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(TAFS-WCA)

E-registration, spatial referencing and tracking of farmers for innovation scaling in Burundi

Technical Report

AfricaRice · IITA · CIP International Potato Center · IWMI International Water Management Institute · Alliance Bioversity & CIAT · WorldFish · CORAF · WorldVeg · icipe

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ABSTRACT

This report presents a dataset of the e-registration of farmers in Burundi for assessing the adoption of innovations and the diffusion of new technologies. Data was collected from actors after a census conducted in three steps. First, main crops production regions and value chain actors were identified. In the second step, the list of actors was updated based on membership of their associations. Finally, a census of all individual actors was conducted as well as the geo-localization of all farmers' fields and villages using GPS device. Data were collected for the 2022 growing seasons and the dataset contains 1,751 observations with 159 variables divided into six sections: (i) preliminary information on the respondents; (ii) socio-economic characteristics; (iii) information on the rice plots; (iv) knowledge, use and access to rice varieties; (v) knowledge, use and access to agricultural equipment and methods; and (vi) information on post-harvest activities. Five categories of actors were identified: seed producers (127), crops producers (1,394), millers (35), traders (231) and service providers (8). On average, a farmer grew three crops. The main crops of farmers were rice (745) followed by cassava (254), banana (202), potato (181) and beans (131). The dataset is valuable for the diffusion at large scale of improved technologies and an effective monitoring of the dissemination. Data can be used by scientists to have better understanding of crops value chains, production systems, the level of knowledge, accessibility and adoption of improved rice varieties and agricultural technologies, for further research in the field of rice value chain development, technologies testing and socioeconomic studies of rice value chain actors and other crops such as cassava, banana, potato, and beans. Because of the large number of observations (1,751 actors), data can be used as sampling frame for further experiments or surveys based on random samples. Moreover, the dataset has the potential of generating descriptive statistics at the most disaggregated level of administrative units or villages for different equipment, methods and varieties adopted by gender and country.

Keywords

Crops, census, agricultural technologies, improved rice varieties, out-scaling, production systems, Burundi.

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Major abbreviations and acronyms

AfricaRice	:	Africa Rice Center
GDP	:	Gross Domestic Product
GEM	:	Grain quality enhancer, Energy-efficient and durable Material
ICT	:	Information and communications technology
IITA	:	International Institute of Tropical Agriculture
PII	:	Policy, innovation systems and impact assessment program
SDG	:	Sustainable Development Goals
SSA	:	Sub-Saharan Africa
TAFS WCA	:	Transforming Agrifood Systems in West and Central Africa initiative

1. INTRODUCTION

1.1. Background

Agriculture represents more than one-third of the Gross Domestic Product (GDP) of African countries[1]. It can contribute towards major continental priorities, such as eradicating poverty and hunger, boosting intra-Africa trade and investments, rapid industrialization and economic diversification, jobs creation and shared prosperity[2]. Rice is one of the most important cereal crops in Africa and now represents the staple food for more than 750 million people in Sub-Saharan Africa. Rice consumption is growing faster in Africa and particularly in West Africa than any part of the World. For instance, approximately 310 million people derived about 20% of their daily calories from rice in West Africa. However, rice demand in this region is growing faster than local supply, leading to substantial rice imports and dependence on international rice prices.

To reduce the importation bills and to achieve Sustainable Development Goals (SDG) in Africa, improved technologies including high yielding and climate smart varieties, good agronomic and postharvest practices are paramount. The diffusion of agricultural technologies faces enormous challenges in the region due to insufficient reach to the real actors in need. The diffusion at large scale of improved technologies, better targeting and effective monitoring of the dissemination required ex-ante information of the situation of the target population. Similarly, sampling frames required for assessing the achievements and impacts are often lacking. To fill these gaps, e-registration and spatial referencing and tracking of farmers and values chain actors are essential. Although, it was difficult in the past to map a whole population, today digital solution offers the possibility of ex-ante registration of the potential beneficiaries using simple ICT tools.

Based on the successful experience of the e-registration of rice value chain actors conducted recently in Benin and Cote d'Ivoire [3] , this report presents the result obtained by extending the e-registration and spatial referencing and tracking system for rice value chain actors and others crops in other African countries such as Burundi.

[1] https://education.nationalgeographic.org/resource/africa-resources/
[2] https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/Inclusive_Growth-An_imperative_for_African_Agriculture.pdf

This report presents the main results of the e-registration and spatial referencing and tracking system for rice value chain actors and other crops such as maize, cassava, sweet potato, yams, banana, soybean, bean, traditional African vegetables in Burundi.

1.2. Objectives of the e-registration in Burundi

The main objective of the e-registration is to collect reliable, accurate and sufficient data for better targeting and monitoring of interventions and accelerating the delivery of inputs and services as well as the tracking of improved technologies and beneficiaries, through an e-registration and spatial referencing of farmers. Specific objectives of the e-registration are:

1. To collect simple and robust socio-economic and geographic data on different types of producers **(**producers of foundation seed, producers of certified seed, producer of crops for consumption) and other actors (millers, parboilers, traders and service providers) in Burundi;
2. To collect GPS coordinates of actors surveyed;
3. To evaluate the knowledge, access to and use of agricultural technologies (new varieties, equipment and methods) by farmers.

2. SPECIFICATIONS TABLE

Subject	Social Sciences
Specific subject area	Agriculture, varieties adoption, agricultural equipment and methods used
Type of data	Table Figure Data in Excel format & STATA format (.dta)
How the data were acquired	Data were collected through census and surveys of rice value chain actors with structured questionnaire using android tablet.
Data format	Raw Analyzed Cleaned
Parameters for data collection	Face-to-face interviews using structured questionnaire and geographic locations obtained with GPS device.
Description of data collection	Census of all rice value chain actors and other crops such as maize, cassava, sweet potato, yams, banana, cocoa, soybean, bean, traditional African vegetables was done in three steps. First, main rice production regions and rice value chain's actors were identified. In the second stage, the list of actors was updated based on memberships of actors' associations. Finally, the census was implemented, and all actors were interviewed and farmers' fields as well as villages were geo-localized by using GPS device.
Data source location	The data were collected in rice hubs: **Burundi:** 6 areas 1.1. Bubanza 1.2. Cibitoke 1.3. Makamba 1.4. Rutana 1.5. Gitega 1.6. Kirundo
Data accessibility	Repository name: Mendeley Data Data identification number: N/A Direct URL to data:

3. VALUE OF THE DATA

- The data presented in this document are useful because they constitute a large multidisciplinary dataset comprising of 1,751 observations from seven different categories of actors (foundation seed producers, certified seed producers, crops

producers, parboilers, millers, traders and service providers) for better understanding of the value chains, production systems and adoption of improved varieties and agricultural technologies.

- This dataset can be used by scientists, policy makers, extension officers, NGO and development agencies such as United Nations organizations.
- The data from this study are valuable for further research regarding rice value chain development, socioeconomic studies of rice value chain actors, yield analysis (spatial distribution and yield gap), knowledge, accessibility and adoption of improved rice varieties and agricultural technologies [2] and to analyze rice cropping systems [3] . The dataset can also be used to map and characterize rice value chain actors in West Africa and to develop appropriate technologies along the rice value chain. The dataset can further be analyzed using advanced analysis methods (e.g. econometric models, spatial analysis).
- These data are also important for diffusion at large scale of improved technologies and for an effective monitoring of the dissemination.
- Because of the large number of observations (1,751), this dataset can be utilized as a sampling frame for future experiments or surveys based on random samples.

4. DATA DESCRIPTION

The diffusion of agricultural technologies faces enormous challenges such as the identification and the geo-location of the real actors in need [2] . Sampling frames required for surveys are often missing. To fill these gaps and better fit the preference of actors, a census and interviews of all rice, maize, cassava, sweet potato, yams, banana, cocoa, soybean, bean, and traditional African vegetables value chain actors were conducted in production zones in Burundi.

The questionnaire which is submitted as supplementary file (Appendix) was used to collect information on farmers' and other actors' demographic characteristics and specific sections related to each category of actors. For producers (seeds producers, producers of each crop for consumption), 150 variables were grouped into five sections: preliminary information on the respondents; socio-economic characteristics; information on the rice plots; knowledge, use, and access to rice varieties; and knowledge, use and access to agricultural equipment and methods. Parboilers, millers and traders were interviewed, in addition to preliminary information on the respondents and socio-economic characteristics (sections 1 and 2) and on nine questions related

to post-harvest activities (section 6 of the questionnaire). Table 1 summarizes the dataset and variables. The dataset is in Microsoft Excel (in one sheet) and STATA format (Appendix). The questionnaire, the Excel sheet and STATA format provide labels and variable names definition.

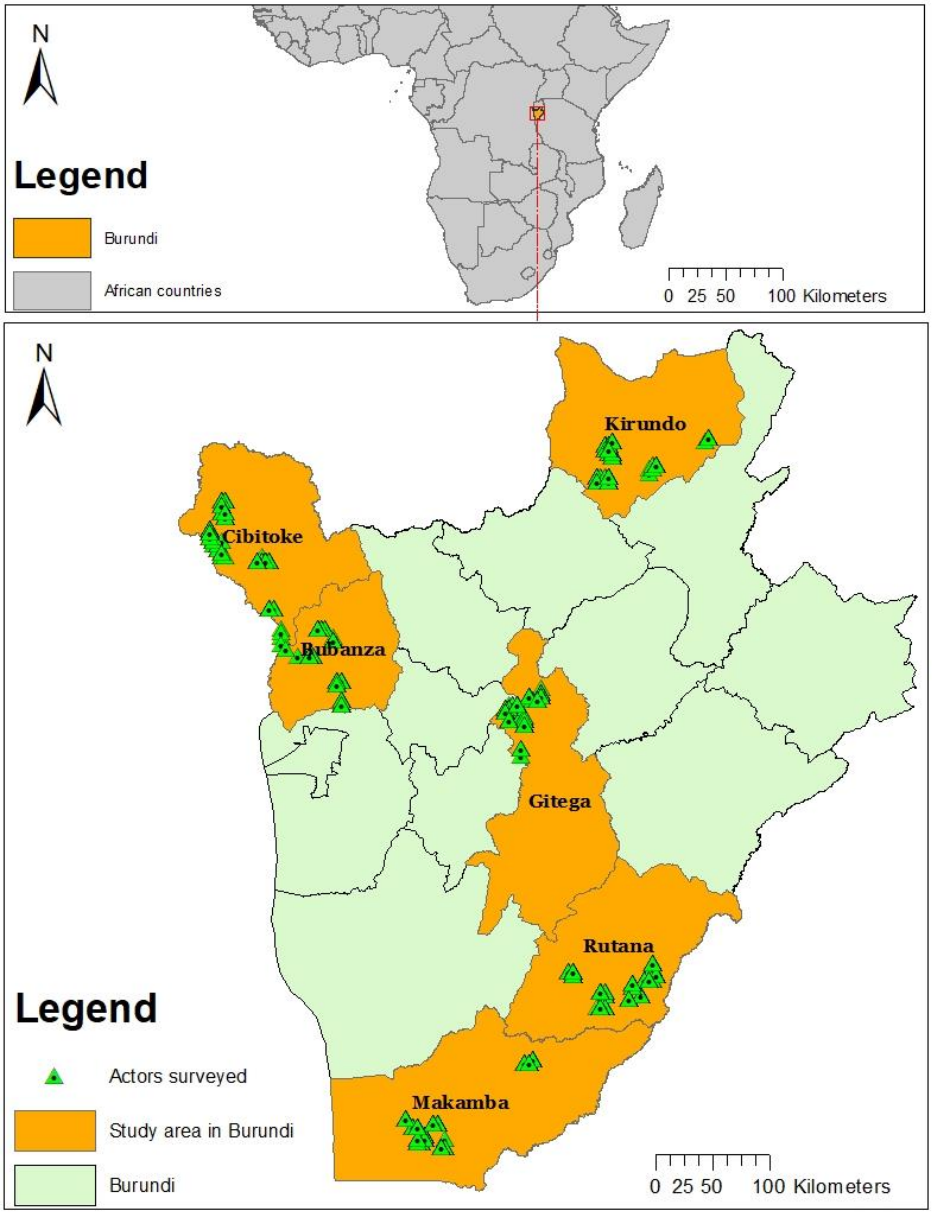

Fig 1. Map highlighting the study area of the e-registration and distribution of actors surveyed in Burundi

In Burundi, data were collected from 1,751 households in 6 regions including 168 in Bubanza, 310 in Cibitoke, 318 in Makamba, 321 in Rutana, 307 in Gitega and 327 in Kirundo (Fig. 2)

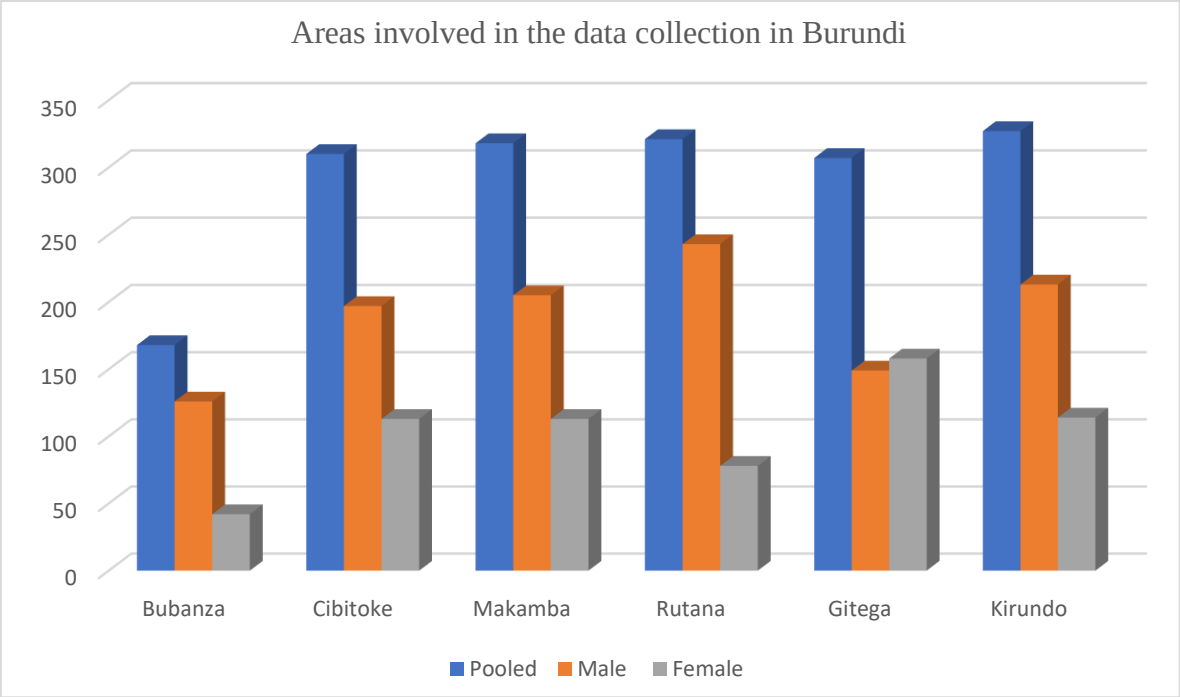

Fig 2. Frequency of actors surveyed per area and gender in Burundi

The data resulted from surveys of seven main categories of rice value chain's actors: foundation seeds producers, certified seeds producers, producers, parboilers, millers, traders and service providers. A total of 1,751 actors (farmers, postharvest actors and service providers) were interviewed and geo-localized (Table 2). Data were collected for the 2022 growing seasons (both first and second seasons). As an example of the potential use of the dataset, Fig. 1 shows a map representing the spatial distribution of different actors surveyed.

Table 1: Summary of the variables included in the dataset grouped by section

Variables	Scale type	Scale class	Source of data
Section 1: Preliminary information on respondents			
Code of the respondent	Numeric	Unique code	surveys
Name of country	Nominal	Ghana, Nigeria, Cote d'Ivoire, Rwanda, Burundi, DRC	surveys
Name of region or district	Nominal		surveys
Name of town or village	Nominal		surveys
Date of survey	Numeric		surveys
Section 2: Socio-economic characteristics of respondents			
Name and surname of the actor	Nominal		surveys
Age	Numeric		surveys
Gender	Nominal	Female, Male	surveys
Education level attended	Ordinal	Illiterate, Primary, Junior high school, Senior high school, University.	surveys

Number of household members producing rice (Having a rice field)	Numeric		surveys
GPS coordinats	Numeric		surveys
Telephone number of the respondent	Numeric		surveys
Type of actors	Nominal	Foundation seeds producers, certified seeds producers, Producers for consumption (paddy rice producers, etc), Parboilers, Millers, Traders and Service providers.	surveys
Section 3: Information on the rice plots			
Number of crops cultivated	Numeric		surveys
Rice area for the first season 2022	Numeric		surveys
Production for the first season	Numeric		surveys
Rice area for the second season 2022	Numeric		surveys
Production for the second season 2022	Numeric		surveys
Section 4: Knowledge, use, access to rice varieties			
Name of variety	Nominal	NERICA, IR841, ARICA, SAHEL, WITA, FARO, BL, NL, BOUAKE, JT11, ORYLUX, AGRA, Jasmine.	surveys
Knowledge of the variety	Nominal	Yes, No	surveys
Name of the variety with its code if applicable	Nominal		surveys
Access to variety	Nominal	Yes, No	surveys
Grown at least once	Nominal	Yes, No	surveys
Grown the variety in 2018	Nominal	Yes, No	surveys
Section 5: Knowledge, use and access to equipment and methods			
Equipment or method	Nominal	ASI thresher (for threshing and winnowing paddy rice), GEM (for rice parboiling), RiceAdvice, Smart-valley, SRI (Intensive Rice Farming System), Manual weeder, Power tiller	surveys
Knowledge of the equipment	Nominal	Yes, No	surveys
Access to the equipment	Nominal	Yes, No	surveys
Use at least one of the equipment	Nominal	Yes, No	surveys
Use in 2018	Nominal	Yes, No	surveys
Section 6: Information on post-harvest activities (for parboilers, millers and traders)			
Quantity of parboiled rice per month	Numeric		surveys
Number of months of work in the year	Numeric		surveys
Knowledge of GEM equipment	Nominal	Yes, No	surveys
Access to GEM equipment	Nominal	Yes, No	surveys
Use of GEM equipment	Nominal	Yes, No	surveys
Quantity of milled rice per month	Numeric		surveys
Quantity of rice sold in the year	Numeric		surveys

Proportion of imported rice sold	Numeric	surveys
Proportion of local rice sold	Numeric	surveys

Table 2: Frequency distribution of actors surveyed per region

Regions name in Burundi	Frequency	Percentage
Bubanza	168	9.59
Cibitoke	310	17.7
Makamba	318	18.16
Rutana	321	18.33
Gitega	307	17.53
Kirundo	327	18.68
Total	1,751	100

Data was collected for the 2022 growing seasons and the dataset contains 1,751 observations (Table 2). Table 3 shows another way of exploiting the dataset by presenting the socioeconomic characteristics of farmers and other actors surveyed.

The average age of respondents was 42 years old for all actors, but millers and service providers appeared to be younger (about 34 years old). Producers had about 30% illiterate, and 50% of them had primary level of education (Table 3). About 65% of actors surveyed are male.

Table 3: Selected socio-economic characteristics of actors registered in 2023 in Burundi

Socioeconomic characteristics		Foundation seed producers	Certified seed producers	Crop producers	Millers	Traders	Service provider	Overall
Age		43.46 (13.30)	43 (12.7)	43.77 (12.62)	35.02 (9.43)	37.23 (11.24)	33.75 (11.04)	42.72 (12.72)
=1 if male (%)		47.06	50.00	66.50	82.86	61.47	100	64.71
Education level (%)	Illiterate	33.61	37.50	30.49	25.71	22.94	00	29.53
	Primary	53.78	37.50	50.36	48.57	50.65	62.50	50.49
	Junior high school	6.72	25	7.82	8.57	12.55	25.00	8.62
	Senior high school	4.2	00	10.19	14.29	13.42	12.50	10.28
	University	1.68	00	1.15	2.86	0.43	00	1.09

() standard deviation

Table 4 shows the distribution of the respondents by crops and country. Farmers grew on average 3 crops. Among the producers in Burundi, 71.91% (1,088) were rice producers, 80.90% (1,224) maize producers, 62.52% (946) cassava producers, 39.06% (591) sweet potato producers, 32.72% (495) banana producers and 65.76% (995) beans producers. Data can be used as sampling frame based on random samples (Table 4).

Table 4: Frequency of producers surveyed in Burundi in 2023 by crop

Type of crops (Burundi)	Frequency (%)	Number (N= 1,751)
Rice	71.91	1,088
Maize	80.90	1,224
Cassava	62.52	946
Sweet potato	39.06	591
Yams	1.32	20
Banana	32.72	495
Soybean	4.63	70
Beans	65.76	995
Traditional African vegetables	4.23	64

Table 5 shows the population's adoption rates of technologies among rice producers registered in Burundi who have knowledge of the technologies. NERICA, IR and ARICA varieties were less known in Burundi. On the other hand, SAHEL, WITA, ORYLUX and JT varieties were not known and adopted at all in Burundi (Table 5). However, ASI thresher, RiceAdvice, Smart-Valley, SRI and Mechanical weeder were well known and adopted by 61.64%, 100%, 51.13%, and 87.50% who have knowledge on technologies, respectively. Mechanical weeder tiller was well known and adopted by 94.21%, % of farmers who know it (Table 5).

Table 5: Population adoption rates of technologies among producers registered in 2023 in Burundi

Technologies	Burundi	
	%	N
Varieties		
NERICA	83.33	15
IR	85.71	24
ARICA	100	1
Technologies		
ASI	61.64	45
RiceAdvice	100	2
Developed inland valleys (Smart-Valley)	51.13	68
SRI	87.50	231
Mechanical weeder	94.21	114

5. EXPERIMENTAL DESIGN, MATERIALS, AND METHODS

Data were collected from farmers through a three-stage census. In the first stage, rice value chain's actors and the regions of rice production were identified in Burundi. Also, actors and regions of production of maize, cassava, sweet potato, banana, soybean and beans were identified. For rice and other crops, the regions selected were the major rice growing areas named hubs. These hubs were zones of high potential impact where rice research innovations are integrated across the value chain to achieve development outcomes and impact [4] [4]. In the hubs, Africa Rice Center (AfricaRice) and national scientists are introducing, evaluating and validating new rice technologies, and work with development partners to facilitate the training of farmers, out-scaling of technologies and establishment of linkages among actors along the rice value chain. Hubs were selected in participatory approach with national partners and value chain actors. Data were collected in the selected hubs in Burundi. In the second stage, the list of actors was obtained from actors' associations and updated through census. All individual actors were interviewed. The questionnaire and the design of an android-based application were developed for e-registration of farmers. Finally, enumerators were recruited and trained for data collection in each country. The questionnaire was pre-tested by enumerators before the beginning of the actual surveys. Data collection was coordinated and supervised by AfricaRice staffs, national agricultural research institutes in Burundi and government extension officers. Actors' leaders facilitated contact with respondents. Face-to-face interviews were conducted, and the location of all ten crops' farmers and villages were geo-referenced using GPS device. Data were analyzed using STATA 15 software.

6. CONCLUSION

The e-registration and spatial referencing and tracking of farmers have been conducted in Burundi. The e-registration survey and spatial referencing and tracking of farmers were organized in the framework of the Transforming Agrifood Systems in West and Central Africa initiative (TAFS-WCA) for better targeting and effective monitoring of the diffusion at large scale of improved technologies. The purpose of the e-registration was to collect reliable, accurate and sufficient data that can be used as sampling frame based on random samples for TAFS-WCA baseline survey. The e-registration in Burundi mainly focuses on five crops: rice, cassava, sweet potato, banana and beans.

In Burundi, data were collected from 1,751 households in 6 regions including 168 in Bubanza, 310 in Cibitoke, 318 in Makamba, 321 in Rutana, 307 in Gitega and 327 in Kirundo. Different categories of actors were identified: producers (1,513), millers (35), traders (231), service providers (8). Among the producers, cassava, rice, banana, potato and beans were the main cultivated crops (42.55% (745) for rice, 14.51% (254) for cassava, 11.54% (202) for banana, 10.34% (181) for potato and 7.48% (131) for beans).

REFERENCES

[1] A. Arouna, R. Aboudou, Dataset of the survey on e-registration and geo-referenced of rice value chain actors for the diffusion of technologies: Case of Benin and Cote d'Ivoire. Data in Brief, (2020) pp. 1-09, doi: https://doi.org/10.1016/j.dib.2020.105642.

[2] A. Arouna, J.C. Lokossou, M.C.S. Wopereis, S. Bruce-Oliver, H. Roy-Macauley, Contribution of improved rice varieties to poverty reduction and food security in sub-Saharan Africa. Global Food Security. 14 (2017) 54–60. https://doi.org/10.1016/j.gfs.2017.03.001.

[3] J. Huat, E. Dossou-Yovo, M. Guindo, H. Avohou, T. Furlan, F. Sanogo, A. Touré, A spatial database of lowland cropping systems in Benin, Mali and Sierra Leone. Data in Brief. 24 (2019), 103876. https://doi.org/10.1016/j.dib.2019.103876.

[4] E. Zossou, A. Arouna, A. Diagne, R.A. Agbo-Noameshie, Gender gap in acquisition and practice of agricultural knowledge: case study of rice farming in West Africa. Exp. Agric. 53 (2017) 566-577. DOI: 10.1017/S0014479716000582.

[5] A. Arouna, R. Aboudou, W. Yergo, M. Ouedraogo, and T. Abdoulaye. E-registration and spatial referencing and tracking of farmers in three countries: Case study of Ghana, Nigeria and Cote d'Ivoire: Technical Report, (2023). Abidjan, Cote d'Ivoire: AfricaRice.