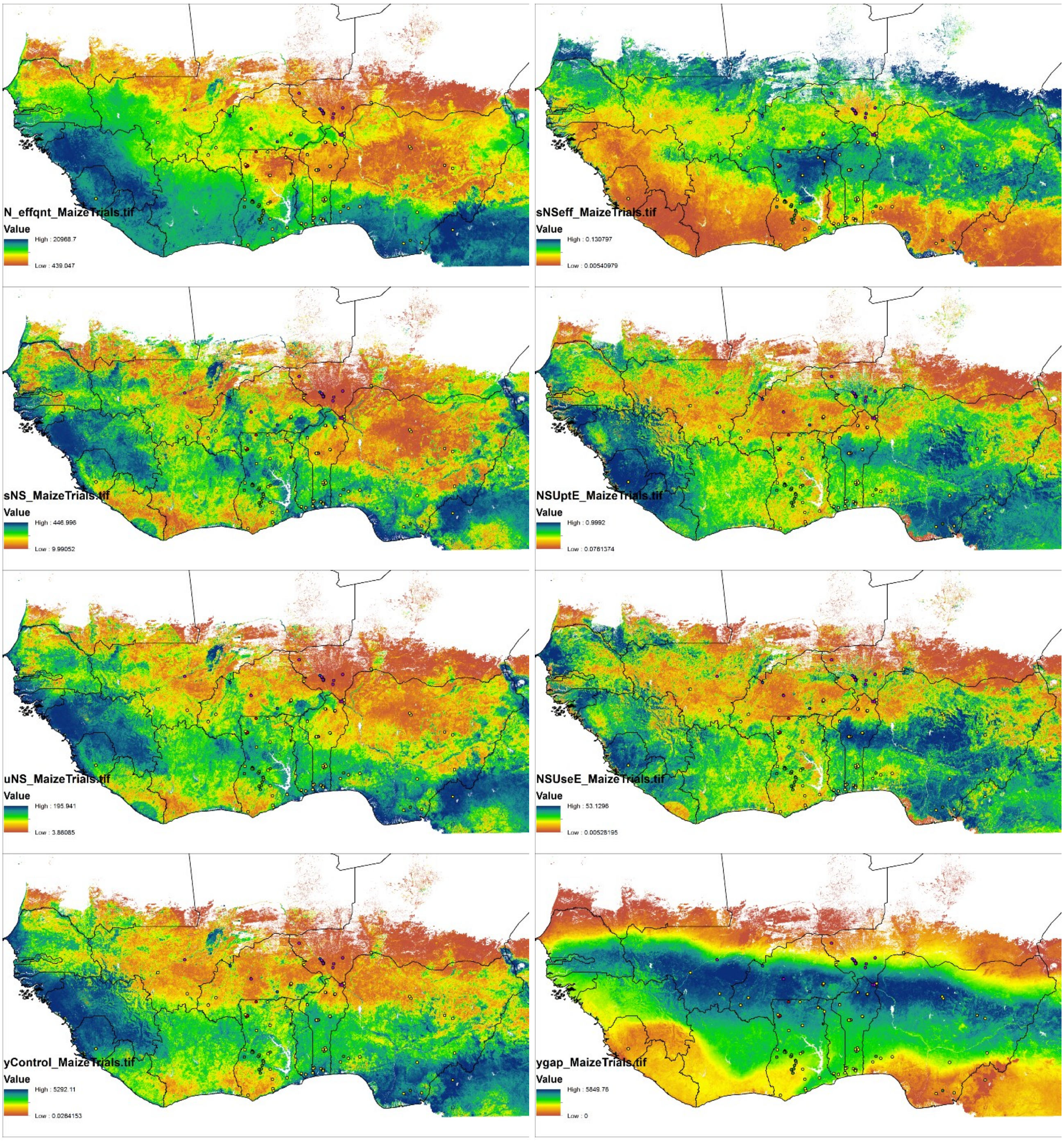


Figure 19. Control yield of maize (Y axis; kg/ha) in response to N base uptake (blue dots), P base uptake (red dots) and K base uptake (yellow dots) on the x-axes; kg/ha, as measured (dots) and modelled (outlined dots) for two selected trials; visualising the physiologic nutrient use efficiencies when unfertilized.

Following the application of the model at point locations, the model was applied to the gridded input maps for the ECOWAS region to calculate and map the nutrient efficiencies and yields etc. and the fertilizer nutrient recommendations. The results including accuracy assessments are available in the project folder at the ISRIC ftp server (\IFDC_upscale\1_ResultsPreValidation\). These results include all steps through the so-called quadrants that explain the soil- and fertilizer nutrient use efficiencies. Figure 20 a-p illustrates part of these pre-validated results at Tier 2 of QUEFTS-R ABC calculations for maize targeting at 80% of the yield attainable at medium management level, including:

a.	N_effqnt_MaizeTrials	Soil N content in absolute terms; effective quantity (kg/ha)
b.	sNSeff_MaizeTrials	Soil N supply efficiency (kg/kg)
c.	sNS_MaizeTrials	Soil N supply (kg/ha)
d.	NSUptE_MaizeTrials	Soil N uptake efficiency (kg/kg)
e.	uNS_MaizeTrials	Soil N uptake (kg/ha)
f.	NSUseE_MaizeTrials	Soil N use efficiency (kg/kg)
g.	yControl_MaizeTrials	Soil N(PK) control yield (kg/ha)
h.	yGap_MaizeTrials	Yield gap (kg/ha)
i.	NuReq_MaizeTrials	Target yield N demand (kg/ha)
j.	fNR_ MaizeTrials	Fertilizer N recommendation (kg/ha)
k.	fPR_ MaizeTrials	Fertilizer P recommendation (kg/ha)

l. fKR_ MaizeTrials — Fertilizer K recommendation (kg/ha)
m. NfertUE_MaizeTrials — Fertilizer N efficiency (kg/kg)
n. PfertUE_MaizeTrials — Fertilizer P efficiency (kg/kg)
o. KfertUE_MaizeTrials — Fertilizer K efficiency (kg/kg)
p. yFertilized_MaizeTrials — NPK fertilized yield (kg/ha)



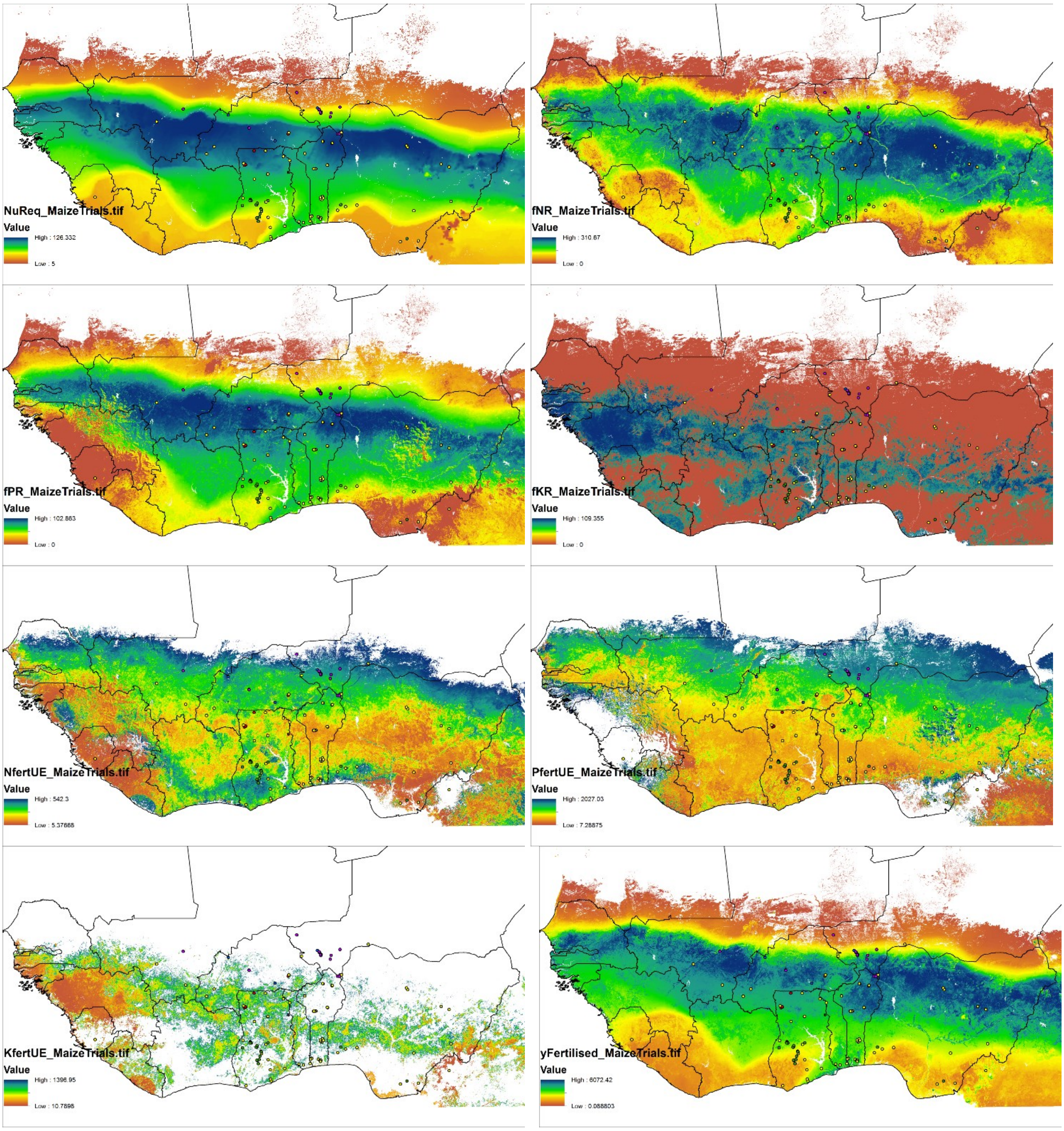


Figure 20. a-p. Pre-validated results of the unfertilized and fertilized soil-crop-response calculations for maize at Tier 2 extrapolated over the ECOWAS region.

Illustrated in Figure 21 are the pre-validated fertilizer N recommendations for maize, targeting at 80% of the yield attainable at medium management level, with the gridded data grouped into legend classes. Note the very high, pre-validated, maximum recommendations.

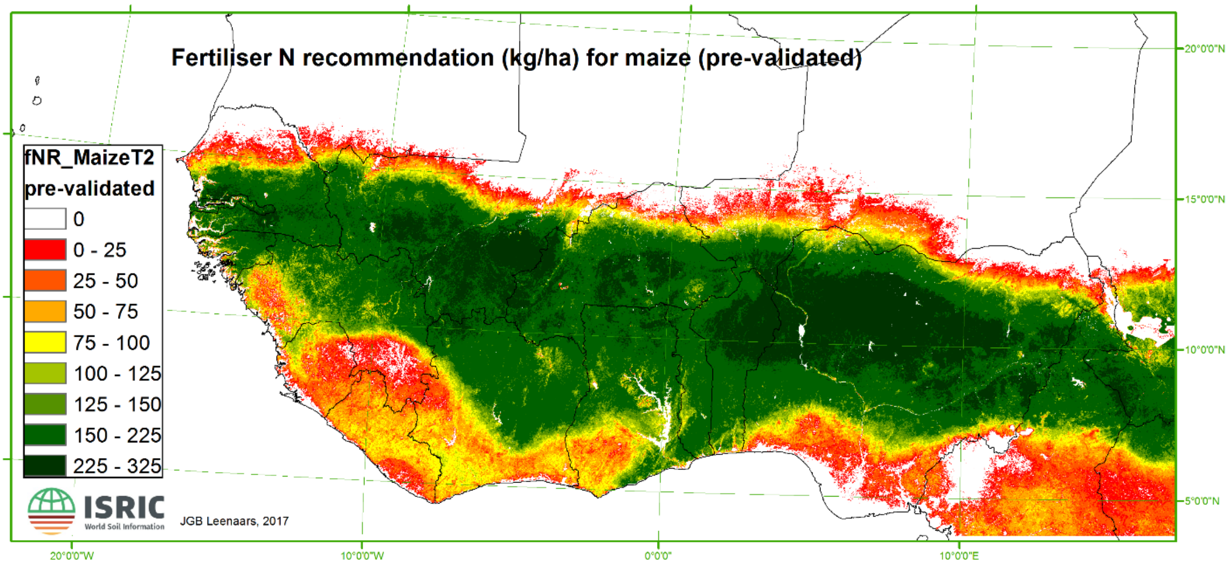


Figure 21. Pre-validated fertilizer N recommendations (kg/ha) for maize at Tier 2 extrapolated over the ECOWAS region.

3.3.2.2. Post validation

Following validation and adjustment of the target yield levels and parameter settings, the model was applied again to the gridded input maps for the ECOWAS region to calculate and map the nutrient efficiencies and yields etc. and the fertilizer nutrient recommendations. The results including accuracy assessments are available in the project folder at the ISRIC ftp server (\IFDC_upscale\2_ResultsPostValidation\TIER2_Grids_QUEFTS\CropT2\). The accuracy assessment is also given in annex 6 for a few selected variables (yControl000, fRyld, fNR, fPR, fKR, fNRec, fPRec, fKRec, NfertUE, PfertUE, KfertUE) including a description the variables.

Figures 22, 23 and 24 illustrate the resulting validated N, P and K recommendations for maize in the ECOWAS region, targeting at 55% of the yield attainable at medium management level. The validated recommendation are well below the pre-validated recommendations.

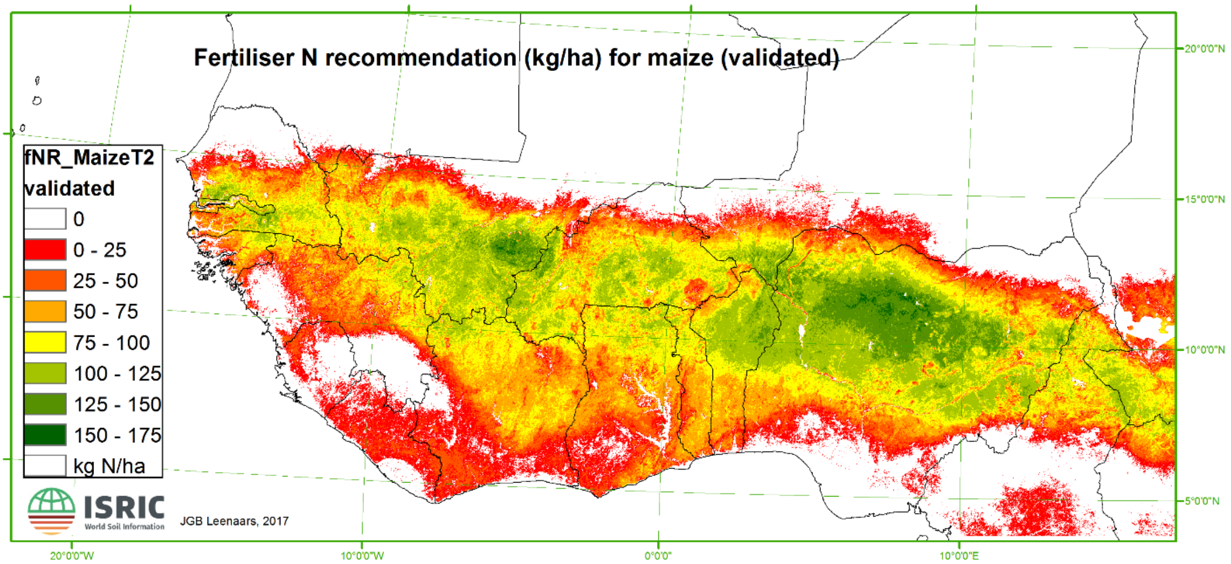


Figure 22. Validated fertilizer N recommendations (kg/ha) for maize at Tier 2 extrapolated over the ECOWAS region

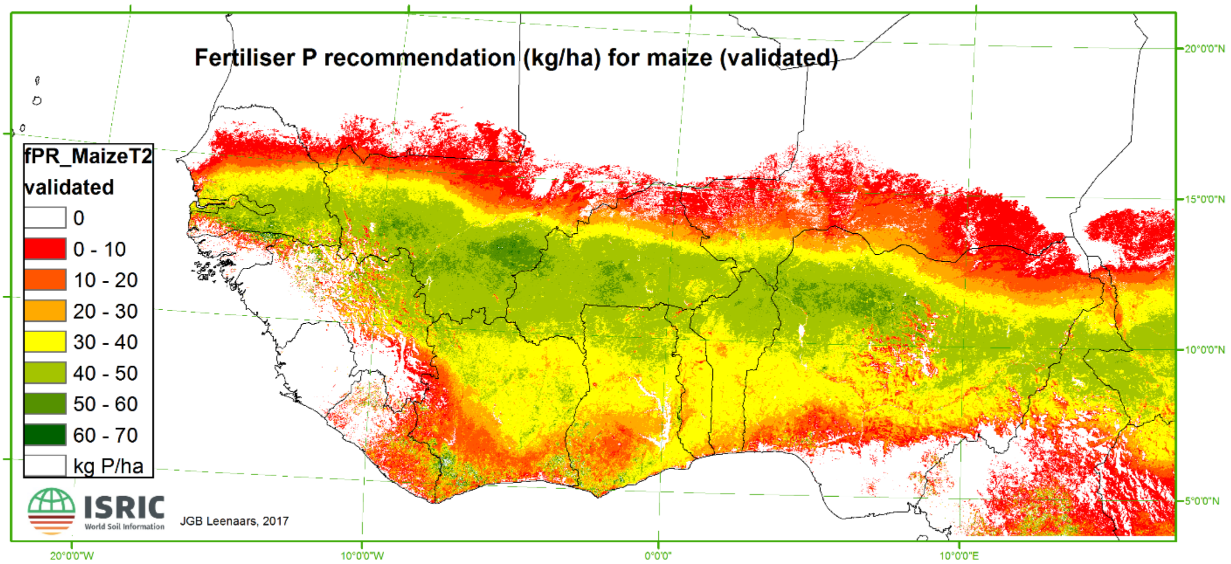


Figure 23. Validated fertilizer P recommendations (kg/ha) for maize at Tier 2 extrapolated over the ECOWAS region

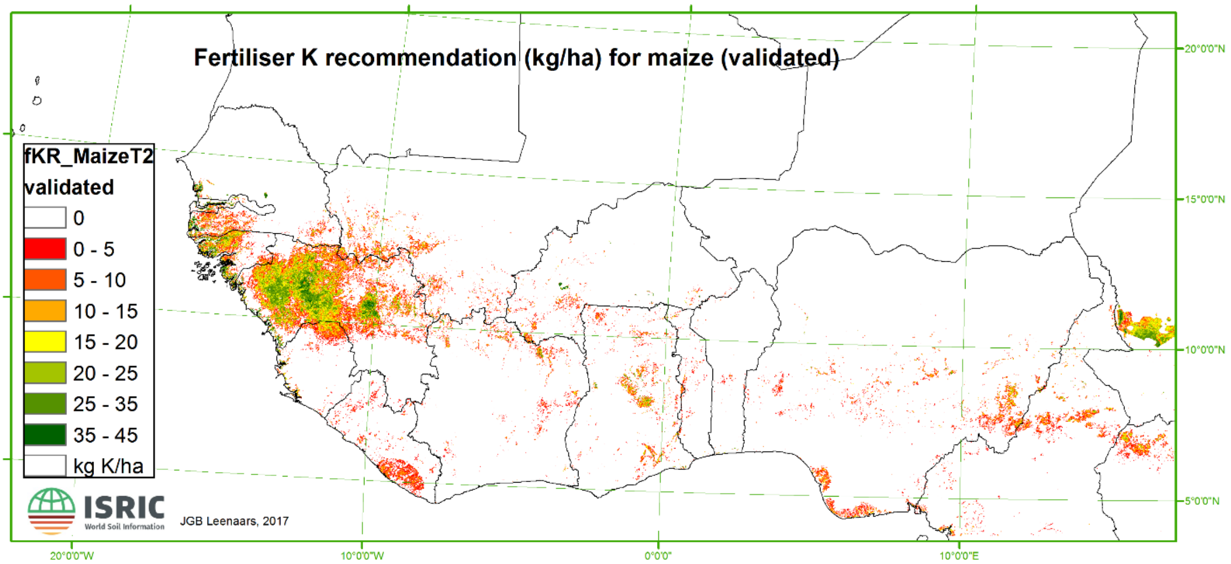


Figure 24. Validated fertilizer K recommendations (kg/ha) for maize at Tier 2 extrapolated over the ECOWAS region

The results including recommendations targeting, fractions of, attainable yield levels which have been downgraded as a function of rootable depth are not available in the project folder. This approach was tested only after the validated results were produced and requires additional fine tuning.

3.3.3. Tier 3, use of reported fertilizer recommendations to validate recommendations mapped in Tier 2 and to extrapolate using machine learning

3.3.3.1. Pre-validation

The fertilizer recommendations calculated and mapped in Tier 2 have been compared with the, reported and newly produced, fertilizer recommendations derived from the fertilizer trial data. This accuracy assessment (quantitative validation) is included in the assessment already reported in the above section and is included in the project folder \IFDC_upscale\
\1_ResultsPreValidation\TIER2_Grids_QUEFTS\Validation\.

The fertilizer recommendations at point locations, as reported and newly produced from the fertilizer trial data, were modelled and mapped using an ensemble of machine learning techniques. The resulting maps and the associated accuracy assessments are available in the project folder \IFDC_upscale\

\1_ResultsPreValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Crop\
\1_ResultsPreValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Validation\ValidationResults_07042017.xls

The fertilizer recommendations extrapolated in Tier 3 were inputted into QUEFTS-R ABC to calculate and map the corresponding yield responses, for which two target yield levels were tested. The results are available at \IFDC_upscale\

\1_ResultsPreValidation\TIER3_Grids_QUEFTS\QUEFTS3B1_Grids_ymaxGAEZ\
\1_ResultsPreValidation\TIER3_Grids_QUEFTS\QUEFTS3B1_Grids_ymaxTrials\
\1_ResultsPreValidation\TIER3_Grids_QUEFTS\Validation\ValidationResults_07042017.xlsx

3.3.3.2. Post-validation

The fertilizer recommendations calculated and mapped in Tier 2 have been compared with the, reported and newly produced, fertilizer recommendations derived from the fertilizer trial data. This accuracy assessment (quantitative validation) is included in the assessment already reported in the above section and is included in annex 6 and the project folder \IFDC_upscale\

\2_ResultsPostValidation\TIER2_Grids_QUEFTS\Validation\.

The fertilizer recommendations at point locations, as reported and newly produced from the fertilizer trial data, were modelled and mapped using an ensemble of machine learning techniques. The resulting maps and the associated accuracy assessments are available in the project folder \IFDC_upscale\

\2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Crop\
\2_ResultsPreValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Validation\ValidationResults_16062017.xls

The latter accuracy assessment is also given in annex 7 and includes fNR, fPR and fKR for maize and sorghum (fertilizer recommendations as reported and extrapolated) and fNRec, fPRec and fKRec for millet, sorghum, maize, cassava and rice (fertilizer recommendations as newly produced and extrapolated). Annex 9 gives the relative importances of the regional covariates in model fitting.

The fertilizer recommendations extrapolated in Tier 3 were inputted into QUEFTS-R ABC to calculate and map the corresponding yield responses. The results are available at \IFDC_upscale\

\2_ResultsPostValidation\TIER3_Grids_QUEFTS\CropT2\
\2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_GridsValidation.xlsx

The availability of time didn't permit to adequately evaluate the accuracies of each of the approaches, including test approaches, applied in Tiers 1, 2 and 3.

3.4. Define generic crop- and site-specific fertilizer recommendations (activity 7 & deliverable)

The availability of time didn't permit to adequately evaluate the accuracies of each of the approaches, including test approaches, applied in Tiers 1, 2 and 3. However, the results of Tier 2 are considered more accurate than the results of Tier 1 and the validated results produced after the validation workshop (fine-tuned following the adjustments suggested by the regional experts) more accurate as well as more appropriate than the pre-validated results produced before the validation workshop. The results of Tier 2 are also considered more accurate as well as more reliable and consistent than the results produced in Tier 3, including the extrapolated maps but also including the fertilizer recommendations themselves which were uniformly calculated in Tier 2 and not-uniformly reported in Tier 3. Tier 3 requires so-called big data, of adequate quantity, quality and nature, whereas the available dataset was limited in this respect and unsuitable for direct extrapolation. Consequently, the fertilizer recommendations calculated and mapped (extrapolated) in Tier 2 using QUEFTS, and validated with the STC during a validation meeting, are identified as the most accurate, appropriate, reliable and consistent input for defining generic crop- and site-specific fertilizer recommendations.

Above conclusion is confirmed by comparing the recommendations at Tier 2 and 3 when averaged per agro-ecological zone. This is shown in Table 14 which gives the recommendations for maize in Benin as averaged per AEZ. Distinguished are the recommendations as calculated and mapped in Tier 2 (fNPKR_T2), as reported and extrapolated in Tier 3 (fNPKR_T3) and as newly derived and extrapolated in Tier 3 (fNPKRec_T3). The results of Tier 2 show clear tendencies over the different AEZ's while the results of Tier 3 are near similar for each of the different AEZ's and lack site-specificity in that respect.

Table 14. Averages of the recommendations mapped in Tier 2 and 3 for maize in Benin aggregated by AEZ.

value	stat	BJ135	BJ165	BJ195	BJ225	BJ255	Description
fNR_MaizeT2	avg	94	103	106	65	40	Fertilizer N recommendation calculated & mapped in Tier 2
fPR_MaizeT2	avg	47	45	36	33	28	Fertilizer P recommendation calculated & mapped in Tier 2
fKR_MaizeT2	avg	0	0	0	0.1	0.1	Fertilizer K recommendation calculated & mapped in Tier 2
rf_fNR_MaizeT3	avg	83	83	82	82	82	Fertilizer N recommendation as reported & extrapolated in Tier 3
rf_fPR_MaizeT3	avg	26	28	27	23	20	Fertilizer P recommendation as reported & extrapolated in Tier 3
rf_fKR_MaizeT3	avg	32	33	31	24	26	Fertilizer K recommendation as reported & extrapolated in Tier 3
rf_fNRec_MaizeT3	avg	73	78	83	75	76	Fertilizer N recommendation as newly derived & extrapolated in Tier 3
rf_fPRec_MaizeT3	avg	25	26	27	24	23	Fertilizer P recommendation as newly derived & extrapolated in Tier 3
rf_fKRec_MaizeT3	avg	32	34	36	33	32	Fertilizer K recommendation as newly derived & extrapolated in Tier 3

The averaged recommendations for maize in Benin correspond rather well with the recommendations reported by Saidou et al. (2018) for locations in the BJ225 zone (210-240 days) and the BJ255 zone (240-270 days) corresponding with the South Sudanian zone and the Sudano-Guinean zone, respectively. Saidou et al. (2018) recommend 80-30-0 in BJ225 which is near equal to the average recommendation calculated and mapped in Tier 2 for that zone (tending to BJ195). To avoid K mining, Saidou et al. adjusted that recommendation to 80-30-25 which is close to the recommendations extrapolated in Tier 3 which is not surprising because the trials and reported recommendations of Saidou et al. were included in the compilation. Saidou et al. (2018) recommend 80-30-25 and 80-15-40 in BJ255 which is again close to the recommendations extrapolated in Tier 3 and indeed close his recommendation for BJ225. These recommendations are, except for P, well above those calculated and mapped in Tier 2 in that zone. The rates recommended in Tier 2 are for P near similar to those of Saidou et al. but for N only half and for K near zero. The low N rates recommended in Tier 2 for this very wet zone are the result of the maps selected for defining target yield which assume attainable yield levels which are importantly reduced relative to water-limited yield levels due to the negative impact of pests and diseases in this zone.

A selection of the results (soil nutrient supplies, yield gap, target yield, fertilizer nutrient recommendations) was aggregated by agro-ecological zone (AEZ) for each of the three target countries and each of the five crops. These aggregates at Tier 2 define the generic crop- and site-specific fertilizer nutrient recommendations, expressed by mean values and full probability distributions (cumulative distribution functions) including min, max, median and the median ±1 and ±2 standard deviations (0, 2.3, 15.9, 50, 84.1, 97.7 and 100 %). These cumulative distributions indicate the probability (%) that an indicated value exceeds all other values within the aggregated zone which quantifies the uncertainty that is associated with the generic recommendations and the associated targeted crop yield responses. Recommended are the fertilizer nutrient rates indicated at a probability of 50% (the median).

The aggregation by AEZ was done for the results of Tier 2, both pre-validated and validated, but also those of Tier 3. These aggregated results are available in the project folder \IFDC_upscale\

\1_ResultsPreValidation\TIER2_SummariesAEZ\
\1_ResultsPreValidation\TIER3_SummariesAEZ\
\2_ResultsPostValidation\TIER2_SummariesAEZ\
\2_ResultsPostValidation\TIER3_SummariesAEZ\.

The results are further compiled and explained in the following files:

\1_ResultsPreValidation\Z_SummaryOfSummaries\Summary_AEZ-Country.xlsx
\2_ResultsPostValidation\ To include: Z_SummaryOfSummaries\Summary_AEZ-Country.xlsx.

The selection of validated results of Tier 2 aggregated by AEZ, including the generic fertilizer nutrient recommendations and full probability distributions, is also given in annexes 10, 11 and 12 for Burkina Faso, Benin and Ghana, respectively. Annex 9 briefly explains the generic recommendations and the preceeding methodological steps and materials applied. Given as an example is Table 15 which indicates the mean values of the selected results of Tier 2 for maize in the AEZ's of Benin. Table 16 gives the full probability distributions of the fertilizer nutrient recommendations for maize in the AEZ's of Benin. Note the target yields which were defined based on the (near) mean of diluted and accumulated crop nutrient use efficiencies. These target yields may be exceeded, when applying the recommendations, reaching yield levels corresponding to diluted crop nutrient use efficiencies at similar nutrient uptake rates.

Table 15. Example of summary tables of the mean of selected results of Tier 2 for maize in Benin aggregated by AEZ.

value	stat	BJ135	BJ165	BJ195	BJ225	BJ255	Description
sNS_MaizeT2	avg	47	42	38	50	59	Soil N supply (kg/ha)
sPS_MaizeT2	avg	3.1	3.5	5.2	5.0	5.9	Soil P supply (kg/ha
sKS_MaizeT2	avg	111	113	109	84	93	Soil K supply (kg/ha
ygap_MaizeT2	avg	6346	6155	5533	5014	4538	Yield gap (kg/ha)
ytarget_MaizeT2	avg	4036	3983	3855	3583	3465	Target yield (kg/ha), at mean concentration
fNR_MaizeT2	avg	94	103	106	65	40	Fertilizer N recommendation (kg/ha)
fPR_MaizeT2	avg	47	45	36	33	28	Fertilizer P recommendation (kg/ha)
fKR_MaizeT2	avg	0	0	0	0.1	0.1	Fertilizer K recommendation (kg/ha)
n		13408	28371	37096	25340	10779	Number of 1 km^2 pixels (area)

Table 16. Example of summary tables of the probability distributions of selected results of Tier 2 for maize in Benin aggregated by AEZ.

value	Stat (%)	BJ135	BJ165	BJ195	BJ225	BJ255	Description
fNR_MaizeT2	0	0	0	10	0	0	Fertilizer N recommendation (kg/ha)
fNR_MaizeT2	2.3	49	45	76	12	0	Fertilizer N recommendation (kg/ha)
fNR_MaizeT2	15.9	69	76	94	53	14	Fertilizer N recommendation (kg/ha)
fNR_MaizeT2	**50**	**95**	**111**	**108**	**68**	**43**	Fertilizer N recommendation (kg/ha)
fNR_MaizeT2	84.1	120	123	118	80	62	Fertilizer N recommendation (kg/ha)
fNR_MaizeT2	97.7	134	131	127	94	74	Fertilizer N recommendation (kg/ha)
fNR_MaizeT2	100	153	146	141	113	92	Fertilizer N recommendation (kg/ha)
fPR_MaizeT2	0	33	9	6	5	0	Fertilizer P recommendation (kg/ha)
fPR_MaizeT2	2.3	40	37	26	22	15	Fertilizer P recommendation (kg/ha)
fPR_MaizeT2	15.9	45	41	33	31	24	Fertilizer P recommendation (kg/ha)
fPR_MaizeT2	**50**	**47**	**45**	**36**	**34**	**29**	Fertilizer P recommendation (kg/ha)
fPR_MaizeT2	84.1	49	48	41	35	32	Fertilizer P recommendation (kg/ha)
fPR_MaizeT2	97.7	50	50	44	37	35	Fertilizer P recommendation (kg/ha)
fPR_MaizeT2	100	54	54	52	45	44	Fertilizer P recommendation (kg/ha)
fKR_MaizeT2	0	0	0	0	0	0	Fertilizer K recommendation (kg/ha)
fKR_MaizeT2	2.3	0	0	0	0	0	Fertilizer K recommendation (kg/ha)
fKR_MaizeT2	15.9	0	0	0	0	0	Fertilizer K recommendation (kg/ha)
fKR_MaizeT2	**50**	**0**	**0**	**0**	**0**	**0**	Fertilizer K recommendation (kg/ha)
fKR_MaizeT2	84.1	0	0	0	0	0	Fertilizer K recommendation (kg/ha)
fKR_MaizeT2	97.7	0	0	0	0	0	Fertilizer K recommendation (kg/ha)
fKR_MaizeT2	100	13	22	21	37	42	Fertilizer K recommendation (kg/ha)
n		13408	28371	37096	25340	10779	Number of 1 km^2 pixels (area)

An example of the probability distributions of the results aggregated by AEZ is given in Figure 25 illustrating the cumulative probabilities (0-100%) of the fertilizer N recommendations (kg/ha) for maize in each AEZ in Benin. The AEZ's in Benin are labeled as BJ135, BJ165, BJ195, BJ225 and BJ255 representing the AEZ's with a length of growing period (LGP) of 120-150, 150-180, 180-210, 210-240 and 240-270 days, respectively. The generic recommendations are defined for each AEZ at a probability of 50 % (median) and are labeled within the graphs. The highest fertilizer N rates are recommended for maize for the AEZ's with LGP of 150-210 days (BJ165 and BJ195). The recommendations in the zones with shorter LGP are lower due to smaller yield gaps as a result of lower attainable yield due to water-limitation and in the zones with longer LGP lower due to smaller yield gaps as a result of lower attainable yield due to pests and diseases.

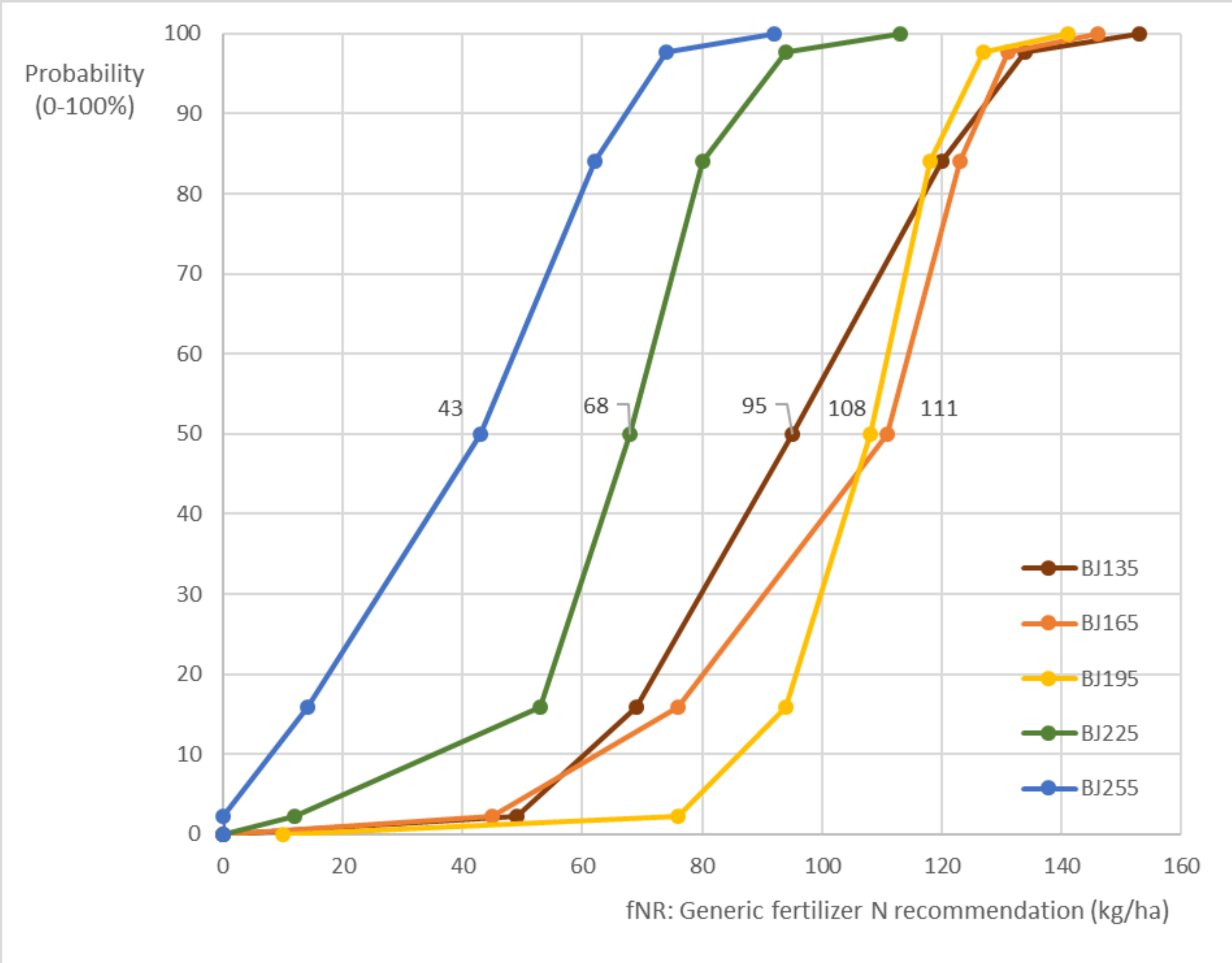


Figure 25. Cumulative probability distributions (0-100%) of the fertilizer N recommendations (kg/ha) for maize in each AEZ in Benin. The generic recommendations are defined at a probability of 50% (median).

An example of the generic crop- and site-specific fertilizer nutrient recommendations is visualized in the form of a map in Figure 26. The map shows the fertilizer N recommendations for maize corresponding with the medians (50%) of the recommendations aggregated by the AEZ's of Benin, Burkina Faso and Ghana.

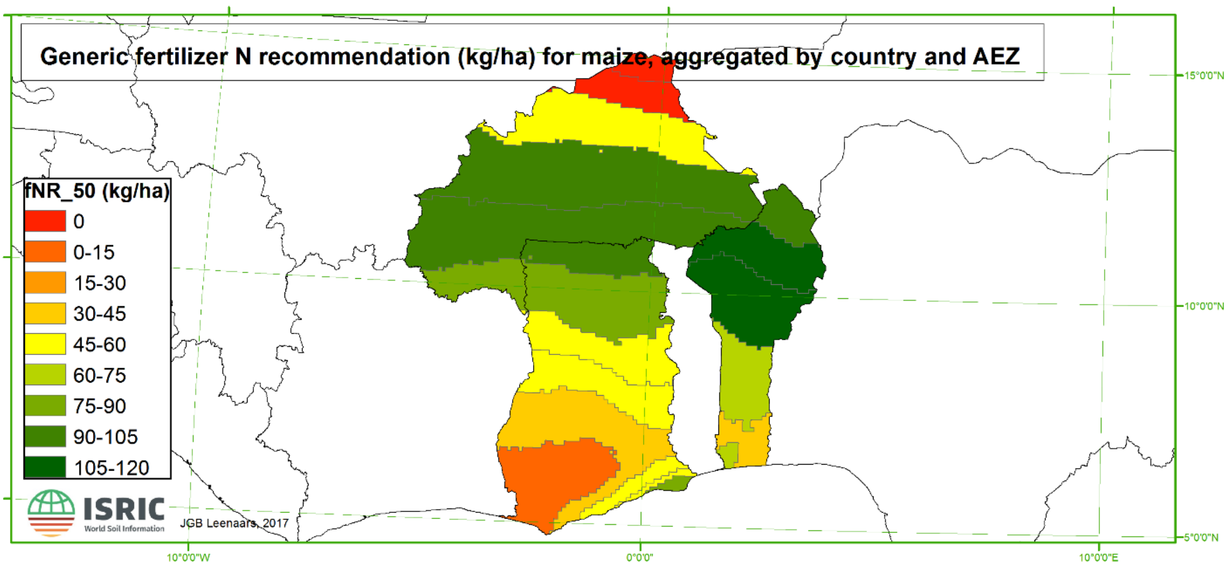


Figure 26. Example map of generic crop- and site-specific fertilizer nutrient recommendations aggregated by country and AEZ

The fertilizer nutrient recommendations aggregated and summarized by country and AEZ for each of the crops are also visualized online at isric.org. These webpages present the data for five crops summarized in the form of Table 16 and Figures 25 and 26.

3.5. Discuss and validate findings with regional experts of the STC (activity 8 & deliverable)

A validation meeting with the STC was held in June 2017. During this meeting, the approach and results were discussed and validated and the proof of concept was approved. It was recognised that no data from FerWam had been shared with the project and that the data which had been made available were inadequate for extrapolation purposes. Emphasis was put on discussing the approach adopted in Tier 2 using QUEFTS-R. Target yield levels and few parameters were fine-tuned together with the regional experts and as specified in a previous section after which the post validation results have been produced.

3.6.Report about the findings of the proof of concept project including data, methods, results and conclusions (activity 9 & deliverable)

A draft version of the final report has been prepared as a deliverable and submitted to IFDC in June 2017. The current report is the 2nd draft version of the final project report. It is highly recommended to condense this report into e.g. a brief report or a paper, based on a selection of the approaches applied, according to a straight forward structure which follows the workflow of the selected approach. Such brief will be more easily to read and understand.

The work has been condensed in an abstract twice, submitted and presented at the Wageningen Soil Conference (2017) and the Ethiopia Soil Science Society conference (2018).

3.7. Propose a pragmatic mechanism for collecting, sharing and processing of data required for all crops, AEZ's and countries targeted for further upscaling to the whole West African region (activity 10)

The mechanism applied for the purpose of this study was inadequate and resulted in inadequate data on fertilizer recommendations from fertilizer trials. Also the FeRWAM mechanism, for which few results were presented towards the end of the project, proved not transparent and far from adequate and at least inadequate to provide this study with the necessary data of adequate quantity, quality and nature.

ISRIC hosts the Global Soil Data Facility for the Global Soil Partnership and developed in that role a mechanism, which is in process of being implemented, for collecting, sharing and processing of soil data. That mechanism could serve as a model for the mechanism here required. The database model developed by ISRIC, upon the demand of IFDC, to compile fertilizer trial data could facilitate this mechanism.

4. Discussion and conclusions

This report describes the materials & methods tested and used to extrapolate fertilizer nutrient recommendations for major crops in West Africa and presents the results according to the ToR's. The fertilizer recommendations reported from fertilizer trial data proved to be of a quantity, quality and nature that didn't suit direct extrapolation. Even though we have produced direct extrapolations of those recommendations (in Tier 3) using an ensemble of machine learning techniques, we have focused on developing an alternative approach to model and map (extrapolate) fertilizer nutrient recommendations (Tier 1) which we tested and applied to produce the aimed for results (Tier 2).

We assessed the accuracy of each of the results from each of the approaches. These accuracies seem limited which may be due to incorrect model assumptions or parameter settings and/or ground truth data of limited quantity, quality and nature. Certainly, the reported fertilizer recommendations have been derived from the fertilizer trial data by a number of persons using different criteria. Moreover, the fertilizer trials themselves were of highly heterogeneous quantity, quality and nature. Therefore we conclude that the model assumptions and parameter settings were adequate and not cause of the apparent limited accuracy. Nevertheless, the approaches developed and applied in this study serve as a proof of concept and can be further improved, including improvements in the modelling framework (modules, assumptions and parameter settings as well as the model input data) and the ground truth data (quantity, quality and nature of fertilizer trials data).

The crop- and site-specific fertilizer recommendations were spatially aggregated for three countries according to agro-ecological zones (AEZ) and these generic recommendations were expressed by probability distributions to quantify the uncertainties of the recommendations and the associated crop responses. These recommendations, including the generic recommendations, are listed in full for Burkina Faso, Benin and Ghana in annex 10, 11 and 12, respectively, and are preceeded by a summary in annex 9 of these results including the basic methodological steps applied in Tier 2 and 3.

The uncertainties reported for each AEZ are basically a function of mainly the spatial variability of the soil nutrient contents within an AEZ. However, the trial data show that this uncertainty, and response in general, is predominantly determined by the spatial and temporal variability of the size of the nutrient gap (deficiency) as governed by water supply. This latter variability is insuffiently well reflected in the maps used for defining the target yields and is insufficiently well modelled with QUEFTS. The framework is therefore preferably further improved by spatio-temporal modelling of the nutrient gap to better estimate and map fertilizer nutrient use efficiencies, and fertilizer nutrient recommendations, and the associated uncertainties. New collaborative developments are underway, as a follow up to this study, and the suggested additional modules have been integrated into the framework indeed. Moreover, some of the modules have been improved importantly using data from well designed nutrient omission trials.

This study provides proof of concept and an operational framework for progressive and collaborative updating and upscaling of fertilizer recommendations across the region, adding value to additional adequate soil-crop-response data, using techniques based on both agronomic and artificial intelligence.

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Acronyms

AfSIS	Africa Soil Information Service project (BMGF)
BF	Burkina Faso
BJ	Benin
BMGF	Bill and Melinda Gates Foundation
C4CP	Cotton Partnership Program (USAID)
ECOWAS	Economic Community of West African States
FAO	Food and Agriculture Organization of the United Nations
FeRWAM	Fertilizer Recommendations for West Africa Map
GAEZ	Global Agro Ecological Zones
GH	Ghana
GYGA	Global Yield Gap Atlas project (BMGF)
IFDC	International Fertilizer Development Center
ISRIC	International Soil Reference and Information Centre
LGP	Length of Growing Period
NAR	National Agricultural Research
NPK	Nitrogen, phosphorus, potassium
NRM	Natural Resource Management
QUEFTS	Quantitative Evaluation of the Fertility of Tropical Soils
RMSE	Root Mean Square Error
STC	Scientific and Technical Committee
USAID	United States Agency for International Development
WAFP	West Africa Fertilizer Program (USAID)

Annexes

Annex 1. Terms of Reference

No.	Terms of Reference	Activity	Deliverable
1	Compile georeferenced site and crop-specific fertilizer recommendations (at xy-point locations), as made readily available by IFDC, and review applicability *> Site specific data (fertilizer recommendations at point locations and related fertilizer trials) as made readily available by IFDC compiled and applicability reviewed*	Y	Y
2	Evaluate the fertilizer recommendations, based on the fertilizer trials data (at xy-point locations and incl. soil data) as made readily available by IFDC	Y	-
3	Fine-tune the evaluation (2) and crop parameterization, for modeling, together with IFDC agronomist	Y	-
4	Model the fertilizer recommendations based on the fertilizer trials data (at xy point locations), using QUEFTS and attainable target yield data, and validate results	Y	-
5	Produce extrapolated covariate maps required to extrapolate fertilizer recommendations, including attainable yield and yield gap estimates, crop variety and management parameters, weather and soil including QUEFTS variables (pH, organic carbon, exchangeable K and available P) and rootable depth. *> Maps of yield gap, where possible, and of soil pH, organic C, exchangeable K, available P for the pilot countries (to be used as covariates for extrapolation)*	Y	Y
6	Extrapolate fertilizer recommendations and validate extrapolation results *> Fertilizer recommendations for the pilot countries extrapolated, and extrapolation results validated;*	Y	Y
7	Define generic crop and site-specific fertilizer recommendations *> Generic crop and site specific fertilizer recommendations defined for Benin, Ghana and Burkina, validated and mapped;*	Y	Y
8	Discuss and validate findings with regional experts (includes 5 days of international travel expert) *> Meeting with regional experts in West Africa to discuss findings of the extrapolation exercise;*	Y	Y
9	Report about the findings of the proof of concept project including data, methods, results and conclusions *> Report on proof of concept findings for fertilizer recommendation extrapolation, including data, methods, results and conclusions;*	Y	Y
10	Propose a pragmatic mechanism for collecting, sharing and processing of data required for all crops, AEZ's and countries targeted for upscaling recommendation to the whole West African Region *> Mechanism proposed for collecting, sharing and processing of data required for upscaling recommendations to different crops, agroecological zones and target countries.*	Y	-

Annex 2. Work plan

Start by January 23, 2017

TIER 1

Get R-Quefts operational and tested; DONE

1. Study Quefts literature and R-Quefts script
2. Adjust R-Quefts to meet project specific goals (expand R-QUEFTS with simple top-up model to R-QUEFTSABC to calculate control yield (A), NPK fertilizer recommendations from target yield (B) and fertilised yield (C) whereby fertilizer rate is either as calculated in B or as externally defined)
3. Define R-Queftsabc input data, parameters and output data
4. Verify input data conversion-factors
5. Prepare gridded maps of input data for AoI (see annex) including conversions
6. Define test area and prepare input data for sharing with WER (gridded input data including pixel ID converted to ascii files)
7. Prepare parameters, including defaults
8. Get R-Queftsabc running for test area with prepared input data and parameters
9. Verify test results
10. Verify script, including formulae, and fine tune further towards project specific goals (to facilitate both default and adjusted runs)
11. Define scenario for second test (both default plus recommendations), do second test and compare results with WER results
12. Evaluate comparison and possibly correct errors
13. Reset formulae and parameters for project purposes (attention to rf definition)

Produce yield gap maps by interpolation (LOWER PRIORITY; we'll do this later)

14. Prepare GYGA point data (see annex) of crop specific YW, YW-sd and YA.
15. Prepare covariates of AoI (see annex)
16. Prepare extrapolation model
17. Newly produce gridded maps of max yields (YW) and actual yields (YA) by interpolation of GYGA points. Produce yield gap maps (YW minus YA)
18. Multiply YW and YA maps with LGP-based AEZ factors (0-1), and possibly merge (average) results of YW (and of YW-sd) with GAEZ-intermed grids and of YA with GAEZ-low grids, after first having looked at the interpolation results, and produce yield gap maps (YW aez minus YA aez)

Collect and compile fertilizer trial point data. DONE

19. Prepare and share template for consultants to compile data under a common standard
20. Monitor and guide compilation; put emphasis on the need for timely results, explicit recommendations on a common basis and georeferencing (of individual plots or aggregated plots)
21. In the meanwhile study and add other available fertilizer trial data (OFRA, CIAT Ag-Trials). DONE
22. Arrange and understand compiled data

Run R-QueftsABC on trial data for 5 crops using default parameters and settings. DONE

23. Run R-QUEFTSabc for point locations. Read soil data and ymax from grids, and fertilizer application rates from table (different fertN, fertP, fertK rates per location), produce tabled results for all output variables added to the input table (same field ID)
24. Compare calculated yields with measured yields (fertilised and control yields), calculated recommendations (fNR, fPR, fKR) with measured (derived) recommendations (fNR, fPR, fKR, fNRec, fPRec, fKRec) and calculated NPK fertilizer efficiencies with measured efficiencies (NfertUE, PfertUE, KfertUE)

Run R-QueftsABC on gridded data for AoI and 5 crops as Tier 1 deliverable => DONE

25. Use GAEZ-intermed maps as ymax
26. Produce tabled R-Quefts results for all output variables and gridded results for yControl, yFertilised, fNR, fPR, fKR, NfertUE, PfertUE, KfertUE.
27. Validate calculated fNR, fPR, fKR with measured trial data on fNR, fPR, fKR (from consultants) and fNRec, fPRec, fKRec (from highest efficiencies).

TIER 2

Adjust parameters. DONE

28. Interpret trial data and derive crop parameters from measurements (a, d, HI, rfNmed, rfPmed, rfKmed) and derive, for each trial, yield levels (yControl000, ymx000, fRyld), recommendations based on efficiencies (fNRec, fPRec, fKRec) and efficiencies (recNfertUE, recPfertUE, recKfertUE). DONE.
29. Adjust crop LandUse parameters based on above interpretation (MilletTrials, etc). DONE

Run R-QueftsABC on trial data for 5 crops using adjusted parameters and default ymax settings. => DONE

30. Run R-QUEFTSabc for point locations again. Read soil data and ymax from grids, and fertilizer application rates from table (different fertN, fertP, fertK rates per location), produce tabled results for all output variables added to the input table (same field ID)
31. Compare calculated yields with measured yields (fertilised and control yields), calculated recommendations (fNR, fPR, fKR) with measured (derived) recommendations (fNR, fPR, fKR, fNRec, fPRec, fKRec) and calculated NPK fertilizer efficiencies with measured efficiencies (NfertUE, PfertUE, KfertUE)

Run R-QueftsABC on gridded data for AoI and 5 crops as Tier 2 default deliverable. => DONE

32. Use GAEZ-intermed maps as ymax
33. Produce tabled R-Quefts results for all output variables and gridded results for yControl, yFertilised, fNR, fPR, fKR, NfertUE, PfertUE, KfertUE.
34. Validate calculated fNR, fPR, fKR with measured trial data on fNR, fPR, fKR (from consultants) and fNRec, fPRec, fKRec (from highest efficiencies), with RMSE, R2 etc. and XY graphs.

Interpolate trial data to adjust ymax settings for QueftsABC and for yield gap => DONE

35. Prepare point data (ymx000 and fRyld and also ycontrol000)
36. Prepare covariates (see annex and earlier discussions)
37. Prepare extrapolation model
38. Produce gridded maps ymax and yrec and also ycontrol (calculate yield gap (GAEZ minus ycontrol) = deliverable)
39. Validate

Run R-QueftsABC on gridded data for AoI and 5 crops as Tier 2b deliverables, using adjusted parameters and settings => DONE

40. Use interpolated map of ymx000 as ymax for QueftsABC and assess fNR, fPR and fKR recommended to meet target yield derived from ymax
41. Produce tabled R-Quefts results for all output variables and gridded results for yControl, yFertilised, fNR, fPR, fKR, NfertUE, PfertUE, KfertUE.
42. Validate calculated fNR, fPR, fKR with measured trial data on fNR, fPR, fKR (from consultants) and fNRec, fPRec, fKRec (from highest efficiencies), with RMSE, R2 etc. and XY graphs.

43. Use interpolated map of fRyld (yrec) as ymax for QueftsABC to assess fNR, fPR and fKR recommended to meet target yield derived from fRyld (at ytargetratio = 1.0) at highest efficiencies
44. Produce tabled R-Quefts results for all output variables and gridded results for yControl, yFertilised, fNR, fPR, fKR, NfertUE, PfertUE, KfertUE.

45. Validate calculated fNR, fPR, fKR with measured trial data on fNR, fPR, fKR (from consultants) and fNRec, fPRec, fKRec (from highest efficiencies), with RMSE, R2 etc. and XY graphs.

TIER 3

Produce interpolated maps from trial data of key deliverables (fNR, fPR, fKR) => DONE important

46. Prepare point data (fNRec, fPRec, fKRec); note that point data for fNR, fPR, fKR are too few to use.
47. Prepare covariates (see annex and earlier discussions)
48. Add to covariates: newly produced grids of yield gap
49. Add to covariates: gridded Quefts outputs (of tier2) of fNR, fPR, fKR, yFertilised
50. Prepare extrapolation model
51. Produce gridded maps of fNRec, fPRec, fKRec
52. Validate with measured (derived) recommendations

Run R-QueftsABC on gridded data for AoI and 5 crops as Tier 3 deliverable => DONE

53. Use map of GAEZ as ymax for QueftsABC
54. Use interpolated map of fNRec, fPRec, fKRec of as input of fertN, fertP, fertK (reach target efficiencies)
55. Produce tabled R-Quefts results for all output variables and gridded results for yControl, yFertilised, fNR, fPR, fKR, NfertUE, PfertUE, KfertUE.
56. Validate yControl, yFertilised, fNR, fPR, fKR, NfertUE, PfertUE, KfertUE with measured trial data on yControl000, fRyld, fNRec, fPRec, fKRec, recNfertUE, recPfertUE, recKfertUE with RMSE, R2 etc. and XY graphs.
57. For sorghum, for a situation (tier 2 or tier 3) to be decided, produce tiffs for all Quefts output variables **=> DONE**

Translate maps into generic maps. => DONE

58. Produce AEZ's (zones) based on LGP (steps of 30 days; < 60, 60-90, 90-120,..)
59. Generalise recommendations to averages per AEZ

Ready for use by March 31, 2017

LATER

Validate with regional experts & present at regional forum

60. Prepare data
61. Prepare presentation
62. Present
63. Discuss and identify issues to be improved and updated

Propose a data sharing mechanism

64. Propose a data sharing mechanism for future ECOWAS partners concerning fertilizer trial data & recommendations

Compile final results

65. Resolve issues and update results
66. Prepare accessible data
67. Prepare report

Annex 3. Summary attached to the ToR's of IFDC's fertilizer recommendation related activities and datasets

Country	Crop	Methods	Sites	Recommendations explicitly included	Supportive data				Made available
					Thesis	Report /Publication	Maps	Database /others	
Burkina Faso									
	Maize	DSSAT Field trials	- Eastern Burkina Faso - Western Burkina Faso	- ?	- Thesis1 - Thesis 2	- Publication 7 - Publication 8	- Map 5	- Database 1 - Database 2 - Database 3 - Database 4 - Database 5	- No
	Maize	NOT, QUEFTS	- Comoe - Gourma - Poni - Fada	- ?		- Publication 7 - Publication 8 - Publication 9	- Map 5	- Database 6 - Database 7	- No
	Rice	NOT, QUEFTS	- Irrigated sites, Sourou	- ?	- Thesis 8			- Database 10	- No
	Sorghum	DSSAT	- Gourma, BF - Comoe - Saria - Zondoma	- ?		- Publication 8 - Publication 9	- Map 6	- Database 12	- No
	Sorghum	NOT, QUEFTS	- Gourma, BF - Comoe - Saria - Zondoma - Fada - Gourcy	- ?		- Publication 8	- Map 6 - Map 7 - Map 8	- Database 6 - Database 8 - Database 12	- No
	Cotton		- Sud Ouest Burkina Faso	- ?		- Publication 8 - Publication 9		- Database 12	- No
	Cotton	NOT, QUEFTS	- Gourma	- ?		- Publication 8		- Database 7 - Database 12	- No
Benin									
	Maize	NOT, QUEFTS	- Dassa - Dogbo - Allada - Save - Bembereke - Kandi - Djougou	- ?	- Thesis 3 - Thesis 5 - Thesis 6		- Map 3	- Database 14	- No
	Maize	DSSAT	- Dassa - Dogbo - Allada - Tanguieta - Banikoara - Bembereke	- ?	- Thesis 7		- Map 1	- Database 13	- No
	Cassava	GSSAT QUEFTS	- Northern Benin	- ?		- Publication 11			- No
Ghana				- ?					
	Cassava	NOT, QUEFTS	- Kumasi - Nyankpala - Gbanlahi - Savelugu	- ?		- Publication 3		- Database 16	- No
	Maize	DSSAT	- North Eastern Ghana	- ?		- Publication 15			- No

Country	Crop	Methods	Sites	Recommendations explicitly included	Supportive data				Made available
					Thesis	Report /Publication	Maps	Database /others	
						- Publication 16			
	Rice	NOT, QUEFTS		- ?		- Publication 15			- No
	Cocoa	Diagnostic Sol	- Cocoa regions of Ghana	- ?		- Publication 10		- Database 15	- No
Togo									
	Maize	NOT, QUEFTS	- Southern Togo	- ?		- Publication 4			- No
	Cassava	NOT, QUEFTS	- Davié - Gbavé - Tekpo - Sevekpota	- ?		- Publication 3 - Publication 4			- No
Nigeria									
	Rice (upland)	NOT, QUEFTS	- Northern Nigeria	- ?		- Publication 4			- No

* NOT= Nutrient Omission Trials

** DSSAT= Decision Support System for Agrotechnology Transfer

*** QUEFTS= Quantitative Evaluation of Fertility of Tropical Soils

**** GSSAT= a GIS integrated to the DSSAT

1-Fertilizer recommendation related theses

1- Agba Pascaline. 2012. Détermination des options de fertilisation organo-minerale et de densité de semis pour une intensification de la production du maïs dans la région de l'Est du Burkina Faso. Mémoire de Masters, Université Polytechnique de Bobo Dioulasso.
2- Bambara Franck, 2012. Optimisation de la fertilisation azotée du maïs en culture pluviale dans l'Ouest du Burkina Faso: Utilisation du modèle agronomique DSSAT. Mémoire d'Ingénieur du Développement Rural. Université Polytechnique de Bobo Dioulasso.
3- Danwanon Hervé François. 2011. Date de semis et formule d'engrais pour une meilleure productivité du maïs (*Zea mays* L.) sur sol ferralitique de la commune d'Allada au Sud du Benin. Mémoire d'Ingénieur Agronome. Université d'Abomey Calavi.
4- Ezui Guillaume. 2010. Optimisation de l'utilisation dans engrais dans les systèmes de culture à base de manioc (*Manihot esculenta* Crantz) sur terres de barre au Togo. Mémoire de DEA, Université de Lome.
5- Balogoun Ibouraiman. 2011. Validation des formules d'engrais et des dates de semis recommandées par le modèle DSSAT pour la production de maïs (*Zea mays* L.) au Bénin. Mémoire de DEA. Université d'Abomey Calavi.
6- Koudjo Gauthier O.B.2011. Date de semis et formule d'engrais pour une meilleure productivité du maïs (*Zea mays* L.) sur sol ferralitique de la commune de Dogbo au Sud du Benin. Mémoire d'Ingénieur Agronome. Université d'Abomey Calavi.
7- Oga A. Codjo.2012. Date de semis et formule d'engrais pour une meilleure productivité du maïs (*Zea mays* L.) sur sols ferrugineux tropicaux au Centre du Benin. Mémoire d'Ingenieur Agronome. Université de Parakou.
8- Siri Adama, 2012. Détermination de la capacité nutritive des sols en riziculture irriguée dans les périmètres de la vallée du Sourou : approche par les essais soustractifs, et utilisation du modèle QUEFTS-WS pour la formulation des options de fertilisations. Mémoire Ingénieur du Développement Rural. Université Polytechnique de Bobo Dioulasso.
9- Yougbare Hadaogo. 2008. Evaluation de la fertilité des terres aménagées en cordons pierreux, demi -lunes et zaï dans le bassin versant de Zondoma. Mémoire Ingénieur du Développement Rural. Université Polytechnique de Bobo Dioulasso.

2-Fertilizer recommendation related publications

1- Balogoun I., et al. 2013. Determination des formules d'engrais et des périodes de semis pour une meilleure production du maïs (*Zea mays* L.) au Sud et au Centre du Benin. Bulletin de Recherche Agronomique du Benin. Numéro spécial Fertilité du maïs. Janvier 2013.
2- Chude V.O., Olayiwola, S.O., Osho, A.O., Daudu, C.K. 2012. Fertilizer use and management practices for crops in Nigeria. 4th Edition. Federal Fertilizer Department, Federal Ministry of Agriculture and Rural Development, Abuja.
3- Ezui K.S. et al, 2016. Fertilizer requirements for balanced nutrition of cassava across eight locations in West Africa. Field Crops Research 185:69-78
4- IFDC, 2010. Combatting Soil Fertility Decline to Implement Small holder agriculture intensification in sub-Saharan Africa. IFAD project report.
5- IFDC, 2011. An emergency initiative to boost rice production in Ghana, Mali, Nigeria and Senegal. End-of-project report.
6- IFDC, 2011. Updating fertilizer recommendations for cereals in West Africa. SAADA report 2011.
7- IFDC, 2011-2013. Fertilizer recommendation validation in Burkina Faso
8- IFDC, 2011. Mise à jour des recommandations au Burkina Faso, Rapport technique.
9- IFDC, 2011. Fertilizer recommendation options for validation
10- IFDC, 2012. Improving fertilizer recommendation for sustainable cocoa production in Ghana
11- IFDC, 2013. Mainstreaming Pro-Poor fertilizer access and innovative practices in West Africa. IFAD project report.
12- IFDC, 2014. Report to Gates Foundation on Fertilizer Recommendations for Selected Sub-Saharan Countries.
13- Igue, A.M. et al. 2013. Application et adaptation de l'approche intégrée DSSAT-SIG à la formulation des doses d'engrais pour la culture du maïs au Sud et Centre du Benin. Bulletin de Recherche Agronomique du Benin. Numéro spécial Fertilité du maïs. Janvier 2013.
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15- SRI, 2008. Fertilizer update and recommendation trials. SRI Technical Report no 283.
16- Tetteh F.M; A.R. Nurudeen, 2015. Modeling site-specific fertilizer recommendation for maize production in the Sudan Savannah agro-ecology of Ghana. African Journal of Agricultural Research. DOI: 10.5897/2013.

3-Maps and posters

1- Mise à jour des recommandations de doses d'engrais pour la production de la variété du maïs SYN 2000 à Bembèrèkè au nord-est du Bénin (Igue et al.)
2- Document Technique d'Information: Mise à jour des recommandations des formules d'engrais pour la production de la variété de maïs EVDT 97 au Nord-Bénin (Igue et al.**)**
3- Mise à jour des recommandations pour la production du maïs au Benin (Ezui et al)
4- Carte des options Gourma et Comoé, Burkina Faso
5- Mise à jour des recommandations d'engrais pour la production du maïs au Burkina Faso (Youl et al)
6- Carte de recommandations de doses d'engrais et de dates de semis du sorgho Sariasso 11 dans le bassin versant de Zondoma au Burkina Faso (Ezui)
7- Système intégré de recommandations d'engrais au Burkina Faso (Pare et al.)
8- Maize yield prediction in Burkina Faso (Paul Wilkens et al.)

4-Fertilizer recommendation databases

1- Base de données de sols pour les recommandations au Burkina Faso
2- Base de données climatiques pour les recommandations au Burkina Faso
3- Base de données des cultures (coton, maïs, sorgho, mil) pour les simulations DSSAT
4- Base de données des recommandations d'engrais 2010-2011 au Burkina Faso
5- Base de données IDSS pour le Burkina Faso
6- Base de données essais soustractifs Fada
7- Base de données essais soustractifs Gourma
8- Base de données essais soustractifs Gourcy
9- Base de données essais soustractifs Sud-Ouest du Burkina Faso
10- Base de données essais soustractifs sur le riz (Bandaogo)
11- Données climatiques et caractérisation de sols au Nord Togo, année 2000
12- Soil and plant analytical data for Bobo Dioulasso, Fada and Gourcy
13- Base de données validation 2011-2012, Benin
14- Base de données essais soustractifs 2012-2013 Benin
15- Data base cocoa fertilizer recommendation in Ghana
16- Data base for cassava fertilizer recommendation trials in Ghana

Annex 4. Compilation of fertilizer trial data including fertilizer nutrient recommendations; data sources

Source ID	Author	Year	Title	Journal	Publisher
0001	Saïdou A., Balogoun I., Ahoton E.L., Igué A.M., Youl S., Ezui G., Mando A.	Sub-mitted	Fertilizer recommendations for maize production in the South Sudan and Sudano-guinean zones of Benin	Nutrient Cycling in Agroecosystems (special issue)	SPRINGER
0002	Igué A.M., Oga C.A., Balogoun I., Saïdou A., Ezui G., Youl S., Kpagbin G., Mando A., Sogbedji M.J.	2016	Détermination des formules d'engrais minéraux et organiques sur deux types de sol pour une meilleure productivité de maïs (*Zea mays* l.) dans la commune de Banikoara (Nord-Est du Bénin).	European Scientific Journal Vol 12 N°30: 362-377.	European Scientific Institute
0003	Igue A.M., Oga C.A., Saïdou A., Balogoun I., Anago F., Ezui G., Youl S., Kpagbin G., Mando A. and SOgbedji M.J.	2015	Updating fertilizer formulation for maize (Zea mays L.) cultivation on Ferric Luvisols and Gleysols in the municipality of Tanguiéta, North-West Benin.	Global Advanced Research Journal of Agricultural Science. 4(12) : 858-863.	Global Advanced Journals Ltd
0004	S. Youl, J. Ouedraogo, G. Ezui et A. Mando	2013	Mise à jour des recommandations d'engrais, Burkina Faso	N/A	IFDC, Ouagadougou, BF
0005	ABGA/KIMA Téné Pascaline	2013	Détermination des options de fertilisation organo-minérale et de densité de semis pour une intensification de la production du maïs dans la région de l'Est du Burkina Faso	N/A	Institut du Développement Rural, Université Polytechnique, Bobo, BF
0006	OUEDRAOGO Rodrigue	2013	Validation des doses d'engrais recommandées pour une intensification de la production du sorgho dans le plateau central du Burkina Faso	N/A	Institut du Développement Rural, Université Polytechnique, Bobo, BF
0007	SIRI Adama	2015	Optimisation de la fertilisation minérale et la rentabilité économique de la production de riz irrigué dans la vallée du Sourou (Burkina Faso)	N/A	Institut du Développement Rural, Université Polytechnique, Bobo, BF
0008	Is ref 0004?	2012	Is ref 0004?	N/A	IFDC, Ouagadougou, BF
0009	Logah	2006	N/A	PhD Thesis	Kwame Nkrumah University of Science and Technology, Kumasi, GH
0010	Tetteh et al.	2015	SRI OFRA Technical Report 2015	N/A	Soil Research Institute, Kumasi, GH
0011	Tetteh et al.	2016	SRI OFRA Technical Report 2016	N/A	Soil Research Institute, Kumasi, GH
0012	Fosu et al.	2006	Modeling maize response to mineral fertilizer on silty clay loam in the Northern Savannah zone of Ghana using DSSAT (In) J. Kihara et al.(eds.) Improving Soil Fertility Recommendation in Africa	N/A	N/A
0013	N/A	N/A	SRI Data	N/A	Soil Research Institute, Kumasi, GH
0014	Tetteh et al.	2015	Modeling site specific fertilizer recommendations for maize production in the Sudan savannah agro-ecology of Ghana.	African Journal of Agricultural Research. 10 (11):1136-1158	N/A
0015	Atakora et al.	2014	Response of maize growth and development to mineral fertilizer and soil characteristics in Northern Ghana.	International Journal of Advanced Agricultural Research. 2 (2014) 67-76	N/A
0016	Nurudeen A. R. et al.	2015	Improving maize yield on Ferric Lixisol by NPK fertilizer use.	Journal of Agricultural Science 7 12:233-237	N/A
0017	Adeyinka O.O.	2015	Optimizing site specific fertilizer recommendation for maize in the transition zone of Ghana.	PhD Thesis	Kwame Nkrumah University of Science and Technology, Kumasi, GH
0018	Tetteh et al.	2008	Fertilizer update and recommendation trials.	Technical Report 283, p33.	Soil Research Institute, Kumasi, GH
0019	Evans Owusu Boateng	2013	N/A	MSc Thesis	Kwame Nkrumah University of Science and Technology, Kumasi, GH
0020	Evans Owusu Boateng	2014	N/A	MSc Thesis	Kwame Nkrumah University of Science and Technology, Kumasi, GH
0021	Evans Owusu Boateng	2015	N/A	MSc Thesis	Kwame Nkrumah University of Science and Technology, Kumasi, GH
0022	OFRA	N/A	N/A	N/A	OFRA
0023	OFRA	2014	Compilation	N/A	OFRA

Annex 5. Metadata of the compilation of fertilizer trial data and recommendations, incl. derived calculations and QUEFTS calculations; description of the column headings

Column heading	Domain	Description of the trial
FieldNr	Trial compiled	ID of the individual field (treatment)
PlotID	Trial compiled	ID of the individual plot (repetitions)
TrialID	Trial compiled	ID of the individual trial
RepNr	Trial compiled	Repetition number
TrtNr	Trial compiled	Treatment number
Treatm	Trial compiled	Treatment (NPK)
Partner	Trial compiled	Partner name, contributing to the compilation
SourceID	Trial compiled	ID of the data source
SourceRef	Trial compiled	Reference to the data source
Site-aez	Trial compiled	Site, Agroecological zone (descriptive)
LGP--days-	Trial compiled	Site, Length of Growing Period (in days)
Site-country	Trial compiled	Site, country name
Site-municipality	Trial compiled	Site, municipality name
Site-village	Trial compiled	Site, village name
Site-farmer	Trial compiled	Site, farmer name
GPS-ID	Trial compiled	ID of the GPS
oX	Trial compiled	Longitude, original (not standardised)
oY	Trial compiled	Latitude, original (not standardised)
EW	Trial compiled	Either east (1) or west (-1)
deg	Trial compiled	Longitude, degrees
min	Trial compiled	Longitude, minutes
sec	Trial compiled	Longitude, seconds
NS	Trial compiled	Either north (1) or south (-1)
deg-1	Trial compiled	Latitude, degrees
min-1	Trial compiled	Latitude, minutes
sec-1	Trial compiled	Latitude, seconds
XY-accuracy	Trial compiled	Accuracy of the lat-lon coordinates
Georef-system	Trial compiled	Geographic system (datum); WGS84
Altitude	Trial compiled	Altitude (m above sealevel)
Landscape-position	Trial compiled	Position in the landscape
Soil-type	Trial compiled	Soil type
SoilOC_gpkg	Trial compiled	Measured soil organic carbon (g/kg)
SoilTN_gpkg	Trial compiled	Measured soil total nitrogen (g/kg)
SoilAvP_mgpkg	Trial compiled	Measured soil available phosphorus (mg/kg)
SoilAvPMeth	Trial compiled	Method applied to measured soil available phosphorus
SoilExK_Mmolcpkg	Trial compiled	Measured soil exchangeable potassium (mmolc/kg)
SoilpHH2O	Trial compiled	Measured soil pH-in H2O (g/kg)
Soil-property-abc	Trial compiled	Measured soil micronutrient (unknown)
NA-	Trial compiled	N/A
Trial-type	Trial compiled	Trial type (e.g. NOT, validation)
Crop	Trial compiled	Crop name
Crop-variety	Trial compiled	Crop variety name
Year	Trial compiled	Year
Season	Trial compiled	Season (descriptive)
Date-sowing	Trial compiled	Date of sowing (calendar)
Date-harvest	Trial compiled	Date of harvest (calendar)
Days	Trial compiled	Growing days
Rain-in-season--mm	Trial compiled	Rain during growing season (mm)
Descr	Trial compiled	Description of the trial
MgtCategory	Trial compiled	Management (categoric description)
Fertiliser-type	Trial compiled	Fertiliser types applied
ManureYN	Trial compiled	Manure used yes (1) or no (0)
fertN	Trial compiled	Fertilizer N rate applied (kg/ha)
fertP	Trial compiled	Fertilizer P rate applied (kg/ha)
fertK	Trial compiled	Fertilizer K rate applied (kg/ha)
Treatm-abc--kg-ha	Trial compiled	Indicates if treatment includes other fertilizer nutrients
Straw	Trial compiled	Measured straw (kg/ha)
oStraw	Trial compiled	Measured straw (kg/ha) original (not standardised)
Yield	Trial compiled	Measured yield (kg/ha)
oYield	Trial compiled	Measured yield (kg/ha) original (not standardised)
yControl000	Trial calculated	Calculated yield at the control treatment (kg/ha)
yControl	Trial calculated	Calculated yield at the control treatment (kg/ha), repeated for all treatments in the trial
yResponse	Trial calculated	Calculated yield response (kg/ha)
yrecnpk	Trial calculated	Calculated yield at the treatment corresponding with the reported fertilizer recommendation (kg/ha)
yrec000	Trial calculated	Calculated yield at the treatment corresponding with the reported fertilizer recommendation (kg/ha), reorganised in the column
yrec	Trial calculated	Calculated yield at the treatment corresponding with the reported fertilizer recommendation (kg/ha), repeated for all treatments in the trial
ymx000	Trial calculated	Calculated maximum yield in the trial (kg/ha)

Column heading	Domain	Description of the trial
ymx	Trial calculated	Calculated maximum yield in the trial (kg/ha)+C96
NinStraw	Trial compiled	Measured N content in the straw (%)
NinYield	Trial compiled	Measured N content in the yield (%)
PinStraw	Trial compiled	Measured P content in the straw (%)
PinYield	Trial compiled	Measured P content in the yield (%)
KinStraw	Trial compiled	Measured K content in the straw (%)
KinYield	Trial compiled	Measured K content in the yield (%)
Weight1000gr--g	Trial compiled	Measured weight of 1000 grains (g)
fNR	Trial compiled	Interpreted fertilizer N recommendation (kg/ha), reported for the trial
fPR	Trial compiled	Interpreted fertilizer P recommendation (kg/ha), reported for the trial
fKR	Trial compiled	Interpreted fertilizer K recommendation (kg/ha), reported for the trial
ofNR	Trial compiled	Interpreted fertilizer N recommendation (kg/ha), reported for the trial, original (not standardised)
ofPR	Trial compiled	Interpreted fertilizer P recommendation (kg/ha), reported for the trial, original (not standardised)
Biomass	Trial calculated	Calculated biomass, straw plus yield (kg/ha)
HI	Trial calculated	Calculated harvest index
uN	Trial calculated	Uptake N from fertilisers and the soil (kg/ha)
uP	Trial calculated	Uptake P from fertilisers and the soil (kg/ha)
uK	Trial calculated	Uptake K from fertilisers and the soil (kg/ha)
uNS	Trial calculated	Uptake N from the soil (kg/ha)
uPS	Trial calculated	Uptake P from the soil (kg/ha)
uKS	Trial calculated	Uptake K from the soil (kg/ha)
rfNu	Trial calculated	Uptake efficiency (recovery fraction) of the fertiliser N (kg/kg)
rfPu	Trial calculated	Uptake efficiency (recovery fraction) of the fertiliser P (kg/kg)
rfKu	Trial calculated	Uptake efficiency (recovery fraction) of the fertiliser K (kg/kg)
NUseE	Trial calculated	Physiologic N use efficiency (kg yield / kg N uptake)
PUseE	Trial calculated	Physiologic P use efficiency (kg yield / kg P uptake)
KUseE	Trial calculated	Physiologic K use efficiency (kg yield / kg K uptake)
NfertUE	Trial calculated	Fertiliser N use efficiency (kg yield / kg fertiliser N applied)
PfertUE	Trial calculated	Fertiliser P use efficiency (kg yield / kg fertiliser P applied)
KfertUE	Trial calculated	Fertiliser K use efficiency (kg yield / kg fertiliser K applied)
mxNfertUE	Trial calculated	Derived maximum fertiliser N use efficiency in the trial (kg/kg), reorganised in the column
mxPfertUE	Trial calculated	Derived maximum fertiliser P use efficiency in the trial (kg/kg), reorganised in the column
mxKfertUE	Trial calculated	Derived maximum fertiliser K use efficiency in the trial (kg/kg), reorganised in the column
mxNfertUE-1	Trial calculated	Derived maximum fertiliser N use efficiency in the trial (kg/kg), repeated for all treatments in the trial
mxPfertUE-1	Trial calculated	Derived maximum fertiliser P use efficiency in the trial (kg/kg), repeated for all treatments in the trial
mxKfertUE-1	Trial calculated	Derived maximum fertiliser K use efficiency in the trial (kg/kg), repeated for all treatments in the trial
selectNfertUE	Trial calculated	Selected maximum fertiliser N use efficiencies in the trial (kg/kg)
selectPfertUE	Trial calculated	Selected maximum fertiliser P use efficiencies in the trial (kg/kg)
selectKfertUE	Trial calculated	Selected maximum fertiliser K use efficiencies in the trial (kg/kg)
selectfNRec	Trial calculated	Selected treatments with maximum fertiliser N use efficiencies in the trial (kg/ha)
selectfPRec	Trial calculated	Selected treatments with maximum fertiliser P use efficiencies in the trial (kg/ha)
selectfKRec	Trial calculated	Selected treatments with maximum fertiliser K use efficiencies in the trial (kg/ha)
selectfNRyld	Trial calculated	Yield of selected treatments with maximum fertiliser N use efficiencies in the trial (kg/ha)
selectfPRyld	Trial calculated	Yield of selected treatments with maximum fertiliser P use efficiencies in the trial (kg/ha)
selectfKRyld	Trial calculated	Yield of selected treatments with maximum fertiliser K use efficiencies in the trial (kg/ha)
recNfertUE	Trial calculated	Fertiliser N use efficiency of the recommendation newly derived from the trial (kg/kg)
recPfertUE	Trial calculated	Fertiliser P use efficiency of the recommendation newly derived from the trial (kg/kg)
recKfertUE	Trial calculated	Fertiliser K use efficiency of the recommendation newly derived from the trial (kg/kg)
fNRec	Trial calculated	Fertiliser N recommendation newly derived from the trial (kg/ha)
fPRec	Trial calculated	Fertiliser P recommendation newly derived from the trial (kg/ha)
fKRec	Trial calculated	Fertiliser K recommendation newly derived from the trial (kg/ha)
fNRyld	Trial calculated	Yield targeted with the fertiliser N recommendation newly derived from the trial (kg/ha)
fPRyld	Trial calculated	Yield targeted with the fertiliser P recommendation newly derived from the trial (kg/ha)
fKRyld	Trial calculated	Yield targeted with the fertiliser K recommendation newly derived from the trial (kg/ha)
Ryld	Trial calculated	Yield targeted with the fertiliser NPK recommendation newly derived from the trial (kg/ha)
fNRyld-1	Trial calculated	Yield targeted with the fertiliser N recommendation newly derived from the trial (kg/ha)
fPRyld-1	Trial calculated	Yield targeted with the fertiliser P recommendation newly derived from the trial (kg/ha)
fKRyld-1	Trial calculated	Yield targeted with the fertiliser K recommendation newly derived from the trial (kg/ha)
fRyld	Trial calculated	Yield targeted with the fertiliser NPK recommendation newly derived from the trial (kg/ha)
Var-127	Trial calculated	Last column
X-1	Trial calculated	Ratio of yield targeted with the fertiliser NPK recommendation newly derived from the trial (kg/ha), relative to maximum yield observed in the trial
XlonDD	QUEFTS-R	Longitude in decimal degrees, of the trial location
YlatDD	QUEFTS-R	Latitude in decimal degrees, of the trial location
pH	QUEFTS-R	Soil pH read from Africa SoilGrids, for the trial location
BD	QUEFTS-R	Soil bulk density read from Africa SoilGrids, for the trial location
CRFVOL	QUEFTS-R	Soil coarse fragments content read from Africa SoilGrids, for the trial location
Corg	QUEFTS-R	Soil organic C content read from Africa SoilGrids, for the trial location
Pm3	QUEFTS-R	Soil extractable P (mehlich3) read from Africa SoilGrids, for the trial location
Ptot	QUEFTS-R	Soil total P read from Africa SoilGrids, for the trial location
Kexch	QUEFTS-R	Soil exchangeable K read from Africa SoilGrids, for the trial location
Norg	QUEFTS-R	Soil total N read from Africa SoilGrids, for the trial location
Zn	QUEFTS-R	Soil extractable Zn read from Africa SoilGrids, for the trial location

Column heading	Domain	Description of the trial
Tmprtr	QUEFTS-R	Soil temperature read from geodata
ymaxCassava	QUEFTS-R	Attainable cassava yield, at intermediate management regime, read from FAO-GAEZ map, for the trial location
ymaxMaize	QUEFTS-R	Attainable maize yield, at intermediate management regime, read from FAO-GAEZ map, for the trial location
ymaxMillet	QUEFTS-R	Attainable millet yield, at intermediate management regime, read from FAO-GAEZ map, for the trial location
ymaxRice	QUEFTS-R	Attainable rice yield, at intermediate management regime, read from FAO-GAEZ map, for the trial location
RZPAWHC	QUEFTS-R	Soil root zone plant-available water holding capacity read from Africa SoilGrids, for the trial location
ymaxSorghum	QUEFTS-R	Attainable sorghum yield, at intermediate management regime, read from FAO-GAEZ map, for the trial location
Polsen	QUEFTS-R	Soil available P (olsen) read from Africa SoilGrids, for the trial location
ymaxMaizeDefault	QUEFTS-R	Attainable maize yield, at intermediate management regime, read from FAO-GAEZ map, for the trial location
crop	QUEFTS-R	Crop considered and parameterised according to Tier 2
C_effqnt	QUEFTS-R	Effective absolute quantity of soil organic C in 0-30 cm depth (kg/ha), at the trial location
N_effqnt	QUEFTS-R	Effective absolute quantity of soil total N in 0-30 cm depth (kg/ha), at the trial location
P_effqnt	QUEFTS-R	Effective absolute quantity of soil extractable P in 0-30 cm depth (kg/ha), at the trial location
Pt_effqnt	QUEFTS-R	Effective absolute quantity of soil total P in 0-30 cm depth (kg/ha), at the trial location
K_effqnt	QUEFTS-R	Effective absolute quantity of soil exchangeable K in 0-30 cm depth (kg/ha), at the trial location
pHfN	QUEFTS-R	Impact of soil pH on soil N supply efficiency (fraction)
pHfP	QUEFTS-R	Impact of soil pH on soil P supply efficiency (fraction)
pHfK	QUEFTS-R	Impact of soil pH on soil K supply efficiency (fraction)
sNSeff	QUEFTS-R	Soil N supply efficiency (kg/kg)
sPSeff	QUEFTS-R	Soil P supply efficiency (kg/kg)
sKSeff	QUEFTS-R	Soil K supply efficiency (kg/kg)
sNS	QUEFTS-R	Soil N supply (kg/ha)
sPS	QUEFTS-R	Soil P supply (kg/ha)
sKS	QUEFTS-R	Soil K supply (kg/ha)
fertN	QUEFTS-R	Fertilizer N rate applied (kg/ha)
fertP	QUEFTS-R	Fertilizer P rate applied (kg/ha)
fertK	QUEFTS-R	Fertilizer K rate applied (kg/ha)
sN	QUEFTS-R	Soil and fertilizer N supply (kg/ha)
sP	QUEFTS-R	Soil and fertilizer P supply (kg/ha)
sK	QUEFTS-R	Soil and fertilizer K supply (kg/ha)
NSUptE	QUEFTS-R	Soil N uptake efficiency (kg/kg)
PSUptE	QUEFTS-R	Soil P uptake efficiency (kg/kg)
KSUptE	QUEFTS-R	Soil K uptake efficiency (kg/kg)
NUptE	QUEFTS-R	Soil and fertilizer N uptake efficiency (kjg/kg)
PUptE	QUEFTS-R	Soil and fertilizer P uptake efficiency (kjg/kg)
KUptE	QUEFTS-R	Soil and fertilizer K uptake efficiency (kjg/kg)
rfNu	QUEFTS-R	Fertiliser N uptake efficiency (recovery fraction) (kg/kg)
rfPu	QUEFTS-R	Fertiliser P uptake efficiency (recovery fraction) (kg/kg)
rfKu	QUEFTS-R	Fertiliser K uptake efficiency (recovery fraction) (kg/kg)
uNS	QUEFTS-R	Soil N uptake (kg/ha)
uPS	QUEFTS-R	Soil P uptake (kg/ha)
uKS	QUEFTS-R	Soil K uptake (kg/ha)
uN	QUEFTS-R	Soil and fertilizer N uptake (kg/ha)
uP	QUEFTS-R	Soil and fertilizer P uptake (kg/ha)
uK	QUEFTS-R	Soil and fertilizer K uptake (kg/ha)
NSUseE	QUEFTS-R	Soil N physiologic use efficiency (kg/kg)
PSUseE	QUEFTS-R	Soil P physiologic use efficiency (kg/kg)
KSUseE	QUEFTS-R	Soil K physiologic use efficiency (kg/kg)
NUseE	QUEFTS-R	Soil and fertilizer N physiologic use efficiency (kg/kg)
PUseE	QUEFTS-R	Soil and fertilizer P physiologic use efficiency (kg/kg)
KUseE	QUEFTS-R	Soil and fertilizer K physiologic use efficiency (kg/kg)
yControl	QUEFTS-R	Unfertilized control yield (kg/ha)
yFertilised	QUEFTS-R	Fertilized yield (kg/ha)
NfertUE	QUEFTS-R	Fertilizer N use efficiency (kg/kg)
PfertUE	QUEFTS-R	Fertilizer P use efficiency (kg/kg)
KfertUE	QUEFTS-R	Fertilizer K use efficiency (kg/kg)
limS	QUEFTS-R	Soil nutrient most limiting crop yield (N, P or K)
lim	QUEFTS-R	Soil and fertilizer nutrient most limiting crop yield (N, P or K)
ymax	QUEFTS-R	Attainable crop yield, at intermediate management regime, read from FAO-GAEZ map, for the trial location
wlimN	QUEFTS-R	Boolean 0/1 about N limitation, meaning forgotten
wlimP	QUEFTS-R	Boolean 0/1 about P limitation, meaning forgotten
wlimK	QUEFTS-R	Boolean 0/1 about K limitation, meaning forgotten
ytarget	QUEFTS-R	Target yield (kg/ha) as a crop-specific fraction of the attainable yield
ytargetgap	QUEFTS-R	Target yield gap (kg/ha) as the gap between target yield and control yield
ygap	QUEFTS-R	Yield gap (kg/ha) as the gap between attainable yield and control yield
NuReq	QUEFTS-R	N uptake required by the target yield (kg/ha)
PuReq	QUEFTS-R	P uptake required by the target yield (kg/ha)
KuReq	QUEFTS-R	K uptake required by the target yield (kg/ha)
fNR	QUEFTS-R	Fertilizer N recommendation (kg/ha) to supply additional N for meeting the N uptake required by the target yield
fPR	QUEFTS-R	Fertilizer P recommendation (kg/ha) to supply additional N for meeting the N uptake required by the target yield
fKR	QUEFTS-R	Fertilizer K recommendation (kg/ha) to supply additional N for meeting the N uptake required by the target yield
fNRblnc	QUEFTS-R	Fertilizer N recommendation (kg/ha) to supply additional N for bringing the crop NPK contents in balance (at uncalculated yield levels possibly exceeding potential yield)

Column heading	Domain	Description of the trial
fPRblnc	QUEFTS-R	Fertilizer P recommendation (kg/ha) to supply additional N for bringing the crop NPK contents in balance (at uncalculated yield levels possibly exceeding potential yield)
fKRblnc	QUEFTS-R	Fertilizer K recommendation (kg/ha) to supply additional N for bringing the crop NPK contents in balance (at uncalculated yield levels possibly exceeding potential yield)

Annex 6. Accuracy assessments of fertilizer trial data (T2) and fertilizer recommendations (T3) modelled and mapped using QUEFTS (Tier 2)

Variable	R2	ME	MAE	RMSE	RMedSE	Crop	n	Description
yControl000	0.065	-120.459	253.93	383.965	178.095	MilletT2	82	Control yield (kg/ha)
fRyld	0.013	115.559	451.682	667.39	335.197	MilletT2	33	Fertilized yield, for newly derived recommendation (kg/ha)
fNR	NA	NA	NA	NA	NA	MilletT2	0	Fertilizer N recommendation, as reported (kg/ha)
fPR	NA	NA	NA	NA	NA	MilletT2	0	Fertilizer P recommendation, as reported (kg/ha)
fKR	NA	NA	NA	NA	NA	MilletT2	0	Fertilizer K recommendation, as reported (kg/ha)
fNRec	0	4.818	34.774	42.665	30	MilletT2	31	Fertilizer N recommendation, as newly derived (kg/ha)
fPRec	0	10.522	13.477	14.643	13.978	MilletT2	34	Fertilizer P recommendation, as newly derived (kg/ha)
fKRec	NA	-24.968	24.968	24.968	25	MilletT2	12	Fertilizer K recommendation, as newly derived (kg/ha)
NfertUE	0.199	6.806	13.793	20.622	7.253	MilletT2	67	Fertilizer N use efficiency, as newly derived (kg/kg)
PfertUE	0.131	-2.322	18.91	24.486	15.457	MilletT2	179	Fertilizer P use efficiency, as newly derived (kg/kg)
KfertUE	NA	NA	NA	NA	NA	MilletT2	0	Fertilizer K use efficiency, as newly derived (kg/kg)
yControl000	0.021	387.29	599.522	797.306	550.707	SorghumT2	83	Control yield (kg/ha)
fRyld	0.013	417.986	823.849	1103.336	655.098	SorghumT2	47	Fertilized yield, for newly derived recommendation (kg/ha)
fNR	0.009	-20.396	27.018	29.665	29.629	SorghumT2	243	Fertilizer N recommendation, as reported (kg/ha)
fPR	0.012	16.891	16.891	18.336	17.974	SorghumT2	243	Fertilizer P recommendation, as reported (kg/ha)
fKR	0	-10.67	10.67	10.938	12	SorghumT2	243	Fertilizer K recommendation, as reported (kg/ha)
fNRec	0.045	-30.005	34.84	41.794	29.879	SorghumT2	45	Fertilizer N recommendation, as newly derived (kg/ha)
fPRec	0	12.974	13.057	15.733	10.135	SorghumT2	46	Fertilizer P recommendation, as newly derived (kg/ha)
fKRec	0.247	-12.615	12.615	13.503	12	SorghumT2	42	Fertilizer K recommendation, as newly derived (kg/ha)
NfertUE	0.129	135.24	136.165	166.161	114.304	SorghumT2	338	Fertilizer N use efficiency, as newly derived (kg/kg)
PfertUE	0.009	-15.262	41.658	72.188	24.663	SorghumT2	338	Fertilizer P use efficiency, as newly derived (kg/kg)
KfertUE	0.024	54.521	54.521	68.491	44.583	SorghumT2	34	Fertilizer K use efficiency, as newly derived (kg/kg)
yControl000	0.009	-83.436	799.602	1144.045	620.759	MaizeT2	374	Control yield (kg/ha)
fRyld	0.012	-678.471	1139.199	1629.451	845.762	MaizeT2	319	Fertilized yield, for newly derived recommendation (kg/ha)
fNR	0.001	-7.207	23.08	28.72	19.531	MaizeT2	1615	Fertilizer N recommendation, as reported (kg/ha)
fPR	0.062	11.258	13.196	14.87	13.173	MaizeT2	1615	Fertilizer P recommendation, as reported (kg/ha)
fKR	NA	-29.324	29.324	31.136	35	MaizeT2	1615	Fertilizer K recommendation, as reported (kg/ha)
fNRec	0.044	-17.365	31.79	40.677	28.731	MaizeT2	355	Fertilizer N recommendation, as newly derived (kg/ha)
fPRec	0.009	10.193	13.118	19.857	11.93	MaizeT2	332	Fertilizer P recommendation, as newly derived (kg/ha)
fKRec	NA	-32.391	32.391	34.531	35	MaizeT2	324	Fertilizer K recommendation, as newly derived (kg/ha)
NfertUE	0.009	19.656	25.251	59.828	15.644	MaizeT2	2432	Fertilizer N use efficiency, as newly derived (kg/kg)
PfertUE	0.026	-3.725	42.983	66.556	31.627	MaizeT2	2245	Fertilizer P use efficiency, as newly derived (kg/kg)
KfertUE	NA	NA	NA	NA	NA	MaizeT2	0	Fertilizer K use efficiency, as newly derived (kg/kg)
yControl000	0.006	-19846.551	19846.551	23435.701	15345.674	CassavaT2	34	Control yield (kg/ha)
fRyld	0.004	-21979.105	21979.105	25580.988	19395.243	CassavaT2	34	Fertilized yield, for newly derived recommendation (kg/ha)
fNR	NA	64.673	64.673	67.158	63.625	CassavaT2	4	Fertilizer N recommendation, as reported (kg/ha)
fPR	NA	120.248	120.248	120.322	120.078	CassavaT2	4	Fertilizer P recommendation, as reported (kg/ha)
fKR	NA	-49.579	49.579	50.486	49.343	CassavaT2	4	Fertilizer K recommendation, as reported (kg/ha)
fNRec	0.081	73.973	73.973	75.324	76.374	CassavaT2	34	Fertilizer N recommendation, as newly derived (kg/ha)
fPRec	0.183	97.714	99.005	100.083	102.61	CassavaT2	34	Fertilizer P recommendation, as newly derived (kg/ha)
fKRec	0.409	-24.075	24.075	28.075	20	CassavaT2	34	Fertilizer K recommendation, as newly derived (kg/ha)
NfertUE	0.006	56.973	180.017	278.474	100.976	CassavaT2	383	Fertilizer N use efficiency, as newly derived (kg/kg)
PfertUE	0.001	59.89	561.819	828.145	397.11	CassavaT2	325	Fertilizer P use efficiency, as newly derived (kg/kg)
KfertUE	0.008	163.578	304.506	411.498	165.079	CassavaT2	49	Fertilizer K use efficiency, as newly derived (kg/kg)
yControl000	0.007	-1593.385	1736.599	2187.931	1449.461	RiceT2	26	Control yield (kg/ha)
fRyld	0.117	-1263.179	1503.988	1754.63	842.833	RiceT2	7	Fertilized yield, for newly derived recommendation (kg/ha)
fNR	NA	-127.5	127.5	127.5	127.5	RiceT2	30	Fertilizer N recommendation, as reported (kg/ha)
fPR	NA	7.477	7.477	7.477	7.477	RiceT2	30	Fertilizer P recommendation, as reported (kg/ha)
fKR	NA	-40	40	40	40	RiceT2	30	Fertilizer K recommendation, as reported (kg/ha)
fNRec	0.816	-33.283	63.317	67.46	76.667	RiceT2	5	Fertilizer N recommendation, as newly derived (kg/ha)
fPRec	0.011	13.163	13.163	17.436	10.874	RiceT2	7	Fertilizer P recommendation, as newly derived (kg/ha)
fKRec	NA	-32.465	32.465	33.344	33.993	RiceT2	6	Fertilizer K recommendation, as newly derived (kg/ha)
NfertUE	NA	-21.274	41.354	60.843	21.69	RiceT2	18	Fertilizer N use efficiency, as newly derived (kg/kg)
PfertUE	0.271	-41.916	67.599	108.074	36.242	RiceT2	74	Fertilizer P use efficiency, as newly derived (kg/kg)
KfertUE	NA	NA	NA	NA	NA	RiceT2	0	Fertilizer K use efficiency, as newly derived (kg/kg)

Annex 7. Accuracy assessments of fertilizer recommendations extrapolated using machine learning (Tier 3)

Results of cross-validation 'randomForest / XGBoost / Ensembe':

MILLET	SORGHUM	MAIZE	CASSAVA	RICE
Extrapolation of recommendations (f Rec) newly derived from trial data				
Variable: fNRec	Variable: fNRec	Variable: fNRec	Variable: fNRec	Variable: fNRec
Model: mrf	Model: mrf	Model: mrf	Model: mrf	Model: mrf
RMSE: 12.114	RMSE: 6.748	RMSE: 13.645	RMSE: 13.627	RMSE: 29.043
R2: 0.018	R2: 0.868	R2: 0.555	R2: 0.086	R2: 0.992
Variable: fPRec	Variable: fPRec	Variable: fPRec	Variable: fPRec	Variable: fPRec
Model: mrf	Model: mrf	Model: mrf	Model: mrf	Model: mrf
RMSE: 8.745	RMSE: 2.85	RMSE: 15.363	RMSE: 4.087	RMSE: 6.321
R2: 0.096	R2: 0.641	R2: 0.07	R2: 0.208	R2: 0.397
Variable: fKRec	Variable: fKRec	Variable: fKRec	Variable: fKRec	Variable: fKRec
Model: mrf	Model: mrf	Model: mrf	Model: mrf	Model: mrf
RMSE: 0.017	RMSE: 4.402	RMSE: 8.902	RMSE: 16.353	RMSE: 5.172
R2: 0.884	R2: 0.311	R2: 0.442	R2: 0.266	R2: 0.654
Extrapolation of recommendations (f R) reported with trial data				
----	Variable: fNR	Variable: fNR	----	----
	Model: mrf	Model: mrf		
	RMSE: 2.052	RMSE: 7.277		
	R2: 0.948	R2: 0.478		
----	Variable: fPR	Variable: fPR	----	----
	Model: mrf	Model: mrf		
	RMSE: 0.284	RMSE: 2.505		
	R2: 0.172	R2: 0.896		
----	Variable: fKR	Variable: fKR	----	----
	Model: mrf	Model: mrf		
	RMSE: 1.555	RMSE: 4.828		
	R2: 0.597	R2: 0.785		

Annex 8. Relative importance of spatial covariates to model and extrapolate fertilizer recommendations using machine learning (Tier 3)

MILLET	SORGHUM	MAIZE	CASSAVA	RICE
Extrapolation of recommendations (f Rec) newly derived from trial data				
Variable: fNRec	**Variable: fNRec**	**Variable: fNRec**	**Variable: fNRec**	**Variable: fNRec**
Zn_M_agg30cm_AF_1km 20.67339	af_agg_30cm_TAWCpF23mm__M_1km 581.5430	NMSD3avg 1600.246	rElevIndex 27.98242	AAIavg_GYGA 0
NMOD3avg 15.48554	OC_M_agg30cm_AF_1km 461.8674	MY2LSTNALT_200207_201609 1396.236	Mg_M_agg30cm_AF_1km 26.04698	af_agg_30cm_AWCpF23__M_1km 0
rElevIndex 15.15507	PRSCHE3 455.7511	PCHE3avg 1287.760	MAXENV3 25.85884	af_agg_30cm_PWP__M_1km 0
Ca_M_agg30cm_AF_1km 15.09574	af_agg_30cm_AWCpF23__M_1km 419.8327	CHIRPSA 1266.126	ECN_M_agg30cm_AF_1km 24.45150	af_agg_30cm_TAWCpF23__M_1km 0
PET 14.91094	AAIavg_GYGA 404.1346	fPR_MaizeT2 1249.811	NMSD3avg 22.62124	af_agg_30cm_TAWCpF23mm__M_1km 0
NCluster_1_AF_1km 14.41977	Fcover 395.9256	MAXENV3 1174.367	P.B_M_agg30cm_AF_1km 22.41333	af_agg_30cm_TETAs__M_1km 0
VDPMRG5 13.40194	LSTD_avgIRI_Jul2002_Sep2016_mosaicLAEA_celsius 390.7130	M43WNALT 1157.679	NCluster_7_AF_1km 22.10676	af_agg_ERZD_TAWCpF23mm__M_1km 0
M13NDVIA01 12.74833	PCHE3avg 382.0430	Water_balance 1141.194	SNDPPT_M_agg30cm_AF_1km 21.49865	af_BDRICM_T__M_1km 0
EVEENV3 12.66813	B02CHE3 373.4869	M43BNALT 1138.697	B13CHE3 21.36394	af_ERZD__M_1km 0
Wdvi 12.36175	GAEZ_LGP 368.6217	Na_M_agg30cm_AF_1km 1120.171	Temperature 21.35071	Al_M_agg30cm_AF_1km 0
ECN_M_agg30cm_AF_1km 12.26274	M13RB3ALT 347.6289	SLTPPT_M_agg30cm_AF_1km 1102.071	NIRL00 19.67176	ASSDAC3 0
yGapMillet 11.90068	Water_balance 345.2260	af_agg_30cm_TAWCpF23mm__M_1km 1087.983	M43WSALT 19.53567	B02CHE3 0
CRFVOL_M_agg30cm_AF_1km 11.61467	BIO1ALT 337.3796	ECN_M_agg30cm_AF_1km 1081.573	VBFMRG5 19.45228	B04CHE3 0
PCHE3avg 11.59631	af_agg_30cm_TAWCpF23__M_1km 337.1992	af_BDRICM_T__M_1km 1071.111	Water_balance 19.23583	B07CHE3 0
MANMCF5 11.26723	M43BSALT 335.8670	PET 1065.389	PRSCHE3 19.12990	B13CHE3 0
Variable: fPRec	**Variable: fPRec**	**Variable: fPRec**	**Variable: fPRec**	**Variable: fPRec**
ENTENV3 33.66248	LSTD_avgIRI_Jul2002_Sep2016_mosaicLAEA_celsius 25.08695	TMSD3avg 570.4339	Fcover 21.529618	NCluster_11_AF_1km 6.681056
af_agg_ERZD_TAWCpF23mm__M_1km 33.20837	EACKCL_M_agg30cm_AF_1km 20.21598	M13RB3A01 551.1673	Fapar 18.440699	L10USG5 6.078063
VW1MOD1avg 28.40401	Al_M_agg30cm_AF_1km 19.13720	Wdvi 471.3502	MANMCF5 18.380451	PHIHOXagg0_30 5.972478
Water_balance 28.06704	Hypsclassc2 17.41442	Cu_M_agg30cm_AF_1km 454.5660	M13RB3A08 18.243483	M43BSALT 5.848447
CEC_M_agg30cm_AF_1km 26.23523	DEMENV5 16.63617	M43WNALT 446.4449	Wdvi 17.372679	ECN_M_agg30cm_AF_1km 5.782310
NCluster_14_AF_1km 25.61363	SW2L00 16.17168	MY2LSTNALT_200207_201609 439.3799	CHIRPSA 13.203840	AfSIS_WRB_RefGc10 5.724592
Lai_avg 23.67068	Sorghum_actual_baseline 16.08887	NCluster_1_AF_1km 435.5829	PHIHOXagg0_30 12.883933	ENTENV3 5.670176
TMDMOD3 23.37652	Mg_M_agg30cm_AF_1km 15.23419	B02CHE3 432.7723	ENAX_M_agg30cm_AF_1km 11.591831	Zn_M_agg30cm_AF_1km 5.496004
M13RB1A08 20.68596	GIEMSD3 14.97347	M17GPPALTfill 429.7262	M13RB3ALT 11.544608	Rice_intermed 5.445234
B13CHE3 20.45764	B14CHE3 14.60650	Lai_avg 417.2153	MAXENV3 11.112103	M13RB3A08 5.370037
MAXENV3 19.50421	GAEZ_LGP 14.14186	MMOD4avg 411.6490	GAEZ_ET 10.988646	Rice_irrigated_high_baseline 5.312803
REDL00 19.07822	Lai_avg 14.11367	M13RB1A01 399.7160	CMCF5avg 10.595683	B13CHE3 5.135677
NIRL00 18.59236	GAEZ_ratioP_PETsea 14.01766	Water_balance 385.3072	Cassave_rainfed_intermed_baseline 10.032044	ENAX_M_agg30cm_AF_1km 5.111473
M17NPPALTfill 18.57956	Na_M_agg30cm_AF_1km 13.97959	C03GLC5 379.0770	VW1MOD1avg 9.201425	Temperature 5.085312
GAEZ_NPP 18.26289	Usgs_lithologyc14 13.56502	M13RB1ALT 374.7210	ESMOD5avg 8.999925	EXMOD5avg 5.038442
Variable: fKRec	**Variable: fKRec**	**Variable: fKRec**	**Variable: fKRec**	**Variable: fKRec**
NMSD3avg 0.0008931829	Sorghum_actual_baseline 46.48986	BIO12ALT 382.1494	Fapar 345.6508	M13RB3A04 8.182305
Fe_M_agg30cm_AF_1km 0.0007574245	Na_M_agg30cm_AF_1km 43.20279	fNR_MaizeT2 357.5438	M13RB1A08 247.2135	Rice_intermed 7.238613
MAXENV3 0.0007459246	VBFMRG5 37.35582	NCluster_1_AF_1km 351.1373	Slopeclassc3 231.9134	C01GLC5 5.252749
K_M_agg30cm_AF_1km 0.0006604222	CRFVOL_M_agg30cm_AF_1km 27.91457	M17NPPALTfill 320.2978	Fcover 230.8948	PHIHOXagg0_30 5.246155
fPR_MilletT2 0.0006570618	C01GLC5 20.02671	M17GPPALTfill 313.2447	CRFVOL_M_agg30cm_AF_1km 229.4407	VDPMRG5 4.714012

NCluster_9_AF_1km 0.0006523573	PET 18.30140	Water_balance 293.6336	EVEENV3 226.4782	NIRL14 4.698626
SNDPPT_M_agg30cm_AF_1km 0.0006382438	Fapar 17.95414	Na_M_agg30cm_AF_1km 283.7402	M43WVALT 214.2407	NCluster_4_AF_1km 4.402626
Na_M_agg30cm_AF_1km 0.0005802217	M13NDVIA01 17.78230	M13RB1ALT 280.5583	M13NDVIA08 197.3992	REDL14 4.360590
yFertilised_MilletT2 0.0005661082	Fcover 17.35199	C03GLC5 275.5281	ENTENV3 194.3412	M13RB1A04 4.261162
Wdvi 0.0005519947	NCluster_8_AF_1km 16.95519	PRSCHE3 275.3184	MAXENV3 187.9370	Temperature 4.243461
NCluster_16_AF_1km 0.0005519947	CMCF5avg 16.51659	Fapar 274.5340	Cassave_actual_baseline 174.2224	EVEENV3 4.181063
CLYPPT_M_agg30cm_AF_1km 0.0005394493	af_agg_ERZD_TAWCpF23mm__M_1km 16.13445	M13RB3A01 269.0853	CLYPPT_M_agg30cm_AF_1km 168.3625	AfSIS_WRB_RefGc10 4.105696
GTDHYS3 0.0005394493	C03GLC5 15.99471	ESMOD5avg 267.8652	BLDFIE_M_agg30cm_AF_1km 164.1207	NCluster_19_AF_1km 4.014402
POSMRG5 0.0005206313	Al_M_agg30cm_AF_1km 15.77632	Fcover 263.9524	P_M_agg30cm_AF_1km 163.9889	af_BDRICM_T__M_1km 4.008058
PHIHOXagg0_30 0.0005143587	GTDHYS3 15.74647	M13RB1A04 254.7153	M43BVALT 156.8672	L10USG5 3.987804

Extrapolation of recommendations (f R) reported with trial data

	Variable: fNR	**Variable: fNR**
	K_M_agg30cm_AF_1km 242.6144	Maize_actualbaseline 4046.119
	M13RB1ALT 204.2825	yGapMaize 3907.206
	GAEZ_LGP 198.5951	N_M_agg30cm_AF_1km 3860.338
	af_agg_30cm_AWCpF23__M_1km 193.2777	Temperature 3391.359
	LSTD_avgIRI_Jul2002_Sep2016_mosaicLAEA_celsius 187.0816	TREL10 2907.284
	Sorghum_rainfed_intermed_baseline 181.7180	CRFVOL_M_agg30cm_AF_1km 2541.250
	AfSIS_WRBc109 181.0244	Maize_rainfed_low_baseline 2283.322
	B02CHE3 170.8982	M13NDVIALT 2035.137
	M13RB3A01 165.0259	NCluster_19_AF_1km 2035.077
	Zn_M_agg30cm_AF_1km 164.5170	B13CHE3 1996.356
	M43BSALT 159.8934	NMOD3avg 1727.890
	MY2LSTNALT_200207_201609 155.0845	BARL10 1424.586
	M02MOD4 154.4834	EXMOD5avg 1326.962
	NIRL14 148.5649	NCluster_14_AF_1km 1112.412
	ENTENV3 148.4262	SSI_NCluster_AF_1km 1092.409
	Variable: fPR	**Variable: fPR**
	af_agg_30cm_TETAs__M_1km 0.4498803	Maize_intermed 3926.730
	af_agg_30cm_TAWCpF23__M_1km 0.3697929	Maize_rainfed_low_baseline 3503.204
	Sorghum_intermed 0.3428970	Maize_rainfed_intermed_baseline 2693.993
	OC_M_agg30cm_AF_1km 0.3423977	yFertilised_MaizeT2 2666.661
	Temperature 0.3422347	Maize_rainfed_high_baseline 2443.650
	Lai_avg 0.3407124	NMOD3avg 2153.018
	GAEZ_LGP 0.3353661	Temperature 2058.690
	M13NDVIA04 0.3245097	Slopeclassc3 1912.595
	fNR_SorghumT2 0.3144237	TMNMOD3 1772.939
	GAEZ_NPP 0.3121376	M13RB3A04 1449.315
	EACKCL_M_agg30cm_AF_1km 0.3108299	B13CHE3 1389.378
	MY2LSTNALT_200207_201609 0.3098515	Water_balance 1379.317
	M13RB3ALT 0.3037426	BIO12ALT 1323.633
	M43WVALT 0.2983198	Riclassc2 1314.384
	VW1MOD1avg 0.2890946	GAEZ_LGP 1289.299
	Variable: fKR	**Variable: fKR**
	MY2LSTNALT_200207_201609 6.245826	GAEZ_ratioP_PETan 4559.534
	ECN_M_agg30cm_AF_1km 5.494395	M43BSALT 4062.930

Sorghum_actual_baseline 4.218615	N_M_agg30cm_AF_1km 3835.904
CMCF5avg 4.034069	M43WSALT 3712.870
B07CHE3 3.788514	NCluster_15_AF_1km 3011.164
af_agg_ERZD_TAWCpF23mm__M_1km 3.713238	BIO12ALT 2892.304
Al_M_agg30cm_AF_1km 3.705416	M13RB3A04 2740.815
NCluster_14_AF_1km 3.698286	Water_balance 2639.733
M13RB1A01 3.677263	IMOD4avg 2420.402
Fcover 3.563114	GAEZ_ET 2317.942
K_M_agg30cm_AF_1km 3.495953	GTDHYS3 2136.651
ENTENV3 3.459652	NCluster_4_AF_1km 2039.069
M43BVALT 3.446987	M13RB1A04 1966.811
Zn_M_agg30cm_AF_1km 3.431057	Maize_actualbaseline 1928.389
NCluster_1_AF_1km 3.351465	NCluster_14_AF_1km 1914.043

Annex 9. Summary of the materials main methodologic steps & materials and of the Tier 2 and 3 results aggregated by country, aez and crop

These tables summarise results of Tier 2 and Tier 3 for each AEZ (Length of Growing Period) and country separately

The results are summarised in separate tables for each crop

For each crop, the average (mean) results per AEZ are given in one table and the full frequency distribution per AEZ in another table.
The frequency distribution gives the results at various percentiles, with the intervals corresponding with standard deviations (in case of a normal distribution), knowing: 0, 2.3, 15.9, 50, 84.1, 97.7, 100%

Note the <u>considerable variation</u> between zones as well as within zones.

N indicates the number of pixels (grid cells of 1*1 km) per AEZ-country zone included in the calculations

In Tier 2, calculations have been made using QUEFTS, with the crop parameters from literature adjusted with parameters derived from the fertilizer trial data (where possible; only few trials included analytical data of the plant tissues).
Input data for QUEFTS included soil property maps, including soil nutrient maps, as produced by ISRIC for the AfSIS project (AfSoilGrids250m; www.isric.org/projects/africa-soil-information-service-afsis) and for other projects (data.isric.org , SEARCH for: Africa SoilGrids).

Input data for QUEFTS included attainable yield maps, from which target yields were derived, as produced by IIASA & FAO for the G-AEZ project (www.fao.org/nr/gaez). The yield levels are presented as attainable at high, moderate and low input levels (management regimes). Selected were the maps with yields attainable at moderate input levels.
The fertilizer NPK recommendations were calculated using QUEFTS based on the nutrient gap between the crop nutrient requirements at target yield and the soil nutrient supply, considering NPK uptake efficiencies and NPK use efficiencies.

The target yield was defined as 80% of the attainable yield. The corresponding yield gaps are rather large. Consequently, the fertilizer NPK recommendations are large.
Added to the summary, for the mean values per AEZ-country zones, are target yields defined at 55% of the attainable yield. The corresponding yield gap and fertilizer NPK recommendations were adjusted accordingly, as an estimate of the impact of lowering target yield.
Following the validation workshop, the target yield levels and parameter settings have been adjusted and fine-tuned and new calculations have been made and aggregated for each crop in each country and AEZ.

(Note that we've been testing various other approaches for defining target yield, which though are not summarised here).

In Tier 3, the fertilizer NPK recommendations, as georeferenced and reported by partner organisations, have been extrapolated using machine learning algorithms (random forest) which model the relationships between the data and spatial covariates. Added to the covariates were the maps resulting from Tier2.
These recommendations, here called fNR, fPR and fKR, were only reported and available for maize and sorghum. Consequently, extrapolation results, here called rf_fNR, rf_fPR and rf_fKR, are only available for maize and sorghum.
Note the <u>very limited variation</u> between zones as well as within zones. This reflects the recommendations as reported which varied only very little from one location to another.
Also in Tier 3, fertilizer NPK recommendations were newly assessed from the fertilizer trial data for all of the five crops and in a single similar way for all countries, all crops, all trials and all nutrients.
The common basis for these newly assessed fertilizer NPK recommendations was the agronomic efficiency, relative to the control yield, as measured in the trials (kg yield per kg fertilizer nutrient).

Those treatments per trial showing highest efficiency exceeding the 67% percentile within the trial, were averaged to assess the associated N, P and K rates.
These recommendations, here called fNRec, fPRec and fKRec, are thus available for all crops and have been extrapolated. The resulting maps are here called rf_fNRec, rf_fPRec and rf_fKRec.
In Tier 3B, we made again calculations using QUEFTS of the crop yield with fertilizer NPK inputs defined equal to the extrapolated fertilizer recommendations (rf_fNRec, rf_fPRec and rf_fKRec).

All results (maps) have been quantitatively validated relative to the available data.

With the currently available data, of variable nature and quality, the tiered approach including modelling (QUEFTS) proved effective to produce results
The approach is highly consistent and repeatable and produces results of an accuracy, or reliability, largely exceeding the accuracy which would had been possible with the currently available data
More data, of complete nature (including coordinates, yield and biomass and NPK uptake, and including control treatments), of homogeneous nature and spatially well distributed over the various zones, would very certainly improve the current results, based on both modelling (QUEFTS) and machine learning.
The current results though are not satisfactory yet, and it seems as if some of the key parameters need further fine tuning in line with either additional data or an adequate reference.
An adequate reference is lacking though. The preparatory FerWAM tables should provide complete information, based on expert knowledge, which permits 1) validation and 2) futher fine tuning.
These should include, for each crop, country and AEZ zone, a quantitatively specified indication of minimally: attainable yield, target yield, N recommendation, P recommendation, K recommendation.

With such table we can compare expert knowledge with the proof of concept results, and redefine e.g. target yields to recalculate NPK recommendations.

Moreover, the crop parameters settings may be evaluated and further fine-tuned based on expert knowledge (yield-uptake efficiencies, recovery fractions) or, better, based on data from well-designed Nutrient Omission Trials (NOT's). Similarly, the soil parameters can be improved to better estimate soil nutrient supply from soil nutrient content, for which NOT's are required as well.

Annex 10. Summary of a selection of the validated Tier 2 results for five crops in Burkina aggregated by AEZ

value	unit	description
sNS	kg/ha	soil N supply (calculated using QUEFTS)
sPS	kg/ha	soil P supply (calculated using QUEFTS)
sKS	kg/ha	soil K supply (calculated using QUEFTS)
ygap	kg/ha	yield gap, relative to attainable AEZ yield and exceeding target yield gap (calculated using QUEFTS)
ytarget	kg/ha	target yield, at crop specific ratio of attainable AEZ yield (calculated using QUEFTS)
fNR	kg/ha	fertilizer N recommendation, for target yield gap (calculated using QUEFTS)
fPR	kg/ha	fertilizer P recommendation, for target yield gap (calculated using QUEFTS)
fKR	kg/ha	fertilizer K recommendation, for target yield gap (calculated using QUEFTS)

value	stat (%)	BF45	BF75	BF105	BF135	BF165	BF195	BF225
sNS_MilletT2	avg	37	38	39	45	48	48	57
sPS_MilletT2	avg	2	3	3	3	3	4	5
sKS_MilletT2	avg	150	119	120	113	93	80	76
ygap_MilletT2	avg	729	1077	1523	1566	1432	843	437
ytarget_MilletT2	avg	864	1170	1486	1519	1484	1169	942
fNR_MilletT2	avg	1	10	29	17	9	1	0
fPR_MilletT2	avg	9	14	21	22	18	4	0
fKR_MilletT2	avg	0	0	2	3	12	4	0
sNS_MilletT2	0	19	20	18	22	27	31	48
sPS_MilletT2	0	1	1	2	1	1	3	4
sKS_MilletT2	0	59	54	29	32	25	36	65
ygap_MilletT2	0	24	173	705	670	586	362	343
ytarget_MilletT2	0	501	944	1300	1484	1267	936	936
fNR_MilletT2	0	0	0	0	0	0	0	0
fPR_MilletT2	0	0	0	0	0	0	0	0
fKR_MilletT2	0	0	0	0	0	0	0	0
sNS_MilletT2	2.3	25	26	27	32	35	37	49
sPS_MilletT2	2.3	1	2	2	2	2	3	4
sKS_MilletT2	2.3	89	73	78	75	61	54	67
ygap_MilletT2	2.3	433	662	1153	1180	1083	503	351
ytarget_MilletT2	2.3	759	960	1351	1486	1333	1004	937
fNR_MilletT2	2.3	0	0	0	0	0	0	0
fPR_MilletT2	2.3	0	3	8	9	2	0	0
fKR_MilletT2	2.3	0	0	0	0	0	0	0
sNS_MilletT2	15.9	30	32	32	37	40	41	52
sPS_MilletT2	15.9	2	2	2	2	3	4	4
sKS_MilletT2	15.9	110	90	97	91	74	69	71
ygap_MilletT2	15.9	598	834	1356	1414	1251	671	370
ytarget_MilletT2	15.9	798	1016	1423	1493	1418	1078	938
fNR_MilletT2	15.9	0	0	8	0	0	0	0
fPR_MilletT2	15.9	5	9	17	18	13	0	0
fKR_MilletT2	15.9	0	0	0	0	0	0	0
sNS_MilletT2	50	37	38	37	43	46	46	56
sPS_MilletT2	50	2	3	3	3	3	4	5
sKS_MilletT2	50	141	117	119	110	90	80	77
ygap_MilletT2	50	737	1089	1547	1596	1441	846	427
ytarget_MilletT2	50	867	1207	1498	1523	1509	1173	941
fNR_MilletT2	50	0	2	30	15	2	0	0
fPR_MilletT2	50	10	14	22	24	19	3	0
fKR_MilletT2	50	0	0	0	0	0	0	0
sNS_MilletT2	84.1	43	44	45	54	57	55	61
sPS_MilletT2	84.1	3	3	4	4	4	5	6
sKS_MilletT2	84.1	192	147	143	133	113	91	81
ygap_MilletT2	84.1	866	1319	1682	1706	1602	1015	502
ytarget_MilletT2	84.1	928	1299	1536	1539	1527	1263	946
fNR_MilletT2	84.1	0	24	48	35	23	0	0
fPR_MilletT2	84.1	13	19	26	27	24	8	0
fKR_MilletT2	84.1	0	0	0	0	30	4	0
sNS_MilletT2	97.7	53	52	57	67	71	68	68
sPS_MilletT2	97.7	4	4	5	5	6	7	6
sKS_MilletT2	97.7	259	177	171	166	140	104	84
ygap_MilletT2	97.7	974	1459	1768	1793	1770	1156	548
ytarget_MilletT2	97.7	954	1336	1546	1559	1534	1307	949
fNR_MilletT2	97.7	8	42	61	52	38	11	0
fPR_MilletT2	97.7	16	23	28	29	28	12	1

value	stat (%)	BF45	BF75	BF105	BF135	BF165	BF195	BF225
fKR_MilletT2	97.7	0	0	27	40	73	43	0
sNS_MilletT2	100	112	214	259	270	231	91	70
sPS_MilletT2	100	10	10	9	10	17	9	7
sKS_MilletT2	100	416	413	283	475	255	138	93
ygap_MilletT2	100	1148	1639	1903	2018	2004	1273	575
ytarget_MilletT2	100	984	1365	1569	1570	1544	1334	949
fNR_MilletT2	100	25	69	85	82	63	29	0
fPR_MilletT2	100	20	32	42	40	33	16	1
fKR_MilletT2	100	0	54	177	167	186	89	0
MilletT2	n	4394	12565	48065	97411	82563	17531	91
sNS_SorghumT2	avg	37	38	39	45	48	48	57
sPS_SorghumT2	avg	2	3	3	3	3	4	5
sKS_SorghumT2	avg	150	119	120	113	93	80	76
ygap_SorghumT2	avg	1374	2089	3875	4382	4200	3844	2877
ytarget_SorghumT2	avg	1108	1558	2484	2740	2711	2621	2210
fNR_SorghumT2	avg	0	2	24	21	14	11	0
fPR_SorghumT2	avg	7	12	27	32	28	20	9
fKR_SorghumT2	avg	0	0	1	2	10	16	0
sNS_SorghumT2	0	19	20	18	22	27	31	48
sPS_SorghumT2	0	1	1	2	1	1	3	4
sKS_SorghumT2	0	59	54	29	32	25	36	65
ygap_SorghumT2	0	190	537	1820	2920	2634	2666	2623
ytarget_SorghumT2	0	616	1209	1834	2662	2617	2198	2198
fNR_SorghumT2	0	0	0	0	0	0	0	0
fPR_SorghumT2	0	0	0	0	0	0	0	0
fKR_SorghumT2	0	0	0	0	0	0	0	0
sNS_SorghumT2	2.3	25	26	27	32	35	37	49
sPS_SorghumT2	2.3	1	2	2	2	2	3	4
sKS_SorghumT2	2.3	89	73	78	75	61	54	67
ygap_SorghumT2	2.3	891	1361	2721	3768	3613	3175	2644
ytarget_SorghumT2	2.3	932	1239	1950	2680	2639	2360	2199
fNR_SorghumT2	2.3	0	0	0	0	0	0	0
fPR_SorghumT2	2.3	0	0	13	19	13	4	1
fKR_SorghumT2	2.3	0	0	0	0	0	0	0
sNS_SorghumT2	15.9	30	32	32	37	40	41	52
sPS_SorghumT2	15.9	2	2	2	2	3	4	4
sKS_SorghumT2	15.9	110	90	97	91	74	69	71
ygap_SorghumT2	15.9	1180	1608	3252	4146	3975	3621	2714
ytarget_SorghumT2	15.9	1036	1314	2179	2697	2676	2542	2201
fNR_SorghumT2	15.9	0	0	3	0	0	0	0
fPR_SorghumT2	15.9	3	7	21	28	24	16	4
fKR_SorghumT2	15.9	0	0	0	0	0	0	0
sNS_SorghumT2	50	37	38	37	43	46	46	56
sPS_SorghumT2	50	2	3	3	3	3	4	5
sKS_SorghumT2	50	141	117	119	110	90	80	77
ygap_SorghumT2	50	1393	2061	4009	4430	4221	3913	2886
ytarget_SorghumT2	50	1116	1577	2567	2744	2719	2657	2209
fNR_SorghumT2	50	0	0	24	21	11	8	0
fPR_SorghumT2	50	7	12	29	33	29	21	10
fKR_SorghumT2	50	0	0	0	0	0	5	0
sNS_SorghumT2	84.1	43	44	45	54	57	55	61
sPS_SorghumT2	84.1	3	3	4	4	4	5	6
sKS_SorghumT2	84.1	192	147	143	133	113	91	81
ygap_SorghumT2	84.1	1585	2591	4410	4600	4421	4048	3027
ytarget_SorghumT2	84.1	1190	1797	2706	2777	2742	2680	2220
fNR_SorghumT2	84.1	0	2	43	39	29	24	0
fPR_SorghumT2	84.1	10	17	34	36	33	25	15
fKR_SorghumT2	84.1	0	0	0	0	27	37	0
sNS_SorghumT2	97.7	53	52	57	67	71	68	68
sPS_SorghumT2	97.7	4	4	5	5	6	7	6
sKS_SorghumT2	97.7	259	177	171	166	140	104	84
ygap_SorghumT2	97.7	1730	2908	4586	4736	4667	4158	3089
ytarget_SorghumT2	97.7	1232	1905	2776	2820	2764	2690	2225
fNR_SorghumT2	97.7	0	19	57	55	44	35	0
fPR_SorghumT2	97.7	13	21	37	38	37	27	17
fKR_SorghumT2	97.7	0	0	7	29	65	75	6
sNS_SorghumT2	100	112	214	259	270	231	91	70
sPS_SorghumT2	100	10	10	9	10	17	9	7
sKS_SorghumT2	100	416	413	283	475	255	138	93
ygap_SorghumT2	100	1970	3235	4830	5036	5000	4314	3135

value	stat (%)	BF45	BF75	BF105	BF135	BF165	BF195	BF225
ytarget_SorghumT2	100	1277	1972	2833	2846	2785	2698	2226
fNR_SorghumT2	100	7	46	85	83	66	52	0
fPR_SorghumT2	100	17	31	57	53	43	31	17
fKR_SorghumT2	100	0	0	158	149	167	126	12
SorghumT2	n	4394	12565	48065	97411	82563	17531	91
sNS_MaizeT2	avg	37	38	39	45	48	48	57
sPS_MaizeT2	avg	2	3	3	3	3	4	5
sKS_MaizeT2	avg	150	119	120	113	93	80	76
ygap_MaizeT2	avg	779	1655	4244	6205	6172	5773	5265
ytarget_MaizeT2	avg	786	1367	2834	3919	3990	3909	3722
fNR_MaizeT2	avg	0	3	56	92	88	85	54
fPR_MaizeT2	avg	4	10	30	46	45	40	35
fKR_MaizeT2	avg	0	0	0	0	0	1	0
sNS_MaizeT2	0	19	20	18	22	27	31	48
sPS_MaizeT2	0	1	1	2	1	1	3	4
sKS_MaizeT2	0	59	54	29	32	25	36	65
ygap_MaizeT2	0	111	352	1573	4196	4226	4990	4948
ytarget_MaizeT2	0	400	919	1744	3437	3853	3709	3712
fNR_MaizeT2	0	0	0	0	0	0	0	20
fPR_MaizeT2	0	0	0	3	14	0	22	29
fKR_MaizeT2	0	0	0	0	0	0	0	0
sNS_MaizeT2	2.3	25	26	27	32	35	37	49
sPS_MaizeT2	2.3	1	2	2	2	2	3	4
sKS_MaizeT2	2.3	89	73	78	75	61	54	67
ygap_MaizeT2	2.3	366	869	2524	5445	5456	5266	4975
ytarget_MaizeT2	2.3	618	950	1898	3548	3885	3769	3713
fNR_MaizeT2	2.3	0	0	3	34	28	34	25
fPR_MaizeT2	2.3	0	2	16	38	36	31	31
fKR_MaizeT2	2.3	0	0	0	0	0	0	0
sNS_MaizeT2	15.9	30	32	32	37	40	41	52
sPS_MaizeT2	15.9	2	2	2	2	3	4	4
sKS_MaizeT2	15.9	110	90	97	91	74	69	71
ygap_MaizeT2	15.9	597	1106	3137	5824	5915	5588	5072
ytarget_MaizeT2	15.9	685	1048	2226	3721	3941	3867	3716
fNR_MaizeT2	15.9	0	0	27	71	65	66	43
fPR_MaizeT2	15.9	0	6	22	42	42	38	32
fKR_MaizeT2	15.9	0	0	0	0	0	0	0
sNS_MaizeT2	50	37	38	37	43	46	46	56
sPS_MaizeT2	50	2	3	3	3	3	4	5
sKS_MaizeT2	50	141	117	119	110	90	80	77
ygap_MaizeT2	50	789	1635	4326	6259	6199	5807	5296
ytarget_MaizeT2	50	788	1385	2890	3975	4001	3922	3722
fNR_MaizeT2	50	0	0	56	96	93	90	55
fPR_MaizeT2	50	4	10	31	46	45	41	36
fKR_MaizeT2	50	0	0	0	0	0	0	0
sNS_MaizeT2	84.1	43	44	45	54	57	55	61
sPS_MaizeT2	84.1	3	3	4	4	4	5	6
sKS_MaizeT2	84.1	192	147	143	133	113	91	81
ygap_MaizeT2	84.1	962	2227	5316	6556	6440	5953	5460
ytarget_MaizeT2	84.1	887	1683	3400	4056	4034	3950	3729
fNR_MaizeT2	84.1	0	7	84	114	109	103	65
fPR_MaizeT2	84.1	6	15	39	49	48	42	38
fKR_MaizeT2	84.1	0	0	0	0	0	0	0
sNS_MaizeT2	97.7	53	52	57	67	71	68	68
sPS_MaizeT2	97.7	4	4	5	5	6	7	6
sKS_MaizeT2	97.7	259	177	171	166	140	104	84
ygap_MaizeT2	97.7	1095	2592	5631	6746	6677	6075	5538
ytarget_MaizeT2	97.7	937	1837	3549	4121	4066	3965	3731
fNR_MaizeT2	97.7	0	25	102	129	123	114	73
fPR_MaizeT2	97.7	7	18	42	51	50	44	39
fKR_MaizeT2	97.7	0	0	0	0	4	11	0
sNS_MaizeT2	100	112	214	259	270	231	91	70
sPS_MaizeT2	100	10	10	9	10	17	9	7
sKS_MaizeT2	100	416	413	283	475	255	138	93
ygap_MaizeT2	100	1319	2903	5933	6997	6963	6259	5568
ytarget_MaizeT2	100	995	1930	3657	4186	4098	3974	3731
fNR_MaizeT2	100	0	52	133	150	142	128	76
fPR_MaizeT2	100	10	26	71	69	58	46	40
fKR_MaizeT2	100	0	0	34	33	49	32	0
MaizeT2	n	4394	12565	48065	97411	82563	17531	91

value	stat (%)	BF45	BF75	BF105	BF135	BF165	BF195	BF225
sNS_CassavaT2	avg	37	38	39	45	48	48	57
sPS_CassavaT2	avg	2	3	3	3	3	4	5
sKS_CassavaT2	avg	150	119	120	113	93	80	76
ygap_CassavaT2	avg	0	0	20	3735	8376	11897	13909
ytarget_CassavaT2	avg	0	0	31	3090	6074	8497	9892
fNR_CassavaT2	avg	0	0	0	2	41	99	110
fPR_CassavaT2	avg	0	0	0	27	67	95	112
fKR_CassavaT2	avg	0	0	0	0	0	2	4
sNS_CassavaT2	0	19	20	18	22	27	31	48
sPS_CassavaT2	0	1	1	2	1	1	3	4
sKS_CassavaT2	0	59	54	29	32	25	36	65
ygap_CassavaT2	0	0	0	0	0	3009	8994	12933
ytarget_CassavaT2	0	0	0	0	0	4028	7457	9665
fNR_CassavaT2	0	0	0	0	0	0	0	73
fPR_CassavaT2	0	0	0	0	0	0	60	100
fKR_CassavaT2	0	0	0	0	0	0	0	0
sNS_CassavaT2	2.3	25	26	27	32	35	37	49
sPS_CassavaT2	2.3	1	2	2	2	2	3	4
sKS_CassavaT2	2.3	89	73	78	75	61	54	67
ygap_CassavaT2	2.3	0	0	0	53	5329	10420	13101
ytarget_CassavaT2	2.3	0	0	0	328	4479	7673	9705
fNR_CassavaT2	2.3	0	0	0	0	0	45	79
fPR_CassavaT2	2.3	0	0	0	0	36	77	101
fKR_CassavaT2	2.3	0	0	0	0	0	0	0
sNS_CassavaT2	15.9	30	32	32	37	40	41	52
sPS_CassavaT2	15.9	2	2	2	2	3	4	4
sKS_CassavaT2	15.9	110	90	97	91	74	69	71
ygap_CassavaT2	15.9	0	0	0	2657	6530	11192	13343
ytarget_CassavaT2	15.9	0	0	0	2436	4944	8093	9803
fNR_CassavaT2	15.9	0	0	0	0	1	76	98
fPR_CassavaT2	15.9	0	0	0	18	51	89	105
fKR_CassavaT2	15.9	0	0	0	0	0	0	0
sNS_CassavaT2	50	37	38	37	43	46	46	56
sPS_CassavaT2	50	2	3	3	3	3	4	5
sKS_CassavaT2	50	141	117	119	110	90	80	77
ygap_CassavaT2	50	0	0	0	3645	8237	11976	13882
ytarget_CassavaT2	50	0	0	0	3065	5983	8514	9891
fNR_CassavaT2	50	0	0	0	0	36	104	111
fPR_CassavaT2	50	0	0	0	27	66	96	112
fKR_CassavaT2	50	0	0	0	0	0	0	0
sNS_CassavaT2	84.1	43	44	45	54	57	55	61
sPS_CassavaT2	84.1	3	3	4	4	4	5	6
sKS_CassavaT2	84.1	192	147	143	133	113	91	81
ygap_CassavaT2	84.1	0	0	0	5133	10547	12560	14487
ytarget_CassavaT2	84.1	0	0	0	3972	7381	8860	9987
fNR_CassavaT2	84.1	0	0	0	1	80	120	123
fPR_CassavaT2	84.1	0	0	0	40	86	102	119
fKR_CassavaT2	84.1	0	0	0	0	0	0	11
sNS_CassavaT2	97.7	53	52	57	67	71	68	68
sPS_CassavaT2	97.7	4	4	5	5	6	7	6
sKS_CassavaT2	97.7	259	177	171	166	140	104	84
ygap_CassavaT2	97.7	0	0	106	6248	11315	13146	14727
ytarget_CassavaT2	97.7	0	0	536	4505	7921	9326	10032
fNR_CassavaT2	97.7	0	0	0	24	108	131	132
fPR_CassavaT2	97.7	0	0	0	50	93	107	121
fKR_CassavaT2	97.7	0	0	0	0	0	31	20
sNS_CassavaT2	100	112	214	259	270	231	91	70
sPS_CassavaT2	100	10	10	9	10	17	9	7
sKS_CassavaT2	100	416	413	283	475	255	138	93
ygap_CassavaT2	100	0	0	2680	7399	12241	14214	14783
ytarget_CassavaT2	100	0	0	2217	5201	8354	9892	10050
fNR_CassavaT2	100	0	0	4	58	130	148	135
fPR_CassavaT2	100	0	0	20	63	108	116	122
fKR_CassavaT2	100	0	0	0	0	60	81	25
CassavaT2	n	4394	12565	48065	97411	82563	17531	91
sNS_RiceT2	avg	37	38	39	45	48	48	57
sPS_RiceT2	avg	2	3	3	3	3	4	5
sKS_RiceT2	avg	150	119	120	113	93	80	76
ygap_RiceT2	avg	4762	4540	4521	4663	4414	3900	3638
ytarget_RiceT2	avg	4013	4020	4048	4144	4142	4078	4073

value	stat (%)	BF45	BF75	BF105	BF135	BF165	BF195	BF225
fNR_RiceT2	avg	22	19	20	10	6	4	0
fPR_RiceT2	avg	46	43	43	44	41	35	32
fKR_RiceT2	avg	0	0	0	0	0	0	0
sNS_RiceT2	0	19	20	18	22	27	31	48
sPS_RiceT2	0	1	1	2	1	1	3	4
sKS_RiceT2	0	59	54	29	32	25	36	65
ygap_RiceT2	0	1399	1553	2537	1996	1479	2349	3030
ytarget_RiceT2	0	3997	3997	3980	4021	4011	4014	4063
fNR_RiceT2	0	0	0	0	0	0	0	0
fPR_RiceT2	0	0	0	13	5	0	11	24
fKR_RiceT2	0	0	0	0	0	0	0	0
sNS_RiceT2	2.3	25	26	27	32	35	37	49
sPS_RiceT2	2.3	1	2	2	2	2	3	4
sKS_RiceT2	2.3	89	73	78	75	61	54	67
ygap_RiceT2	2.3	4199	3907	3732	3762	3393	3076	3140
ytarget_RiceT2	2.3	4002	4003	3999	4044	4046	4034	4064
fNR_RiceT2	2.3	0	0	0	0	0	0	0
fPR_RiceT2	2.3	39	36	33	34	29	23	26
fKR_RiceT2	2.3	0	0	0	0	0	0	0
sNS_RiceT2	15.9	30	32	32	37	40	41	52
sPS_RiceT2	15.9	2	2	2	2	3	4	4
sKS_RiceT2	15.9	110	90	97	91	74	69	71
ygap_RiceT2	15.9	4522	4275	4223	4356	4076	3697	3301
ytarget_RiceT2	15.9	4007	4012	4017	4081	4096	4059	4066
fNR_RiceT2	15.9	2	0	0	0	0	0	0
fPR_RiceT2	15.9	43	40	39	41	38	33	28
fKR_RiceT2	15.9	0	0	0	0	0	0	0
sNS_RiceT2	50	37	38	37	43	46	46	56
sPS_RiceT2	50	2	3	3	3	3	4	5
sKS_RiceT2	50	141	117	119	110	90	80	77
ygap_RiceT2	50	4789	4564	4586	4742	4459	3941	3672
ytarget_RiceT2	50	4013	4020	4035	4141	4152	4079	4072
fNR_RiceT2	50	20	17	20	5	0	0	0
fPR_RiceT2	50	46	43	43	45	42	36	33
fKR_RiceT2	50	0	0	0	0	0	0	0
sNS_RiceT2	84.1	43	44	45	54	57	55	61
sPS_RiceT2	84.1	3	3	4	4	4	5	6
sKS_RiceT2	84.1	192	147	143	133	113	91	81
ygap_RiceT2	84.1	5019	4818	4805	4954	4771	4134	3976
ytarget_RiceT2	84.1	4020	4028	4086	4203	4184	4096	4079
fNR_RiceT2	84.1	40	35	37	24	16	11	0
fPR_RiceT2	84.1	48	46	46	47	45	38	37
fKR_RiceT2	84.1	0	0	0	0	0	0	0
sNS_RiceT2	97.7	53	52	57	67	71	68	68
sPS_RiceT2	97.7	4	4	5	5	6	7	6
sKS_RiceT2	97.7	259	177	171	166	140	104	84
ygap_RiceT2	97.7	5189	5022	4948	5128	5098	4312	4112
ytarget_RiceT2	97.7	4027	4032	4150	4268	4209	4111	4082
fNR_RiceT2	97.7	55	52	52	40	31	23	0
fPR_RiceT2	97.7	51	48	48	49	49	40	38
fKR_RiceT2	97.7	0	0	0	0	0	0	0
sNS_RiceT2	100	112	214	259	270	231	91	70
sPS_RiceT2	100	10	10	9	10	17	9	7
sKS_RiceT2	100	416	413	283	475	255	138	93
ygap_RiceT2	100	5401	5221	5175	5505	5479	4560	4131
ytarget_RiceT2	100	4034	4045	4276	4308	4240	4121	4083
fNR_RiceT2	100	75	69	75	69	55	40	0
fPR_RiceT2	100	70	78	79	68	55	43	39
fKR_RiceT2	100	0	0	16	10	25	0	0
RiceT2	n	4394	12565	48065	97411	82563	17531	91

Annex 11. Summary of a selection of the validated Tier 2 results for five crops in Benin aggregated by AEZ

value	unit	description
sNS	kg/ha	soil N supply (calculated using QUEFTS)
sPS	kg/ha	soil P supply (calculated using QUEFTS)
sKS	kg/ha	soil K supply (calculated using QUEFTS)
ygap	kg/ha	yield gap, relative to attainable AEZ yield and exceeding target yield gap (calculated using QUEFTS)
ytarget	kg/ha	target yield, at crop specific ratio of attainable AEZ yield (calculated using QUEFTS)
fNR	kg/ha	fertilizer N recommendation, for target yield gap (calculated using QUEFTS)
fPR	kg/ha	fertilizer P recommendation, for target yield gap (calculated using QUEFTS)
fKR	kg/ha	fertilizer K recommendation, for target yield gap (calculated using QUEFTS)

value	stat (%)	BJ135	BJ165	BJ195	BJ225	BJ255
sNS_MilletT2	avg	47	42	38	50	59
sPS_MilletT2	avg	3	3	5	5	6
sKS_MilletT2	avg	111	113	109	84	93
ygap_MilletT2	avg	1545	1373	692	409	267
ytarget_MilletT2	avg	1539	1460	1111	913	854
fNR_MilletT2	avg	16	21	4	0	0
fPR_MilletT2	avg	22	17	2	0	0
fKR_MilletT2	avg	2	1	0	0	0
sNS_MilletT2	0	23	26	26	32	37
sPS_MilletT2	0	2	2	2	3	2
sKS_MilletT2	0	55	44	45	26	19
ygap_MilletT2	0	902	715	275	79	2
ytarget_MilletT2	0	1508	1246	921	888	465
fNR_MilletT2	0	0	0	0	0	0
fPR_MilletT2	0	0	0	0	0	0
fKR_MilletT2	0	0	0	0	0	0
sNS_MilletT2	2.3	31	31	31	40	45
sPS_MilletT2	2.3	2	2	3	4	4
sKS_MilletT2	2.3	77	76	76	59	64
ygap_MilletT2	2.3	1221	968	419	188	45
ytarget_MilletT2	2.3	1512	1311	940	891	577
fNR_MilletT2	2.3	0	0	0	0	0
fPR_MilletT2	2.3	10	4	0	0	0
fKR_MilletT2	2.3	0	0	0	0	0
sNS_MilletT2	15.9	37	35	34	44	50
sPS_MilletT2	15.9	3	3	4	4	5
sKS_MilletT2	15.9	92	93	93	70	78
ygap_MilletT2	15.9	1423	1140	486	356	181
ytarget_MilletT2	15.9	1522	1364	993	899	805
fNR_MilletT2	15.9	0	0	0	0	0
fPR_MilletT2	15.9	18	10	0	0	0
fKR_MilletT2	15.9	0	0	0	0	0
sNS_MilletT2	50	46	39	38	48	56
sPS_MilletT2	50	3	3	5	5	6
sKS_MilletT2	50	109	115	109	82	91
ygap_MilletT2	50	1556	1370	660	421	280
ytarget_MilletT2	50	1538	1473	1110	915	892
fNR_MilletT2	50	9	23	0	0	0
fPR_MilletT2	50	22	17	0	0	0
fKR_MilletT2	50	0	0	0	0	0
sNS_MilletT2	84.1	57	52	42	54	66
sPS_MilletT2	84.1	4	4	6	6	7
sKS_MilletT2	84.1	129	132	123	95	107
ygap_MilletT2	84.1	1676	1618	923	472	354
ytarget_MilletT2	84.1	1558	1550	1238	924	898
fNR_MilletT2	84.1	38	38	12	0	0
fPR_MilletT2	84.1	25	24	4	0	0
fKR_MilletT2	84.1	0	0	0	0	0
sNS_MilletT2	97.7	64	63	50	69	90
sPS_MilletT2	97.7	5	5	8	8	9
sKS_MilletT2	97.7	158	147	140	126	137
ygap_MilletT2	97.7	1779	1750	1091	532	403
ytarget_MilletT2	97.7	1563	1562	1303	933	901
fNR_MilletT2	97.7	55	48	27	0	0
fPR_MilletT2	97.7	28	27	12	0	0

value	stat (%)	BJ135	BJ165	BJ195	BJ225	BJ255
fKR_MilletT2	97.7	33	24	0	0	0
sNS_MilletT2	100	100	106	77	182	234
sPS_MilletT2	100	6	12	13	12	17
sKS_MilletT2	100	236	179	170	193	298
ygap_MilletT2	100	1905	1919	1316	854	754
ytarget_MilletT2	100	1566	1568	1349	944	904
fNR_MilletT2	100	78	69	48	0	0
fPR_MilletT2	100	31	32	20	4	133
fKR_MilletT2	100	102	122	75	77	71
MilletT2	n	13408	28371	37096	25340	10779
sNS_SorghumT2	avg	47	42	38	50	59
sPS_SorghumT2	avg	3	3	5	5	6
sKS_SorghumT2	avg	111	113	109	84	93
ygap_SorghumT2	avg	4325	4151	3460	2694	2219
ytarget_SorghumT2	avg	2748	2705	2518	2119	2003
fNR_SorghumT2	avg	18	27	25	0	0
fPR_SorghumT2	avg	31	28	13	8	3
fKR_SorghumT2	avg	1	1	0	1	0
sNS_SorghumT2	0	23	26	26	32	37
sPS_SorghumT2	0	2	2	2	3	2
sKS_SorghumT2	0	55	44	45	26	19
ygap_SorghumT2	0	3359	3111	2561	1528	656
ytarget_SorghumT2	0	2711	2607	2137	2071	1276
fNR_SorghumT2	0	0	0	0	0	0
fPR_SorghumT2	0	9	0	0	0	0
fKR_SorghumT2	0	0	0	0	0	0
sNS_SorghumT2	2.3	31	31	31	40	45
sPS_SorghumT2	2.3	2	2	3	4	4
sKS_SorghumT2	2.3	77	76	76	59	64
ygap_SorghumT2	2.3	3841	3639	2824	1985	1166
ytarget_SorghumT2	2.3	2718	2613	2187	2077	1460
fNR_SorghumT2	2.3	0	0	0	0	0
fPR_SorghumT2	2.3	20	16	0	0	0
fKR_SorghumT2	2.3	0	0	0	0	0
sNS_SorghumT2	15.9	37	35	34	44	50
sPS_SorghumT2	15.9	3	3	4	4	5
sKS_SorghumT2	15.9	92	93	93	70	78
ygap_SorghumT2	15.9	4146	3891	3003	2558	1897
ytarget_SorghumT2	15.9	2730	2651	2315	2093	1878
fNR_SorghumT2	15.9	0	0	9	0	0
fPR_SorghumT2	15.9	28	23	6	3	0
fKR_SorghumT2	15.9	0	0	0	0	0
sNS_SorghumT2	50	46	39	38	48	56
sPS_SorghumT2	50	3	3	5	5	6
sKS_SorghumT2	50	109	115	109	82	91
ygap_SorghumT2	50	4340	4154	3532	2747	2303
ytarget_SorghumT2	50	2747	2709	2600	2116	2082
fNR_SorghumT2	50	14	31	26	0	0
fPR_SorghumT2	50	32	28	12	8	0
fKR_SorghumT2	50	0	0	0	0	0
sNS_SorghumT2	84.1	57	52	42	54	66
sPS_SorghumT2	84.1	4	4	6	6	7
sKS_SorghumT2	84.1	129	132	123	95	107
ygap_SorghumT2	84.1	4519	4424	3847	2867	2568
ytarget_SorghumT2	84.1	2770	2750	2669	2146	2099
fNR_SorghumT2	84.1	40	44	40	0	0
fPR_SorghumT2	84.1	35	33	21	11	6
fKR_SorghumT2	84.1	0	0	0	0	0
sNS_SorghumT2	97.7	64	63	50	69	90
sPS_SorghumT2	97.7	5	5	8	8	9
sKS_SorghumT2	97.7	158	147	140	126	137
ygap_SorghumT2	97.7	4671	4612	4059	2967	2724
ytarget_SorghumT2	97.7	2780	2772	2684	2180	2111
fNR_SorghumT2	97.7	56	53	50	5	0
fPR_SorghumT2	97.7	37	36	27	14	10
fKR_SorghumT2	97.7	21	18	0	20	0
sNS_SorghumT2	100	100	106	77	182	234
sPS_SorghumT2	100	6	12	13	12	17
sKS_SorghumT2	100	236	179	170	193	298
ygap_SorghumT2	100	4851	4833	4375	3161	2921

value	stat (%)	BJ135	BJ165	BJ195	BJ225	BJ255
ytarget_SorghumT2	100	2786	2784	2697	2212	2116
fNR_SorghumT2	100	78	68	66	26	7
fPR_SorghumT2	100	40	40	36	19	720
fKR_SorghumT2	100	85	105	101	108	97
SorghumT2	n	13408	28371	37096	25340	10779
sNS_MaizeT2	avg	47	42	38	50	59
sPS_MaizeT2	avg	3	3	5	5	6
sKS_MaizeT2	avg	111	113	109	84	93
ygap_MaizeT2	avg	6346	6155	5533	5014	4538
ytarget_MaizeT2	avg	4036	3983	3855	3583	3465
fNR_MaizeT2	avg	94	103	106	65	40
fPR_MaizeT2	avg	47	45	36	33	28
fKR_MaizeT2	avg	0	0	0	0	0
sNS_MaizeT2	0	23	26	26	32	37
sPS_MaizeT2	0	2	2	2	3	2
sKS_MaizeT2	0	55	44	45	26	19
ygap_MaizeT2	0	5049	4838	4690	3596	2609
ytarget_MaizeT2	0	3739	3844	3625	3495	2627
fNR_MaizeT2	0	0	0	10	0	0
fPR_MaizeT2	0	33	9	6	5	0
fKR_MaizeT2	0	0	0	0	0	0
sNS_MaizeT2	2.3	31	31	31	40	45
sPS_MaizeT2	2.3	2	2	3	4	4
sKS_MaizeT2	2.3	77	76	76	59	64
ygap_MaizeT2	2.3	5768	5516	5101	4241	3494
ytarget_MaizeT2	2.3	3887	3853	3665	3506	2937
fNR_MaizeT2	2.3	49	45	76	12	0
fPR_MaizeT2	2.3	40	37	26	22	15
fKR_MaizeT2	2.3	0	0	0	0	0
sNS_MaizeT2	15.9	37	35	34	44	50
sPS_MaizeT2	15.9	3	3	4	4	5
sKS_MaizeT2	15.9	92	93	93	70	78
ygap_MaizeT2	15.9	6144	5850	5261	4858	4257
ytarget_MaizeT2	15.9	4011	3905	3747	3535	3411
fNR_MaizeT2	15.9	69	76	94	53	14
fPR_MaizeT2	15.9	45	41	33	31	24
fKR_MaizeT2	15.9	0	0	0	0	0
sNS_MaizeT2	50	46	39	38	48	56
sPS_MaizeT2	50	3	3	5	5	6
sKS_MaizeT2	50	109	115	109	82	91
ygap_MaizeT2	50	6378	6179	5515	5076	4597
ytarget_MaizeT2	50	4041	3991	3870	3582	3514
fNR_MaizeT2	50	95	111	108	68	43
fPR_MaizeT2	50	47	45	36	34	29
fKR_MaizeT2	50	0	0	0	0	0
sNS_MaizeT2	84.1	57	52	42	54	66
sPS_MaizeT2	84.1	4	4	6	6	7
sKS_MaizeT2	84.1	129	132	123	95	107
ygap_MaizeT2	84.1	6560	6468	5818	5207	4865
ytarget_MaizeT2	84.1	4074	4046	3946	3633	3545
fNR_MaizeT2	84.1	120	123	118	80	62
fPR_MaizeT2	84.1	49	48	41	35	32
fKR_MaizeT2	84.1	0	0	0	0	0
sNS_MaizeT2	97.7	64	63	50	69	90
sPS_MaizeT2	97.7	5	5	8	8	9
sKS_MaizeT2	97.7	158	147	140	126	137
ygap_MaizeT2	97.7	6697	6639	6047	5332	5048
ytarget_MaizeT2	97.7	4090	4078	3964	3687	3565
fNR_MaizeT2	97.7	134	131	127	94	74
fPR_MaizeT2	97.7	50	50	44	37	35
fKR_MaizeT2	97.7	0	0	0	0	0
sNS_MaizeT2	100	100	106	77	182	234
sPS_MaizeT2	100	6	12	13	12	17
sKS_MaizeT2	100	236	179	170	193	298
ygap_MaizeT2	100	6864	6826	6407	5546	5330
ytarget_MaizeT2	100	4097	4098	3979	3706	3577
fNR_MaizeT2	100	153	146	141	113	92
fPR_MaizeT2	100	54	54	52	45	1814
fKR_MaizeT2	100	13	22	21	37	42
MaizeT2	n	13408	28371	37096	25340	10779

value	stat (%)	BJ135	BJ165	BJ195	BJ225	BJ255
sNS_CassavaT2	avg	47	42	38	50	59
sPS_CassavaT2	avg	3	3	5	5	6
sKS_CassavaT2	avg	111	113	109	84	93
ygap_CassavaT2	avg	4397	9621	12295	13917	13681
ytarget_CassavaT2	avg	3578	6834	8952	9917	10069
fNR_CassavaT2	avg	7	73	135	130	110
fPR_CassavaT2	avg	33	78	97	111	110
fKR_CassavaT2	avg	0	0	0	5	3
sNS_CassavaT2	0	23	26	26	32	37
sPS_CassavaT2	0	2	2	2	3	2
sKS_CassavaT2	0	55	44	45	26	19
ygap_CassavaT2	0	773	5283	8896	11448	9898
ytarget_CassavaT2	0	2196	4394	6949	9394	9405
fNR_CassavaT2	0	0	0	13	0	0
fPR_CassavaT2	0	0	12	50	67	32
fKR_CassavaT2	0	0	0	0	0	0
sNS_CassavaT2	2.3	31	31	31	40	45
sPS_CassavaT2	2.3	2	2	3	4	4
sKS_CassavaT2	2.3	77	76	76	59	64
ygap_CassavaT2	2.3	2060	6637	10749	12880	12265
ytarget_CassavaT2	2.3	2356	4918	7588	9538	9535
fNR_CassavaT2	2.3	0	0	80	80	30
fPR_CassavaT2	2.3	9	52	81	96	88
fKR_CassavaT2	2.3	0	0	0	0	0
sNS_CassavaT2	15.9	37	35	34	44	50
sPS_CassavaT2	15.9	3	3	4	4	5
sKS_CassavaT2	15.9	92	93	93	70	78
ygap_CassavaT2	15.9	2887	8189	11443	13451	13074
ytarget_CassavaT2	15.9	2691	5922	8319	9726	9802
fNR_CassavaT2	15.9	0	33	119	116	87
fPR_CassavaT2	15.9	19	65	89	106	100
fKR_CassavaT2	15.9	0	0	0	0	0
sNS_CassavaT2	50	46	39	38	48	56
sPS_CassavaT2	50	3	3	5	5	6
sKS_CassavaT2	50	109	115	109	82	91
ygap_CassavaT2	50	4242	9907	12185	13957	13744
ytarget_CassavaT2	50	3508	6980	8987	9902	10159
fNR_CassavaT2	50	0	79	138	132	117
fPR_CassavaT2	50	32	80	96	112	109
fKR_CassavaT2	50	0	0	0	0	0
sNS_CassavaT2	84.1	57	52	42	54	66
sPS_CassavaT2	84.1	4	4	6	6	7
sKS_CassavaT2	84.1	129	132	123	95	107
ygap_CassavaT2	84.1	6021	10914	13307	14373	14297
ytarget_CassavaT2	84.1	4487	7687	9595	10133	10287
fNR_CassavaT2	84.1	21	108	152	146	135
fPR_CassavaT2	84.1	48	89	106	117	116
fKR_CassavaT2	84.1	0	0	0	12	0
sNS_CassavaT2	97.7	64	63	50	69	90
sPS_CassavaT2	97.7	5	5	8	8	9
sKS_CassavaT2	97.7	158	147	140	126	137
ygap_CassavaT2	97.7	7070	11431	13932	14696	14719
ytarget_CassavaT2	97.7	5104	7975	9914	10259	10319
fNR_CassavaT2	97.7	46	124	163	160	148
fPR_CassavaT2	97.7	57	96	112	121	136
fKR_CassavaT2	97.7	0	0	0	42	34
sNS_CassavaT2	100	100	106	77	182	234
sPS_CassavaT2	100	6	12	13	12	17
sKS_CassavaT2	100	236	179	170	193	298
ygap_CassavaT2	100	8005	11959	14619	15211	15863
ytarget_CassavaT2	100	5563	8239	10125	10315	10343
fNR_CassavaT2	100	74	140	178	180	168
fPR_CassavaT2	100	67	110	125	162	6705
fKR_CassavaT2	100	0	3	50	139	156
CassavaT2	n	13408	28371	37096	25340	10779
sNS_RiceT2	avg	47	42	38	50	59
sPS_RiceT2	avg	3	3	5	5	6
sKS_RiceT2	avg	111	113	109	84	93
ygap_RiceT2	avg	4594	4384	3700	3477	2993
ytarget_RiceT2	avg	4167	4131	4097	3962	3880

value	stat (%)	BJ135	BJ165	BJ195	BJ225	BJ255
fNR_RiceT2	avg	10	16	20	1	0
fPR_RiceT2	avg	43	41	31	30	25
fKR_RiceT2	avg	0	0	0	0	0
sNS_RiceT2	0	23	26	26	32	37
sPS_RiceT2	0	2	2	2	3	2
sKS_RiceT2	0	55	44	45	26	19
ygap_RiceT2	0	3138	1942	1818	1398	790
ytarget_RiceT2	0	4052	3994	3993	3823	3817
fNR_RiceT2	0	0	0	0	0	0
fPR_RiceT2	0	26	0	0	0	0
fKR_RiceT2	0	0	0	0	0	0
sNS_RiceT2	2.3	31	31	31	40	45
sPS_RiceT2	2.3	2	2	3	4	4
sKS_RiceT2	2.3	77	76	76	59	64
ygap_RiceT2	2.3	3837	3601	2997	2376	1927
ytarget_RiceT2	2.3	4089	4005	4008	3853	3829
fNR_RiceT2	2.3	0	0	0	0	0
fPR_RiceT2	2.3	35	32	19	16	8
fKR_RiceT2	2.3	0	0	0	0	0
sNS_RiceT2	15.9	37	35	34	44	50
sPS_RiceT2	15.9	3	3	4	4	5
sKS_RiceT2	15.9	92	93	93	70	78
ygap_RiceT2	15.9	4346	4025	3431	3235	2623
ytarget_RiceT2	15.9	4129	4059	4067	3889	3848
fNR_RiceT2	15.9	0	0	7	0	0
fPR_RiceT2	15.9	41	37	27	27	20
fKR_RiceT2	15.9	0	0	0	0	0
sNS_RiceT2	50	46	39	38	48	56
sPS_RiceT2	50	3	3	5	5	6
sKS_RiceT2	50	109	115	109	82	91
ygap_RiceT2	50	4643	4401	3707	3573	3064
ytarget_RiceT2	50	4172	4141	4104	3955	3879
fNR_RiceT2	50	0	17	20	0	0
fPR_RiceT2	50	44	41	32	32	26
fKR_RiceT2	50	0	0	0	0	0
sNS_RiceT2	84.1	57	52	42	54	66
sPS_RiceT2	84.1	4	4	6	6	7
sKS_RiceT2	84.1	129	132	123	95	107
ygap_RiceT2	84.1	4858	4764	3988	3745	3364
ytarget_RiceT2	84.1	4205	4184	4127	4040	3910
fNR_RiceT2	84.1	26	31	31	0	0
fPR_RiceT2	84.1	46	45	36	34	30
fKR_RiceT2	84.1	0	0	0	0	0
sNS_RiceT2	97.7	64	63	50	69	90
sPS_RiceT2	97.7	5	5	8	8	9
sKS_RiceT2	97.7	158	147	140	126	137
ygap_RiceT2	97.7	5037	5003	4319	3912	3618
ytarget_RiceT2	97.7	4224	4212	4158	4107	3925
fNR_RiceT2	97.7	42	41	40	14	0
fPR_RiceT2	97.7	48	48	41	36	34
fKR_RiceT2	97.7	0	0	0	0	0
sNS_RiceT2	100	100	106	77	182	234
sPS_RiceT2	100	6	12	13	12	17
sKS_RiceT2	100	236	179	170	193	298
ygap_RiceT2	100	5251	5290	4754	4193	4506
ytarget_RiceT2	100	4233	4231	4218	4114	3945
fNR_RiceT2	100	65	57	55	37	16
fPR_RiceT2	100	51	51	49	43	2137
fKR_RiceT2	100	0	0	0	18	32
RiceT2	n	13408	28371	37096	25340	10779

Annex 12. Summary of a selection of the validated Tier 2 results for five crops in Ghana aggregated by AEZ

value	unit	description
sNS	kg/ha	soil N supply (calculated using QUEFTS)
sPS	kg/ha	soil P supply (calculated using QUEFTS)
sKS	kg/ha	soil K supply (calculated using QUEFTS)
ygap	kg/ha	yield gap, relative to attainable AEZ yield and exceeding target yield gap (calculated using QUEFTS)
ytarget	kg/ha	target yield, at crop specific ratio of attainable AEZ yield (calculated using QUEFTS)
fNR	kg/ha	fertilizer N recommendation, for target yield gap (calculated using QUEFTS)
fPR	kg/ha	fertilizer P recommendation, for target yield gap (calculated using QUEFTS)
fKR	kg/ha	fertilizer K recommendation, for target yield gap (calculated using QUEFTS)

value	stat (%)	GH165	GH195	GH225	GH255	GH285	GH315
sNS_MilletT2	avg	48	49	55	56	48	41
sPS_MilletT2	avg	4	4	5	5	4	3
sKS_MilletT2	avg	83	82	82	75	73	61
ygap_MilletT2	avg	1281	766	417	348	145	9
ytarget_MilletT2	avg	1415	1120	907	813	556	64
fNR_MilletT2	avg	6	0	0	0	0	0
fPR_MilletT2	avg	13	4	0	0	0	0
fKR_MilletT2	avg	12	3	1	1	0	0
sNS_MilletT2	0	28	28	33	29	23	23
sPS_MilletT2	0	2	2	2	2	1	1
sKS_MilletT2	0	30	20	21	6	19	19
ygap_MilletT2	0	681	100	13	6	0	0
ytarget_MilletT2	0	1278	887	675	521	0	0
fNR_MilletT2	0	0	0	0	0	0	0
fPR_MilletT2	0	0	0	0	0	0	0
fKR_MilletT2	0	0	0	0	0	0	0
sNS_MilletT2	2.3	35	38	41	41	33	30
sPS_MilletT2	2.3	3	3	4	3	3	2
sKS_MilletT2	2.3	61	59	48	40	46	37
ygap_MilletT2	2.3	942	340	223	117	4	0
ytarget_MilletT2	2.3	1322	942	771	599	20	0
fNR_MilletT2	2.3	0	0	0	0	0	0
fPR_MilletT2	2.3	0	0	0	0	0	0
fKR_MilletT2	2.3	0	0	0	0	0	0
sNS_MilletT2	15.9	40	42	47	47	41	35
sPS_MilletT2	15.9	3	4	4	4	3	3
sKS_MilletT2	15.9	72	71	67	59	60	49
ygap_MilletT2	15.9	1125	556	329	200	29	0
ytarget_MilletT2	15.9	1347	983	857	662	385	0
fNR_MilletT2	15.9	0	0	0	0	0	0
fPR_MilletT2	15.9	8	0	0	0	0	0
fKR_MilletT2	15.9	0	0	0	0	0	0
sNS_MilletT2	50	47	48	53	53	47	40
sPS_MilletT2	50	4	4	5	4	4	3
sKS_MilletT2	50	83	82	82	76	73	62
ygap_MilletT2	50	1285	747	411	358	126	0
ytarget_MilletT2	50	1415	1115	931	851	566	0
fNR_MilletT2	50	0	0	0	0	0	0
fPR_MilletT2	50	14	2	0	0	0	0
fKR_MilletT2	50	0	0	0	0	0	0
sNS_MilletT2	84.1	55	55	62	63	55	47
sPS_MilletT2	84.1	5	5	6	5	5	4
sKS_MilletT2	84.1	95	94	96	91	85	72
ygap_MilletT2	84.1	1439	1012	516	468	255	15
ytarget_MilletT2	84.1	1484	1265	937	919	748	252
fNR_MilletT2	84.1	17	0	0	0	0	0
fPR_MilletT2	84.1	19	8	0	0	0	0
fKR_MilletT2	84.1	31	0	0	0	0	0
sNS_MilletT2	97.7	66	71	80	84	66	57
sPS_MilletT2	97.7	6	7	8	7	6	5
sKS_MilletT2	97.7	110	111	119	106	100	83
ygap_MilletT2	97.7	1583	1165	611	595	428	84
ytarget_MilletT2	97.7	1511	1315	943	927	860	425
fNR_MilletT2	97.7	33	5	0	0	0	0
fPR_MilletT2	97.7	23	13	2	2	0	0

value	stat (%)	GH165	GH195	GH225	GH255	GH285	GH315
fKR_MilletT2	97.7	63	33	14	22	0	0
sNS_MilletT2	100	140	373	252	459	184	115
sPS_MilletT2	100	19	18	17	14	14	12
sKS_MilletT2	100	157	199	205	359	204	172
ygap_MilletT2	100	1756	1400	1022	1321	747	256
ytarget_MilletT2	100	1524	1347	967	930	917	576
fNR_MilletT2	100	58	44	0	0	0	0
fPR_MilletT2	100	36	20	7	16	381	0
fKR_MilletT2	100	170	115	100	140	66	14
MilletT2	n	21773	47931	33193	35957	51151	40272
sNS_SorghumT2	avg	48	49	55	56	48	41
sPS_SorghumT2	avg	4	4	5	5	4	3
sKS_SorghumT2	avg	83	82	82	75	73	61
ygap_SorghumT2	avg	4111	3652	2722	2412	1614	667
ytarget_SorghumT2	avg	2703	2531	2121	1925	1470	831
fNR_SorghumT2	avg	13	6	0	0	0	0
fPR_SorghumT2	avg	25	19	9	7	3	1
fKR_SorghumT2	avg	14	11	4	5	1	0
sNS_SorghumT2	0	28	28	33	29	23	23
sPS_SorghumT2	0	2	2	2	2	1	1
sKS_SorghumT2	0	30	20	21	6	19	19
ygap_SorghumT2	0	2927	1837	1245	929	275	10
ytarget_SorghumT2	0	2631	2082	1668	1365	746	539
fNR_SorghumT2	0	0	0	0	0	0	0
fPR_SorghumT2	0	0	0	0	0	0	0
fKR_SorghumT2	0	0	0	0	0	0	0
sNS_SorghumT2	2.3	35	38	41	41	33	30
sPS_SorghumT2	2.3	3	3	4	3	3	2
sKS_SorghumT2	2.3	61	59	48	40	46	37
ygap_SorghumT2	2.3	3596	2693	2018	1567	739	282
ytarget_SorghumT2	2.3	2656	2204	1804	1526	896	580
fNR_SorghumT2	2.3	0	0	0	0	0	0
fPR_SorghumT2	2.3	8	0	0	0	0	0
fKR_SorghumT2	2.3	0	0	0	0	0	0
sNS_SorghumT2	15.9	40	42	47	47	41	35
sPS_SorghumT2	15.9	3	4	4	4	3	3
sKS_SorghumT2	15.9	72	71	67	59	60	49
ygap_SorghumT2	15.9	3921	3174	2460	1873	1096	430
ytarget_SorghumT2	15.9	2683	2302	1997	1619	1163	679
fNR_SorghumT2	15.9	0	0	0	0	0	0
fPR_SorghumT2	15.9	20	13	2	0	0	0
fKR_SorghumT2	15.9	0	0	0	0	0	0
sNS_SorghumT2	50	47	48	53	53	47	40
sPS_SorghumT2	50	4	4	5	4	4	3
sKS_SorghumT2	50	83	82	82	76	73	62
ygap_SorghumT2	50	4134	3750	2766	2520	1618	611
ytarget_SorghumT2	50	2707	2616	2175	2001	1476	822
fNR_SorghumT2	50	9	0	0	0	0	0
fPR_SorghumT2	50	27	20	10	8	0	0
fKR_SorghumT2	50	3	0	0	0	0	0
sNS_SorghumT2	84.1	55	55	62	63	55	47
sPS_SorghumT2	84.1	5	5	6	5	5	4
sKS_SorghumT2	84.1	95	94	96	91	85	72
ygap_SorghumT2	84.1	4305	4054	2997	2828	2081	904
ytarget_SorghumT2	84.1	2723	2685	2194	2153	1772	978
fNR_SorghumT2	84.1	29	17	0	0	0	0
fPR_SorghumT2	84.1	31	25	14	13	7	0
fKR_SorghumT2	84.1	35	28	0	1	0	0
sNS_SorghumT2	97.7	66	71	80	84	66	57
sPS_SorghumT2	97.7	6	7	8	7	6	5
sKS_SorghumT2	97.7	110	111	119	106	100	83
ygap_SorghumT2	97.7	4469	4213	3128	2999	2664	1421
ytarget_SorghumT2	97.7	2732	2708	2213	2169	2021	1229
fNR_SorghumT2	97.7	43	31	0	0	0	0
fPR_SorghumT2	97.7	34	29	18	18	15	7
fKR_SorghumT2	97.7	66	60	49	54	12	0
sNS_SorghumT2	100	140	373	252	459	184	115
sPS_SorghumT2	100	19	18	17	14	14	12
sKS_SorghumT2	100	157	199	205	359	204	172
ygap_SorghumT2	100	4748	4480	3581	4121	3241	1828

value	stat (%)	GH165	GH195	GH225	GH255	GH285	GH315
ytarget_SorghumT2	100	2739	2725	2271	2177	2154	1486
fNR_SorghumT2	100	62	60	21	20	18	0
fPR_SorghumT2	100	51	35	23	41	938	400
fKR_SorghumT2	100	149	150	131	169	95	52
SorghumT2	n	21773	47931	33193	35957	51151	40272
sNS_MaizeT2	avg	48	49	55	56	48	41
sPS_MaizeT2	avg	4	4	5	5	4	3
sKS_MaizeT2	avg	83	82	82	75	73	61
ygap_MaizeT2	avg	6048	5707	5155	4903	4025	2662
ytarget_MaizeT2	avg	3981	3874	3645	3468	2926	2024
fNR_MaizeT2	avg	89	81	55	47	37	13
fPR_MaizeT2	avg	43	39	34	34	29	26
fKR_MaizeT2	avg	0	0	1	1	0	0
sNS_MaizeT2	0	28	28	33	29	23	23
sPS_MaizeT2	0	2	2	2	2	1	1
sKS_MaizeT2	0	30	20	21	6	19	19
ygap_MaizeT2	0	4708	2949	3001	2951	1664	1093
ytarget_MaizeT2	0	3882	3514	3326	2776	1921	1919
fNR_MaizeT2	0	0	0	0	0	0	0
fPR_MaizeT2	0	0	0	0	0	0	0
fKR_MaizeT2	0	0	0	0	0	0	0
sNS_MaizeT2	2.3	35	38	41	41	33	30
sPS_MaizeT2	2.3	3	3	4	3	3	2
sKS_MaizeT2	2.3	61	59	48	40	46	37
ygap_MaizeT2	2.3	5439	4819	4465	4061	2612	2195
ytarget_MaizeT2	2.3	3920	3667	3472	3069	1981	1927
fNR_MaizeT2	2.3	43	17	0	0	0	0
fPR_MaizeT2	2.3	33	28	23	22	16	11
fKR_MaizeT2	2.3	0	0	0	0	0	0
sNS_MaizeT2	15.9	40	42	47	47	41	35
sPS_MaizeT2	15.9	3	4	4	4	3	3
sKS_MaizeT2	15.9	72	71	67	59	60	49
ygap_MaizeT2	15.9	5818	5464	4908	4498	3235	2412
ytarget_MaizeT2	15.9	3952	3753	3558	3227	2437	1946
fNR_MaizeT2	15.9	70	65	37	22	15	0
fPR_MaizeT2	15.9	40	37	31	30	22	16
fKR_MaizeT2	15.9	0	0	0	0	0	0
sNS_MaizeT2	50	47	48	53	53	47	40
sPS_MaizeT2	50	4	4	5	4	4	3
sKS_MaizeT2	50	83	82	82	76	73	62
ygap_MaizeT2	50	6079	5758	5194	5007	4104	2608
ytarget_MaizeT2	50	3986	3913	3671	3527	2972	1966
fNR_MaizeT2	50	91	84	58	52	38	11
fPR_MaizeT2	50	44	40	36	34	29	22
fKR_MaizeT2	50	0	0	0	0	0	0
sNS_MaizeT2	84.1	55	55	62	63	55	47
sPS_MaizeT2	84.1	5	5	6	5	5	4
sKS_MaizeT2	84.1	95	94	96	91	85	72
ygap_MaizeT2	84.1	6276	5985	5415	5217	4759	2877
ytarget_MaizeT2	84.1	4007	3961	3703	3636	3425	2113
fNR_MaizeT2	84.1	109	98	74	67	57	26
fPR_MaizeT2	84.1	46	43	38	37	35	35
fKR_MaizeT2	84.1	0	0	0	0	0	0
sNS_MaizeT2	97.7	66	71	80	84	66	57
sPS_MaizeT2	97.7	6	7	8	7	6	5
sKS_MaizeT2	97.7	110	111	119	106	100	83
ygap_MaizeT2	97.7	6458	6160	5561	5375	5154	3615
ytarget_MaizeT2	97.7	4021	3991	3733	3659	3547	2541
fNR_MaizeT2	97.7	121	110	90	79	72	40
fPR_MaizeT2	97.7	48	45	40	42	49	63
fKR_MaizeT2	97.7	5	5	13	19	4	0
sNS_MaizeT2	100	140	373	252	459	184	115
sPS_MaizeT2	100	19	18	17	14	14	12
sKS_MaizeT2	100	157	199	205	359	204	172
ygap_MaizeT2	100	6731	6444	5842	6246	5631	4357
ytarget_MaizeT2	100	4031	4018	3774	3675	3656	2982
fNR_MaizeT2	100	138	136	109	103	102	69
fPR_MaizeT2	100	73	48	50	96	1848	1241
fKR_MaizeT2	100	41	48	47	64	41	26
MaizeT2	n	21773	47931	33193	35957	51151	40272

value	stat (%)	GH165	GH195	GH225	GH255	GH285	GH315
sNS_CassavaT2	avg	48	49	55	56	48	41
sPS_CassavaT2	avg	4	4	5	5	4	3
sKS_CassavaT2	avg	83	82	82	75	73	61
ygap_CassavaT2	avg	9751	12007	14184	14930	14978	15148
ytarget_CassavaT2	avg	7031	8560	10022	10395	10317	10122
fNR_CassavaT2	avg	63	97	118	127	144	157
fPR_CassavaT2	avg	78	96	114	124	137	191
fKR_CassavaT2	avg	0	1	10	22	22	43
sNS_CassavaT2	0	28	28	33	29	23	23
sPS_CassavaT2	0	2	2	2	2	1	1
sKS_CassavaT2	0	30	20	21	6	19	19
ygap_CassavaT2	0	5065	6792	9717	10231	10607	11762
ytarget_CassavaT2	0	5967	7008	8979	9920	10064	9971
fNR_CassavaT2	0	0	0	0	0	0	0
fPR_CassavaT2	0	0	4	29	52	50	62
fKR_CassavaT2	0	0	0	0	0	0	0
sNS_CassavaT2	2.3	35	38	41	41	33	30
sPS_CassavaT2	2.3	3	3	4	3	3	2
sKS_CassavaT2	2.3	61	59	48	40	46	37
ygap_CassavaT2	2.3	7827	9700	12497	13582	13997	14295
ytarget_CassavaT2	2.3	6327	7333	9279	10123	10128	9999
fNR_CassavaT2	2.3	14	40	47	50	98	116
fPR_CassavaT2	2.3	55	70	92	103	110	121
fKR_CassavaT2	2.3	0	0	0	0	0	0
sNS_CassavaT2	15.9	40	42	47	47	41	35
sPS_CassavaT2	15.9	3	4	4	4	3	3
sKS_CassavaT2	15.9	72	71	67	59	60	49
ygap_CassavaT2	15.9	8826	10794	13452	14479	14569	14790
ytarget_CassavaT2	15.9	6598	7811	9645	10243	10185	10039
fNR_CassavaT2	15.9	39	74	101	105	126	141
fPR_CassavaT2	15.9	69	86	106	116	118	133
fKR_CassavaT2	15.9	0	0	0	0	0	10
sNS_CassavaT2	50	47	48	53	53	47	40
sPS_CassavaT2	50	4	4	5	4	4	3
sKS_CassavaT2	50	83	82	82	76	73	62
ygap_CassavaT2	50	9726	12083	14300	15022	15003	15163
ytarget_CassavaT2	50	6934	8564	10038	10395	10310	10102
fNR_CassavaT2	50	62	100	123	132	145	158
fPR_CassavaT2	50	78	97	116	123	126	162
fKR_CassavaT2	50	0	0	0	6	14	40
sNS_CassavaT2	84.1	55	55	62	63	55	47
sPS_CassavaT2	84.1	5	5	6	5	5	4
sKS_CassavaT2	84.1	95	94	96	91	85	72
ygap_CassavaT2	84.1	10785	13246	14914	15366	15395	15525
ytarget_CassavaT2	84.1	7552	9252	10394	10545	10428	10203
fNR_CassavaT2	84.1	89	120	138	150	161	174
fPR_CassavaT2	84.1	88	108	122	129	149	247
fKR_CassavaT2	84.1	0	0	23	53	47	75
sNS_CassavaT2	97.7	66	71	80	84	66	57
sPS_CassavaT2	97.7	6	7	8	7	6	5
sKS_CassavaT2	97.7	110	111	119	106	100	83
ygap_CassavaT2	97.7	11547	14002	15319	15754	15806	15853
ytarget_CassavaT2	97.7	7943	10002	10606	10691	10638	10338
fNR_CassavaT2	97.7	111	136	150	166	180	188
fPR_CassavaT2	97.7	95	114	128	158	256	437
fKR_CassavaT2	97.7	0	19	75	102	87	108
sNS_CassavaT2	100	140	373	252	459	184	115
sPS_CassavaT2	100	19	18	17	14	14	12
sKS_CassavaT2	100	157	199	205	359	204	172
ygap_CassavaT2	100	12139	15226	16595	16837	16507	16347
ytarget_CassavaT2	100	8116	10489	10978	11051	11159	10633
fNR_CassavaT2	100	133	164	175	195	208	210
fPR_CassavaT2	100	118	130	216	380	7067	7046
fKR_CassavaT2	100	47	145	145	197	161	162
CassavaT2	n	21773	47931	33193	35957	51151	40272
sNS_RiceT2	avg	48	49	55	56	48	41
sPS_RiceT2	avg	4	4	5	5	4	3
sKS_RiceT2	avg	83	82	82	75	73	61
ygap_RiceT2	avg	4213	3897	3611	3631	3737	4056
ytarget_RiceT2	avg	4128	4070	4013	3959	3933	3875

value	stat (%)	GH165	GH195	GH225	GH255	GH285	GH315
fNR_RiceT2	avg	6	2	0	0	3	10
fPR_RiceT2	avg	39	35	32	33	38	58
fKR_RiceT2	avg	0	0	0	0	0	0
sNS_RiceT2	0	28	28	33	29	23	23
sPS_RiceT2	0	2	2	2	2	1	1
sKS_RiceT2	0	30	20	21	6	19	19
ygap_RiceT2	0	1596	736	789	974	1071	1488
ytarget_RiceT2	0	4027	3903	3853	3834	3831	3811
fNR_RiceT2	0	0	0	0	0	0	0
fPR_RiceT2	0	0	0	0	0	0	0
fKR_RiceT2	0	0	0	0	0	0	0
sNS_RiceT2	2.3	35	38	41	41	33	30
sPS_RiceT2	2.3	3	3	4	3	3	2
sKS_RiceT2	2.3	61	59	48	40	46	37
ygap_RiceT2	2.3	3173	2812	2556	2751	2953	3335
ytarget_RiceT2	2.3	4062	3974	3904	3843	3841	3821
fNR_RiceT2	2.3	0	0	0	0	0	0
fPR_RiceT2	2.3	25	20	16	20	24	31
fKR_RiceT2	2.3	0	0	0	0	0	0
sNS_RiceT2	15.9	40	42	47	47	41	35
sPS_RiceT2	15.9	3	4	4	4	3	3
sKS_RiceT2	15.9	72	71	67	59	60	49
ygap_RiceT2	15.9	3868	3629	3241	3328	3404	3770
ytarget_RiceT2	15.9	4099	4036	3978	3908	3892	3844
fNR_RiceT2	15.9	0	0	0	0	0	0
fPR_RiceT2	15.9	35	32	28	29	30	38
fKR_RiceT2	15.9	0	0	0	0	0	0
sNS_RiceT2	50	47	48	53	53	47	40
sPS_RiceT2	50	4	4	5	4	4	3
sKS_RiceT2	50	83	82	82	76	73	62
ygap_RiceT2	50	4279	3973	3704	3680	3748	4080
ytarget_RiceT2	50	4132	4071	4010	3967	3938	3875
fNR_RiceT2	50	0	0	0	0	0	6
fPR_RiceT2	50	40	37	34	34	35	49
fKR_RiceT2	50	0	0	0	0	0	0
sNS_RiceT2	84.1	55	55	62	63	55	47
sPS_RiceT2	84.1	5	5	6	5	5	4
sKS_RiceT2	84.1	95	94	96	91	85	72
ygap_RiceT2	84.1	4574	4203	3974	3942	4080	4348
ytarget_RiceT2	84.1	4158	4108	4055	3997	3969	3905
fNR_RiceT2	84.1	16	6	0	0	6	23
fPR_RiceT2	84.1	43	39	37	37	44	76
fKR_RiceT2	84.1	0	0	0	0	0	0
sNS_RiceT2	97.7	66	71	80	84	66	57
sPS_RiceT2	97.7	6	7	8	7	6	5
sKS_RiceT2	97.7	110	111	119	106	100	83
ygap_RiceT2	97.7	4823	4432	4159	4206	4467	4608
ytarget_RiceT2	97.7	4173	4132	4099	4045	4018	3941
fNR_RiceT2	97.7	31	19	7	8	28	37
fPR_RiceT2	97.7	46	42	39	46	80	138
fKR_RiceT2	97.7	0	0	0	0	0	0
sNS_RiceT2	100	140	373	252	459	184	115
sPS_RiceT2	100	19	18	17	14	14	12
sKS_RiceT2	100	157	199	205	359	204	172
ygap_RiceT2	100	5212	4853	4816	5004	5057	5153
ytarget_RiceT2	100	4185	4159	4181	4127	4144	3992
fNR_RiceT2	100	50	48	30	40	58	60
fPR_RiceT2	100	70	46	53	123	2387	2473
fKR_RiceT2	100	15	32	31	60	34	32
RiceT2	n	21773	47931	33193	35957	51151	40272

Annex 13. Metadata; description of data folders and file names

Project folder is at ftp://ftp.isric.org (username ifdc, password IFDCWAIFDCWA). All files are available according to the ISRIC data policy (www.isric.org/about/data-policy) and are licensed according to CC-BY 4.0 (free for use by attribution).

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
-	IFDC_upscale_Metadata_folders-files.xlsx	Metadata; description of data folders and file names	-	xlsx (tables)	-	-	Leenaars et al, 2018
0_Inputdata\0_AoI_ECOWAS_AEZ	AoI_ECOWAS.shp	Area of Interest; ECOWAS region	-	shp (map)	wgs84, deg	-	ECOWAS
0_Inputdata\0_AoI_ECOWAS_AEZ	LGP_country_ECOWAS.shp	Agro-Ecological Zones (LGP) per country in ECOWAS region	days	shp (map)	wgs84, deg	-	FAO-GAEZ
0_Inputdata\0_Covariates	IFDC_Covariates_List_Final_adjusted.xlsx	List of spatial covariates used for extrapolation	-	xlsx (tables)	-	-	ISRIC
0_Inputdata\0_InputData_QUEFTS\CropParameters4QUEFTS	QUEFTS_LandUseParameters.xlsx	Land use (crop) parameters used for QUEFTS	-	xlsx (tables)	-	-	Leenaars et al, 2018
0_Inputdata\0_InputData_QUEFTS\InputDataGrids4QUEFTS	BD.tif	Bulk density of the soil fine earth fraction over 0-30 cm depth	kg/dm3	tif (map)	wgs84 laea, m	1km	Hengl et al, 2017
0_Inputdata\0_InputData_QUEFTS\InputDataGrids4QUEFTS	Corg.tif	Organic C content of the soil fine earth fraction over 0-30 cm depth	g/kg	tif (map)	wgs84 laea, m	1km	Hengl et al, 2017
0_Inputdata\0_InputData_QUEFTS\InputDataGrids4QUEFTS	CRFVOL.tif	Volumetric coarse fragments content of the soil whole earth fraction over 0-30 cm depth	m3/100 m3	tif (map)	wgs84 laea, m	1km	Hengl et al, 2017
0_Inputdata\0_InputData_QUEFTS\InputDataGrids4QUEFTS	ERZD.tif	Rootable depth of soil	cm	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_InputData_QUEFTS\InputDataGrids4QUEFTS	Kexch.tif	Exchangeable K content of the soil fine earth fraction over 0-30 cm depth	mmolc/kg	tif (map)	wgs84 laea, m	1km	Hengl, Leenaars et al, 2017
0_Inputdata\0_InputData_QUEFTS\InputDataGrids4QUEFTS	Norg.tif	Total N content of the soil fine earth fraction over 0-30 cm depth	g/kg	tif (map)	wgs84 laea, m	1km	Hengl, Leenaars, et al, 2017
0_Inputdata\0_InputData_QUEFTS\InputDataGrids4QUEFTS	pH.tif	pH (H2O) of the soil over 0-30 cm depth	-	tif (map)	wgs84 laea, m	1km	Hengl et al, 2017
0_Inputdata\0_InputData_QUEFTS\InputDataGrids4QUEFTS	Pm3.tif	Available P content of the soil fine earth fraction over 0-30 cm depth, extracted by Mehlich 3 method	mg/kg	tif (map)	wgs84 laea, m	1km	Hengl, Leenaars, et al, 2017
0_Inputdata\0_InputData_QUEFTS\InputDataGrids4QUEFTS	Polsen.tif	Available P content of the soil fine earth fraction over 0-30 cm depth, extracted by Olsen method	mg/kg	tif (map)	wgs84 laea, m	1km	Hengl, Leenaars et al, 2017
0_Inputdata\0_InputData_QUEFTS\InputDataGrids4QUEFTS	Ptot.tif	Total P content of the soil fine earth fraction over 0-30 cm depth	mg/kg	tif (map)	wgs84 laea, m	1km	Hengl, Leenaars et al, 2017
0_Inputdata\0_InputData_QUEFTS\InputDataGrids4QUEFTS	RZPAWHC.tif	Root zone plant-available water holding capacity of the soil	mm	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_InputData_QUEFTS\InputDataGrids4QUEFTS	Tmprtr.tif	Soil temperature	degree Celcius	tif (map)	wgs84 laea, m	1km	-
0_Inputdata\0_InputData_QUEFTS\InputDataGrids4QUEFTS	ymaxCassava.tif	Maximally attainable yield Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	FAO-GAEZ
0_Inputdata\0_InputData_QUEFTS\InputDataGrids4QUEFTS	ymaxMaize.tif	Maximally attainable yield Maize	kg/ha	tif (map)	wgs84 laea, m	1km	FAO-GAEZ
0_Inputdata\0_InputData_QUEFTS\InputDataGrids4QUEFTS	ymaxMillet.tif	Maximally attainable yield Millet	kg/ha	tif (map)	wgs84 laea, m	1km	FAO-GAEZ
0_Inputdata\0_InputData_QUEFTS\InputDataGrids4QUEFTS	ymaxRice.tif	Maximally attainable yield Rice	kg/ha	tif (map)	wgs84 laea, m	1km	FAO-GAEZ
0_Inputdata\0_InputData_QUEFTS\InputDataGrids4QUEFTS	ymaxSorghum.tif	Maximally attainable yield Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	FAO-GAEZ
0_Inputdata\0_InputData_QUEFTS\InputDataGrids4QUEFTS	Zn.tif	Zn content of the soil fine earth fraction over 0-30 cm depth, extracted by Mehlich 3 method	mg/kg	tif (map)	wgs84 laea, m	1km	Hengl, Leenaars et al, 2017
0_Inputdata\0_TrialData__Points	PointsDictionary_FertilizerTrialData_Tier2.xlsx	Dictionary of column headings of the compilation (metadata)	-	xlsx (tables)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialData__Points	FertiliserTrialData.xlsx	Compilation of fertilizer trial data & reported recommendations	-	xlsx (tables)	-	-	IFDC
0_Inputdata\0_TrialData__Points	QUEFTS_FertiliserTrialData_Tier2Calculations.xlsx	Compilation of fertilizer trial data & reported and newly derived recommendations	-	xlsx (tables)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialData__Points	QUEFTS_FertiliserTrialData_Tier2ToUse.xlsx	Compilation of fertilizer trial data & reported and newly derived recommendations, cleaned for use	-	xlsx (tables)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Maize	ens_YA.kml	Actual yield GYGA extrapolated, Maize	kg/ha	kml (map)	-	-	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Maize	ens_YA.png	Actual yield GYGA extrapolated, Maize	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Maize	ens_YA.tif	Actual yield GYGA extrapolated, Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Maize	ens_YA_legend.png	Actual yield GYGA extrapolated legend, Maize	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Maize	ens_YW.kml	Actual yield GYGA extrapolated, Maize	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Maize	ens_YW.png	Water-limited yield GYGA extrapolated, Maize	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Maize	ens_YW.tif	Water-limited yield GYGA extrapolated, Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Maize	ens_YW_legend.png	Water-limited yield GYGA extrapolated legend, Maize	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Maize	ens_YW_SD.kml	Water-limited yield standard deviation GYGA extrapolated, Maize	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Maize	ens_YW_SD.png	Water-limited yield standard deviation GYGA extrapolated, Maize	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Maize	ens_YW_SD.tif	Water-limited yield standard deviation GYGA extrapolated, Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Maize	ens_YW_SD_legend.png	Water-limited yield standard deviation GYGA extrapolated legend, Maize	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Maize	IFDC_tvar_CVresults.txt	Cross validation of the extrapolations Maize	-	txt (text)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Maize	IFDC_tvar_resultsFit.txt	Extrapolation model Maize	-	txt (text)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Millet	ens_YA.kml	Actual yield GYGA extrapolated, Millet	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Millet	ens_YA.png	Actual yield GYGA extrapolated, Millet	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Millet	ens_YA.tif	Actual yield GYGA extrapolated, Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Millet	ens_YA_legend.png	Actual yield GYGA extrapolated legend, Millet	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Millet	ens_YW.kml	Actual yield GYGA extrapolated, Millet	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Millet	ens_YW.png	Water-limited yield GYGA extrapolated, Millet	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Millet	ens_YW.tif	Water-limited yield GYGA extrapolated, Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Millet	ens_YW_legend.png	Water-limited yield GYGA extrapolated legend, Millet	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Millet	ens_YW_SD.kml	Water-limited yield standard deviation GYGA extrapolated, Millet	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Millet	ens_YW_SD.png	Water-limited yield standard deviation GYGA extrapolated, Millet	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Millet	ens_YW_SD.tif	Water-limited yield standard deviation GYGA extrapolated, Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Millet	ens_YW_SD_legend.png	Water-limited yield standard deviation GYGA extrapolated legend, Millet	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Millet	IFDC_tvar_CVresults.txt	Cross validation of the extrapolations Millet	-	txt (text)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Millet	IFDC_tvar_resultsFit.txt	Extrapolation model Millet	-	txt (text)	-	-	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Rice	ens_YA.kml	Actual yield GYGA extrapolated, Rice	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Rice	ens_YA.png	Actual yield GYGA extrapolated, Rice	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Rice	ens_YA.tif	Actual yield GYGA extrapolated, Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Rice	ens_YA_legend.png	Actual yield GYGA extrapolated legend, Rice	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Rice	ens_YW.kml	Actual yield GYGA extrapolated, Rice	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Rice	ens_YW.png	Water-limited yield GYGA extrapolated, Rice	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Rice	ens_YW.tif	Water-limited yield GYGA extrapolated, Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Rice	ens_YW_legend.png	Water-limited yield GYGA extrapolated legend, Rice	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Rice	ens_YW_SD.kml	Water-limited yield standard deviation GYGA extrapolated, Rice	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Rice	ens_YW_SD.png	Water-limited yield standard deviation GYGA extrapolated, Rice	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Rice	ens_YW_SD.tif	Water-limited yield standard deviation GYGA extrapolated, Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Rice	ens_YW_SD_legend.png	Water-limited yield standard deviation GYGA extrapolated legend, Rice	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Rice	IFDC_tvar_CVresults.txt	Cross validation of the extrapolations Rice	-	txt (text)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Rice	IFDC_tvar_resultsFit.txt	Extrapolation model Rice	-	txt (text)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Sorghum	ens_YA.kml	Actual yield GYGA extrapolated, Sorghum	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Sorghum	ens_YA.png	Actual yield GYGA extrapolated, Sorghum	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Sorghum	ens_YA.tif	Actual yield GYGA extrapolated, Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Sorghum	ens_YA_legend.png	Actual yield GYGA extrapolated legend, Sorghum	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Sorghum	ens_YW.kml	Actual yield GYGA extrapolated, Sorghum	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Sorghum	ens_YW.png	Water-limited yield GYGA extrapolated, Sorghum	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Sorghum	ens_YW.tif	Water-limited yield GYGA extrapolated, Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Sorghum	ens_YW_legend.png	Water-limited yield GYGA extrapolated legend, Sorghum	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Sorghum	ens_YW_SD.kml	Water-limited yield standard deviation GYGA extrapolated, Sorghum	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Sorghum	ens_YW_SD.png	Water-limited yield standard deviation GYGA extrapolated, Sorghum	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Sorghum	ens_YW_SD.tif	Water-limited yield standard deviation GYGA extrapolated, Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Sorghum	ens_YW_SD_legend.png	Water-limited yield standard deviation GYGA extrapolated legend, Sorghum	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Sorghum	IFDC_tvar_CVresults.txt	Cross validation of the extrapolations, Sorghum	-	txt (text)	-	-	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER0_Grids_ExtrapolateGYGAWaterLimitedYields_Points2Maps\Sorghum	IFDC_tvar_resultsFit.txt	Extrapolation model, Sorghum	-	txt (text)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Maize	IFDC_tvar_CVresults.txt	Cross validation of the extrapolations, Maize	-	txt (text)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Maize	IFDC_tvar_resultsFit.txt	Extrapolation model, Maize	-	txt (text)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Maize	rf_fRyld.png	Measured yield IFDC, fertilized with newly derived recommendation, extrapolated using Random Forests, Maize	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Maize	rf_fRyld_legend.png	Measured yield IFDC, fertilized with newly derived recommendation, extrapolated using Random Forests legend, Maize	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Maize	rf_fRyld_Maize.kml	Measured yield IFDC, fertilized with newly derived recommendation, extrapolated using Random Forests, Maize	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Maize	rf_fRyld_Maize.tif	Measured yield IFDC, fertilized with newly derived recommendation, extrapolated using Random Forests, Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Maize	rf_yControl000.png	Measured yield IFDC, unfertilized, extrapolated using Random Forests, Maize	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Maize	rf_yControl000_legend.png	Measured yield IFDC, unfertilized, extrapolated using Random Forests legend, Maize	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Maize	rf_yControl000_Maize.kml	Measured yield IFDC, unfertilized, extrapolated using Random Forests, Maize	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Maize	rf_yControl000_Maize.tif	Measured yield IFDC, unfertilized, extrapolated using Random Forests, Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Maize	rf_ymx000.png	Measured yield IFDC, maximum, extrapolated using Random Forests, Maize	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Maize	rf_ymx000_legend.png	Measured yield IFDC, maximum, extrapolated using Random Forests legend, Maize	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Maize	rf_ymx000_Maize.kml	Measured yield IFDC, maximum, extrapolated using Random Forests, Maize	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Maize	rf_ymx000_Maize.tif	Measured yield IFDC, maximum, extrapolated using Random Forests, Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Millet	IFDC_tvar_CVresults.txt	Cross validation of the extrapolations, Millet	-	txt (text)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Millet	IFDC_tvar_resultsFit.txt	Extrapolation model, Millet	-	txt (text)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Millet	rf_fRyld.png	Measured yield IFDC, fertilized with newly derived recommendation, extrapolated using Random Forests, Millet	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Millet	rf_fRyld_legend.png	Measured yield IFDC, fertilized with newly derived recommendation, extrapolated using Random Forests legend, Millet	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Millet	rf_fRyld_Millet.kml	Measured yield IFDC, fertilized with newly derived recommendation, extrapolated using Random Forests, Millet	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Millet	rf_fRyld_Millet.tif	Measured yield IFDC, fertilized with newly derived recommendation, extrapolated using Random Forests, Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Millet	rf_yControl000.png	Measured yield IFDC, unfertilized, extrapolated using Random Forests, Millet	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Millet	rf_yControl000_legend.png	Measured yield IFDC, unfertilized, extrapolated using Random Forests legend, Millet	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Millet	rf_yControl000_Millet.kml	Measured yield IFDC, unfertilized, extrapolated using Random Forests, Millet	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Millet	rf_yControl000_Millet.tif	Measured yield IFDC, unfertilized, extrapolated using Random Forests, Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Millet	rf_ymx000.png	Measured yield IFDC, maximum, extrapolated using Random Forests, Millet	kg/ha	png (pic)	-	-	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Millet	rf_ymx000_legend.png	Measured yield IFDC, maximum, extrapolated using Random Forests legend, Millet	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Millet	rf_ymx000_Millet.kml	Measured yield IFDC, maximum, extrapolated using Random Forests, Millet	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Millet	rf_ymx000_Millet.tif	Measured yield IFDC, maximum, extrapolated using Random Forests, Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Rice	IFDC_tvar_CVresults.txt	Cross validation of the extrapolations, Rice	-	txt (text)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Rice	IFDC_tvar_resultsFit.txt	Extrapolation model, Rice	-	txt (text)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Rice	rf_fRyld.png	Measured yield IFDC, fertilized with newly derived recommendation, extrapolated using Random Forests, Rice	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Rice	rf_fRyld_legend.png	Measured yield IFDC, fertilized with newly derived recommendation, extrapolated using Random Forests legend, Rice	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Rice	rf_fRyld_Rice.kml	Measured yield IFDC, fertilized with newly derived recommendation, extrapolated using Random Forests, Rice	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Rice	rf_fRyld_Rice.tif	Measured yield IFDC, fertilized with newly derived recommendation, extrapolated using Random Forests, Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Rice	rf_yControl000.png	Measured yield IFDC, unfertilized, extrapolated using Random Forests, Rice	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Rice	rf_yControl000_legend.png	Measured yield IFDC, unfertilized, extrapolated using Random Forests legend, Rice	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Rice	rf_yControl000_Rice.kml	Measured yield IFDC, unfertilized, extrapolated using Random Forests, Rice	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Rice	rf_yControl000_Rice.tif	Measured yield IFDC, unfertilized, extrapolated using Random Forests, Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Rice	rf_ymx000.png	Measured yield IFDC, maximum, extrapolated using Random Forests, Rice	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Rice	rf_ymx000_legend.png	Measured yield IFDC, maximum, extrapolated using Random Forests legend, Rice	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Rice	rf_ymx000_Rice.kml	Measured yield IFDC, maximum, extrapolated using Random Forests, Rice	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Rice	rf_ymx000_Rice.tif	Measured yield IFDC, maximum, extrapolated using Random Forests, Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Sorghum	IFDC_tvar_CVresults.txt	Cross validation of the extrapolations, Sorghum	-	txt (text)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Sorghum	IFDC_tvar_resultsFit.txt	Extrapolation model, Sorghum	-	txt (text)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Sorghum	rf_fRyld.png	Measured yield IFDC, fertilized with newly derived recommendation, extrapolated using Random Forests, Sorghum	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Sorghum	rf_fRyld_legend.png	Measured yield IFDC, fertilized with newly derived recommendation, extrapolated using Random Forests legend, Sorghum	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Sorghum	rf_fRyld_Sorghum.kml	Measured yield IFDC, fertilized with newly derived recommendation, extrapolated using Random Forests, Sorghum	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Sorghum	rf_fRyld_Sorghum.tif	Measured yield IFDC, fertilized with newly derived recommendation, extrapolated using Random Forests, Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Sorghum	rf_yControl000.png	Measured yield IFDC, unfertilized, extrapolated using Random Forests, Sorghum	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Sorghum	rf_yControl000_legend.png	Measured yield IFDC, unfertilized, extrapolated using Random Forests legend, Sorghum	kg/ha	png (pic)	-	-	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Sorghum	rf_yControl000_Sorghum.kml	Measured yield IFDC, unfertilized, extrapolated using Random Forests, Sorghum	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Sorghum	rf_yControl000_Sorghum.tif	Measured yield IFDC, unfertilized, extrapolated using Random Forests, Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Sorghum	rf_ymx000.png	Measured yield IFDC, maximum, extrapolated using Random Forests, Sorghum	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Sorghum	rf_ymx000_legend.png	Measured yield IFDC, maximum, extrapolated using Random Forests legend, Sorghum	kg/ha	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Sorghum	rf_ymx000_Sorghum.kml	Measured yield IFDC, maximum, extrapolated using Random Forests, Sorghum	kg/ha	kml (map)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Sorghum	rf_ymx000_Sorghum.tif	Measured yield IFDC, maximum, extrapolated using Random Forests, Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2B_Grids_ExtrapolateYieldPoints2Maps\Validation	ValidationResults_16062017.xlsx	Validation results summarized for 5 crops	-	xlsx (tables)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fKRCassavaT2b.png	Graph of predicted vs observed fKR Cassava	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fKRecCassavaT2b.png	Graph of predicted vs observed fKRec Cassava	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fKRecMaizeT2b.png	Graph of predicted vs observed fKRec Maize	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fKRecMilletT2b.png	Graph of predicted vs observed fKRec Millet	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fKRecRiceT2b.png	Graph of predicted vs observed fKRec Rice	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fKRecSorghumT2b.png	Graph of predicted vs observed fKRec Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fKRMaizeT2b.png	Graph of predicted vs observed fKR Maize	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fKRMilletT2b.png	Graph of predicted vs observed fKR Millet	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fKRRiceT2b.png	Graph of predicted vs observed fKR Rice	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fKRSorghumT2b.png	Graph of predicted vs observed fKR Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fNRCassavaT2b.png	Graph of predicted vs observed fNR Cassava	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fNRecCassavaT2b.png	Graph of predicted vs observed fNRec Cassava	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fNRecMaizeT2b.png	Graph of predicted vs observed fNRec Maize	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fNRecMilletT2b.png	Graph of predicted vs observed fNRec Millet	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fNRecRiceT2b.png	Graph of predicted vs observed fNRec Rice	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fNRecSorghumT2b.png	Graph of predicted vs observed fNRec Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fNRMaizeT2b.png	Graph of predicted vs observed fNR Maize	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fNRMilletT2b.png	Graph of predicted vs observed fNR Millet	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fNRRiceT2b.png	Graph of predicted vs observed fNR Rice	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fNRSorghumT2b.png	Graph of predicted vs observed fNR Sorghum	-	png (pic)	-	-	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fPRCassavaT2b.png	Graph of predicted vs observed fPR Cassava	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fPRecCassavaT2b.png	Graph of predicted vs observed fPRec Cassava	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fPRecMaizeT2b.png	Graph of predicted vs observed fPRec Maize	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fPRecMilletT2b.png	Graph of predicted vs observed fPRec Millet	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fPRecRiceT2b.png	Graph of predicted vs observed fPRec Rice	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fPRecSorghumT2b.png	Graph of predicted vs observed fPRec Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fPRMaizeT2b.png	Graph of predicted vs observed fPR Maize	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fPRMilletT2b.png	Graph of predicted vs observed fPR Millet	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fPRRiceT2b.png	Graph of predicted vs observed fPR Rice	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fPRSorghumT2b.png	Graph of predicted vs observed fPR Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fRyldCassavaT2b.png	Graph of predicted vs observed fRyld Cassava	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fRyldMaizeT2b.png	Graph of predicted vs observed fRyld Maize	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fRyldMilletT2b.png	Graph of predicted vs observed fRyld Millet	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fRyldRiceT2b.png	Graph of predicted vs observed fRyld Rice	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	fRyldSorghumT2b.png	Graph of predicted vs observed fRyld Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	KfertUECassavaT2b.png	Graph of predicted vs observed KfertUE Cassava	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	KfertUEMaizeT2b.png	Graph of predicted vs observed KfertUE Maize	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	KfertUEMilletT2b.png	Graph of predicted vs observed KfertUE Millet	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	KfertUERiceT2b.png	Graph of predicted vs observed KfertUE Rice	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	KfertUESorghumT2b.png	Graph of predicted vs observed KfertUE Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	NfertUECassavaT2b.png	Graph of predicted vs observed NfertUE Cassava	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	NfertUEMaizeT2b.png	Graph of predicted vs observed NfertUE Maize	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	NfertUEMilletT2b.png	Graph of predicted vs observed NfertUE Millet	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	NfertUERiceT2b.png	Graph of predicted vs observed NfertUE Rice	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	NfertUESorghumT2b.png	Graph of predicted vs observed NfertUE Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	PfertUECassavaT2b.png	Graph of predicted vs observed PfertUE Cassava	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	PfertUEMaizeT2b.png	Graph of predicted vs observed PfertUE Maize	-	png (pic)	-	-	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	PfertUEMilletT2b.png	Graph of predicted vs observed PfertUE Millet	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	PfertUERiceT2b.png	Graph of predicted vs observed PfertUE Rice	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	PfertUESorghumT2b.png	Graph of predicted vs observed PfertUE Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	yControl000CassavaT2b.png	Graph of predicted vs observed yControl000 Cassava	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	yControl000MaizeT2b.png	Graph of predicted vs observed yControl000 Maize	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	yControl000MilletT2b.png	Graph of predicted vs observed yControl000 Millet	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	yControl000RiceT2b.png	Graph of predicted vs observed yControl000 Rice	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated_Grids_ExtrapolateYieldPoints2Maps\Validation_Graphs	yControl000SorghumT2b.png	Graph of predicted vs observed yControl000 Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2C_Grids_YieldGaps	yGapCassava.tif	Yield gap Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2C_Grids_YieldGaps	yGapMaize.tif	Yield gap Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2C_Grids_YieldGaps	yGapMillet.tif	Yield gap Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2C_Grids_YieldGaps	yGapRice.tif	Yield gap Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
0_Inputdata\0_TrialYieldData_Grids_Extrapolated\TIER2C_Grids_YieldGaps	yGapSorghum.tif	Yield gap Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1__Points_QUEFTS	Cassavadata.shp	QUEFTS input data read-in from maps at Cassava trial point locations	-	shp (map)	wgs84 laea, m	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER1__Points_QUEFTS	Maizedata.shp	QUEFTS input data read-in from maps at Maize trial point locations	-	shp (map)	wgs84 laea, m	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER1__Points_QUEFTS	Milletdata.shp	QUEFTS input data read-in from maps at Millet trial point locations	-	shp (map)	wgs84 laea, m	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER1__Points_QUEFTS	QUEFTS_FertiliserDataToUse.xlsx	Compilation of fertilizer trial data & reported and newly derived recommendations, cleaned for use	-	xlsx (tables)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER1__Points_QUEFTS	QUEFTSTRIALData_Default_Cassava.csv	QUEFTS calculations added to the Cassava Compilation of fertilizer trial data & reported and newly derived recommendations, cleaned for use	-	csv (table)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER1__Points_QUEFTS	QUEFTSTRIALData_Default_Maize.csv	QUEFTS calculations added to the Maize Compilation of fertilizer trial data & reported and newly derived recommendations, cleaned for use	-	csv (table)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER1__Points_QUEFTS	QUEFTSTRIALData_Default_Millet.csv	QUEFTS calculations added to the Millet Compilation of fertilizer trial data & reported and newly derived recommendations, cleaned for use	-	csv (table)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER1__Points_QUEFTS	QUEFTSTRIALData_Default_Rice.csv	QUEFTS calculations added to the Rice Compilation of fertilizer trial data & reported and newly derived recommendations, cleaned for use	-	csv (table)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER1__Points_QUEFTS	QUEFTSTRIALData_Default_Sorghum.csv	QUEFTS calculations added to the Sorghum Compilation of fertilizer trial data & reported and newly derived recommendations, cleaned for use	-	csv (table)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER1__Points_QUEFTS	Ricedata.shp	-	-	shp (map)	wgs84 laea, m	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER1__Points_QUEFTS	Sorghumdata.shp	QUEFTS input data read-in from maps at Sorghum trial point locations	-	shp (map)	wgs84 laea, m	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	C_effqnt_Cassava.tif	Effective quantity of Soil C over 0-30 cm depth calculated by QUEFTS-R ABC forCassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	fertK_Cassava.tif	Fertilizer K rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	fertN_Cassava.tif	Fertilizer N rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	fertP_Cassava.tif	Fertilizer P rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	fKR_Cassava.tif	Fertilizer K recommendation calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	fKRblnc_Cassava.tif	Fertilizer K recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	fNR_Cassava.tif	Fertilizer N recommendation calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	fNRblnc_Cassava.tif	Fertilizer N recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	fPR_Cassava.tif	Fertilizer P recommendation calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	fPRblnc_Cassava.tif	Fertilizer P recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	K_effqnt_Cassava.tif	Effective quantity of Soil K over 0-30 cm depth calculated by QUEFTS-R ABC forCassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	KfertUE_Cassava.tif	Fertilizer K use efficiency calculated by QUEFTS-R ABC for Cassava	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	KSUptE_Cassava.tif	Soil K uptake efficiency calculated by QUEFTS-R ABC for Cassava	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	KSUseE_Cassava.tif	Soil K use efficiency calculated by QUEFTS-R ABC for Cassava	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	KUptE_Cassava.tif	K uptake efficiency calculated by QUEFTS-R ABC for Cassava	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	KuReq_Cassava.tif	K uptake requirement at target yield calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	KUseE_Cassava.tif	K use efficiency calculated by QUEFTS-R ABC for Cassava	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	N_effqnt_Cassava.tif	Effective quantity of Soil N over 0-30 cm depth calculated by QUEFTS-R ABC forCassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	NfertUE_Cassava.tif	Fertilizer N use efficiency calculated by QUEFTS-R ABC for Cassava	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	NSUptE_Cassava.tif	Soil N uptake efficiency calculated by QUEFTS-R ABC for Cassava	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	NSUseE_Cassava.tif	Soil N use efficiency calculated by QUEFTS-R ABC for Cassava	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	NUptE_Cassava.tif	N uptake efficiency calculated by QUEFTS-R ABC for Cassava	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	NuReq_Cassava.tif	N uptake requirement at target yield calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	NUseE_Cassava.tif	N use efficiency calculated by QUEFTS-R ABC for Cassava	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	P_effqnt_Cassava.tif	Effective quantity of Soil P over 0-30 cm depth calculated by QUEFTS-R ABC forCassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	PfertUE_Cassava.tif	Fertilizer P use efficiency calculated by QUEFTS-R ABC for Cassava	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	pHfK_Cassava.tif	Impact of soil pH on soil K supply fraction calculated by QUEFTS-R ABC for Cassava	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	pHfN_Cassava.tif	Impact of soil pH on soil N supply fraction calculated by QUEFTS-R ABC for Cassava	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	pHfP_Cassava.tif	Impact of soil pH on soil P supply fraction calculated by QUEFTS-R ABC for Cassava	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	PSUptE_Cassava.tif	Soil P uptake efficiency calculated by QUEFTS-R ABC for Cassava	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	PSUseE_Cassava.tif	Soil P use efficiency calculated by QUEFTS-R ABC for Cassava	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	Pt_effqnt_Cassava.tif	Effective quantity of Soil total-P over 0-30 cm depth calculated by QUEFTS-R ABC forCassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	PUptE_Cassava.tif	P uptake efficiency calculated by QUEFTS-R ABC for Cassava	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	PuReq_Cassava.tif	P uptake requirement at target yield calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	PUseE_Cassava.tif	P use efficiency calculated by QUEFTS-R ABC for Cassava	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	rfKu_Cassava.tif	Recovery fraction fertilizer K calculated by QUEFTS-R ABC for Cassava	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	rfNu_Cassava.tif	Recovery fraction fertilizer N calculated by QUEFTS-R ABC for Cassava	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	rfPu_Cassava.tif	Recovery fraction fertilizer P calculated by QUEFTS-R ABC for Cassava	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	sK_Cassava.tif	K supply calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	sKS_Cassava.tif	Soil K supply calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	sKSeff_Cassava.tif	Soil K supply efficiency calculated by QUEFTS-R ABC for Cassava	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	sN_Cassava.tif	N supply calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	sNS_Cassava.tif	Soil N supply calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	sNSeff_Cassava.tif	Soil N supply efficiency calculated by QUEFTS-R ABC for Cassava	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	sP_Cassava.tif	P supply calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	sPS_Cassava.tif	Soil P supply calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	sPSeff_Cassava.tif	Soil P supply efficiency calculated by QUEFTS-R ABC for Cassava	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	uK_Cassava.tif	K uptake calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	uKS_Cassava.tif	K uptake from soil calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	uN_Cassava.tif	N uptake calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	uNS_Cassava.tif	N uptake from soil calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	uP_Cassava.tif	P uptake calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	uPS_Cassava.tif	P uptake from soil calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	yControl_Cassava.tif	Unfertilized control yield calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	yFertilised_Cassava.tif	Fertilized yield, according to recommendation, calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	ygap_Cassava.tif	Yield gap calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Cassava	ytarget_Cassava.tif	Target yield calculated by QUEFTS-R ABC for Cassava	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	C_effqnt_Maize.tif	Effective quantity of Soil C over 0-30 cm depth calculated by QUEFTS-R ABC forMaize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	fertK_Maize.tif	Fertilizer K rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	fertN_Maize.tif	Fertilizer N rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	fertP_Maize.tif	Fertilizer P rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	fKR_Maize.tif	Fertilizer K recommendation calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	fKRblnc_Maize.tif	Fertilizer K recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	fNR_Maize.tif	Fertilizer N recommendation calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	fNRblnc_Maize.tif	Fertilizer N recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	fPR_Maize.tif	Fertilizer P recommendation calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	fPRblnc_Maize.tif	Fertilizer P recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	K_effqnt_Maize.tif	Effective quantity of Soil K over 0-30 cm depth calculated by QUEFTS-R ABC forMaize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	KfertUE_Maize.tif	Fertilizer K use efficiency calculated by QUEFTS-R ABC for Maize	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	KSUptE_Maize.tif	Soil K uptake efficiency calculated by QUEFTS-R ABC for Maize	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	KSUseE_Maize.tif	Soil K use efficiency calculated by QUEFTS-R ABC for Maize	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	KUptE_Maize.tif	K uptake efficiency calculated by QUEFTS-R ABC for Maize	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	KuReq_Maize.tif	K uptake requirement at target yield calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	KUseE_Maize.tif	K use efficiency calculated by QUEFTS-R ABC for Maize	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	N_effqnt_Maize.tif	Effective quantity of Soil N over 0-30 cm depth calculated by QUEFTS-R ABC forMaize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	NfertUE_Maize.tif	Fertilizer N use efficiency calculated by QUEFTS-R ABC for Maize	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	NSUptE_Maize.tif	Soil N uptake efficiency calculated by QUEFTS-R ABC for Maize	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	NSUseE_Maize.tif	Soil N use efficiency calculated by QUEFTS-R ABC for Maize	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	NUptE_Maize.tif	N uptake efficiency calculated by QUEFTS-R ABC for Maize	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	NuReq_Maize.tif	N uptake requirement at target yield calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	NUseE_Maize.tif	N use efficiency calculated by QUEFTS-R ABC for Maize	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	P_effqnt_Maize.tif	Effective quantity of Soil P over 0-30 cm depth calculated by QUEFTS-R ABC forMaize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	PfertUE_Maize.tif	Fertilizer P use efficiency calculated by QUEFTS-R ABC for Maize	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	pHfK_Maize.tif	Impact of soil pH on soil K supply fraction calculated by QUEFTS-R ABC for Maize	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	pHfN_Maize.tif	Impact of soil pH on soil N supply fraction calculated by QUEFTS-R ABC for Maize	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	pHfP_Maize.tif	Impact of soil pH on soil P supply fraction calculated by QUEFTS-R ABC for Maize	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	PSUptE_Maize.tif	Soil P uptake efficiency calculated by QUEFTS-R ABC for Maize	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	PSUseE_Maize.tif	Soil P use efficiency calculated by QUEFTS-R ABC for Maize	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	Pt_effqnt_Maize.tif	Effective quantity of Soil total-P over 0-30 cm depth calculated by QUEFTS-R ABC forMaize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	PUptE_Maize.tif	P uptake efficiency calculated by QUEFTS-R ABC for Maize	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	PuReq_Maize.tif	P uptake requirement at target yield calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	PUseE_Maize.tif	P use efficiency calculated by QUEFTS-R ABC for Maize	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	rfKu_Maize.tif	Recovery fraction fertilizer K calculated by QUEFTS-R ABC for Maize	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	rfNu_Maize.tif	Recovery fraction fertilizer N calculated by QUEFTS-R ABC for Maize	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	rfPu_Maize.tif	Recovery fraction fertilizer P calculated by QUEFTS-R ABC for Maize	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	sK_Maize.tif	K supply calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	sKS_Maize.tif	Soil K supply calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	sKSeff_Maize.tif	Soil K supply efficiency calculated by QUEFTS-R ABC for Maize	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	sN_Maize.tif	N supply calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	sNS_Maize.tif	Soil N supply calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	sNSeff_Maize.tif	Soil N supply efficiency calculated by QUEFTS-R ABC for Maize	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	sP_Maize.tif	P supply calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	sPS_Maize.tif	Soil P supply calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	sPSeff_Maize.tif	Soil P supply efficiency calculated by QUEFTS-R ABC for Maize	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	uK_Maize.tif	K uptake calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	uKS_Maize.tif	K uptake from soil calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	uN_Maize.tif	N uptake calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	uNS_Maize.tif	N uptake from soil calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	uP_Maize.tif	P uptake calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	uPS_Maize.tif	P uptake from soil calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	yControl_Maize.tif	Unfertilized control yield calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	yFertilised_Maize.tif	Fertilized yield, according to recommendation, calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	ygap_Maize.tif	Yield gap calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Maize	ytarget_Maize.tif	Target yield calculated by QUEFTS-R ABC for Maize	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	C_effqnt_Millet.tif	Effective quantity of Soil C over 0-30 cm depth calculated by QUEFTS-R ABC forMillet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	fertK_Millet.tif	Fertilizer K rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	fertN_Millet.tif	Fertilizer N rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	fertP_Millet.tif	Fertilizer P rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	fKR_Millet.tif	Fertilizer K recommendation calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	fKRblnc_Millet.tif	Fertilizer K recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	fNR_Millet.tif	Fertilizer N recommendation calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	fNRblnc_Millet.tif	Fertilizer N recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	fPR_Millet.tif	Fertilizer P recommendation calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	fPRblnc_Millet.tif	Fertilizer P recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	K_effqnt_Millet.tif	Effective quantity of Soil K over 0-30 cm depth calculated by QUEFTS-R ABC forMillet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	KfertUE_Millet.tif	Fertilizer K use efficiency calculated by QUEFTS-R ABC for Millet	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	KSUptE_Millet.tif	Soil K uptake efficiency calculated by QUEFTS-R ABC for Millet	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	KSUseE_Millet.tif	Soil K use efficiency calculated by QUEFTS-R ABC for Millet	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	KUptE_Millet.tif	K uptake efficiency calculated by QUEFTS-R ABC for Millet	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	KuReq_Millet.tif	K uptake requirement at target yield calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	KUseE_Millet.tif	K use efficiency calculated by QUEFTS-R ABC for Millet	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	N_effqnt_Millet.tif	Effective quantity of Soil N over 0-30 cm depth calculated by QUEFTS-R ABC forMillet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	NfertUE_Millet.tif	Fertilizer N use efficiency calculated by QUEFTS-R ABC for Millet	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	NSUptE_Millet.tif	Soil N uptake efficiency calculated by QUEFTS-R ABC for Millet	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	NSUseE_Millet.tif	Soil N use efficiency calculated by QUEFTS-R ABC for Millet	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	NUptE_Millet.tif	N uptake efficiency calculated by QUEFTS-R ABC for Millet	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	NuReq_Millet.tif	N uptake requirement at target yield calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	NUseE_Millet.tif	N use efficiency calculated by QUEFTS-R ABC for Millet	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	P_effqnt_Millet.tif	Effective quantity of Soil P over 0-30 cm depth calculated by QUEFTS-R ABC forMillet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	PfertUE_Millet.tif	Fertilizer P use efficiency calculated by QUEFTS-R ABC for Millet	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	pHfK_Millet.tif	Impact of soil pH on soil K supply fraction calculated by QUEFTS-R ABC for Millet	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	pHfN_Millet.tif	Impact of soil pH on soil N supply fraction calculated by QUEFTS-R ABC for Millet	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	pHfP_Millet.tif	Impact of soil pH on soil P supply fraction calculated by QUEFTS-R ABC for Millet	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	PSUptE_Millet.tif	Soil P uptake efficiency calculated by QUEFTS-R ABC for Millet	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	PSUseE_Millet.tif	Soil P use efficiency calculated by QUEFTS-R ABC for Millet	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	Pt_effqnt_Millet.tif	Effective quantity of Soil total-P over 0-30 cm depth calculated by QUEFTS-R ABC forMillet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	PUptE_Millet.tif	P uptake efficiency calculated by QUEFTS-R ABC for Millet	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	PuReq_Millet.tif	P uptake requirement at target yield calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	PUseE_Millet.tif	P use efficiency calculated by QUEFTS-R ABC for Millet	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	rfKu_Millet.tif	Recovery fraction fertilizer K calculated by QUEFTS-R ABC for Millet	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	rfNu_Millet.tif	Recovery fraction fertilizer N calculated by QUEFTS-R ABC for Millet	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	rfPu_Millet.tif	Recovery fraction fertilizer P calculated by QUEFTS-R ABC for Millet	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	sK_Millet.tif	K supply calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	sKS_Millet.tif	Soil K supply calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	sKSeff_Millet.tif	Soil K supply efficiency calculated by QUEFTS-R ABC for Millet	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	sN_Millet.tif	N supply calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	sNS_Millet.tif	Soil N supply calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	sNSeff_Millet.tif	Soil N supply efficiency calculated by QUEFTS-R ABC for Millet	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	sP_Millet.tif	P supply calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	sPS_Millet.tif	Soil P supply calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	sPSeff_Millet.tif	Soil P supply efficiency calculated by QUEFTS-R ABC for Millet	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	uK_Millet.tif	K uptake calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	uKS_Millet.tif	K uptake from soil calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	uN_Millet.tif	N uptake calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	uNS_Millet.tif	N uptake from soil calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	uP_Millet.tif	P uptake calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	uPS_Millet.tif	P uptake from soil calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	yControl_Millet.tif	Unfertilized control yield calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	yFertilised_Millet.tif	Fertilized yield, according to recommendation, calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	ygap_Millet.tif	Yield gap calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Millet	ytarget_Millet.tif	Target yield calculated by QUEFTS-R ABC for Millet	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	C_effqnt_Rice.tif	Effective quantity of Soil C over 0-30 cm depth calculated by QUEFTS-R ABC forRice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	fertK_Rice.tif	Fertilizer K rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	fertN_Rice.tif	Fertilizer N rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	fertP_Rice.tif	Fertilizer P rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	fKR_Rice.tif	Fertilizer K recommendation calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	fKRblnc_Rice.tif	Fertilizer K recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	fNR_Rice.tif	Fertilizer N recommendation calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	fNRblnc_Rice.tif	Fertilizer N recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	fPR_Rice.tif	Fertilizer P recommendation calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	fPRblnc_Rice.tif	Fertilizer P recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	K_effqnt_Rice.tif	Effective quantity of Soil K over 0-30 cm depth calculated by QUEFTS-R ABC forRice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	KfertUE_Rice.tif	Fertilizer K use efficiency calculated by QUEFTS-R ABC for Rice	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	KSUptE_Rice.tif	Soil K uptake efficiency calculated by QUEFTS-R ABC for Rice	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	KSUseE_Rice.tif	Soil K use efficiency calculated by QUEFTS-R ABC for Rice	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	KUptE_Rice.tif	K uptake efficiency calculated by QUEFTS-R ABC for Rice	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	KuReq_Rice.tif	K uptake requirement at target yield calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	KUseE_Rice.tif	K use efficiency calculated by QUEFTS-R ABC for Rice	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	N_effqnt_Rice.tif	Effective quantity of Soil N over 0-30 cm depth calculated by QUEFTS-R ABC forRice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	NfertUE_Rice.tif	Fertilizer N use efficiency calculated by QUEFTS-R ABC for Rice	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	NSUptE_Rice.tif	Soil N uptake efficiency calculated by QUEFTS-R ABC for Rice	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	NSUseE_Rice.tif	Soil N use efficiency calculated by QUEFTS-R ABC for Rice	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	NUptE_Rice.tif	N uptake efficiency calculated by QUEFTS-R ABC for Rice	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	NuReq_Rice.tif	N uptake requirement at target yield calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	NUseE_Rice.tif	N use efficiency calculated by QUEFTS-R ABC for Rice	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	P_effqnt_Rice.tif	Effective quantity of Soil P over 0-30 cm depth calculated by QUEFTS-R ABC forRice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	PfertUE_Rice.tif	Fertilizer P use efficiency calculated by QUEFTS-R ABC for Rice	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	pHfK_Rice.tif	Impact of soil pH on soil K supply fraction calculated by QUEFTS-R ABC for Rice	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	pHfN_Rice.tif	Impact of soil pH on soil N supply fraction calculated by QUEFTS-R ABC for Rice	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	pHfP_Rice.tif	Impact of soil pH on soil P supply fraction calculated by QUEFTS-R ABC for Rice	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	PSUptE_Rice.tif	Soil P uptake efficiency calculated by QUEFTS-R ABC for Rice	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	PSUseE_Rice.tif	Soil P use efficiency calculated by QUEFTS-R ABC for Rice	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	Pt_effqnt_Rice.tif	Effective quantity of Soil total-P over 0-30 cm depth calculated by QUEFTS-R ABC forRice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	PUptE_Rice.tif	P uptake efficiency calculated by QUEFTS-R ABC for Rice	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	PuReq_Rice.tif	P uptake requirement at target yield calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	PUseE_Rice.tif	P use efficiency calculated by QUEFTS-R ABC for Rice	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	rfKu_Rice.tif	Recovery fraction fertilizer K calculated by QUEFTS-R ABC for Rice	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	rfNu_Rice.tif	Recovery fraction fertilizer N calculated by QUEFTS-R ABC for Rice	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	rfPu_Rice.tif	Recovery fraction fertilizer P calculated by QUEFTS-R ABC for Rice	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	sK_Rice.tif	K supply calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	sKS_Rice.tif	Soil K supply calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	sKSeff_Rice.tif	Soil K supply efficiency calculated by QUEFTS-R ABC for Rice	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	sN_Rice.tif	N supply calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	sNS_Rice.tif	Soil N supply calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	sNSeff_Rice.tif	Soil N supply efficiency calculated by QUEFTS-R ABC for Rice	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	sP_Rice.tif	P supply calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	sPS_Rice.tif	Soil P supply calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	sPSeff_Rice.tif	Soil P supply efficiency calculated by QUEFTS-R ABC for Rice	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	uK_Rice.tif	K uptake calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	uKS_Rice.tif	K uptake from soil calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	uN_Rice.tif	N uptake calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	uNS_Rice.tif	N uptake from soil calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	uP_Rice.tif	P uptake calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	uPS_Rice.tif	P uptake from soil calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	yControl_Rice.tif	Unfertilized control yield calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	yFertilised_Rice.tif	Fertilized yield, according to recommendation, calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	ygap_Rice.tif	Yield gap calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Rice	ytarget_Rice.tif	Target yield calculated by QUEFTS-R ABC for Rice	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	C_effqnt_Sorghum.tif	Effective quantity of Soil C over 0-30 cm depth calculated by QUEFTS-R ABC forSorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	fertK_Sorghum.tif	Fertilizer K rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	fertN_Sorghum.tif	Fertilizer N rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	fertP_Sorghum.tif	Fertilizer P rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	fKR_Sorghum.tif	Fertilizer K recommendation calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	fKRblnc_Sorghum.tif	Fertilizer K recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	fNR_Sorghum.tif	Fertilizer N recommendation calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	fNRblnc_Sorghum.tif	Fertilizer N recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	fPR_Sorghum.tif	Fertilizer P recommendation calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	fPRblnc_Sorghum.tif	Fertilizer P recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	K_effqnt_Sorghum.tif	Effective quantity of Soil K over 0-30 cm depth calculated by QUEFTS-R ABC forSorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	KfertUE_Sorghum.tif	Fertilizer K use efficiency calculated by QUEFTS-R ABC for Sorghum	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	KSUptE_Sorghum.tif	Soil K uptake efficiency calculated by QUEFTS-R ABC for Sorghum	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	KSUseE_Sorghum.tif	Soil K use efficiency calculated by QUEFTS-R ABC for Sorghum	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	KUptE_Sorghum.tif	K uptake efficiency calculated by QUEFTS-R ABC for Sorghum	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	KuReq_Sorghum.tif	K uptake requirement at target yield calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	KUseE_Sorghum.tif	K use efficiency calculated by QUEFTS-R ABC for Sorghum	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	N_effqnt_Sorghum.tif	Effective quantity of Soil N over 0-30 cm depth calculated by QUEFTS-R ABC forSorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	NfertUE_Sorghum.tif	Fertilizer N use efficiency calculated by QUEFTS-R ABC for Sorghum	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	NSUptE_Sorghum.tif	Soil N uptake efficiency calculated by QUEFTS-R ABC for Sorghum	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	NSUseE_Sorghum.tif	Soil N use efficiency calculated by QUEFTS-R ABC for Sorghum	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	NUptE_Sorghum.tif	N uptake efficiency calculated by QUEFTS-R ABC for Sorghum	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	NuReq_Sorghum.tif	N uptake requirement at target yield calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	NUseE_Sorghum.tif	N use efficiency calculated by QUEFTS-R ABC for Sorghum	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	P_effqnt_Sorghum.tif	Effective quantity of Soil P over 0-30 cm depth calculated by QUEFTS-R ABC forSorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	PfertUE_Sorghum.tif	Fertilizer P use efficiency calculated by QUEFTS-R ABC for Sorghum	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	pHfK_Sorghum.tif	Impact of soil pH on soil K supply fraction calculated by QUEFTS-R ABC for Sorghum	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	pHfN_Sorghum.tif	Impact of soil pH on soil N supply fraction calculated by QUEFTS-R ABC for Sorghum	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	pHfP_Sorghum.tif	Impact of soil pH on soil P supply fraction calculated by QUEFTS-R ABC for Sorghum	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	PSUptE_Sorghum.tif	Soil P uptake efficiency calculated by QUEFTS-R ABC for Sorghum	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	PSUseE_Sorghum.tif	Soil P use efficiency calculated by QUEFTS-R ABC for Sorghum	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	Pt_effqnt_Sorghum.tif	Effective quantity of Soil total-P over 0-30 cm depth calculated by QUEFTS-R ABC forSorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	PUptE_Sorghum.tif	P uptake efficiency calculated by QUEFTS-R ABC for Sorghum	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	PuReq_Sorghum.tif	P uptake requirement at target yield calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	PUseE_Sorghum.tif	P use efficiency calculated by QUEFTS-R ABC for Sorghum	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	rfKu_Sorghum.tif	Recovery fraction fertilizer K calculated by QUEFTS-R ABC for Sorghum	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	rfNu_Sorghum.tif	Recovery fraction fertilizer N calculated by QUEFTS-R ABC for Sorghum	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	rfPu_Sorghum.tif	Recovery fraction fertilizer P calculated by QUEFTS-R ABC for Sorghum	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	sK_Sorghum.tif	K supply calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	sKS_Sorghum.tif	Soil K supply calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	sKSeff_Sorghum.tif	Soil K supply efficiency calculated by QUEFTS-R ABC for Sorghum	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	sN_Sorghum.tif	N supply calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	sNS_Sorghum.tif	Soil N supply calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	sNSeff_Sorghum.tif	Soil N supply efficiency calculated by QUEFTS-R ABC for Sorghum	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	sP_Sorghum.tif	P supply calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	sPS_Sorghum.tif	Soil P supply calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	sPSeff_Sorghum.tif	Soil P supply efficiency calculated by QUEFTS-R ABC for Sorghum	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	uK_Sorghum.tif	K uptake calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	uKS_Sorghum.tif	K uptake from soil calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	uN_Sorghum.tif	N uptake calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	uNS_Sorghum.tif	N uptake from soil calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	uP_Sorghum.tif	P uptake calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	uPS_Sorghum.tif	P uptake from soil calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	yControl_Sorghum.tif	Unfertilized control yield calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	yFertilised_Sorghum.tif	Fertilized yield, according to recommendation, calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	ygap_Sorghum.tif	Yield gap calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Sorghum	ytarget_Sorghum.tif	Target yield calculated by QUEFTS-R ABC for Sorghum	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
1_ResultsPreValidation\TIER1_Grids_QUEFTS\Validation	ValidationResults_07042017.xlsx	Validation results for selected variables	-	xlsx (tables)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER2__Points_QUEFTS	-	-	-	- (-)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER2_Grids_QUEFTS\CassavaTrials	-	-	-	- (-)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER2_Grids_QUEFTS\MaizeTrials	-	-	-	- (-)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER2_Grids_QUEFTS\MilletTrials	-	-	-	- (-)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER2_Grids_QUEFTS\RiceTrials	-	-	-	- (-)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER2_Grids_QUEFTS\SorghumTrials	-	-	-	- (-)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER2_Grids_QUEFTS\Validation	-	-	-	- (-)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	-	-	-	- (-)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER2_SummariesAEZ	-	-	-	- (-)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps	-	-	-	- (-)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Cassava	-	-	-	- (-)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	-	-	-	- (-)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Millet	-	-	-	- (-)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Rice	-	-	-	- (-)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	-	-	-	- (-)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Validation	-	-	-	- (-)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER3_Grids_QUEFTS\Validation	-	-	-	- (-)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER3_Grids_QUEFTS\Validation\TIER3B2_graphs	-	-	-	- (-)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\TIER3_SummariesAEZ	-	-	-	- (-)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\Z_SummaryOfSummaries	Summary_AEZ-Benin.xlsx	Fertilizer recommendations for 5 crops in Benin aggregated by AEZ (cumulative probability)	-	xlsx (tables)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\Z_SummaryOfSummaries	Summary_AEZ-Burkina.xlsx	Fertilizer recommendations for 5 crops in Burkina Faso aggregated by AEZ (cumulative probability)	-	xlsx (tables)	-	-	Leenaars et al, 2018
1_ResultsPreValidation\Z_SummaryOfSummaries	Summary_AEZ-Ghana.xlsx	Fertilizer recommendations for 5 crops in Ghana aggregated by AEZ (cumulative probability)	-	xlsx (tables)	-	-	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
1_ResultsPreValidation\Z_SummaryOfSummaries	ValidationResults_07042017.xlsx	Validation results for selected variables extrapolated in Tier 1, 2 and 3	-	xlsx (tables)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER2__Points_QUEFTS	Cassavadata.shp	QUEFTS input data read-in from maps at Cassava trial point locations	-	shp (map)	wgs84 laea, m	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER2__Points_QUEFTS	Maizedata.shp	QUEFTS input data read-in from maps at Maize trial point locations	-	shp (map)	wgs84 laea, m	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER2__Points_QUEFTS	Milletdata.shp	QUEFTS input data read-in from maps at Millet trial point locations	-	shp (map)	wgs84 laea, m	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER2__Points_QUEFTS	PointsDictionary_QUEFTS_FertilizerTrialData_Tier2.xlsx	Dictionary of column headings of the compilation incl. QUEFTS calculations (metadata)	-	xlsx (tables)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER2__Points_QUEFTS	PointsQUEFTS_CassavaT2.csv	QUEFTS calculations added to the Cassava Compilation of fertilizer trial data & reported and newly derived recommendations, cleaned for use	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER2__Points_QUEFTS	PointsQUEFTS_MaizeT2.csv	QUEFTS calculations added to the Maize Compilation of fertilizer trial data & reported and newly derived recommendations, cleaned for use	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER2__Points_QUEFTS	PointsQUEFTS_MilletT2.csv	QUEFTS calculations added to the Millet Compilation of fertilizer trial data & reported and newly derived recommendations, cleaned for use	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER2__Points_QUEFTS	PointsQUEFTS_RiceT2.csv	QUEFTS calculations added to the Rice Compilation of fertilizer trial data & reported and newly derived recommendations, cleaned for use	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER2__Points_QUEFTS	PointsQUEFTS_SorghumT2.csv	QUEFTS calculations added to the Sorghum Compilation of fertilizer trial data & reported and newly derived recommendations, cleaned for use	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER2__Points_QUEFTS	Ricedata.shp	QUEFTS input data read-in from maps at Rice trial point locations	-	shp (map)	wgs84 laea, m	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER2__Points_QUEFTS	Sorghumdata.shp	QUEFTS input data read-in from maps at Sorghum trial point locations	-	shp (map)	wgs84 laea, m	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER2_Grids_QUEFTS\	-	See folder 3_FinalResultsAndReport	-	- (-)	-	-	-
2_ResultsPostValidation\TIER2_SummariesAEZ -this one	-	See folder 3_FinalResultsAndReport	-	- (-)	-	-	-
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps	Covariates_Importance_overview16062017.xlsx	Relative importances of the spatial covariates used for machine learning	-	xlsx (tables)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Cassava	IFDC_tvar_CVresults.txt	Cross validation of the extrapolations, Cassava	-	txt (text)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Cassava	IFDC_tvar_resultsFit.txt	Extrapolation model, Cassava	-	txt (text)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Cassava	rf_fKRec.png	Fertilizer K recommendation, newly derived from trial data, extrapolated using Random Forests, for Cassava	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Cassava	rf_fKRec_Cassava.kml	Fertilizer K recommendation for Cassava newly derived from trial data, extrapolated using Random Forests	kg/ha	kml (map)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Cassava	rf_fKRec_Cassava.tif	Fertilizer K recommendation for Cassava newly derived from trial data, extrapolated using Random Forests	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Cassava	rf_fKRec_legend.png	Fertilizer K recommendation for Cassava newly derived from trial data, extrapolated using Random Forests	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Cassava	rf_fNRec.png	Fertilizer N recommendation, newly derived from trial data, extrapolated using Random Forests, for Cassava	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Cassava	rf_fNRec_Cassava.kml	Fertilizer N recommendation for Cassava newly derived from trial data, extrapolated using Random Forests	kg/ha	kml (map)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Cassava	rf_fNRec_Cassava.tif	Fertilizer N recommendation for Cassava newly derived from trial data, extrapolated using Random Forests	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Cassava	rf_fNRec_legend.png	Fertilizer N recommendation for Cassava newly derived from trial data, extrapolated using Random Forests	kg/ha	png (pic)	-	-	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Cassava	rf_fPRec.png	Fertilizer P recommendation, newly derived from trial data, extrapolated using Random Forests, for Cassava	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Cassava	rf_fPRec_Cassava.kml	Fertilizer P recommendation for Cassava newly derived from trial data, extrapolated using Random Forests	kg/ha	kml (map)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Cassava	rf_fPRec_Cassava.tif	Fertilizer P recommendation for Cassava newly derived from trial data, extrapolated using Random Forests	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Cassava	rf_fPRec_legend.png	Fertilizer P recommendation for Cassava newly derived from trial data, extrapolated using Random Forests	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	IFDC_tvar_CVresults.txt	Cross validation of the extrapolations, Maize	-	txt (text)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	IFDC_tvar_resultsFit.txt	Extrapolation model, Maize	-	txt (text)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fKR.png	Fertilizer K recommendation, as reported from trial data, extrapolated using Random Forests, for Maize	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fKR_legend.png	Fertilizer K recommendation for Maize as reported from trial data, extrapolated using Random Forests	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fKR_Maize.kml	Fertilizer K recommendation for Maize as reported from trial data, extrapolated using Random Forests	kg/ha	kml (map)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fKR_Maize.tif	Fertilizer K recommendation for Maize as reported from trial data, extrapolated using Random Forests	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fKRec.png	Fertilizer K recommendation, newly derived from trial data, extrapolated using Random Forests, for Maize	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fKRec_legend.png	Fertilizer K recommendation for Maize newly derived from trial data, extrapolated using Random Forests	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fKRec_Maize.kml	Fertilizer K recommendation for Maize newly derived from trial data, extrapolated using Random Forests	kg/ha	kml (map)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fKRec_Maize.tif	Fertilizer K recommendation for Maize newly derived from trial data, extrapolated using Random Forests	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fNR.png	Fertilizer N recommendation, as reported from trial data, extrapolated using Random Forests, for Maize	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fNR_legend.png	Fertilizer N recommendation for Maize as reported from trial data, extrapolated using Random Forests	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fNR_Maize.kml	Fertilizer N recommendation for Maize as reported from trial data, extrapolated using Random Forests	kg/ha	kml (map)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fNR_Maize.tif	Fertilizer N recommendation for Maize as reported from trial data, extrapolated using Random Forests	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fNRec.png	Fertilizer N recommendation, newly derived from trial data, extrapolated using Random Forests, for Maize	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fNRec_legend.png	Fertilizer N recommendation for Maize newly derived from trial data, extrapolated using Random Forests	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fNRec_Maize.kml	Fertilizer N recommendation for Maize newly derived from trial data, extrapolated using Random Forests	kg/ha	kml (map)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fNRec_Maize.tif	Fertilizer N recommendation for Maize newly derived from trial data, extrapolated using Random Forests	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fPR.png	Fertilizer P recommendation, as reported from trial data, extrapolated using Random Forests, for Maize	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fPR_legend.png	Fertilizer P recommendation for Maize as reported from trial data, extrapolated using Random Forests	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fPR_Maize.kml	Fertilizer P recommendation for Maize as reported from trial data, extrapolated using Random Forests	kg/ha	kml (map)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fPR_Maize.tif	Fertilizer P recommendation for Maize as reported from trial data, extrapolated using Random Forests	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fPRec.png	Fertilizer P recommendation, newly derived from trial data, extrapolated using Random Forests, for Maize	kg/ha	png (pic)	-	-	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fPRec_legend.png	Fertilizer P recommendation for Maize newly derived from trial data, extrapolated using Random Forests	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fPRec_Maize.kml	Fertilizer P recommendation for Maize newly derived from trial data, extrapolated using Random Forests	kg/ha	kml (map)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Maize	rf_fPRec_Maize.tif	Fertilizer P recommendation for Maize newly derived from trial data, extrapolated using Random Forests	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Millet	IFDC_tvar_CVresults.txt	Cross validation of the extrapolations, Millet	-	txt (text)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Millet	IFDC_tvar_resultsFit.txt	Extrapolation model, Millet	-	txt (text)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Millet	rf_fKRec.png	Fertilizer K recommendation, newly derived from trial data, extrapolated using Random Forests, for Millet	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Millet	rf_fKRec_legend.png	Fertilizer K recommendation for Millet newly derived from trial data, extrapolated using Random Forests	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Millet	rf_fKRec_Millet.kml	Fertilizer K recommendation for Millet newly derived from trial data, extrapolated using Random Forests	kg/ha	kml (map)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Millet	rf_fKRec_Millet.tif	Fertilizer K recommendation for Millet newly derived from trial data, extrapolated using Random Forests	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Millet	rf_fNRec.png	Fertilizer N recommendation, newly derived from trial data, extrapolated using Random Forests, for Millet	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Millet	rf_fNRec_legend.png	Fertilizer N recommendation for Millet newly derived from trial data, extrapolated using Random Forests	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Millet	rf_fNRec_Millet.kml	Fertilizer N recommendation for Millet newly derived from trial data, extrapolated using Random Forests	kg/ha	kml (map)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Millet	rf_fNRec_Millet.tif	Fertilizer N recommendation for Millet newly derived from trial data, extrapolated using Random Forests	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Millet	rf_fPRec.png	Fertilizer P recommendation, newly derived from trial data, extrapolated using Random Forests, for Millet	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Millet	rf_fPRec_legend.png	Fertilizer P recommendation for Millet newly derived from trial data, extrapolated using Random Forests	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Millet	rf_fPRec_Millet.kml	Fertilizer P recommendation for Millet newly derived from trial data, extrapolated using Random Forests	kg/ha	kml (map)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Millet	rf_fPRec_Millet.tif	Fertilizer P recommendation for Millet newly derived from trial data, extrapolated using Random Forests	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Rice	IFDC_tvar_CVresults.txt	Cross validation of the extrapolations, Rice	-	txt (text)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Rice	IFDC_tvar_resultsFit.txt	Extrapolation model, Rice	-	txt (text)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Rice	rf_fKRec.png	Fertilizer K recommendation, newly derived from trial data, extrapolated using Random Forests, for Rice	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Rice	rf_fKRec_legend.png	Fertilizer K recommendation for Rice newly derived from trial data, extrapolated using Random Forests	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Rice	rf_fKRec_Rice.kml	Fertilizer K recommendation for Rice newly derived from trial data, extrapolated using Random Forests	kg/ha	kml (map)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Rice	rf_fKRec_Rice.tif	Fertilizer K recommendation for Rice newly derived from trial data, extrapolated using Random Forests	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Rice	rf_fNRec.png	Fertilizer N recommendation, newly derived from trial data, extrapolated using Random Forests, for Rice	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Rice	rf_fNRec_legend.png	Fertilizer N recommendation for Rice newly derived from trial data, extrapolated using Random Forests	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Rice	rf_fNRec_Rice.kml	Fertilizer N recommendation for Rice newly derived from trial data, extrapolated using Random Forests	kg/ha	kml (map)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Rice	rf_fNRec_Rice.tif	Fertilizer N recommendation for Rice newly derived from trial data, extrapolated using Random Forests	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Rice	rf_fPRec.png	Fertilizer P recommendation, newly derived from trial data, extrapolated using Random Forests, for Rice	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Rice	rf_fPRec_legend.png	Fertilizer P recommendation for Rice newly derived from trial data, extrapolated using Random Forests	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Rice	rf_fPRec_Rice.kml	Fertilizer P recommendation for Rice newly derived from trial data, extrapolated using Random Forests	kg/ha	kml (map)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Rice	rf_fPRec_Rice.tif	Fertilizer P recommendation for Rice newly derived from trial data, extrapolated using Random Forests	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	IFDC_tvar_CVresults.txt	Cross validation of the extrapolations, Sorghum	-	txt (text)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	IFDC_tvar_resultsFit.txt	Extrapolation model, Sorghum	-	txt (text)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fKR.png	Fertilizer K recommendation, as reported from trial data, extrapolated using Random Forests, for Sorghum	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fKR_legend.png	Fertilizer K recommendation for Sorghum as reported from trial data, extrapolated using Random Forests	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fKR_Sorghum.kml	Fertilizer K recommendation for Sorghum as reported from trial data, extrapolated using Random Forests	kg/ha	kml (map)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fKR_Sorghum.tif	Fertilizer K recommendation for Sorghum as reported from trial data, extrapolated using Random Forests	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fKRec.png	Fertilizer K recommendation, newly derived from trial data, extrapolated using Random Forests, for Sorghum	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fKRec_legend.png	Fertilizer K recommendation for Sorghum newly derived from trial data, extrapolated using Random Forests	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fKRec_Sorghum.kml	Fertilizer K recommendation for Sorghum newly derived from trial data, extrapolated using Random Forests	kg/ha	kml (map)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fKRec_Sorghum.tif	Fertilizer K recommendation for Sorghum newly derived from trial data, extrapolated using Random Forests	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fNR.png	Fertilizer N recommendation, as reported from trial data, extrapolated using Random Forests, for Sorghum	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fNR_legend.png	Fertilizer N recommendation for Sorghum as reported from trial data, extrapolated using Random Forests	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fNR_Sorghum.kml	Fertilizer N recommendation for Sorghum as reported from trial data, extrapolated using Random Forests	kg/ha	kml (map)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fNR_Sorghum.tif	Fertilizer N recommendation for Sorghum as reported from trial data, extrapolated using Random Forests	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fNRec.png	Fertilizer N recommendation, newly derived from trial data, extrapolated using Random Forests, for Sorghum	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fNRec_legend.png	Fertilizer N recommendation for Sorghum newly derived from trial data, extrapolated using Random Forests	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fNRec_Sorghum.kml	Fertilizer N recommendation for Sorghum newly derived from trial data, extrapolated using Random Forests	kg/ha	kml (map)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fNRec_Sorghum.tif	Fertilizer N recommendation for Sorghum newly derived from trial data, extrapolated using Random Forests	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fPR.png	Fertilizer P recommendation, as reported from trial data, extrapolated using Random Forests, for Sorghum	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fPR_legend.png	Fertilizer P recommendation for Sorghum as reported from trial data, extrapolated using Random Forests	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fPR_Sorghum.kml	Fertilizer P recommendation for Sorghum as reported from trial data, extrapolated using Random Forests	kg/ha	kml (map)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fPR_Sorghum.tif	Fertilizer P recommendation for Sorghum as reported from trial data, extrapolated using Random Forests	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fPRec.png	Fertilizer P recommendation, newly derived from trial data, extrapolated using Random Forests, for Sorghum	kg/ha	png (pic)	-	-	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fPRec_legend.png	Fertilizer P recommendation for Sorghum newly derived from trial data, extrapolated using Random Forests	kg/ha	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fPRec_Sorghum.kml	Fertilizer P recommendation for Sorghum newly derived from trial data, extrapolated using Random Forests	kg/ha	kml (map)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Sorghum	rf_fPRec_Sorghum.tif	Fertilizer P recommendation for Sorghum newly derived from trial data, extrapolated using Random Forests	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_ExtrapolateRecommendationPoints2Maps\Validation	ValidationResults_16062017.xlsx	Validation results for selected variables extrapolated using machine learning	-	xlsx (tables)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	C_effqnt_CassavaT2.tif	Effective quantity of Soil C over 0-30 cm depth calculated by QUEFTS-R ABC forCassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	fertK_CassavaT2.tif	Fertilizer K rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	fertN_CassavaT2.tif	Fertilizer N rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	fertP_CassavaT2.tif	Fertilizer P rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	fKR_CassavaT2.tif	Fertilizer K recommendation calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	fKRblnc_CassavaT2.tif	Fertilizer K recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	fNR_CassavaT2.tif	Fertilizer N recommendation calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	fNRblnc_CassavaT2.tif	Fertilizer N recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	fPR_CassavaT2.tif	Fertilizer P recommendation calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	fPRblnc_CassavaT2.tif	Fertilizer P recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	K_effqnt_CassavaT2.tif	Effective quantity of Soil K over 0-30 cm depth calculated by QUEFTS-R ABC forCassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	KfertUE_CassavaT2.tif	Fertilizer K use efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	KSUptE_CassavaT2.tif	Soil K uptake efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	KSUseE_CassavaT2.tif	Soil K use efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	KUptE_CassavaT2.tif	K uptake efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	KuReq_CassavaT2.tif	K uptake requirement at target yield calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	KUseE_CassavaT2.tif	K use efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	N_effqnt_CassavaT2.tif	Effective quantity of Soil N over 0-30 cm depth calculated by QUEFTS-R ABC forCassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	NfertUE_CassavaT2.tif	Fertilizer N use efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	NSUptE_CassavaT2.tif	Soil N uptake efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	NSUseE_CassavaT2.tif	Soil N use efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	NUptE_CassavaT2.tif	N uptake efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	NuReq_CassavaT2.tif	N uptake requirement at target yield calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	NUseE_CassavaT2.tif	N use efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	P_effqnt_CassavaT2.tif	Effective quantity of Soil P over 0-30 cm depth calculated by QUEFTS-R ABC forCassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	PfertUE_CassavaT2.tif	Fertilizer P use efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	pHfK_CassavaT2.tif	Impact of soil pH on soil K supply fraction calculated by QUEFTS-R ABC for CassavaT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	pHfN_CassavaT2.tif	Impact of soil pH on soil N supply fraction calculated by QUEFTS-R ABC for CassavaT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	pHfP_CassavaT2.tif	Impact of soil pH on soil P supply fraction calculated by QUEFTS-R ABC for CassavaT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	PSUptE_CassavaT2.tif	Soil P uptake efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	PSUseE_CassavaT2.tif	Soil P use efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	Pt_effqnt_CassavaT2.tif	Effective quantity of Soil total-P over 0-30 cm depth calculated by QUEFTS-R ABC forCassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	PUptE_CassavaT2.tif	P uptake efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	PuReq_CassavaT2.tif	P uptake requirement at target yield calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	PUseE_CassavaT2.tif	P use efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	rfKu_CassavaT2.tif	Recovery fraction fertilizer K calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	rfNu_CassavaT2.tif	Recovery fraction fertilizer N calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	rfPu_CassavaT2.tif	Recovery fraction fertilizer P calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	sK_CassavaT2.tif	K supply calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	sKS_CassavaT2.tif	Soil K supply calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	sKSeff_CassavaT2.tif	Soil K supply efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	sN_CassavaT2.tif	N supply calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	sNS_CassavaT2.tif	Soil N supply calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	sNSeff_CassavaT2.tif	Soil N supply efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	sP_CassavaT2.tif	P supply calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	sPS_CassavaT2.tif	Soil P supply calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	sPSeff_CassavaT2.tif	Soil P supply efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	uK_CassavaT2.tif	K uptake calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	uKS_CassavaT2.tif	K uptake from soil calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	uN_CassavaT2.tif	N uptake calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	uNS_CassavaT2.tif	N uptake from soil calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	uP_CassavaT2.tif	P uptake calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	uPS_CassavaT2.tif	P uptake from soil calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	wlimK_CassavaT2.tif	Boolean 0/1, meaning forgotten for CassavaT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	wlimN_CassavaT2.tif	Boolean 0/1, meaning forgotten for CassavaT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	wlimP_CassavaT2.tif	Boolean 0/1, meaning forgotten for CassavaT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	yControl_CassavaT2.tif	Unfertilized control yield calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	yFertilised_CassavaT2.tif	Fertilized yield, according to recommendation, calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	ygap_CassavaT2.tif	Yield gap calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	ymax_CassavaT2.tif	Maximum attainable yield read from GAEZ map for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	ytarget_CassavaT2.tif	Target yield calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\CassavaT2	ytargetgap_CassavaT2.tif	Yield gap, relative to target yield, calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	C_effqnt_MaizeT2.tif	Effective quantity of Soil C over 0-30 cm depth calculated by QUEFTS-R ABC forMaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	fertK_MaizeT2.tif	Fertilizer K rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	fertN_MaizeT2.tif	Fertilizer N rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	fertP_MaizeT2.tif	Fertilizer P rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	fKR_MaizeT2.tif	Fertilizer K recommendation calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	fKRblnc_MaizeT2.tif	Fertilizer K recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	fNR_MaizeT2.tif	Fertilizer N recommendation calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	fNRblnc_MaizeT2.tif	Fertilizer N recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	fPR_MaizeT2.tif	Fertilizer P recommendation calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	fPRblnc_MaizeT2.tif	Fertilizer P recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	K_effqnt_MaizeT2.tif	Effective quantity of Soil K over 0-30 cm depth calculated by QUEFTS-R ABC forMaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	KfertUE_MaizeT2.tif	Fertilizer K use efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	KSUptE_MaizeT2.tif	Soil K uptake efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	KSUseE_MaizeT2.tif	Soil K use efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	KUptE_MaizeT2.tif	K uptake efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	KuReq_MaizeT2.tif	K uptake requirement at target yield calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	KUseE_MaizeT2.tif	K use efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	N_effqnt_MaizeT2.tif	Effective quantity of Soil N over 0-30 cm depth calculated by QUEFTS-R ABC forMaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	NfertUE_MaizeT2.tif	Fertilizer N use efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	NSUptE_MaizeT2.tif	Soil N uptake efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	NSUseE_MaizeT2.tif	Soil N use efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	NUptE_MaizeT2.tif	N uptake efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	NuReq_MaizeT2.tif	N uptake requirement at target yield calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	NUseE_MaizeT2.tif	N use efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	P_effqnt_MaizeT2.tif	Effective quantity of Soil P over 0-30 cm depth calculated by QUEFTS-R ABC forMaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	PfertUE_MaizeT2.tif	Fertilizer P use efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	pHfK_MaizeT2.tif	Impact of soil pH on soil K supply fraction calculated by QUEFTS-R ABC for MaizeT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	pHfN_MaizeT2.tif	Impact of soil pH on soil N supply fraction calculated by QUEFTS-R ABC for MaizeT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	pHfP_MaizeT2.tif	Impact of soil pH on soil P supply fraction calculated by QUEFTS-R ABC for MaizeT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	PSUptE_MaizeT2.tif	Soil P uptake efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	PSUseE_MaizeT2.tif	Soil P use efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	Pt_effqnt_MaizeT2.tif	Effective quantity of Soil total-P over 0-30 cm depth calculated by QUEFTS-R ABC forMaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	PUptE_MaizeT2.tif	P uptake efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	PuReq_MaizeT2.tif	P uptake requirement at target yield calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	PUseE_MaizeT2.tif	P use efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	rfKu_MaizeT2.tif	Recovery fraction fertilizer K calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	rfNu_MaizeT2.tif	Recovery fraction fertilizer N calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	rfPu_MaizeT2.tif	Recovery fraction fertilizer P calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	sK_MaizeT2.tif	K supply calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	sKS_MaizeT2.tif	Soil K supply calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	sKSeff_MaizeT2.tif	Soil K supply efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	sN_MaizeT2.tif	N supply calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	sNS_MaizeT2.tif	Soil N supply calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	sNSeff_MaizeT2.tif	Soil N supply efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	sP_MaizeT2.tif	P supply calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	sPS_MaizeT2.tif	Soil P supply calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	sPSeff_MaizeT2.tif	Soil P supply efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	uK_MaizeT2.tif	K uptake calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	uKS_MaizeT2.tif	K uptake from soil calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	uN_MaizeT2.tif	N uptake calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	uNS_MaizeT2.tif	N uptake from soil calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	uP_MaizeT2.tif	P uptake calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	uPS_MaizeT2.tif	P uptake from soil calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	wlimK_MaizeT2.tif	Boolean 0/1, meaning forgotten for MaizeT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	wlimN_MaizeT2.tif	Boolean 0/1, meaning forgotten for MaizeT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	wlimP_MaizeT2.tif	Boolean 0/1, meaning forgotten for MaizeT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	yControl_MaizeT2.tif	Unfertilized control yield calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	yFertilised_MaizeT2.tif	Fertilized yield, according to recommendation, calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	ygap_MaizeT2.tif	Yield gap calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	ymax_MaizeT2.tif	Maximum attainable yield read from GAEZ map for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	ytarget_MaizeT2.tif	Target yield calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MaizeT2	ytargetgap_MaizeT2.tif	Yield gap, relative to target yield, calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	C_effqnt_MilletT2.tif	Effective quantity of Soil C over 0-30 cm depth calculated by QUEFTS-R ABC forMilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	fertK_MilletT2.tif	Fertilizer K rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	fertN_MilletT2.tif	Fertilizer N rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	fertP_MilletT2.tif	Fertilizer P rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	fKR_MilletT2.tif	Fertilizer K recommendation calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	fKRblnc_MilletT2.tif	Fertilizer K recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	fNR_MilletT2.tif	Fertilizer N recommendation calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	fNRblnc_MilletT2.tif	Fertilizer N recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	fPR_MilletT2.tif	Fertilizer P recommendation calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	fPRblnc_MilletT2.tif	Fertilizer P recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	K_effqnt_MilletT2.tif	Effective quantity of Soil K over 0-30 cm depth calculated by QUEFTS-R ABC forMilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	KfertUE_MilletT2.tif	Fertilizer K use efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	KSUptE_MilletT2.tif	Soil K uptake efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	KSUseE_MilletT2.tif	Soil K use efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	KUptE_MilletT2.tif	K uptake efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	KuReq_MilletT2.tif	K uptake requirement at target yield calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	KUseE_MilletT2.tif	K use efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	N_effqnt_MilletT2.tif	Effective quantity of Soil N over 0-30 cm depth calculated by QUEFTS-R ABC forMilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	NfertUE_MilletT2.tif	Fertilizer N use efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	NSUptE_MilletT2.tif	Soil N uptake efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	NSUseE_MilletT2.tif	Soil N use efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	NUptE_MilletT2.tif	N uptake efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	NuReq_MilletT2.tif	N uptake requirement at target yield calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	NUseE_MilletT2.tif	N use efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	P_effqnt_MilletT2.tif	Effective quantity of Soil P over 0-30 cm depth calculated by QUEFTS-R ABC forMilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	PfertUE_MilletT2.tif	Fertilizer P use efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	pHfK_MilletT2.tif	Impact of soil pH on soil K supply fraction calculated by QUEFTS-R ABC for MilletT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	pHfN_MilletT2.tif	Impact of soil pH on soil N supply fraction calculated by QUEFTS-R ABC for MilletT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	pHfP_MilletT2.tif	Impact of soil pH on soil P supply fraction calculated by QUEFTS-R ABC for MilletT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	PSUptE_MilletT2.tif	Soil P uptake efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	PSUseE_MilletT2.tif	Soil P use efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	Pt_effqnt_MilletT2.tif	Effective quantity of Soil total-P over 0-30 cm depth calculated by QUEFTS-R ABC forMilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	PUptE_MilletT2.tif	P uptake efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	PuReq_MilletT2.tif	P uptake requirement at target yield calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	PUseE_MilletT2.tif	P use efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	rfKu_MilletT2.tif	Recovery fraction fertilizer K calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	rfNu_MilletT2.tif	Recovery fraction fertilizer N calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	rfPu_MilletT2.tif	Recovery fraction fertilizer P calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	sK_MilletT2.tif	K supply calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	sKS_MilletT2.tif	Soil K supply calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	sKSeff_MilletT2.tif	Soil K supply efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	sN_MilletT2.tif	N supply calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	sNS_MilletT2.tif	Soil N supply calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	sNSeff_MilletT2.tif	Soil N supply efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	sP_MilletT2.tif	P supply calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	sPS_MilletT2.tif	Soil P supply calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	sPSeff_MilletT2.tif	Soil P supply efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	uK_MilletT2.tif	K uptake calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	uKS_MilletT2.tif	K uptake from soil calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	uN_MilletT2.tif	N uptake calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	uNS_MilletT2.tif	N uptake from soil calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	uP_MilletT2.tif	P uptake calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	uPS_MilletT2.tif	P uptake from soil calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	wlimK_MilletT2.tif	Boolean 0/1, meaning forgotten for MilletT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	wlimN_MilletT2.tif	Boolean 0/1, meaning forgotten for MilletT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	wlimP_MilletT2.tif	Boolean 0/1, meaning forgotten for MilletT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	yControl_MilletT2.tif	Unfertilized control yield calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	yFertilised_MilletT2.tif	Fertilized yield, according to recommendation, calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	ygap_MilletT2.tif	Yield gap calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	ymax_MilletT2.tif	Maximum attainable yield read from GAEZ map for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	ytarget_MilletT2.tif	Target yield calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\MilletT2	ytargetgap_MilletT2.tif	Yield gap, relative to target yield, calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	C_effqnt_RiceT2.tif	Effective quantity of Soil C over 0-30 cm depth calculated by QUEFTS-R ABC forRiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	fertK_RiceT2.tif	Fertilizer K rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	fertN_RiceT2.tif	Fertilizer N rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	fertP_RiceT2.tif	Fertilizer P rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	fKR_RiceT2.tif	Fertilizer K recommendation calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	fKRblnc_RiceT2.tif	Fertilizer K recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	fNR_RiceT2.tif	Fertilizer N recommendation calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	fNRblnc_RiceT2.tif	Fertilizer N recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	fPR_RiceT2.tif	Fertilizer P recommendation calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	fPRblnc_RiceT2.tif	Fertilizer P recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	K_effqnt_RiceT2.tif	Effective quantity of Soil K over 0-30 cm depth calculated by QUEFTS-R ABC forRiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	KfertUE_RiceT2.tif	Fertilizer K use efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	KSUptE_RiceT2.tif	Soil K uptake efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	KSUseE_RiceT2.tif	Soil K use efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	KUptE_RiceT2.tif	K uptake efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	KuReq_RiceT2.tif	K uptake requirement at target yield calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	KUseE_RiceT2.tif	K use efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	N_effqnt_RiceT2.tif	Effective quantity of Soil N over 0-30 cm depth calculated by QUEFTS-R ABC forRiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	NfertUE_RiceT2.tif	Fertilizer N use efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	NSUptE_RiceT2.tif	Soil N uptake efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	NSUseE_RiceT2.tif	Soil N use efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	NUptE_RiceT2.tif	N uptake efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	NuReq_RiceT2.tif	N uptake requirement at target yield calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	NUseE_RiceT2.tif	N use efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	P_effqnt_RiceT2.tif	Effective quantity of Soil P over 0-30 cm depth calculated by QUEFTS-R ABC forRiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	PfertUE_RiceT2.tif	Fertilizer P use efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	pHfK_RiceT2.tif	Impact of soil pH on soil K supply fraction calculated by QUEFTS-R ABC for RiceT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	pHfN_RiceT2.tif	Impact of soil pH on soil N supply fraction calculated by QUEFTS-R ABC for RiceT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	pHfP_RiceT2.tif	Impact of soil pH on soil P supply fraction calculated by QUEFTS-R ABC for RiceT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	PSUptE_RiceT2.tif	Soil P uptake efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	PSUseE_RiceT2.tif	Soil P use efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	Pt_effqnt_RiceT2.tif	Effective quantity of Soil total-P over 0-30 cm depth calculated by QUEFTS-R ABC forRiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	PUptE_RiceT2.tif	P uptake efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	PuReq_RiceT2.tif	P uptake requirement at target yield calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	PUseE_RiceT2.tif	P use efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	rfKu_RiceT2.tif	Recovery fraction fertilizer K calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	rfNu_RiceT2.tif	Recovery fraction fertilizer N calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	rfPu_RiceT2.tif	Recovery fraction fertilizer P calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	sK_RiceT2.tif	K supply calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	sKS_RiceT2.tif	Soil K supply calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	sKSeff_RiceT2.tif	Soil K supply efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	sN_RiceT2.tif	N supply calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	sNS_RiceT2.tif	Soil N supply calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	sNSeff_RiceT2.tif	Soil N supply efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	sP_RiceT2.tif	P supply calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	sPS_RiceT2.tif	Soil P supply calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	sPSeff_RiceT2.tif	Soil P supply efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	uK_RiceT2.tif	K uptake calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	uKS_RiceT2.tif	K uptake from soil calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	uN_RiceT2.tif	N uptake calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	uNS_RiceT2.tif	N uptake from soil calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	uP_RiceT2.tif	P uptake calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	uPS_RiceT2.tif	P uptake from soil calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	wlimK_RiceT2.tif	Boolean 0/1, meaning forgotten for RiceT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	wlimN_RiceT2.tif	Boolean 0/1, meaning forgotten for RiceT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	wlimP_RiceT2.tif	Boolean 0/1, meaning forgotten for RiceT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	yControl_RiceT2.tif	Unfertilized control yield calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	yFertilised_RiceT2.tif	Fertilized yield, according to recommendation, calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	ygap_RiceT2.tif	Yield gap calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	ymax_RiceT2.tif	Maximum attainable yield read from GAEZ map for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	ytarget_RiceT2.tif	Target yield calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\RiceT2	ytargetgap_RiceT2.tif	Yield gap, relative to target yield, calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	C_effqnt_SorghumT2.tif	Effective quantity of Soil C over 0-30 cm depth calculated by QUEFTS-R ABC forSorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	fertK_SorghumT2.tif	Fertilizer K rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	fertN_SorghumT2.tif	Fertilizer N rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	fertP_SorghumT2.tif	Fertilizer P rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	fKR_SorghumT2.tif	Fertilizer K recommendation calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	fKRblnc_SorghumT2.tif	Fertilizer K recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	fNR_SorghumT2.tif	Fertilizer N recommendation calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	fNRblnc_SorghumT2.tif	Fertilizer N recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	fPR_SorghumT2.tif	Fertilizer P recommendation calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	fPRblnc_SorghumT2.tif	Fertilizer P recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	K_effqnt_SorghumT2.tif	Effective quantity of Soil K over 0-30 cm depth calculated by QUEFTS-R ABC forSorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	KfertUE_SorghumT2.tif	Fertilizer K use efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	KSUptE_SorghumT2.tif	Soil K uptake efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	KSUseE_SorghumT2.tif	Soil K use efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	KUptE_SorghumT2.tif	K uptake efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	KuReq_SorghumT2.tif	K uptake requirement at target yield calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	KUseE_SorghumT2.tif	K use efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	N_effqnt_SorghumT2.tif	Effective quantity of Soil N over 0-30 cm depth calculated by QUEFTS-R ABC forSorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	NfertUE_SorghumT2.tif	Fertilizer N use efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	NSUptE_SorghumT2.tif	Soil N uptake efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	NSUseE_SorghumT2.tif	Soil N use efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	NUptE_SorghumT2.tif	N uptake efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	NuReq_SorghumT2.tif	N uptake requirement at target yield calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	NUseE_SorghumT2.tif	N use efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	P_effqnt_SorghumT2.tif	Effective quantity of Soil P over 0-30 cm depth calculated by QUEFTS-R ABC forSorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	PfertUE_SorghumT2.tif	Fertilizer P use efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	pHfK_SorghumT2.tif	Impact of soil pH on soil K supply fraction calculated by QUEFTS-R ABC for SorghumT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	pHfN_SorghumT2.tif	Impact of soil pH on soil N supply fraction calculated by QUEFTS-R ABC for SorghumT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	pHfP_SorghumT2.tif	Impact of soil pH on soil P supply fraction calculated by QUEFTS-R ABC for SorghumT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	PSUptE_SorghumT2.tif	Soil P uptake efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	PSUseE_SorghumT2.tif	Soil P use efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	Pt_effqnt_SorghumT2.tif	Effective quantity of Soil total-P over 0-30 cm depth calculated by QUEFTS-R ABC forSorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	PUptE_SorghumT2.tif	P uptake efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	PuReq_SorghumT2.tif	P uptake requirement at target yield calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	PUseE_SorghumT2.tif	P use efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	rfKu_SorghumT2.tif	Recovery fraction fertilizer K calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	rfNu_SorghumT2.tif	Recovery fraction fertilizer N calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	rfPu_SorghumT2.tif	Recovery fraction fertilizer P calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	sK_SorghumT2.tif	K supply calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	sKS_SorghumT2.tif	Soil K supply calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	sKSeff_SorghumT2.tif	Soil K supply efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	sN_SorghumT2.tif	N supply calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	sNS_SorghumT2.tif	Soil N supply calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	sNSeff_SorghumT2.tif	Soil N supply efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	sP_SorghumT2.tif	P supply calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	sPS_SorghumT2.tif	Soil P supply calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	sPSeff_SorghumT2.tif	Soil P supply efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	uK_SorghumT2.tif	K uptake calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	uKS_SorghumT2.tif	K uptake from soil calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	uN_SorghumT2.tif	N uptake calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	uNS_SorghumT2.tif	N uptake from soil calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	uP_SorghumT2.tif	P uptake calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	uPS_SorghumT2.tif	P uptake from soil calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	wlimK_SorghumT2.tif	Boolean 0/1, meaning forgotten for SorghumT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	wlimN_SorghumT2.tif	Boolean 0/1, meaning forgotten for SorghumT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	wlimP_SorghumT2.tif	Boolean 0/1, meaning forgotten for SorghumT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	yControl_SorghumT2.tif	Unfertilized control yield calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	yFertilised_SorghumT2.tif	Fertilized yield, according to recommendation, calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	ygap_SorghumT2.tif	Yield gap calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	ymax_SorghumT2.tif	Maximum attainable yield read from GAEZ map for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	ytarget_SorghumT2.tif	Target yield calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\SorghumT2	ytargetgap_SorghumT2.tif	Yield gap, relative to target yield, calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation	TIER3_GridsValidation.csv	Validation results for selected variables extrapolated using machine learning	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fKRCassavaQUEFTSTier3.png	Graph of predicted vs observed fKR Cassava	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fKRecCassavaQUEFTSTier3.png	Graph of predicted vs observed fKRec Cassava	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fKRecMaizeQUEFTSTier3.png	Graph of predicted vs observed fKRec Maize	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fKRecMilletQUEFTSTier3.png	Graph of predicted vs observed fKRec Millet	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fKRecRiceQUEFTSTier3.png	Graph of predicted vs observed fKRec Rice	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fKRecSorghumQUEFTSTier3.png	Graph of predicted vs observed fKRec Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fKRMaizeQUEFTSTier3.png	Graph of predicted vs observed fKR Maize	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fKRMilletQUEFTSTier3.png	Graph of predicted vs observed fKR Millet	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fKRRiceQUEFTSTier3.png	Graph of predicted vs observed fKR Rice	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fKRSorghumQUEFTSTier3.png	Graph of predicted vs observed fKR Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fNRCassavaQUEFTSTier3.png	Graph of predicted vs observed fNR Cassava	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fNRecCassavaQUEFTSTier3.png	Graph of predicted vs observed fNRec Cassava	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fNRecMaizeQUEFTSTier3.png	Graph of predicted vs observed fNRec Maize	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fNRecMilletQUEFTSTier3.png	Graph of predicted vs observed fNRec Millet	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fNRecRiceQUEFTSTier3.png	Graph of predicted vs observed fNRec Rice	-	png (pic)	-	-	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fNRecSorghumQUEFTSTier3.png	Graph of predicted vs observed fNRec Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fNRMaizeQUEFTSTier3.png	Graph of predicted vs observed fNR Maize	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fNRMilletQUEFTSTier3.png	Graph of predicted vs observed fNR Millet	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fNRRiceQUEFTSTier3.png	Graph of predicted vs observed fNR Rice	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fNRSorghumQUEFTSTier3.png	Graph of predicted vs observed fNR Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fPRCassavaQUEFTSTier3.png	Graph of predicted vs observed fPR Cassava	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fPRecCassavaQUEFTSTier3.png	Graph of predicted vs observed fPRec Cassava	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fPRecMaizeQUEFTSTier3.png	Graph of predicted vs observed fPRec Maize	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fPRecMilletQUEFTSTier3.png	Graph of predicted vs observed fPRec Millet	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fPRecRiceQUEFTSTier3.png	Graph of predicted vs observed fPRec Rice	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fPRecSorghumQUEFTSTier3.png	Graph of predicted vs observed fPRec Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fPRMaizeQUEFTSTier3.png	Graph of predicted vs observed fPR Maize	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fPRMilletQUEFTSTier3.png	Graph of predicted vs observed fPR Millet	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fPRRiceQUEFTSTier3.png	Graph of predicted vs observed fPR Rice	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fPRSorghumQUEFTSTier3.png	Graph of predicted vs observed fPR Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fRyldCassavaQUEFTSTier3.png	Graph of predicted vs observed fRyld Cassava	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fRyldMaizeQUEFTSTier3.png	Graph of predicted vs observed fRyld Maize	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fRyldMilletQUEFTSTier3.png	Graph of predicted vs observed fRyld Millet	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fRyldRiceQUEFTSTier3.png	Graph of predicted vs observed fRyld Rice	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	fRyldSorghumQUEFTSTier3.png	Graph of predicted vs observed fRyld Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	KfertUECassavaQUEFTSTier3.png	Graph of predicted vs observed KfertUE Cassava	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	KfertUEMaizeQUEFTSTier3.png	Graph of predicted vs observed KfertUE Maize	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	KfertUEMilletQUEFTSTier3.png	Graph of predicted vs observed KfertUE Millet	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	KfertUERiceQUEFTSTier3.png	Graph of predicted vs observed KfertUE Rice	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	KfertUESorghumQUEFTSTier3.png	Graph of predicted vs observed KfertUE Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	NfertUECassavaQUEFTSTier3.png	Graph of predicted vs observed NfertUE Cassava	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	NfertUEMaizeQUEFTSTier3.png	Graph of predicted vs observed NfertUE Maize	-	png (pic)	-	-	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	NfertUEMilletQUEFTSTier3.png	Graph of predicted vs observed NfertUE Millet	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	NfertUERiceQUEFTSTier3.png	Graph of predicted vs observed NfertUE Rice	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	NfertUESorghumQUEFTSTier3.png	Graph of predicted vs observed NfertUE Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	PfertUECassavaQUEFTSTier3.png	Graph of predicted vs observed PfertUE Cassava	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	PfertUEMaizeQUEFTSTier3.png	Graph of predicted vs observed PfertUE Maize	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	PfertUEMilletQUEFTSTier3.png	Graph of predicted vs observed PfertUE Millet	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	PfertUERiceQUEFTSTier3.png	Graph of predicted vs observed PfertUE Rice	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	PfertUESorghumQUEFTSTier3.png	Graph of predicted vs observed PfertUE Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	yControl000CassavaQUEFTSTier3.png	Graph of predicted vs observed yControl000 Cassava	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	yControl000MaizeQUEFTSTier3.png	Graph of predicted vs observed yControl000 Maize	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	yControl000MilletQUEFTSTier3.png	Graph of predicted vs observed yControl000 Millet	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	yControl000RiceQUEFTSTier3.png	Graph of predicted vs observed yControl000 Rice	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_Grids_QUEFTS\Validation\TIER3_graphs	yControl000SorghumQUEFTSTier3.png	Graph of predicted vs observed yControl000 Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3__Cassava_BF.csv	Fertilizer recommendations for cassava in Burkina Faso aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3__Cassava_BJ.csv	Fertilizer recommendations for cassava in Benin aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3__Cassava_GH.csv	Fertilizer recommendations for cassava in Ghana aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3__Maize_BF.csv	Fertilizer recommendations for maize in Burkina Faso aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3__Maize_BJ.csv	Fertilizer recommendations for maize in Benin aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3__Maize_GH.csv	Fertilizer recommendations for maize in Ghana aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3__Millet_BF.csv	Fertilizer recommendations for millet in Burkina Faso aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3__Millet_BJ.csv	Fertilizer recommendations for millet in Benin aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3__Millet_GH.csv	Fertilizer recommendations for millet in Ghana aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3__Rice_BF.csv	Fertilizer recommendations for rice in Burkina Faso aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3__Rice_BJ.csv	Fertilizer recommendations for rice in Benin aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3__Rice_GH.csv	Fertilizer recommendations for rice in Ghana aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3__Sorghum_BF.csv	Fertilizer recommendations for sorghum in Burkina Faso aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3__Sorghum_BJ.csv	Fertilizer recommendations for sorghum in Benin aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3__Sorghum_GH.csv	Fertilizer recommendations for sorghum in Ghana aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3QUEFTS__CassavaT2_BF.csv	Fertilizer recommendations for cassava in Burkina Faso aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3QUEFTS__CassavaT2_BJ.csv	Fertilizer recommendations for cassava in Benin aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3QUEFTS__CassavaT2_GH.csv	Fertilizer recommendations for cassava in Ghana aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3QUEFTS__MaizeT2_BF.csv	Fertilizer recommendations for maize in Burkina Faso aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3QUEFTS__MaizeT2_BJ.csv	Fertilizer recommendations for maize in Benin aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3QUEFTS__MaizeT2_GH.csv	Fertilizer recommendations for maize in Ghana aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3QUEFTS__MilletT2_BF.csv	Fertilizer recommendations for millet in Burkina Faso aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3QUEFTS__MilletT2_BJ.csv	Fertilizer recommendations for millet in Benin aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3QUEFTS__MilletT2_GH.csv	Fertilizer recommendations for millet in Ghana aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3QUEFTS__RiceT2_BF.csv	Fertilizer recommendations for rice in Burkina Faso aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3QUEFTS__RiceT2_BJ.csv	Fertilizer recommendations for rice in Benin aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3QUEFTS__RiceT2_GH.csv	Fertilizer recommendations for rice in Ghana aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3QUEFTS__SorghumT2_BF.csv	Fertilizer recommendations for sorghum in Burkina Faso aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3QUEFTS__SorghumT2_BJ.csv	Fertilizer recommendations for sorghum in Benin aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
2_ResultsPostValidation\TIER3_SummariesAEZ	TIER3QUEFTS__SorghumT2_GH.csv	Fertilizer recommendations for sorghum in Ghana aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	C_effqnt_CassavaT2.tif	Effective quantity of Soil C over 0-30 cm depth calculated by QUEFTS-R ABC forCassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	fertK_CassavaT2.tif	Fertilizer K rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	fertN_CassavaT2.tif	Fertilizer N rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	fertP_CassavaT2.tif	Fertilizer P rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	fKR_CassavaT2.tif	Fertilizer K recommendation calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	fKRblnc_CassavaT2.tif	Fertilizer K recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	fNR_CassavaT2.tif	Fertilizer N recommendation calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	fNRblnc_CassavaT2.tif	Fertilizer N recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	fPR_CassavaT2.tif	Fertilizer P recommendation calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	fPRblnc_CassavaT2.tif	Fertilizer P recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	K_effqnt_CassavaT2.tif	Effective quantity of Soil K over 0-30 cm depth calculated by QUEFTS-R ABC forCassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	KfertUE_CassavaT2.tif	Fertilizer K use efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	KSUptE_CassavaT2.tif	Soil K uptake efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	KSUseE_CassavaT2.tif	Soil K use efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	KUptE_CassavaT2.tif	K uptake efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	KuReq_CassavaT2.tif	K uptake requirement at target yield calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	KUseE_CassavaT2.tif	K use efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	N_effqnt_CassavaT2.tif	Effective quantity of Soil N over 0-30 cm depth calculated by QUEFTS-R ABC forCassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	NfertUE_CassavaT2.tif	Fertilizer N use efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	NSUptE_CassavaT2.tif	Soil N uptake efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	NSUseE_CassavaT2.tif	Soil N use efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	NUptE_CassavaT2.tif	N uptake efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	NuReq_CassavaT2.tif	N uptake requirement at target yield calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	NUseE_CassavaT2.tif	N use efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	P_effqnt_CassavaT2.tif	Effective quantity of Soil P over 0-30 cm depth calculated by QUEFTS-R ABC forCassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	PfertUE_CassavaT2.tif	Fertilizer P use efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	pHfK_CassavaT2.tif	Impact of soil pH on soil K supply fraction calculated by QUEFTS-R ABC for CassavaT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	pHfN_CassavaT2.tif	Impact of soil pH on soil N supply fraction calculated by QUEFTS-R ABC for CassavaT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	pHfP_CassavaT2.tif	Impact of soil pH on soil P supply fraction calculated by QUEFTS-R ABC for CassavaT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	PSUptE_CassavaT2.tif	Soil P uptake efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	PSUseE_CassavaT2.tif	Soil P use efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	Pt_effqnt_CassavaT2.tif	Effective quantity of Soil total-P over 0-30 cm depth calculated by QUEFTS-R ABC forCassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	PUptE_CassavaT2.tif	P uptake efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	PuReq_CassavaT2.tif	P uptake requirement at target yield calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	PUseE_CassavaT2.tif	P use efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	rfKu_CassavaT2.tif	Recovery fraction fertilizer K calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	rfNu_CassavaT2.tif	Recovery fraction fertilizer N calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	rfPu_CassavaT2.tif	Recovery fraction fertilizer P calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	sK_CassavaT2.tif	K supply calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	sKS_CassavaT2.tif	Soil K supply calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	sKSeff_CassavaT2.tif	Soil K supply efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	sN_CassavaT2.tif	N supply calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	sNS_CassavaT2.tif	Soil N supply calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	sNSeff_CassavaT2.tif	Soil N supply efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	sP_CassavaT2.tif	P supply calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	sPS_CassavaT2.tif	Soil P supply calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	sPSeff_CassavaT2.tif	Soil P supply efficiency calculated by QUEFTS-R ABC for CassavaT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	uK_CassavaT2.tif	K uptake calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	uKS_CassavaT2.tif	K uptake from soil calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	uN_CassavaT2.tif	N uptake calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	uNS_CassavaT2.tif	N uptake from soil calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	uP_CassavaT2.tif	P uptake calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	uPS_CassavaT2.tif	P uptake from soil calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	wlimK_CassavaT2.tif	Boolean 0/1, meaning forgotten for CassavaT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	wlimN_CassavaT2.tif	Boolean 0/1, meaning forgotten for CassavaT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	wlimP_CassavaT2.tif	Boolean 0/1, meaning forgotten for CassavaT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	yControl_CassavaT2.tif	Unfertilized control yield calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	yFertilised_CassavaT2.tif	Fertilized yield, according to recommendation, calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	ygap_CassavaT2.tif	Yield gap calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	ymax_CassavaT2.tif	Maximum attainable yield read from GAEZ map for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	ytarget_CassavaT2.tif	Target yield calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\CassavaT2	ytargetgap_CassavaT2.tif	Yield gap, relative to target yield, calculated by QUEFTS-R ABC for CassavaT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	C_effqnt_MaizeT2.tif	Effective quantity of Soil C over 0-30 cm depth calculated by QUEFTS-R ABC forMaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	fertK_MaizeT2.tif	Fertilizer K rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	fertN_MaizeT2.tif	Fertilizer N rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	fertP_MaizeT2.tif	Fertilizer P rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	fKR_MaizeT2.tif	Fertilizer K recommendation calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	fKRblnc_MaizeT2.tif	Fertilizer K recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	fNR_MaizeT2.tif	Fertilizer N recommendation calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	fNRblnc_MaizeT2.tif	Fertilizer N recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	fPR_MaizeT2.tif	Fertilizer P recommendation calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	fPRblnc_MaizeT2.tif	Fertilizer P recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	K_effqnt_MaizeT2.tif	Effective quantity of Soil K over 0-30 cm depth calculated by QUEFTS-R ABC forMaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	KfertUE_MaizeT2.tif	Fertilizer K use efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	KSUptE_MaizeT2.tif	Soil K uptake efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	KSUseE_MaizeT2.tif	Soil K use efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	KUptE_MaizeT2.tif	K uptake efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	KuReq_MaizeT2.tif	K uptake requirement at target yield calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	KUseE_MaizeT2.tif	K use efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	N_effqnt_MaizeT2.tif	Effective quantity of Soil N over 0-30 cm depth calculated by QUEFTS-R ABC forMaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	NfertUE_MaizeT2.tif	Fertilizer N use efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	NSUptE_MaizeT2.tif	Soil N uptake efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	NSUseE_MaizeT2.tif	Soil N use efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	NUptE_MaizeT2.tif	N uptake efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	NuReq_MaizeT2.tif	N uptake requirement at target yield calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	NUseE_MaizeT2.tif	N use efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	P_effqnt_MaizeT2.tif	Effective quantity of Soil P over 0-30 cm depth calculated by QUEFTS-R ABC forMaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	PfertUE_MaizeT2.tif	Fertilizer P use efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	pHfK_MaizeT2.tif	Impact of soil pH on soil K supply fraction calculated by QUEFTS-R ABC for MaizeT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	pHfN_MaizeT2.tif	Impact of soil pH on soil N supply fraction calculated by QUEFTS-R ABC for MaizeT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	pHfP_MaizeT2.tif	Impact of soil pH on soil P supply fraction calculated by QUEFTS-R ABC for MaizeT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	PSUptE_MaizeT2.tif	Soil P uptake efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	PSUseE_MaizeT2.tif	Soil P use efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	Pt_effqnt_MaizeT2.tif	Effective quantity of Soil total-P over 0-30 cm depth calculated by QUEFTS-R ABC forMaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	PUptE_MaizeT2.tif	P uptake efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	PuReq_MaizeT2.tif	P uptake requirement at target yield calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	PUseE_MaizeT2.tif	P use efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	rfKu_MaizeT2.tif	Recovery fraction fertilizer K calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	rfNu_MaizeT2.tif	Recovery fraction fertilizer N calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	rfPu_MaizeT2.tif	Recovery fraction fertilizer P calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	sK_MaizeT2.tif	K supply calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	sKS_MaizeT2.tif	Soil K supply calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	sKSeff_MaizeT2.tif	Soil K supply efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	sN_MaizeT2.tif	N supply calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	sNS_MaizeT2.tif	Soil N supply calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	sNSeff_MaizeT2.tif	Soil N supply efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	sP_MaizeT2.tif	P supply calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	sPS_MaizeT2.tif	Soil P supply calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	sPSeff_MaizeT2.tif	Soil P supply efficiency calculated by QUEFTS-R ABC for MaizeT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	uK_MaizeT2.tif	K uptake calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	uKS_MaizeT2.tif	K uptake from soil calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	uN_MaizeT2.tif	N uptake calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	uNS_MaizeT2.tif	N uptake from soil calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	uP_MaizeT2.tif	P uptake calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	uPS_MaizeT2.tif	P uptake from soil calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	wlimK_MaizeT2.tif	Boolean 0/1, meaning forgotten for MaizeT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	wlimN_MaizeT2.tif	Boolean 0/1, meaning forgotten for MaizeT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	wlimP_MaizeT2.tif	Boolean 0/1, meaning forgotten for MaizeT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	yControl_MaizeT2.tif	Unfertilized control yield calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	yFertilised_MaizeT2.tif	Fertilized yield, according to recommendation, calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	ygap_MaizeT2.tif	Yield gap calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	ymax_MaizeT2.tif	Maximum attainable yield read from GAEZ map for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	ytarget_MaizeT2.tif	Target yield calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MaizeT2	ytargetgap_MaizeT2.tif	Yield gap, relative to target yield, calculated by QUEFTS-R ABC for MaizeT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	C_effqnt_MilletT2.tif	Effective quantity of Soil C over 0-30 cm depth calculated by QUEFTS-R ABC forMilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	fertK_MilletT2.tif	Fertilizer K rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	fertN_MilletT2.tif	Fertilizer N rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	fertP_MilletT2.tif	Fertilizer P rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	fKR_MilletT2.tif	Fertilizer K recommendation calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	fKRblnc_MilletT2.tif	Fertilizer K recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	fNR_MilletT2.tif	Fertilizer N recommendation calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	fNRblnc_MilletT2.tif	Fertilizer N recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	fPR_MilletT2.tif	Fertilizer P recommendation calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	fPRblnc_MilletT2.tif	Fertilizer P recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	K_effqnt_MilletT2.tif	Effective quantity of Soil K over 0-30 cm depth calculated by QUEFTS-R ABC forMilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	KfertUE_MilletT2.tif	Fertilizer K use efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	KSUptE_MilletT2.tif	Soil K uptake efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	KSUseE_MilletT2.tif	Soil K use efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	KUptE_MilletT2.tif	K uptake efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	KuReq_MilletT2.tif	K uptake requirement at target yield calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	KUseE_MilletT2.tif	K use efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	N_effqnt_MilletT2.tif	Effective quantity of Soil N over 0-30 cm depth calculated by QUEFTS-R ABC forMilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	NfertUE_MilletT2.tif	Fertilizer N use efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	NSUptE_MilletT2.tif	Soil N uptake efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	NSUseE_MilletT2.tif	Soil N use efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	NUptE_MilletT2.tif	N uptake efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	NuReq_MilletT2.tif	N uptake requirement at target yield calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	NUseE_MilletT2.tif	N use efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	P_effqnt_MilletT2.tif	Effective quantity of Soil P over 0-30 cm depth calculated by QUEFTS-R ABC forMilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	PfertUE_MilletT2.tif	Fertilizer P use efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	pHfK_MilletT2.tif	Impact of soil pH on soil K supply fraction calculated by QUEFTS-R ABC for MilletT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	pHfN_MilletT2.tif	Impact of soil pH on soil N supply fraction calculated by QUEFTS-R ABC for MilletT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	pHfP_MilletT2.tif	Impact of soil pH on soil P supply fraction calculated by QUEFTS-R ABC for MilletT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	PSUptE_MilletT2.tif	Soil P uptake efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	PSUseE_MilletT2.tif	Soil P use efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	Pt_effqnt_MilletT2.tif	Effective quantity of Soil total-P over 0-30 cm depth calculated by QUEFTS-R ABC forMilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	PUptE_MilletT2.tif	P uptake efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	PuReq_MilletT2.tif	P uptake requirement at target yield calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	PUseE_MilletT2.tif	P use efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	rfKu_MilletT2.tif	Recovery fraction fertilizer K calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	rfNu_MilletT2.tif	Recovery fraction fertilizer N calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	rfPu_MilletT2.tif	Recovery fraction fertilizer P calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	sK_MilletT2.tif	K supply calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	sKS_MilletT2.tif	Soil K supply calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	sKSeff_MilletT2.tif	Soil K supply efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	sN_MilletT2.tif	N supply calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	sNS_MilletT2.tif	Soil N supply calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	sNSeff_MilletT2.tif	Soil N supply efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	sP_MilletT2.tif	P supply calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	sPS_MilletT2.tif	Soil P supply calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	sPSeff_MilletT2.tif	Soil P supply efficiency calculated by QUEFTS-R ABC for MilletT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	uK_MilletT2.tif	K uptake calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	uKS_MilletT2.tif	K uptake from soil calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	uN_MilletT2.tif	N uptake calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	uNS_MilletT2.tif	N uptake from soil calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	uP_MilletT2.tif	P uptake calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	uPS_MilletT2.tif	P uptake from soil calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	wlimK_MilletT2.tif	Boolean 0/1, meaning forgotten for MilletT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	wlimN_MilletT2.tif	Boolean 0/1, meaning forgotten for MilletT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	wlimP_MilletT2.tif	Boolean 0/1, meaning forgotten for MilletT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	yControl_MilletT2.tif	Unfertilized control yield calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	yFertilised_MilletT2.tif	Fertilized yield, according to recommendation, calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	ygap_MilletT2.tif	Yield gap calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	ymax_MilletT2.tif	Maximum attainable yield read from GAEZ map for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	ytarget_MilletT2.tif	Target yield calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\MilletT2	ytargetgap_MilletT2.tif	Yield gap, relative to target yield, calculated by QUEFTS-R ABC for MilletT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	C_effqnt_RiceT2.tif	Effective quantity of Soil C over 0-30 cm depth calculated by QUEFTS-R ABC forRiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	fertK_RiceT2.tif	Fertilizer K rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	fertN_RiceT2.tif	Fertilizer N rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	fertP_RiceT2.tif	Fertilizer P rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	fKR_RiceT2.tif	Fertilizer K recommendation calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	fKRblnc_RiceT2.tif	Fertilizer K recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	fNR_RiceT2.tif	Fertilizer N recommendation calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	fNRblnc_RiceT2.tif	Fertilizer N recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	fPR_RiceT2.tif	Fertilizer P recommendation calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	fPRblnc_RiceT2.tif	Fertilizer P recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	K_effqnt_RiceT2.tif	Effective quantity of Soil K over 0-30 cm depth calculated by QUEFTS-R ABC forRiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	KfertUE_RiceT2.tif	Fertilizer K use efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	KSUptE_RiceT2.tif	Soil K uptake efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	KSUseE_RiceT2.tif	Soil K use efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	KUptE_RiceT2.tif	K uptake efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	KuReq_RiceT2.tif	K uptake requirement at target yield calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	KUseE_RiceT2.tif	K use efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	N_effqnt_RiceT2.tif	Effective quantity of Soil N over 0-30 cm depth calculated by QUEFTS-R ABC forRiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	NfertUE_RiceT2.tif	Fertilizer N use efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	NSUptE_RiceT2.tif	Soil N uptake efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	NSUseE_RiceT2.tif	Soil N use efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	NUptE_RiceT2.tif	N uptake efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	NuReq_RiceT2.tif	N uptake requirement at target yield calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	NUseE_RiceT2.tif	N use efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	P_effqnt_RiceT2.tif	Effective quantity of Soil P over 0-30 cm depth calculated by QUEFTS-R ABC forRiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	PfertUE_RiceT2.tif	Fertilizer P use efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	pHfK_RiceT2.tif	Impact of soil pH on soil K supply fraction calculated by QUEFTS-R ABC for RiceT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	pHfN_RiceT2.tif	Impact of soil pH on soil N supply fraction calculated by QUEFTS-R ABC for RiceT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	pHfP_RiceT2.tif	Impact of soil pH on soil P supply fraction calculated by QUEFTS-R ABC for RiceT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	PSUptE_RiceT2.tif	Soil P uptake efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	PSUseE_RiceT2.tif	Soil P use efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	Pt_effqnt_RiceT2.tif	Effective quantity of Soil total-P over 0-30 cm depth calculated by QUEFTS-R ABC forRiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	PUptE_RiceT2.tif	P uptake efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	PuReq_RiceT2.tif	P uptake requirement at target yield calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	PUseE_RiceT2.tif	P use efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	rfKu_RiceT2.tif	Recovery fraction fertilizer K calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	rfNu_RiceT2.tif	Recovery fraction fertilizer N calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	rfPu_RiceT2.tif	Recovery fraction fertilizer P calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	sK_RiceT2.tif	K supply calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	sKS_RiceT2.tif	Soil K supply calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	sKSeff_RiceT2.tif	Soil K supply efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	sN_RiceT2.tif	N supply calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	sNS_RiceT2.tif	Soil N supply calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	sNSeff_RiceT2.tif	Soil N supply efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	sP_RiceT2.tif	P supply calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	sPS_RiceT2.tif	Soil P supply calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	sPSeff_RiceT2.tif	Soil P supply efficiency calculated by QUEFTS-R ABC for RiceT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	uK_RiceT2.tif	K uptake calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	uKS_RiceT2.tif	K uptake from soil calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	uN_RiceT2.tif	N uptake calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	uNS_RiceT2.tif	N uptake from soil calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	uP_RiceT2.tif	P uptake calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	uPS_RiceT2.tif	P uptake from soil calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	wlimK_RiceT2.tif	Boolean 0/1, meaning forgotten for RiceT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	wlimN_RiceT2.tif	Boolean 0/1, meaning forgotten for RiceT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	wlimP_RiceT2.tif	Boolean 0/1, meaning forgotten for RiceT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	yControl_RiceT2.tif	Unfertilized control yield calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	yFertilised_RiceT2.tif	Fertilized yield, according to recommendation, calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	ygap_RiceT2.tif	Yield gap calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	ymax_RiceT2.tif	Maximum attainable yield read from GAEZ map for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	ytarget_RiceT2.tif	Target yield calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\RiceT2	ytargetgap_RiceT2.tif	Yield gap, relative to target yield, calculated by QUEFTS-R ABC for RiceT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	C_effqnt_SorghumT2.tif	Effective quantity of Soil C over 0-30 cm depth calculated by QUEFTS-R ABC forSorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	fertK_SorghumT2.tif	Fertilizer K rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	fertN_SorghumT2.tif	Fertilizer N rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	fertP_SorghumT2.tif	Fertilizer P rate calculated by QUEFTS-R ABC and applied to calculate fertilized yield for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	fKR_SorghumT2.tif	Fertilizer K recommendation calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	fKRblnc_SorghumT2.tif	Fertilizer K recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	fNR_SorghumT2.tif	Fertilizer N recommendation calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	fNRblnc_SorghumT2.tif	Fertilizer N recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	fPR_SorghumT2.tif	Fertilizer P recommendation calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	fPRblnc_SorghumT2.tif	Fertilizer P recommendation, balanced assuming zero soil fertility, calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	K_effqnt_SorghumT2.tif	Effective quantity of Soil K over 0-30 cm depth calculated by QUEFTS-R ABC forSorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	KfertUE_SorghumT2.tif	Fertilizer K use efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	KSUptE_SorghumT2.tif	Soil K uptake efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	KSUseE_SorghumT2.tif	Soil K use efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	KUptE_SorghumT2.tif	K uptake efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	KuReq_SorghumT2.tif	K uptake requirement at target yield calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	KUseE_SorghumT2.tif	K use efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	N_effqnt_SorghumT2.tif	Effective quantity of Soil N over 0-30 cm depth calculated by QUEFTS-R ABC forSorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	NfertUE_SorghumT2.tif	Fertilizer N use efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	NSUptE_SorghumT2.tif	Soil N uptake efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	NSUseE_SorghumT2.tif	Soil N use efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	NUptE_SorghumT2.tif	N uptake efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	NuReq_SorghumT2.tif	N uptake requirement at target yield calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	NUseE_SorghumT2.tif	N use efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	P_effqnt_SorghumT2.tif	Effective quantity of Soil P over 0-30 cm depth calculated by QUEFTS-R ABC forSorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	PfertUE_SorghumT2.tif	Fertilizer P use efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	pHfK_SorghumT2.tif	Impact of soil pH on soil K supply fraction calculated by QUEFTS-R ABC for SorghumT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	pHfN_SorghumT2.tif	Impact of soil pH on soil N supply fraction calculated by QUEFTS-R ABC for SorghumT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	pHfP_SorghumT2.tif	Impact of soil pH on soil P supply fraction calculated by QUEFTS-R ABC for SorghumT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	PSUptE_SorghumT2.tif	Soil P uptake efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	PSUseE_SorghumT2.tif	Soil P use efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	Pt_effqnt_SorghumT2.tif	Effective quantity of Soil total-P over 0-30 cm depth calculated by QUEFTS-R ABC forSorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	PUptE_SorghumT2.tif	P uptake efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	PuReq_SorghumT2.tif	P uptake requirement at target yield calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	PUseE_SorghumT2.tif	P use efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	rfKu_SorghumT2.tif	Recovery fraction fertilizer K calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	rfNu_SorghumT2.tif	Recovery fraction fertilizer N calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	rfPu_SorghumT2.tif	Recovery fraction fertilizer P calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	sK_SorghumT2.tif	K supply calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	sKS_SorghumT2.tif	Soil K supply calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	sKSeff_SorghumT2.tif	Soil K supply efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	sN_SorghumT2.tif	N supply calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	sNS_SorghumT2.tif	Soil N supply calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	sNSeff_SorghumT2.tif	Soil N supply efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	sP_SorghumT2.tif	P supply calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	sPS_SorghumT2.tif	Soil P supply calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	sPSeff_SorghumT2.tif	Soil P supply efficiency calculated by QUEFTS-R ABC for SorghumT2	kg/kg	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	uK_SorghumT2.tif	K uptake calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	uKS_SorghumT2.tif	K uptake from soil calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	uN_SorghumT2.tif	N uptake calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	uNS_SorghumT2.tif	N uptake from soil calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	uP_SorghumT2.tif	P uptake calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	uPS_SorghumT2.tif	P uptake from soil calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	wlimK_SorghumT2.tif	Boolean 0/1, meaning forgotten for SorghumT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	wlimN_SorghumT2.tif	Boolean 0/1, meaning forgotten for SorghumT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	wlimP_SorghumT2.tif	Boolean 0/1, meaning forgotten for SorghumT2	-	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	yControl_SorghumT2.tif	Unfertilized control yield calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	yFertilised_SorghumT2.tif	Fertilized yield, according to recommendation, calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	ygap_SorghumT2.tif	Yield gap calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	ymax_SorghumT2.tif	Maximum attainable yield read from GAEZ map for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	ytarget_SorghumT2.tif	Target yield calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\SorghumT2	ytargetgap_SorghumT2.tif	Yield gap, relative to target yield, calculated by QUEFTS-R ABC for SorghumT2	kg/ha	tif (map)	wgs84 laea, m	1km	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation	TIER2_GridsValidation.csv	Validation results for selected variables	-	csv (table)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fKRCassava.png	Graph of predicted vs observed fKR Cassava	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fKRecCassava.png	Graph of predicted vs observed fKRec Cassava	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fKRecMaize.png	Graph of predicted vs observed fKRec Maize	-	png (pic)	-	-	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fKRecMillet.png	Graph of predicted vs observed fKRec Millet	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fKRecRice.png	Graph of predicted vs observed fKRec Rice	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fKRecSorghum.png	Graph of predicted vs observed fKRec Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fKRMaize.png	Graph of predicted vs observed fKR Maize	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fKRMillet.png	Graph of predicted vs observed fKR Millet	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fKRRice.png	Graph of predicted vs observed fKR Rice	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fKRSorghum.png	Graph of predicted vs observed fKR Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fNRCassava.png	Graph of predicted vs observed fNR Cassava	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fNRecCassava.png	Graph of predicted vs observed fNRec Cassava	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fNRecMaize.png	Graph of predicted vs observed fNRec Maize	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fNRecMillet.png	Graph of predicted vs observed fNRec Millet	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fNRecRice.png	Graph of predicted vs observed fNRec Rice	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fNRecSorghum.png	Graph of predicted vs observed fNRec Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fNRMaize.png	Graph of predicted vs observed fNR Maize	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fNRMillet.png	Graph of predicted vs observed fNR Millet	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fNRRice.png	Graph of predicted vs observed fNR Rice	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fNRSorghum.png	Graph of predicted vs observed fNR Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fPRCassava.png	Graph of predicted vs observed fPR Cassava	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fPRecCassava.png	Graph of predicted vs observed fPRec Cassava	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fPRecMaize.png	Graph of predicted vs observed fPRec Maize	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fPRecMillet.png	Graph of predicted vs observed fPRec Millet	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fPRecRice.png	Graph of predicted vs observed fPRec Rice	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fPRecSorghum.png	Graph of predicted vs observed fPRec Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fPRMaize.png	Graph of predicted vs observed fPR Maize	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fPRMillet.png	Graph of predicted vs observed fPR Millet	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fPRRice.png	Graph of predicted vs observed fPR Rice	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fPRSorghum.png	Graph of predicted vs observed fPR Sorghum	-	png (pic)	-	-	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fRyldCassava.png	Graph of predicted vs observed fRyld Cassava	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fRyldMaize.png	Graph of predicted vs observed fRyld Maize	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fRyldMillet.png	Graph of predicted vs observed fRyld Millet	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fRyldRice.png	Graph of predicted vs observed fRyld Rice	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	fRyldSorghum.png	Graph of predicted vs observed fRyld Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	KfertUECassava.png	Graph of predicted vs observed KfertUE Cassava	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	KfertUEMaize.png	Graph of predicted vs observed KfertUE Maize	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	KfertUEMillet.png	Graph of predicted vs observed KfertUE Millet	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	KfertUERice.png	Graph of predicted vs observed KfertUE Rice	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	KfertUESorghum.png	Graph of predicted vs observed KfertUE Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	NfertUECassava.png	Graph of predicted vs observed NfertUE Cassava	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	NfertUEMaize.png	Graph of predicted vs observed NfertUE Maize	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	NfertUEMillet.png	Graph of predicted vs observed NfertUE Millet	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	NfertUERice.png	Graph of predicted vs observed NfertUE Rice	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	NfertUESorghum.png	Graph of predicted vs observed NfertUE Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	PfertUECassava.png	Graph of predicted vs observed PfertUE Cassava	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	PfertUEMaize.png	Graph of predicted vs observed PfertUE Maize	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	PfertUEMillet.png	Graph of predicted vs observed PfertUE Millet	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	PfertUERice.png	Graph of predicted vs observed PfertUE Rice	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	PfertUESorghum.png	Graph of predicted vs observed PfertUE Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	yControl000Cassava.png	Graph of predicted vs observed yControl000 Cassava	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	yControl000Maize.png	Graph of predicted vs observed yControl000 Maize	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	yControl000Millet.png	Graph of predicted vs observed yControl000 Millet	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	yControl000Rice.png	Graph of predicted vs observed yControl000 Rice	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_Grids_QUEFTS\Validation\TIER2_graphs	yControl000Sorghum.png	Graph of predicted vs observed yControl000 Sorghum	-	png (pic)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one	cassava.html	Data visualisation of fertilizer recommendations for cassava aggregated by AEZ (cumulative probability)	-	html (web)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one	maize.html	Data visualisation of fertilizer recommendations for maize aggregated by AEZ (cumulative probability)	-	html (web)	-	-	Leenaars et al, 2018

Folder path \IFDC_upscale\	File name	File description	Units	File type	Georef	Grid	Reference
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one	millet.html	Data visualisation of fertilizer recommendations formillet aggregated by AEZ (cumulative probability)	-	html (web)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one	rice.html	Data visualisation of fertilizer recommendations for rice aggregated by AEZ (cumulative probability)	-	html (web)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one	sorghum.html	Data visualisation of fertilizer recommendations for sorghum aggregated by AEZ (cumulative probability)	-	html (web)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one	TIER2__CassavaT2_BF.csv	Fertilizer recommendations for cassava in Burkina Faso aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one	TIER2__CassavaT2_BJ.csv	Fertilizer recommendations for cassava in Benin aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one	TIER2__CassavaT2_GH.csv	Fertilizer recommendations for cassava in Ghana aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one	TIER2__MaizeT2_BF.csv	Fertilizer recommendations for maize in Burkina Faso aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one	TIER2__MaizeT2_BJ.csv	Fertilizer recommendations for maize in Benin aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one	TIER2__MaizeT2_GH.csv	Fertilizer recommendations for maize in Ghana aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one	TIER2__MilletT2_BF.csv	Fertilizer recommendations for millet in Burkina Faso aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one	TIER2__MilletT2_BJ.csv	Fertilizer recommendations for millet in Benin aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one	TIER2__MilletT2_GH.csv	Fertilizer recommendations for millet in Ghana aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one	TIER2__RiceT2_BF.csv	Fertilizer recommendations for rice in Burkina Faso aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one	TIER2__RiceT2_BJ.csv	Fertilizer recommendations for rice in Benin aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one	TIER2__RiceT2_GH.csv	Fertilizer recommendations for rice in Ghana aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one	TIER2__SorghumT2_BF.csv	Fertilizer recommendations for sorghum in Burkina Faso aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one	TIER2__SorghumT2_BJ.csv	Fertilizer recommendations for sorghum in Benin aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one	TIER2__SorghumT2_GH.csv	Fertilizer recommendations for sorghum in Ghana aggregated by AEZ (cumulative probability)	-	csv (table)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one	TIER2_Summary_AEZ.xlsx	ReadMe summary & fertilizer recommendations for 5 crops in 3 countries aggregated by AEZ (cumulative probability)	-	xlsx (tables)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one\AEZ-Crop_shapefiles	Cassava_NPK_ygap.shp	Fertilizer recommendations for cassava in BF, BJ and GH, aggregated by country & AEZ (cumulative probability)	-	shp (map)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one\AEZ-Crop_shapefiles	Maize_NPK_ygap.shp	Fertilizer recommendations for maize in BF, BJ and GH, aggregated by country & AEZ (cumulative probability)	-	shp (map)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one\AEZ-Crop_shapefiles	Millet_NPK_ygap.shp	Fertilizer recommendations for millet in BF, BJ and GH, aggregated by country & AEZ (cumulative probability)	-	shp (map)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one\AEZ-Crop_shapefiles	Rice_NPK_ygap.shp	Fertilizer recommendations for rice in BF, BJ and GH, aggregated by country & AEZ (cumulative probability)	-	shp (map)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\TIER2_SummariesAEZ -this one\AEZ-Crop_shapefiles	Sorghum_NPK_ygap.shp	Fertilizer recommendations for sorghum in BF, BJ and GH, aggregated by country & AEZ (cumulative probability)	-	shp (map)	-	-	Leenaars et al, 2018
3_FinalResultsAndReport\Report	20181012_ISRIC_UpscaleProjectDraftFullReport-IFDC.pdf	Poject draft full report	-	pdf (text)	-	-	Leenaars et al, 2018

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