



Capacity for Agricultural Research for Development (C4R4D) in Sub-Saharan Africa

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1. Executive summary

The Capacity for Agricultural Research for Development (C4R4D) Project is a response to the challenge of developing research capacity in West and Central Africa (WCA). The project is funded by the International Development Research Centre (IDRC), managed by Conseil Ouest et Centre Africain pour la Recherche et le Développement Agricoles/West and Central Africa Agricultural Research and Development (CORAF/WECARD) and implemented in collaboration with IITA in four countries: Chad, Democratic Republic of Congo, Sierra Leone, and Togo.

The Project is for three years and its objective will be achieved through four expected outputs: (i) research, communication and leadership capacities, and skills of students to undertake quality AR4D sustainably strengthened; (ii) delivery of research outputs in line with national priority research areas supported; (iii) capacities and skills of women scientists strengthened for a better representation in AR4D; and (iv) collaboration and networking among National Agricultural Research Systems (NARS), CORAF, and IITA increased. Specifically, the Project aimed at supporting, at least, 20 MSc and PhD candidates, through a competitive process during the three years. Each country should receive five scholarships (3 MSc and 2 PhD).

C4R4D is mainly a coaching program. It provided support to the awardees when they had completed their course work and were preparing the dissertation proposal. In preparation for this critical task, IITA scientists and the national supervisors coached the students to help them to achieve their professional goals. The coaching focused on developing research knowledge and skills that complement the material provided by their respective university's programs while supporting their research objectives. This involved bringing students to IITA hubs to work on their research projects and develop their skills and competency. This establishes them as scholars in their fields.

The originality of this program is related to the attempt to address the capacity building needs of the four targeted countries. Each candidate was asked to have his/her application endorsed and validated by national research centers in their respective countries. The Program has been demand-driven, responding to NARS requests for assistance and providing grants to young scientists. The project also organized four different short courses to strengthen student capacity in agricultural research. These trainings are R4D methodologies, scientific writing, data management and pedagogy. It was the first time that a training in pedagogy is delivered to prepare Ph.D. Students for the art of teaching as future scientists, supervisors and/or teachers or instructors, and as they prepare for future academic and research positions.

Advertisements were issued in the form of an open call for proposals prepared and circulated through various channels including the email addresses of the national research institutes and universities, and IITA and CORAF/WECARD websites. The call was also sent to IITA Central and West Africa hubs, to National Agricultural Research Institutes and Universities for dissemination. The first call for proposals for interested MSc and PhD students was closed on June 18, 2015. The deadline was extended to September 18, 2015 due to the limited number of applications received, particularly from Sierra Leone, and in general the limited number of candidates for the doctorate research and finally the limited number of female candidates. In the second announcement, the call was still sent to national institutes and universities, but in addition networks of IITA and CORAF/WECARD scientists and gender specialists in the targeted countries were used to encourage potential female candidates to apply as well as students' associations of the targeted countries. In addition to the online information, paper-based brochures and posters were produced, distributed in the countries and posted in CORAF/WECARD Secretariat and IITA hubs.

The extension permitted to increase the number of applications as well as the number of female applicants from 7 to 20 in general and female applications for PhDs increased from 1 to 9. A total of 92 applications comprising 42 for MSc students and 50 for PhD students' applications with 33 from Togo, 32 from DRC, 17 from Chad and 10 from Sierra Leone (see table 1) were finally received in response to the first and second calls for the awards fellowship from the four countries. For the 42 MSc, 19 were submitted by female candidates and 23 by male candidates and with regards to PhD candidates, 09 are women and 41 men.

The 92 applications were evaluated by a Committee composed of:

- a representative from the CORAF/WECARD Executive Secretariat;
- a representative from IDRC;
- a representative of National Agricultural Research institute (ITRA – Togo); and
- two representatives of the Ibadan Hub of IITA.

The evaluation was based on the relevance, the research project quality and feasibility (timeframe and originality of the research), and the quality of writing using the following criteria:

- clarity in identifying the problem / research theme;
- clarity of the scientific and technical objectives;
- feasibility and appropriateness of the methodology with regards to the targeted objectives;
- overall quality of the application - (ability or potential to communicate scientific concepts clearly and logically); and
- candidate's ability to conduct research and to innovate.

Each criterion was scored from (5 being a high rate, and 1, a low rate). At the end of the evaluation process, 21 candidates (13 PhD and 8 MSc) were recommended: (i) 04 PhD and 01 MSc for DRC; (ii) 03 PhD and 0 Master for Sierra Leone; (iii) 02 PhD and 01 MSc for Chad and (iv) 05 PhD and 5 MSc for Togo. Seven additional students were recruited later, of which four were female. The total number of awardees are 28 of which eight are MSc students and 20 PhD students. The total number of female students is 12 (five MSc and seven PhD). While the expected number of students has been exceeded, the project has faced challenges in recruiting MSc students in all the four countries. Recruitment of students has been particularly challenging in Chad, DRC and Sierra Leone. However, the project has been very successful in recruiting female PhD students in Sierra Leone, where 4 of the 6 awardees are female.

The following courses have been offered to MSc and PhD students brought together: research methodologies, scientific writing and communication skills, data management, pedagogy and a writeshop. Fifteen IITA research fellows attended the training course on scientific writing, twenty-one on data management, eighteen on research methodology, twenty on pedagogy, and twenty-seven attended the writeshop. Five students who were sponsored by the International Development Research Centre (IDRC) could not participate in the training due to ongoing laboratory or field work.

Sixteen out of the 28 students (3 from Chad, 7 from Togo, 4 from Sierra Leone, and 2 from Congo), had submitted their theses. All eight MSc students (3 from Chad, 1 from DRC and 4 from Togo) have graduated of which 5 females). Eight PhD students – 4 female and 4 male - have graduated (1 from DRC, 4 from Sierra Leone and 3 from Togo. As we prepare this report, one student from Togo has submitted his PhD thesis and graduated in November 2018.

As of today, 11 PhD students have not graduated yet (2 from Chad, 4 from DRC, 2 from Sierra Leone and 3 from Togo) of which 3 females. Six students are behind in the analysis of their data, while four mentioned the inadequacy of funding to complete their research to justify the delay in the submission of their theses. The reason for the delay for the eleventh is the long strike of the university teachers. It is expected that all students will graduate by April 2019, except one. The lack of funds mentioned by students is due to the addition of new components at a later stage of the research work that the project could not support, given that they had not been budgeted for.

The main outcomes of the Project can be summarized as follows:

- i. IDRC support helped increase the number of young scientists in the four countries. This is particularly important for a country such as Chad where postgraduate studies is not well developed, and the number

of scientists is limited. As of 2014, the Institut Tchadien de Recherche pour le Développement (ITRAD) had just seven PhD-qualified researchers, all of whom were approaching retirement age. Most of Chad's agricultural researchers with PhD degrees are in their 50s or 60s and approaching the mandatory retirement age of 65 years. This situation is particularly severe at ITRAD. It is therefore crucial that younger MSc-qualified researchers are given the opportunity to undertake PhD training¹.

- ii. IDRC support contributed considerably to increase the overall share of female researchers employed at the Sierra Leone Agricultural Research Institute. The Project supported four female PhDs.
- iii. IDRC support contributed to improved collaboration with national research institutes, particularly those in Chad and Togo. For example, ITRAD has invited IITA to visit the country to develop collaborative research programs. IITA is collaborating with Institut Togolais de Recherche Agronomique (ITRA) in the implementation of the transformation program in Togo.

Main lessons learned during implementation are the following:

- i. Projects for developing the next generation of scholars should have at least a duration of 4 years. Three years are short for the supervision of PhD students in Africa. Four years to develop 3 batches of young scholars will be reasonable because, it is also necessary to consider the time needed to start the project, including the long process of recruiting students, the transfer of research grants, etc.
- ii. A well-targeted and aggressive communication strategy should be developed to attract female candidates. The target countries could also be visited to meet potential female graduates.
- iii. For PhDs, universities must confirm that students are at an advanced level of their research. We believe that the stage of completion of research of the students who have not finished yet under the Project was not well evaluated.
- iv. The use of an external coaching system (IITA Researchers were assigned to 18 students) is very important as it has allowed students to improve their research proposals and to be more confident.
- v. The involvement of external supervision of students is also crucial. CORAF supervision permitted to identify students' challenges such as lack of laptops and ensure that the identified challenges are adequately addressed by IITA.
- vi. The field of research must be considered in determining the amount of the research grant. Students conducting plant breeding research often have higher needs.
- vii. With the scientific writing and data management courses provided, students became more confident, improved their capabilities in writing and sped up the writing of their papers and thesis. These courses should continue to be incorporated to help students produce good quality theses and publish articles.
- viii. Other courses such as training in management and leadership should also be incorporated to provide young scholars with management and leadership skills.

¹ ASTI (2017). Chad: Agricultural R&D Indicators Factsheet.

2. Research problem

A well-educated agricultural research workforce that effectively applies professional competencies and skills promotes sustainable agricultural development. Investment in AR4D generates growth, reduces poverty, and protects the environment. The World Bank World Development Report—Agriculture for Development, 2008—indicates that agricultural growth is twice as effective in reducing poverty as non-agricultural growth. The same report underlines the necessity for more research to drive sustainable productivity growth into the future in which an increase of about 70 percent in food supply will be needed to feed the anticipated population expansion and meet global food demand.

Agricultural development in Africa is hampered by a lack of adequate investment in the human capacity required in AR4D. Recent studies and surveys found that in most countries in sub-Saharan Africa (SSA) there are too few researchers and many of them lack the key skills needed. In 2010, the International Association of Universities carried out studies in a group of SSA universities and the findings revealed that more support for both PhD and staff was a prerequisite for success² in AR4D. Another issue is the rapidly aging pool of scientists, many of whom will approach retirement within the next decade³.

Also, of concern is the low level of female participation in agricultural research even though the majority of those who produce, process, and market Africa's food are women; only one in four agricultural researchers is female⁴. A study by Africa Women in Agricultural Research and Development (AWARD) and the Agricultural Science and Technology Indicators (ASTI) on “Women's participation in agricultural research and higher education” in SSA found that women are more represented in junior roles requiring only a BSc-level qualification. The benchmarking survey—which was conducted in 125 agricultural research and higher education agencies in 15 SSA countries by ASTI and the CGIAR Gender & Diversity program—showed that only 14 percent of the management positions were held by women. This is also confirmed by the weak response of women to the call launched within this Project.

The agricultural sector is changing rapidly, and this has affected capacity development. Threats from climate change and increasing resource scarcity are some of the new challenges affecting AR4D and smallholder farmers. With the technology revolution, new regulatory requirements, and breakthroughs in areas such as nutrition, genetics, informatics, remote sensing, meteorology, and precision farming, most of NARS management is confronted with how to ensure that the skills of both job entrants and existing researchers remain relevant throughout their careers. For example, several countries in SSA lack the necessary technical capacity to conduct or review risk assessment dossiers for genetically modified (GM) crops and to monitor for compliance⁵. These require a new focus on developing research capacities needed to promote innovation, technology development, and food security.

Securing an adequate supply of suitably skilled researchers is important for optimizing agricultural productivity and outputs. This is recognized by initiatives and frameworks such as the Comprehensive African Agricultural Development Program (CAADP), and by research coordination bodies such as FARA, CORAF/WECARD, and ASARECA, and by ECOWAS under its Agricultural Policy for West African States (ECOWAP). The fourth pillar of CAADP calls for the improvement of agricultural research, technology dissemination, and adoption. The workforce needs to be large enough to enable the sector to remain productive and competitive; it must also have the right skills to allow NARS to grow and improve their performance by becoming more innovative and responsive to change. As such, it is important to develop and implement targeted capacity development programs to meet the demand for skills and competencies.

²IAU (International Association of Universities). 2010. Changing nature of doctoral studies in sub-Saharan Africa, IAU. This reference is incomplete. Where was it published?

³ASTI (Agricultural Science and Technology Indicators). 2012. Global assessment of agricultural R&D spending: developing countries accelerate investment. Where was this published?

⁴Beintema, N.M. and F. Di Marcantonio. 2010. Female participation in African agricultural research and higher education: New insights. IFPRI.

⁵Obonyo, D.N., L.M. Nfor, S. Uzochukwu, M. Araya-Quesada, F. Farolfi, D. Ripandelli, and W. Craig. 2011. Identified gaps in biosafety knowledge and expertise in sub-Saharan Africa. *AgBioForum* 14(2): 71–82. Available on the World Wide Web: <http://www.agbioforum.org>.

The Capacity for Agricultural Research for Development (C4R4D) is a response to the challenge of developing research capacity in West and Central Africa (WCA) and is coherent with the strategy of the West and Central African Council for Agriculture (CORAF/WECARD) for capacity strengthening. It is also coherent with the IITA's Strategy 2012–2020 which identified capacity strengthening as among the critical cross-cutting areas that require greater attention. The Project is also in line with IDRC Innovating for Development Strategic Framework 2010–2015 which seeks to strengthen research capacities across its five program areas, which include agriculture and the environment, in developing countries.

C4R4D is targeting the following countries in WCA: Chad, Democratic Republic of Congo, Sierra Leone, and Togo. Priority is given to these countries because they have more critical food security needs according to the Global Food Security Index⁶ released in July 2013. The Democratic Republic of Congo is ranked 107 out of 107 countries in the Index. Chad, Sierra Leone, and Togo are also at the bottom of the ranking.

The request for support to C4R4D is based on this background and the premise that it is cost-effective to promote human resource development and opportunities to advance knowledge. As such, the Project seeks to provide a regional response to the need for high-level expertise in AR4D by expanding opportunities for fellowships, grants, and short-term training programs. By developing required skills, countries will have more capacity to generate growth and accelerate economic development. C4R4D, while increasing the number, competency, and skills of scientists, will improve collaboration among IITA, CORAF/WECARD, NARS, and higher education institutions.

The Project's objective is to improve the institutional capacity of NARS in the targeted countries through the increased number and quality of qualified agricultural science graduates in AR4D capable of identifying, generating, and disseminating research outputs that meet the needs of smallholder farmers and other actors in the food chains.

The objective would be achieved through four expected outputs:

- a) Research, communication and leadership capacities, and skills of students to undertake quality AR4D sustainably strengthened;
- b) Delivery of research outputs in line with national priority research areas supported;
- c) Capacities and skills of women scientists strengthened for a better representation in AR4D;
- d) Collaboration and networking among NARS, CORAF, and IITA increased.

⁶The Economist. 2013. Global food security index 2013: An annual measure of the state of global food security.

3. Progress towards milestones

3.1 Research, communication and leadership capacities, and skills of students to undertake quality AR4D sustainably strengthened

Overall assessment of the Project indicates that this objective has been met. The Project aimed to train a total of 20 students and has contributed to increase the number of scientists in the target countries. According to the Agricultural Science and Technology Indicators (ASTI), which provide trusted open-source data on agricultural research systems, the four countries are challenged by a severe lack of scientists qualified to the PhD level; moreover, most that do have PhD degrees are approaching retirement age. In 2012, ITRAD, in Chad, employed just seven PhD-qualified researchers. The number of current researchers, together with their mix of skills, is insufficient for the institute to effectively fulfill its mandate, as is reflected by the relatively low number of research outputs the institute produces. In DRC, Sierra Leone and Togo, the national agricultural research institutes and the other government agencies continue to lack a critical mass of scientists qualified to the PhD level.

The total number trained is 28 of which eight are MSc students and 20 PhD students. The total number of female students is 12 (five MSc and seven PhD). The allocated number of scholarships per country (five per country) has been exceeded in Democratic Republic of Congo, Sierra Leone, and Togo. The number of PhD students has also been exceeded in these three countries. In Sierra Leone, C4R4D has supported six PhD students of which four are female. In Chad, the number has not been exceeded due to challenges in identifying students in the country. The final allocation of the fellowships is indicated in the Table 1.

Table 1. Status of students supported per country

Country	PhD		MSc		Total
	M	F	M	F	
Chad	2	–	1	2	5
DRC	3	2	1	–	6
Sierra Leone	2	4	–	–	6
Togo	6	1	1	3	11
Total	13	7	3	5	28

3.1.1 Recruitment of MSc and PhD students

(i) Interaction with the director generals of the national research institutes

After project approval by IDRC and finalization of the implementation modalities, notifications were sent to the director generals of the research institutes of the target countries to inform them of the availability of the research grants and conditions to be met. Subsequent emails were also sent to follow-up on the level of applications. In addition, a meeting was held between the Director General of SLARI, Sierra Leone and the C4R4D IITA team during his visit to IITA.

(ii) Dissemination of the announcement of the research grants

Advertisements were issued in the form of an open call for proposals prepared and circulated through various channels including the email addresses of the national research institutes and universities, and IITA and CORAF/WECARD websites. The call was also sent to IITA Central and West Africa hubs, and to national agricultural research institutes and universities for dissemination. The initial deadline for proposals for interested MSc and PhD students was 18 June 2015. The deadline was extended to 18 September 2015 due to the limited number of applications received, particularly from Sierra Leone, and, in general, the limited number of candidates for the doctorate research and the limited number of female candidates. The extension resulted

in an increase in the number of applications from 40 to 92 with an average of 23 applications per country. The number of female applicants equally increased from seven to 20 and female applications for PhDs increased from one to nine.

In disseminating the first call, we relied on national research institutes and universities to reach potential candidates. In the new announcement, the call was still sent to national institutes and universities, but in addition networks of IITA and CORAF/WECARD scientists and gender specialists were used to encourage potential candidates to apply as well as student associations of the targeted countries. Also, in addition to the online information, brochures and posters were produced, distributed in the countries, and posted in the CORAF/WECARD Secretariat and in IITA hubs.

Samples of websites, which advertised the call and permitted to improve the visibility of this initiative of short training are:

- <http://www.slu.se/Documents/externwebben/overgripande-slu-dokument/samverkan-dok/agric-sci-global-dev/PDF/CORAF-WECARD-IITA-Research-grant-for-agricultural-research-for-development.pdf>
- <http://www.scholarshipandgrants.com/africans/coraf-wecardiita-research-grant-for-agricultural-research-for-development-for-african-graduate-students/>
- <http://www.awardfellowships.org/96-myaward/news/research-grants/965-coraf-wecard-iita-research-grant-for-agricultural-research-for-development>
- <https://www.facebook.com/opportunitiesforafricans/posts/926327180762051>
- https://groups.google.com/forum/#!topic/reseau-doctorants-nigeriens/4V_vNo5Cleo
- <http://www.ypard.net/opportunity/graduate-agricultural-research-grant>
- <http://www.terravivagrants.info/grantdetail.php?id=2631>
- <http://www.cambridge-africa.cam.ac.uk/opportunities/career-development-opportunities/>
- http://researchsea.com/html/announcements.php/aid/9055/cid/1/research/call_for_applications_for_agricultural_research_for_development_in_africa.html (Asia Research News).

(iii) *Status of applications received*

A total of 92 applications comprising 42 for MSc and 50 for PhD with 33 from Togo, 32 from DRC, 17 from Chad, and 10 from Sierra Leone (Table2) were finally received in response to the first and second calls from the four countries. For the 42 MSc, 19 were submitted by female candidates and 23 by male candidates and for the PhD candidates, nine are women and 41 men (Tables 2 & 3).

Table 2. Total number of applications received

Country	PhD	MSc	Total
Togo	15	18	33
Chad	13	4	17
DRC	15	17	32
Sierra Leone	7	3	10
Total	50	42	92

Table 3. Distribution of applications by country, degree, and gender

Country/Degree/Gender									
Degree	DRC		Sierra Leone		Togo		Chad		Total
	M	F	M	F	M	F	M	F	
PhD	12	3	4	3	15	0	10	3	50
MSc	12	5	3	0	5	13	3	1	42
Total	24	8	7	3	20	13	13	4	92

M = Male; F = Female

(iv) *Selection process*

The 92 applications were evaluated by a committee composed of:

- A representative from the CORAF/WECARD Executive Secretariat,
- A representative from IDRC,
- A representative of the National Agricultural Research Institute (ITRA–Togo),
- Two representatives of the Ibadan hub of IITA.

The evaluation was based on the relevance, research project quality and feasibility (timeframe and originality of the research), and quality of writing using the following criteria:

- Clarity in identifying the problem/research theme,
- Clarity of the scientific and technical objectives,
- Feasibility and appropriateness of the methodology with regards to the targeted objectives,
- Overall quality of the application (ability or potential to communicate scientific concepts clearly and logically),
- Candidates ‘ability to conduct research and to innovate.

Each criterion was scored on a scale of 1–5 (5 being a high rate, and 1 a low rate). The total number of graduate students was 28 of which eight were MSc students and 20 PhD students. The total number of female students was 12 (five MSc and seven PhD). The details on students are attached to this report. Even though the Project set out to allocate 50% of scholarships to female students, the Project achieved about 43%. However, the Project exceeded the number of targeted students (20). The allocated number of scholarships per country was exceeded in DRC, Sierra Leone, and Togo. The target in Chad has been reached as planned (3MSc and 2 PhD). After the selection, IITA informed the selected candidates and the NARS about the outcome of their application by email. Those who were not eligible or who had not been selected were also notified by email.

3.1.2 *Support and Coaching of students*

Out of 28 selected, 18 were assigned IITA researchers within their discipline to act as coaches. The coaches provided the graduate students with support, feedback and advice, and helped them focus and move forward on their personal and professional goals. The list of the 28 students with their research title is in Annex 1.

The coaches have provided the students with support, feedback and advice so that they focus and move forward on their personal and professional goals. All awardees have once at least travelled to IITA hubs. The IITA supervisors, in collaboration with their national counterparts, helped each selected student better refine his/her research topic with the appropriate objectives and experimental plan. Their suggestions led the graduate students to establishing milestones to mark achievement and creating a strong connection to the national research programs. In cooperation with the NARS and the universities, IITA made all arrangements with the selected candidates (payment of research grant, review of research projects, travel plan). Each student received the research grant to support their data collection. These funds have been made available to students after approval of their research proposal by their advisor/supervisors. The project average contribution per student amounted to CAD\$14,600. Also, twenty-five laptops procured by the project were distributed to the students

during the IITA symposium held in July 2017 to facilitate the writing of their theses. This was of great help because most of the students had outdated computers.

Students will conduct their lab work at the IITA hub that is closer and/or has relevance to their research project. At the hubs, they will use research facilities to finalize their research projects under the supervision of the scientists and in close collaboration with the national supervisors. They will also undertake field trips to research sites. Finally, they will attend short term training classes, participate in research seminars and informal discussion groups, and interact with fellow students.

Sixteen out of the (28) students (3 from Chad, 7 from Togo, 4 from Sierra Leone, and 2 from Congo), have submitted their theses while other students are expected to submit on or before December 2018. This hold-up is due to the delay in finalizing research activities owing to the nature of some crops (long crop cycle), data analysis and interpretation, university strikes, insufficient funds, and waiting to defend at the university. While, some additional components have been added to students’ research leading to increase the required budget, experience over the years has shown that scholarships are largely insufficient for students conducting breeding research and the institute has been bearing part of the research costs. In future projects, resources should be allocated according to the research areas.

Out of 16 students who graduated, nine are female of which 4PhD. All 8 MSc students graduated as planned. Figure 1 indicates the status of submission per degree. Considering the progress made by the late students, it is expected that all awardees will graduate, except one. Despite being coached by different supervisors, he was not able to make tangible progress in his research work. One supervisor provided the following statement *“Franchement did not seem to have the needed scientifically sound approach and qualities to carry out a PhD. The few documents that he produced covering research methods and some initial results were very poorly written and lacked structure/details”*.

Table 4: Students’ Thesis received according to country

Country/Degree/Gender									
Degree	DRC		Sierra Leone		Togo		Chad		Total
	M	F	M	F	M	F	M	F	
PhD	1	-	1	3	2	1	-	-	8
MSc	1	-	-	-	1	3	1	2	8
Total	2	-	1	3	3	3	1	2	16

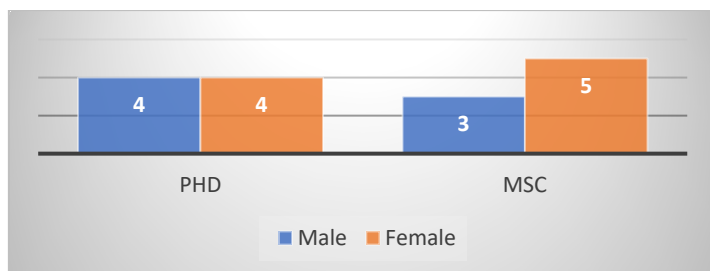


Figure 1: Students’ Thesis received according to Degree

Table 5 below provides the detailed information on the student and the title of their theses. Three from Chad, seven from Togo, four from Sierra Leone, and two from Congo, have submitted their theses. All eight MSc students (3 from Chad, 1 from DRC and 4 from Togo) have graduated of which five females. Eight PhD students – 4 female and 4 male - have graduated (1 from DRC, 4 from Sierra Leone and 3 from Togo. As we prepare this report, one student from Togo has submitted his PhD thesis and graduated in November 2018.

Table 5. Students' thesis submission

S/N	Name	Nationality	Gender	Degree	Thesis Title
1	Adele Noudjilembaye	Chadian	F	MSc	Effet combiné de l'huile de <i>Azadirachta indica</i> A. Jus (Meliaceae), d'appât alimentaire et du métristar sur quelques maladies et insectes ravageurs de deux Cucurbitaceae (<i>Cucumis sativus</i> L. et <i>Cucurbita pepo</i> L.) dans la ville de Yaoundé-Cameroun
2	Denise Nanguianan	Chadian	F	MSc	Efficacité insecticide de l'extrait méthanolique et d'huile essentielle de <i>Lippia adoensis</i> contre <i>Callosobruchus maculatus</i> (F.) (Coleoptera: Chrysomelidae) sur le voandzou (<i>Vigna subterranea</i>) et leurs impacts sur la qualité organoleptique des produits dérivés
3	Théophile Dessenbe	Chadian	M	MSc	Bio-efficacité des extraits méthanoliques des feuilles de <i>Plectranthus glandulosus</i> (Lamiaceae) à l'égard de <i>Sitophilus zeamais</i> (Coleoptera: Curculionidae)
4	Assani Neville Mapenzi	Congolese	M	MSc	Analysis of farmers soil conservation practices for soil erosion management in Cirhanyobwa (Kabamba) catchment, South-Kivu Province, DR Congo
5	Bwihangane Ahadi Birindwa	Congolese	M	PhD	Epidemiological study of Peste Des Petis ruminants in goats and sheep in South Kivu, Democratic Republic of Congo
6	Isata Kamanda	Sierra Leonean	F	PhD	Genetic improvement of root yield and nutritional quality of cassava (<i>Manihot esculenta</i> Crantz)
7	Kumba Karim	Sierra Leonean	F	PhD	Genetic analysis for high starch, dry matter content and storage root yield in cassava (<i>Manihot esculenta</i> Crantz)
8	Theresa Tenneh Dick	Sierra Leonean	F	PhD	Women organizations as innovation platforms for empowerment of rural women cassava processors in Southern Province of Sierra Leone
9	Tamba Bandabla	Sierra Leonean	M	PhD	A Bayesian statistical model for assessing stability of quantitative traits of crops across environments
10	Badjissaga Maba	Togolese	M	PhD	Identification et hiérarchisation des éléments nutritifs majeurs limitant le rendement du maïs dans la région des Plateaux au Togo
11	Essossinam Ali	Togolese	M	PhD	Climate variability and cereal farmers' willingness to pay for weather index-based insurance in Northern Togo
12	Essossolim Nadege Awade	Togolese	F	MSc	Adaptation to climate change and access to credit on soybean farmers' revenue in Tchamba District of Togo: A gender analysis
13	Oluyemi Titilola Akintayo	Togolese	F	PhD	Identification of quantitative trait locus for submergence tolerance at seedling stage in two rice (<i>Oryza</i> spp) populations derived from African rice
14	Roukeyatou Atarigbe	Togolese	F	MSc	Effectiveness of public and NGO agricultural extension services: The cases of ICAT and ETD among rice farmers in the Plateaux region of Togo
15	Yawavi Eyram Gnomou	Togolese	F	MSc	Etude de quelques paramètres de reproduction et de développement de <i>Paracoccus marginatus</i> Williams et Granara de Willink (Hemiptera: Pseudococcidae) et de son ennemi naturel <i>Acerophagus papayae</i> Noyes et Schauff (Hymenoptera: Encyrtidae) en conditions de laboratoire
16	Yendou-Gname Kolani	Togolese	M	MSc	Effet de l'incorporation de l'huile de palme sur les performances de ponte et les paramètres sériques des poules pondeuses

As of today, 12 PhD students have not graduated yet (2 from Chad, 4 from DRC, 2 from Sierra Leone and 4 from Togo) of which three females. Six students are behind in the analysis of their data, while four mentioned the inadequacy of funding to complete their research to justify the delay in the submission of their theses. The reason for the delay for the eleventh is the long strike of the university teachers. It is expected that all students

will graduate by April 2019, except one. The lack of funds mentioned by students is due to the addition of new components at a later stage of the research work that the project could not support, given that they had not been budgeted for.

Table 6. List of students who are yet to submit their thesis and reasons for delay

S/N	Name	Nationality	Gender	Degree	Reasons for delay
1	Christophe Haouvang Laba	Chadian	M	PhD	Insufficient funds
2	Nideou Dassidi	Chadian	M	PhD	Data analysis and interpretation
3	Isaac Balume	Congolese	M	PhD	Data analysis and interpretation
4	Franchement Mukeshambala	Congolese	M	PhD	Insufficient funds
5	Bintu Nabintu Ndusha	Congolese	F	PhD	Due to university strike
6	Caroline Sibomana	Congolese	F	PhD	Insufficient funds
7	Prince Norman	Sierra Leonean	M	PhD	Due to nature of crop (long crop cycle)
8	Georgiana Allie	Sierra Leonean	F	PhD	Data analysis and interpretation
9	Maglwa Tcha-Thom	Togolese	M	PhD	Data analysis and interpretation
10	Voemesse Kokou	Togolese	M	PhD	Insufficient funds
11	Oumbortime N'nanle	Togolese	M	PhD	Data analysis and interpretation
12	Damigou Bammite	Togolese	M	PhD	Waiting to defend at the university

This Figure 2 shows that 42% of the students were delayed due to data analysis and interpretation, 8% due to the nature of crop, 8% due to university strikes, 34% due to insufficient funds, and 8% are waiting to defend their thesis at the university.

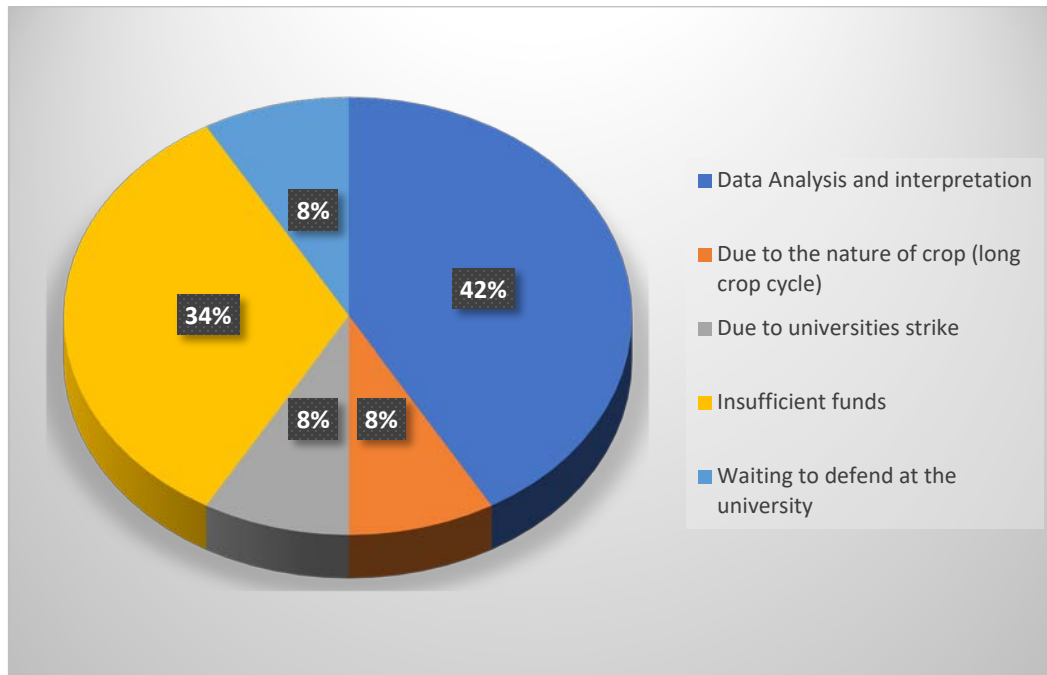


Figure 2 A pie chart showing the reasons for delay in thesis submission

3.1.3 Supervision of students by CORAF

CORAF seized the opportunity offered by the training courses organized in Ibadan in June-August 2016 and in July 2017 and the one in Benin in July 2017 and which brought together MSc and PhD students to meet and exchange with each of the students. These face-to-face meetings allowed CORAF to know the level of progress made, constraints encountered by students and to jointly with IITA address those constraints.

The first supervision mission was conducted by two CORAF staff (the C4R4D Project Leader and the Accountant) in July 2016, at IITA Ibadan during the first batch of the training sessions. The objective of the mission was to ensure that students are in good conditions to conduct their research work. Exchange and discussions with students and IITA project members permitted to identify the need (i) to supply students with laptops to facilitate their research; and (ii) to well explain the duration of contracts to students and the need to meet the deadline. This mission was also useful in the sense that the CORAF Accountant sensitized the IITA fiduciary team in the importance of using the IDRC financial template in producing financial reports.

The second supervision mission was conducted during the writeshop held in Cotonou from 3 to 7 July 2017. The CORAF Project Leader met and exchanges with all the 18 students present. The students were all very satisfied with the scholarship program. The financial contribution of the program has been instrumental in speeding their research work. The networking set up through the program was greeted by all, and according to them it is facilitating information sharing among them. The writeshop organized enabled them to improve their skills in scientific writing, using of statistic software, communication, etc. The students appreciated the quality and fluency of the communication between them and IITA. However, there were some main concerns raised by the students: (i) low collaboration between internal (university) and external Supervisors (IITA); (ii) insufficient funding for research works such as analyses. Considering these concerns CORAF recommends for the future project the reinforcement of communication and establishment of contracts between (i) the external supervision (in this case IITA), (ii) student, and (iii) and the internal supervision (university) with clear responsibilities and roles to facilitate the collaboration between the supervisors.

3.1.4 Short skills and competency development

The following training courses were organized for the students in Ibadan from 27 June to 22 July 2016: research methodologies, data management, scientific writing, and pedagogy. The trainings were conducted by six trainers and the students were from different countries: Chad, DRC, Nigeria, Sierra Leone, and Togo. Five students who were sponsored by the Project could not participate in the training due to ongoing laboratory or field work. A total of 31 students participated in the four training courses, of which 10 were female. A Writeshop on Scientific Writing took place at the training room of IITA Cotonou from 3-7 July 2017. This last training workshop was attended by 27 graduate students.

The guiding philosophy of the training courses was to enable participants to have a highly interactive course. Consequently, the class was very vibrant, and discussions were reflective of the experiences of both the participants and the resource persons. Training methodologies used are presentations, plenary discussions, and practical group sessions; exercises; hands-on techniques and practices; and field visits. During the training courses, there was continuous evaluation at the end of each day followed by feedback at the beginning of each day. This allowed participants and facilitators to jointly steer the courses and agree on any adjustments to ensure successful outcomes. At the end of each course, participants completed a standard IITA training course evaluation form designed to find out if the objectives of the course had been met. Participants completed the form online using the SurveyMonkey survey tool.

The objectives of the training courses are been achieved. The courses allowed students to: (i) be equipped with the tools to enable them to write and present well-argued and documented scientific work that is acceptable for theses and peer-reviewed publications and whose results are easy to comprehend and use by other stakeholders; (ii) learn and understand the concept of research and the dimensions and types of social science and experimental research designs, procedure, and tools; (iii) make an informed choice of appropriate research

methods; (iv) appreciate the nature and steps in identifying research problems and understand the structure and importance of literature review; (v) link research questions, hypotheses, and research objectives; (vi) differentiate references, bibliography, referencing styles, and choices; (vii) possess enhanced knowledge and skill in research and scientific writing required to present an award-winning research proposal and thesis; (viii) understand and appropriately use statistical terms and concepts, data and data management; (ix) design and implement universally acceptable surveys and concepts and convert data into various formats using appropriate software; (x) be equipped with the tools to enable them to teach and conduct training upon the conclusion of their MSc and PhD programs.

3.1.5 Research methodology skills development

The research skill development scheme aimed to provide students with the knowledge of a range of transferable skills that they can apply in the future as researchers and teachers. It has developed the ability of students to undertake independent research. The skills gained through a series of short trainings from the scheme have assisted graduates in their personal development and helped them to improve their ability to become proficient in research, writing, and teaching.

The learning objectives of the course were to: (i) familiarize participants with the dimensions and methods of research; (ii) orient the participants to make an informed choice from the large number of alternative social science and experimental research designs available; (iii) enable the participants to identify research problems and review relevant and up-to-date literature in their field of study; (iv) familiarize the participants with the nature and linkage of research questions and research objectives, and assist them in formulating and testing hypotheses; (v) enable the participants to understand variable measurements and data collection instruments and approaches; (vi) enable the participants to choose and use appropriate referencing styles; and (vii) equip the participants with the knowledge and skills needed to present an award-winning proposal and thesis.

The course was divided into 10 core modules targeted at the learning objectives of the course, with an additional module on proposal and thesis writing format. Each module was structured into about six sessions of 1–2 hours per session. Power point presentations were used to deliver course content in the different modules in a highly interactive way, that involved question and answer sessions. A field tour was also organized for practical exposure of participants to support the learning sessions.

3.1.6 Scientific writing for agricultural research

The training course intended to equip the students with the tools to enable them to write and present well-argued and documented scientific work that is acceptable for thesis and peer-reviewed publication and whose results are easy to comprehend and use by other stakeholders. Content covered included (i) avenues for and the importance of communicating R4D results, principles and methods of communicating R4D results, processes in writing a R4D paper, scientific style, editorial and publishing process, presenting statistical data, publishing ethics and Intellectual Property Rights (IPR), and electronic publishing. Capacities of 11 students including seven men and four women were strengthened in scientific writing for agricultural research.

3.1.7 Data management

The main objectives were to help the students to: (i) understand and appropriately use statistical terms and concepts; (ii) understand data and data management; (iii) design and implement universally accepted surveys and concepts; (iv) convert data into various formats using appropriate software; (v) perform basic data analysis and complex data management with R; (vi) correctly identify appropriate statistical tests; and (vii) put strategies to improve data demand and use in research. Capacities of 16 students including 10 men and six women were strengthened in data management.

3.1.8 Pedagogy for agricultural research

The goal was to strengthen the knowledge and skills of research students on pedagogical teaching so that they can impart that knowledge to their future students and trainees. The training course aimed to equip IITA graduate students with the tools to enable them to teach and conduct training upon the conclusion of their MSc and PhD programs. Course content included: (i) the concept of pedagogy, (ii) importance of pedagogy for research students, (iii) learning styles and how people learn, (iv) setting learning objectives and Bloom's taxonomy, (v) teaching methods and pedagogy approaches, (vi) use of technology in teaching, and (vii) facilitation skills.

3.1.9 Journal articles write-shop

The write-shop was a follow-up to the training courses in four related areas namely, research methodology, data analysis, scientific writing, and pedagogy to bolster trainee research effectiveness and their capacity to disseminate their research findings to scientific audiences. This write-shop was organized to consolidate the previous trainings by providing an opportunity for the students to write up their own research work to a standard ready for submission and at a quality level suitable for acceptance for publication in reputable peer-reviewed journals. The write-shop was, therefore, intended to strengthen the skills of the students to enable them to write a draft article and go through a peer review process to get their articles ready for publication in a standard journal format.

All students benefitting from the IDRC research grant were asked to submit their articles as a prerequisite for participating in the write-shop. Twenty students submitted and were invited to the write-shop (see table 4) while eight did not because they were not advanced enough in their research activities. The submitted articles were forwarded to the facilitators for review by external reviewers. The write-shop workshop combined the following activities: (i) revision of the IMRAD format for scientific writing, (ii) revision on choosing a journal to publish a research paper, (iii) reviewing of individual manuscripts, and (iv) revision of the manuscripts by respective individuals during the write-shop.

The list of articles submitted for review of the in table 4. At the end of the write-shop, participants were better able to:

- Write scientific articles using appropriate journal formats,
- Respond appropriately to reviewers' comments on their drafts,
- Finalize corrected manuscripts for publication,
- Prepare a plan of action to develop other available research material to full journal articles.

3.1.10 Training evaluation by students

The overall impression of the participants of the training course in Scientific Writing was very good as indicated in the responses to all the items of the questionnaire. The final evaluation report can also be viewed by clicking the following hyperlink: <https://www.surveymonkey.net/results/SM-MPC9LR9M/>

The overall impression of the participants of the training course in pedagogy was also very good. The final evaluation report can be viewed by clicking the following hyperlink: <https://www.surveymonkey.net/results/SM-BWYRYS9M/>

With regards to data management training, most of the participants wanted more time to practice and felt the one-week training was not enough; a suggestion of two weeks was given. Some also suggested one-on-one training. The Francophone participants suggested that future trainings should be organized separately for Anglophone and Francophone participants. Some participants feel it would be easier to follow if they were given the materials at the beginning of the training.

Daily evaluations of the write-shop were done to highlight what went well and what could be improved. At the end of the course, participants completed a standard IITA training course evaluation form designed to find out if the objectives of the course had been met. This was used as a basis for this training report. The results can be viewed by clicking the following link: <https://www.surveymonkey.net/results/SM-V5LR8RZP/>

At the end of the courses the skills and understanding of participants have been enhanced in research methodology, scientific writing and peer reviewed publications, data management and pedagogy. Already, the few articles published in peer reviewed journals are an indication of the quality of the training courses. Informal feedback from supervisors and the positive evaluations from the students suggest that the workshops have been of value in improving students' awareness of good research methodology and thesis writing practices. Students almost unfailingly indicate that they would recommend the workshops to other research students.

3.2 Delivery of research outputs in line with national priority research supported

Research outputs are in the form of journal articles, books, book chapters, occasional papers, monographs, policy briefs, conferences and media appearances. The Project has contributed to research outputs and will continue contributing to science through the delivery of technologies, scientific papers, and publications. Twenty draft articles have been prepared, and so far, seven articles from four Togolese and one Chadian and one Congolese have been published. The list of the twenty draft articles and the eight published are in annex2.

Awardees also participated in few international conferences to present their research results. 27 graduate students attended the annual symposium of the International Association of Research Scholars and Fellows (IARSAF) of IITA held at IITA Ibadan, Nigeria from 10 to 14 July 2016. The theme of the symposium was "Contributions of IITA postgraduate students' research for transforming African agriculture". The symposium offered opportunities to students to share their research findings and interact and exchange ideas on their research activities with various participants. Three of the students received awards from the Symposium as the best poster and oral presentations.

Isata kamanda from Sierra Leone, attended the International Symposium of the International Society for Root and Tuber Crops - Africa Branch (ISTRC-AB) that took place in Dar es Salaam, Tanzania, 6–10 March 2017 to present her results "Farmers' adoption challenges, perception and preferences for yellow root cassava through participatory rural appraisal in Sierra Leone". Essossinam Ali attended the International Conference on Climate Change and Sustainable Development in Africa, organized by the University of Energy and Natural Resources of Sunyani of Ghana from July 24 to 28, 2017.

3.3 Capacities and skills of women scientists strengthened for a better representation in AR4D

The Project planned to allocate 50% of scholarships to female students but was only able to achieve about 43%. Among the 28 students being supported by the Project, 12 are female (5 MSc and 7 PhD) have graduated. Overall, the number of female scientists in AR4D in the targeted countries will be increased. At scale, this will result in a better representation of women scientists in AR4D, particularly in Sierra Leone.

The Project has been very successful in recruiting female PhD students in Sierra Leone, where four of the six awardees are female. Only 2 female PhDs in DRC, one in Togo and none in Chad. However, the Project has not been able to recruit a female MSc student, despite several visits of IITA scientists to Njala University, the leading institution in agriculture and environmental sciences. In DRC, the attempts have also been unsuccessful.

Despite the relative success of the project in developing women's capacities, a communication strategy targeting young female scientists should be developed and put in place for future projects. These projects should also work closely with women's networks in sciences such as AWARD (African Women in Agricultural Research and Development).

3.4 Collaboration and networking among NARS, CORAF and IITA increased

This objective has been achieved. The project has contributed to create linkages with Togo and Chad, where IITA had very little presence, and to strengthening existing collaboration with national research institutes in DRC and Sierra Leone. The project manager met the executive directors for ITRA, ITRAD and SLARI. The three directors greatly appreciated the project's support in building the capacity of young researchers in their respective countries.

ITRAD, in Chad, has invited IITA to visit the country to develop collaborative research programs. Discussions are underway at IITA Central Africa Hub to organize the visit to Chad. In Togo, IITA is collaborating with ITRA in the implementation of the transformation program in Togo, a project financed by the African Development bank. Collaboration with Congo has been strengthened through new projects such as Action to Control Cassava Brown Streak Disease in DRC funded by USAID. Recently, four scientists from DRC have been trained in IITA on seeds technology.

In Sierra Leone, IITA has been working in the country to provide technical assistance for the development of an ENABLE Youth (Empowering Novel Agri-Business Led Employment) project, funded by the African Development Bank. The main objectives of the assistance were to (i) to evaluate the agribusiness development potential by District; (ii) design youth incubation models in agribusiness and contribute to the customization of training modules/ curriculum so they reflect local content; and (iii) facilitate the test of a pilot ENABLE-Youth concept.

Collaboration between CORAF/WECARD and IITA has been strengthened. This facilitated the signing of an agreement between CORAF and IITA which aims at: (i) contributing to the control of mycotoxins including aflatoxins in maize and groundnut in West Africa (Benin, Mali and Togo); (ii) hosting the IITA Aflasafe Commercialization in Dakar; (and) providing administrative and logistic support to IITA operations in Senegal. CORAF is chairing the steering committee of the Biorisk Management Facility (BIMAF) that was established by IITA and its partners under the authority of CORAF/WECARD. Aslo CORAF has ensured a good administration and management of funds provided by IDRC for the C4R4D project.

4. Synthesis of project results and outcomes

- All the activities in the initial Project implementation plan have been implemented, except the tracer study that is scheduled to be conducted in 2019.
- Even though the expected number of students has been exceeded, the Project faced challenges in recruiting MSc students in all the four countries. The main challenge was the recruitment of students, particularly in Chad. However, the required number for the country (5 students—2 PhD and 3 MSc) has been reached. According to many sources, opportunities for graduate studies are limited in the country. Université de N'Djaména offers programs leading to a master's degree in jurisprudence, economics, biology, history, geography, and Arabic literature. Most of the scientific domains relevant to the Project are not covered such as agronomy, forestry, veterinary, and nutrition. It is not surprising that even today, many Chadian students in science continue their graduate education in other African countries such as Cameroon and Senegal.
- The Project has exceeded the number of targeted students (20). The total number of graduate students is 28 of which eight are MSc students and 20 PhD students. The total number of female students is 12 (five MSc and seven PhD). The allocated number of scholarships per country exceeded the required number in DRC, Sierra Leone, and Togo. The target in Chad has been reached as planned (3 MSc and 2 PhD).
- IITA is confident that all the remaining students, but one, will submit their thesis by the end of the year. Scientists will continue to follow up the students.
- The Project planned to allocate 50% of scholarships to female students but was only able to achieve about 43%. Among the 28 students being supported by the Project, 12 are female. At scale, this will result in a better representation of women scientists in AR4D, particularly in Sierra Leone. Overall, the number of scientists (female and male) in AR4D in the targeted countries will be increased. However, the Project has been very successful in recruiting female PhD students in Sierra Leone, where four of the six students are female. In Sierra Leone the Project has not been able to recruit a female MSc student, despite several visits of IITA scientists to Njala University, the leading institution in agriculture and environmental sciences. In the Democratic Republic of Congo, the attempts have also been unsuccessful. In implementing subsequent projects, a better and stronger marketing of scholarships should be developed for female networks, probably a collaborative arrangement with African Women in Agricultural Research and Development.
- Scholarships have been largely insufficient for students studying breeding hence the institute has provided additional fund to sponsor the research costs for six students. In future projects, resource allocation should consider research areas.
- The four trainings organized in scientific writing, research methodology, data management, and pedagogy have allowed students to: (i) be equipped with the tools to enable them to write and present well-argued and documented scientific work that is acceptable for theses and peer-reviewed publications and whose results are easy to comprehend and use by other stakeholders; (ii) learn and understand the concept of research and the dimensions and types of social science and experimental research designs, procedure, and tools; (iii) make an informed choice of appropriate research methods; (iv) understand and appropriately use statistical terms and concepts, data and data management; (ix) design and implement universally accepted surveys and concepts and convert data into various formats using appropriate software; (x) be equipped with the tools to enable them to teach and conduct training upon the conclusion of their MSc and PhD programs.
- The Project is contributing to science through the delivery of technologies, scientific papers, and publications. Twenty draft articles have been prepared, and so far, eight articles from four Togolese, one Sierra Leonean, one Congolese and one Chadian have been published.
- The networking set up through the program was embraced by all students, and according to them it is facilitating information sharing among them and other IITA students in different countries. All the students participated in the write-shop and attended the annual symposium of the International Association of Research Scholars and Fellows (IARSAF) of IITA held at IITA Ibadan, Nigeria from 10 to 14 July 2016. The theme of the symposium was “Contributions of IITA postgraduate students' research for transforming African agriculture”. The symposium offered opportunities to students to

share their research findings and interact and exchange ideas on their research activities with various participants. Three of the students received awards from the Symposium as the best poster and oral presentations.

- Adele Noudjilembaye, one of the awardees, won the first prize in her country (Chad) in a competition with more than 500 participants. The award was presented by the Director of the Housing Bank and the certificate by the First Lady of Chad Hinda Deby Itno.

5. Methodology

The project was administered by CORAF/WECARD and implemented by IITA in full collaboration with CORAF/WECARD and the national Agricultural Research Systems (NARS). Prior to project implementation, Internal discussions were held among IITA for their buying-in and clarity of corporate responsibility in implementation and integration in corporate project management system. Three main steps were followed in the implementation: (i) selection of MSc and PhD students; (ii) review of research projects and grant award; and (iii) short skills and competencies development.

C4R4D was mainly a coaching program. The Program has provided support to selected awardees at the point that they have completed all course work and are preparing the dissertation proposal. In preparation for this critical task, IITA scientists and the national supervisors coached the students to help them achieve their professional goals. The coaching and training have focused on developing research knowledge and skills that complement the material provided by their respective university's programs while supporting their research objectives. That has involved bringing students to IITA hubs to work on their research projects and developing their skills and competency and establishing them as scholars in their fields.

The methodology and steps for implementing the Project is described below:

- Targeting - The C4R4D targeted the following countries in West Central Africa: Chad, Democratic Republic of Congo, Sierra Leone and Togo. Special attention has been given to female candidates, particularly PhD. To increase the selection base of female candidates, a specific communication plan has been implemented. The call for applications has been sent to women associations for the promotion of science such as the Togolese Association for the Promotion of Women in Science at the university and the Sierra Leone Association of University Women.
- Announcement, publicity of the awards competition - Each country was to receive a minimum of 5 scholarships. Nominations were to be endorsed by the national research center of each country. This approach has been adopted with the aim of involving countries in the selection of research projects. Announcement of the scholarship has been prepared to invite applications. The invitation to apply has been distributed to a mailing list of targeted NARS and African universities and appropriate list-serves. Applications have been submitted directly to IITA after endorsement by the national research center. The following criteria have been set for the scholarship: (i) Must be a citizen of any of the eligible countries; (ii) Applicants must not be more than 40 years old at the time of application; (iii) Applicants must be currently registered in a Ph.D. or master program in recognized universities and are expected to graduate in 2016 for MSc students and 2017 for PhDs; (iv) Applicants must submit a document describing how he/she will use his skills and competencies to contribute to their country's social or economic development; and (v) Be available to take up the scholarship in the calendar year for which the scholarship is offered.

Eligible applicants have been asked to submit the following: (i) A completed form available at <http://www.iita.org> and <http://www.coraf.org>; (ii) A research proposal outlining their project's goals, questions and significance, and its relevance to his country NARS's central concerns. Proposals should include a clearly formulated, realistic research design and a plan of work responsive to the project's theoretical and methodological concerns. Proposals should be no longer than seven pages, including a bibliography; (iii) A certified copy of current passport or identity card showing evidence of citizenship; (iv) A certified copy of academic transcript and a curriculum vitae; (v) Two referee letters; one of these must be from the NARS supervisor; and (vi) A letter of support from the applicant country's NARS.

- Selection process – a selection committee has been established, composed of one representative from the CORAF/WECARD Executive Secretariat, IDRC, one scientist from the National Agricultural Research Institute (ITRA–Togo) to represent the country and two representatives of the IITA. The

following first-order selection criteria have been used to score the applications: (i) Clarity of the scientific and technical objectives; (ii) Feasibility and appropriateness of the methodology with regards to the targeted objectives; (iii) Overall quality of the application (ability or potential to communicate scientific concepts clearly and logically); and (iv) Candidates 'ability to conduct research and to innovate.

- Coaching awardees - After the selection, IITA has informed the selected candidates and the NARS about the outcome of their application by email, and those who have not been selected for a scholarship by email. Awardees have been assigned an IITA researcher as coach within their discipline. Each coach has provided graduate with support, feedback and advice and helped them focus and moved forward on their personal and professional goals. Each student has received a research grant to support their data collection. These funds have been made available to students after approval of their research proposal by their advisor/supervisors.
- Short term training courses - The following courses have been offered in English and French: Thesis preparation and AR4D methodologies, scientific writing and communication skills, data management and Pedagogy, mentoring and research supervision.
- Student Monitoring - a monitoring system has been put in place to track students' progress in implementing their research programs.

6. Project outputs

1. The response to the call is considered as good. A total of 92 proposals were received.
2. The Project has increased IDRC's visibility in West and Central Africa.
3. In all, 28 students of which eight are MSc students (three men and five women) and 20 PhD students (13 men and seven women) were supported by the Project to conduct their research work. The Project has exceeded the number of targeted students (20). Women represent 42.8% compared to the allocated 50% of scholarships to female students.
4. Sixteen out of the 28 students (3 from Chad, 7 from Togo, 4 from Sierra Leone, and 2 from Congo) have submitted their theses while other students are expected to submit on or before December 2018. This hold-up is due to delay in finalizing research activities owing to the nature of some crops (long crop cycle), data analysis and interpretation, university strikes, insufficient funds, and waiting to defend at the university.
5. The four training courses organized in scientific writing, research methodology, data management and pedagogy have equipped students with the tools to write and present well-argued and documented scientific work.
6. Twenty draft articles have been prepared and to date, eight papers have been published.
7. Project technical and financial reports were submitted to IDRC.
8. Participation of the Executive Director of CORAF, and CORAF and IITA Project leaders in the side event: "Research to Support Agricultural Transformation in Francophone Countries of West and Central Africa" organized by IDRC during AGRF 2017 in Abidjan, Côte d'Ivoire:
 - The Executive Director of CORAF/WECARD, Dr Abdou Tenkouano, made a speech during the opening of the site event and also made a presentation entitled 'Agricultural research for development in West and Central Africa: lessons and perspectives'. He insisted on (i) the role and place of CORAF/WECARD, the technical arm in agricultural research for Regional Economic Communities (UEMOA, ECOWAS, CEMAC, ECCAS); and (ii) one of CORAF flagship program which is the West Africa Agricultural Productivity Program with the objective to fill the food and economic gaps through the regional integration.
 - The IITA Project leader made a presentation entitled "Developing the leaders of tomorrow to support economic growth and agricultural transformation: practices and new pathways". The purpose of the oral presentation was to present the challenges and skills needed to contribute to the transformation of agriculture in Africa. The project manager highlighted the opportunities of agriculture to create wealth and jobs for a young and growing African population. Based on the implementation of three capacity development projects in the areas of research and entrepreneurship, including the IDRC-funded Project C4R4D, he highlighted the difficulties encountered in identifying potential young leaders. These difficulties included, among others, the generality of calls for applications that are not related to the challenges faced in the countries, the weakness of applications by women, the weakness of the public-private partnership in the preparation of future entrepreneurs in agriculture, and the different specific needs for capacity building of each student and young scholar. Appropriate development programs for young leaders in the different sectors of research, civil society, and entrepreneurship are needed. All these programs should include training modules in leadership, project management, communication, and policy dialogue.

7. Problems and challenges

- The main challenge has been the recruitment of students, particularly in Chad. However, the required number for the country (5 students—2 PhD and 3 MSc) has been reached. All students from Chad have been recruited in Cameroon by IITA scientists based in the country.
- In Sierra Leone the Project has not been able to recruit a female MSc student, despite several visits of IITA scientists to Njala University, the leading institution in agriculture and environmental sciences. In implementing subsequent projects, we advise a better and stronger marketing of the scholarship to female networks.
- Four students were not able to finish their research activities due the lack of additional funding. IITA's experience over the years has shown that scholarships are largely insufficient for students conducting breeding research and the institute has been bearing part of the research costs. In future projects, resources should be allocated according to the research areas.

8. Administrative reflections and recommendations

- For agriculture to become an opportunity to convert the continent's youth population into a viable demographic dividend, it is recommended that appropriate development programs be established for young leaders in the different sectors of research, civil society, and entrepreneurship. All these programs should include training modules in leadership, project management, communication, and policy dialogue.
- Realizing the full potential of the youth to support sustainable socioeconomic growth and improve food security requires the availability of leaders in agricultural science, policy-making, and agribusiness. The speed and quality of the development in Africa is intimately linked to the quality of leadership to lead change. Fostering the leadership skills of African youth in agricultural science, policy making, and entrepreneurship is an essential investment to meet the increasingly advanced needs of the expanding African economies and to foster agricultural innovation.
- More opportunities to develop the transformative leadership of women are needed. Women in Africa face particularly high barriers to becoming leaders in many areas. According to the World Economic Forum's Global Gender Gap Report, SSA has closed only approximately 68 percent of its gender gap in economic empowerment, as measured by women's share of employment in the formal sector and women's advancement to senior management positions. The small number of women in leadership positions across fields from business to science and politics in Africa is both an indicator of these barriers, and a barrier itself.

Annex 1: List of students with research titles

S/N	Name	Gender	Degree	Research Title	Supervisor	University	Research Location	Progress Report	Thesis Completion Date
Chad									
1	Adele Noudjilembaye	Female	MSc	Utilisation des extraits de plantes contre les ravageurs des denrées stockés	Dr. Rachid Hanna	Université de N'Gaoundéré, Cameroun	Cameroun	Yes	31-Oct-16
2	Christophe Haouvang Laba	Male	PhD	Influence des amendements organiques sur la production et les caractéristiques physiques, chimiques et nutritionnelles de Moringa oleifera cultivé au sud du Tchad	Dr. Martin Yemefack	Université de N'Gaoundéré, Cameroun	Chad	Yes	30-Mar-17
3	Nideou Dassidi	Male	PhD	Effets de l'incorporation des graines de papaye sur les paramètres physiologiques et zootechniques des poules pondeuses	Prof. Tona Kokou	Université de Lomé, Togo	Togo	Yes	30-Dec-17
4	Denise Nanguianan	Female	MSc	Evaluation de l'efficacité des extraits méthanoliques et huile essentielle de Lippia adoensis sur Callosobruchus maculatus des graines de voandzou (Vigna subterranea) et l'impact des traitements sur sa qualité nutritionnelle	Dr Elias Nukene	Université de N'Gaoundéré, Cameroun	Cameroun	Too soon	30 April 2017
Togo									
1	Badjissaga Maba	Male	PhD	Identification des éléments nutritifs majeurs limitant et des stratégies appropriées de fertilisation sous culture du maïs dans l'Ogou-Est de la région des plateaux	Dr. Stefan Hauser	Université de Lomé, Togo	Togo	Yes	30-Sep-16
2	Kolani Ali Yendou-Gname	Male	MSc	Effets de l'incorporation de l'huile de palme sur les paramètres zootechniques des poules pondeuses	Prof. Tona Kokou	Université de Lomé, Togo	Togo	Yes	30-Oct-16
3	Voemesse Kokou	Male	PhD	Effet des feuilles de Moringa oleifera sur l'expression des gènes hépatiques des poules pondeuses	Prof. Tona Kokou	Université de Lomé, Togo	Togo	Yes	30-Dec-17
5	Atarigbe Roukayatou	Female	MSc	Comparative effectiveness of public and NGOs extension approaches, cases of ICAT, ETD and INADES-Formation: Agricultural extension policy in Togo	Dr. Abdoulaye Tahirou	Nanjing Agricultural University, China	Togo	Yes	30-Sep-16
6	Yawavi Eyram Gnomou	Female	MSc	Lutte biologique contre la cochenille farineuse du papayer : Nécessité des études sur les interactions entre l'hôte et parasitoïde, Acerophagus papayae pour un contre efficace du ravageur au Togo	Dr. Goergen Georg	Université de Lomé, Togo	Togo	No	30-Sep-16
7	Essossinam Ali	Male	PhD	Climate variability and farmers' willingness to pay for weather index insurance: The case of small-scale cereals farmers in Northern Togo	Dr. Tahirou Abdoulaye	University of Ghana, Accra, Ghana	Togo	Yes	28-Feb-17
8	Maglwa Tcha-Thom	Male	PhD	Recherche d'une filière durable pour la méthanisation des déchets de fruits et d'abattoirs du Togo : Evaluation du potentiel agronomique des digestats sur les sols agricoles pauvres de la région Kara	Dr. Gnanvossou Desire Dr. Muaka Toko	Université de Lomé, Togo	Togo	Yes	30-Mar-17
9	Damigou Bammitte	Male	PhD	Assessment of the Agromorphologic and genetic diversity of taro (Colocasia esculenta (L.) Schott) in Togo	Prof. Koffi Tozo	Université de Lomé, Togo	Togo	Yes	30-Dec-17
10	Oumbortime N'nanle	Male	PhD	Effet de l'incorporation des feuilles de Moringa oleifera dans la ration des reproductrices et dans l'alimentation in Togo	Prof. Amivi Kafui Tete-Benissan	Université de Lomé, Togo	Togo	Yes	30-Dec-17

11	Essossolim Nadege Awade	Female	MSc	Gender and impact of access to credit on agricultural productivity: The case of grain legume farmers in the contest of climate change in Central Region of Togo	Prof. Pam Zahonogo	Université Ouagadougou 2, Burkina Faso	Togo	Too Soon	30-Apr-17
12	Oluyemi Titilola Akintayo	Female	PhD	Identification of quantitative trait locus for submergence tolerance in rice populations	Dr. Ramaiah Venuprasad	Federal University of Agriculture, Abeokuta, Nigeria	Nigeria	Too Soon	31-Dec-17
DRC									
1	Mapenzi Assani Neville	Male	MSc	Farmer's awareness, perception and practices on soil erosion control in high altitude of South-Kivu, DR Congo	Dr. Leon Nabahungu	Kenyatta University, Kenya	Congo	Yes	31-Dec-16
2	Franchement Mukeshambala	Male	PhD	Diversite du <i>Xanthomonas campestris</i> pv <i>Musacearum</i> et essai de lutte par les extraits des plantes	Dr. Guy Blomme (Bioversity) Dr. Flemming Nielsen	Universite de Kisangani, DR Congo	Congo	Yes	28-Feb-17
3	Imani Caroline Sibomana	Female	PhD	Implementation of tomato fruit processing techniques and evaluation of their impact on food security and livelihoods of small farmers in eastern DR Congo	Dr. Peter Kolawole	University of Yaounde I, Cameroon	Congo	Yes	28-Feb-17
4	Isaac Balume	Male	PhD	Integrating legumes with enhanced biological nitrogen fixation capacities in smallholder farming systems in South-Kivu/DR Congo	Dr. Generose Nziguheba	University of Hohenheim, Germany	Congo	No	30-Jun-17
5	Bwihangane Ahadi Birindwa	Male	PhD	Assessment of peste des petits ruminants status in goats and sheep genotypes in South Kivu, Democratic Republic of Congo	Prof. George Gitao	University of Nairobi, Kenya	Congo	No	30-Jun-17
6	Bintu Nabintu Ndusha	Female	PhD	Strategies to maximize the contribution of BNF on soybean production in South Kivu	Dr. Leon Nabahungu	University of Nairobi, Kenya	Congo	No	31-Aug-17
Sierra Leone									
1	Prince Emmanuel Norman	Male	PhD	Genetic improvement of mapping population of yams for field and food quality traits	Dr. Asrat Amele	Njala University, Sierra Leone	Nigeria	Yes	28-Feb-18
2	Tamba Bandabla	Male	PhD	A Bayesian statistical model for assessing stability of quantitative trait across environments	Dr. Baffour Badu-Apraku	Federal University of Agriculture, Abeokuta, Nigeria	Nigeria	Yes	28-Feb-18
3	Georgiana Allie	Female	PhD	Germination process optimization and drying of rice and soybean	Dr. Peter Kolawole	Njala University, Sierra Leone	Nigeria	Yes	28-Feb-18
4	Isata Kamanda	Female	PhD	Genetic improvement of root yield and nutritional quality of cassava (<i>Manihot esculenta</i> Crantz)	Dr. Elizabeth Parkes	University of Ghana, Legon, Ghana	Sierra Leone	Yes	31-Mar-18
5	Kumba Yannah Karim	Female	PhD	Genetic analysis and selection for high starch, dry matter content and root yield in cassava (<i>Manihot esculentata</i> Crantz)	Dr. Elizabeth Parkes	University of Ghana, Legon, Ghana	Sierra Leone	No	28-Feb-18
6	Theresa Tenneh Dick	Female	PhD	Women organizations as innovation platforms for empowerment of rural women through cassava processing in southern province of Sierra Leone	Dr. Tahirou Abdoulaye	Federal University of Agriculture, Abeokuta, Nigeria	Sierra Leone	Yes	31-Dec-16

Annex 2a: List of draft articles

S/No.	Name	Country	Article Title
1	Adele Noudjilembaye	Chad	Effet de l'huile de neem sur quelques maladies et insectes ravageurs de la Courgette dans la ville de Yaoundé-Cameroun
2	Haouvang Laba Christophe	Chad	Growth response of <i>Moringa oleifera</i> affected by various amounts of compost under greenhouse conditions
3	Denise Nanguianan	Chad	Efficacité insecticide de l'extrait méthanolique et d'huile essentielle de <i>Lippia adoensis</i> contre <i>Callosobruchus maculatus</i> (F.) sur le voandzou (<i>Vigna subterranea</i>) et leurs impacts sur la qualité organoleptique des produits dérivés
4	Theophile Dessenbe	Chad	Effet des extraits méthanoliques des feuilles de <i>Plectranthus glandulosus</i> sur la mortalité, la progéniture, la croissance de population, la réduction des pertes causées aux graines de maïs par <i>Sitophilus zeamais</i> et la répulsion
5	Birindwa Ahadi	DRC	Mitochondrial DNA variation of indigenous goats suspected with Peste-des-petits ruminants in South Kivu, Democratic Republic of the Congo
6	Isaac Balume	DRC	Variability on soil fertility influenced by farm resource endowment and fertility gradients in smallholder farming systems of South-Kivu DR Congo
7	Neville Mapenzi	DRC	Challenges, strategies and adoption determinants of soil conservation practices by farmers in South-Kivu Province, DR Congo
8	Caroline Sibomana	DRC	Influence of chlorine and rosemary essential oil postharvest pre-treatments on some quality parameters of fresh tomatoes during storage
9	Franchement Mukeshambala	DRC	In vitro evaluation of antibacterial activity of selected plant extracts against <i>Xanthomonas campestris</i> pv <i>Musacearum</i>
10	Prince Norman	Sierra Leone	Reviews on genetics and breeding of yams for yield and quality traits: current status and future prospects Pollination success and seed set in some white (<i>Dioscorea rotundata</i>) genotypes assessed under different mating system
11	Essossinam Ali	Togo	Assessing cereal farmers' willingness to pay for weather index-based insurance in Northern Togo: choice modelling approach
12	Damigou Bammitte	Togo	Constraints to production and preference criteria of <i>Colocasia esculenta</i> L. Schott and <i>Xanthosoma sagittifolium</i> L. Schott in Togo
13	Nideou Dassidi	Togo	Effect of low-energy and low-protein diets on the performance of boiler breeders and hatching parameter
14	N'nanle Oumbortime	Togo	Effect of in ovo inoculation of <i>Moringa oleifera</i> leaves extract on hatchability and day-old chick growth performance
15	Voemesse Kokou	Togo	Effect of <i>Moringa oleifera</i> leaf meal on growth performance and blood parameters of chicks during starter period
16	Awade Essossolim Nadege	Togo	Adaptation to climate change on soybean farmers revenue in Tchamba District of Togo
17	Badjissaga Maba	Togo	Identification et hiérarchisation des éléments nutritifs majeurs limitant la production du maïs dans la région des plateaux au Togo
18	Kolani Yendou-Gname	Togo	Effects of palm oil supplementation on growth and production performance, and serum characteristics of laying hens
19	Oluyemi Akintayo	Togo	Identification of Quantitative Trait Locus (QTL) associated with submergence tolerance in Tos6454 rice (<i>Oryza</i> spp) variety
20	Atarigbe Roukeyatou	Togo	Effectiveness of public and NGO extension services: Perception of rice farmers in the Plateaux region of Togo

Annex 2b: List of published papers

- **N’nanle, O.**, K. Amivi Tété-Béniissan, A. Tona, K. Teteh, E. Voemesse, Decuypere, and M. Gbeassor. 2017. Effect of in ovo inoculation of *Moringa oleifera* leaves extract on hatchability and chicken growth performance. *European Poultry Science*, 81. DOI: 10.1399/eps.2017.213
- **Laba Christophe Haouvanga**, Ngakou Alberta, Yemefack Martin, Mbailao Mbaiguinam. 2017. Growth response of *Moringa oleifera* Lam. as affected by various amounts of compost under greenhouse conditions. *Annals of Agricultural Sciences*, 62: 221–226.
- **Voemesse, K.**, 1.A. Teteh, 1.D. Nideou, 1.O. N’nanlé, 1.M. Gbeassor, 2E. Decuypere and 1K. Tona. 2018. Effect of *Moringa oleifera* leaf meal on growth performance and blood parameters of egg type chicken during juvenile growth. *International Journal of Poultry Science*, DOI: 10.3923/ijps. 154.159
- **BAMMITE, D.**, P.J. MATTHEWS, D.Y. DAGNON, A. AGBOGAN, K. ODAH, A. DANSI, and K. TOZO. 2018. Agro morphological characterization of taro (*Colocasia esculenta*) and yautia (*Xanthosoma mafaffa*) in Togo, West Africa. Vol. 13(18): 934–945. DOI: 10.5897/AJAR2018.13043, Article Number: DD4641056919, ISSN 1991-637X. <http://www.academicjournals.org/AJAR>.
- **Ahadi Bwihangane Birindwa**. Mixed infection of peste des petits ruminants and Capripox in goats in South Kivu, Democratic Republic of Congo. *Journal of Advanced Veterinary and Animal Research*.
- Adetumbi, J. A., Orimadegun, I. O., Akinyosoye S. T., **Akintayo, O. T.** and Agbeleye O. A. 2019. Enhancing planting value of rice seed through priming with humic substance. *Journal of Experimental Agriculture International*, 29(6):1-8.
- **Prince E. Norman**, Asrat Asfaw, Pangirayi Bernard Tongoona, Agyemang Danquah, Eric Yirenkyi Danquah, David De Koeyer and Robert Asiedu, (2018). Pollination success in some white yam genotypes under polycross and nested mating designs. *International Journal of Biological Sciences and Applications*, 5(2):19-28.
- **Prince E. Norman**, Asrat Asfaw, Pangirayi Bernard Tongoona, Agyemang Danquah, Eric Yirenkyi Danquah, David De Koeyer and Robert Asiedu, (2018). Can parentage analysis facilitate breeding in root and tuber crops? *Agriculture Journal* 8(95):1-24.