Synergizing fertilizer micro-dosing and indigenous vegetable production to enhance food and economic security of West African farmers
(CIFSRF Phase 2)

Project Number 107983
Location of Study: Nigeria and Benin Republic

By

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12-MONTH PROJECT UPDATE (2ND INTERIM TECHNICAL REPORT)

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1. Executive summary

The agrarian, rural and resource-poor inhabitants of Nigeria and Benin depend on indigenous edible vegetables for daily supplies of vitamins and nutrients. Since these indigenous vegetables had not been a subject of organized research, this research project was initiated to develop new technologies to improve farming practices, post-harvest handling and value addition for these indigenous vegetables. This offers tremendous opportunities for food security and economic empowerment of the poor rural population, especially the resource-poor women farmers.

During the last 6 months, our team (MicroVeg Project) has conducted innovative research and public awareness and is pleased to present the following Key "take-away" messages from this study (Project 107983):

1. We concluded and completed writing of the report of our baseline study. The summary of our findings are in the body of this report (Section 4).
2. As at the February 2016, more than 5506 farmers (45% women) have adopted the fertilizer microdosing agronomic technology developed by this project for growing indigenous vegetables.
3. In Benin we established Young Vegetable Scientists Clubs (YVSC) in secondary schools with 3510 students members in Nigeria and Benin. Together with 97 agricultural science teachers, we trained these students on indigenous vegetables agronomy.
4. Fertlizer microdsing at the rate of 40-60 kgN/ha(Urea 46%N) proved to be optimum for the production of the vegetables with a suprior performance of about 50% over the control and about 20% over the conventionally recommended rate (80 kgN/ha)
5. In Nigeria, the total land area under cultivation is 331.7 ha across the project locations compared to 30.6 ha that we recorded under NiCanVeg Project (Phase 1). In Benin, this area is estimated to 97.5 ha.
6. Our project is gaining huge prominence in the public domain and demand for indigenous vegetables is on the rise due to our Radio and TV programmes which are estimated to reach about 15.0 million listeners daily in Nigeria and Benin.
7. Our scaling up strategy (innovation platform) is being established and is currently opening up new opportunities which will facilitate better access to credit, inputs and opportunities for collective marketing of vegetables.

The Research Task Teams, partners and collaborators have achieved all of the milestones established for this reporting period and have made significant progress towards the intermediate outcomes of awareness, value addition, microdosing agronomic trials.

2. The Research Problem:

Under-utilized indigenous vegetables are extremely important to poor rural women in West Africa, but were initially gathered from the wild and therefore, there was no agronomic package for production, crop protection and even marketing and economics. Their production is generally low (yields and quality) due to acute soil fertility and land degradation problems. This project is a

synergy of the Nigeria-Canada Indigenous Vegetables Project (NiCanVeg Project 106511) and the Integrated Nutrient and Water Management in the Sahel (INuWaM Project 106516). The promising results of the innovations that were developed by the two projects are being explored for complementarity to accelerate large-scale adoption and impacts of underutilized indigenous vegetable and fertilizer micro-dosing innovations to increase food and nutritional security and economic empowerment of resource-poor farming communities in Nigeria and Benin. The project will develop, test and deploy approaches for scaling up fertilizer micro-dosing innovations to improve production, directly reaching over 255,000 households. This project aims at:

- Refining and deploying technologies for fertilizer micro-dosing, water management, value addition and seed production for growing indigenous vegetables.
- Testing, demonstrating and deploying two different models (Innovations Platform IP and Satellite Dissemination Approach SDA) for reaching and benefiting more farmers with sustainable vegetable production and marketing innovations.
- Scaling the capsule technology to advance indigenous vegetables production, increase yields and income through value addition, preserve soil and water ecosystems, and enable fertilizer cost saving.
- Promoting policy advocacy for the integration of the successful scaling up model into local, national and regional food security programs in West Africa.

We target the following outcomes in 36 months:

- Large-scale adoption of technologies for optimum combination of fertilizer micro-dose for production of indigenous vegetables, directly reaching over 255,000 male and female vegetable farmers in new locations within Nigeria and Benin Republic.
- At least 20 private sector partners, farmers cooperatives, women's associations and government agencies involved directly in building rural small and medium businesses of vegetables and inputs.
- Doubling of the income of at least one million farmers in West Africa along the indigenous vegetable value chains.
- Economic empowerment of at least 50 vegetable value chain cooperative groups to develop profitable vegetable businesses in small and medium towns and large urban centers,
- Increased utilization and consumption of indigenous vegetables in the diets of poor rural farmers and urban dwellers in West Africa.

- Training of young vegetable scientist clubs in secondary schools in critical areas of vegetable seed systems and agronomy, value addition, efficient water management, scaling up and agri-business development.

- Emergence of research leaders and champions supported to inform and shape food and nutrition security debates, programmes and policies in West Africa and beyond

3. Progress towards milestones (3 pages maximum)

a. Comprehensive report on pre-project impact assessment/baseline survey:

Baseline surveys were conducted in Nigeria and Benin Republic with 2678 respondents (1198 men and 1480 women) made up of 1357 producers, 583 marketers and 738 consumers. Focus Group Discussion (FGD) was also conducted at 38 locations with 252 respondents. The reports of Benin and Nigeria attached as Appendices 1 and 2, are separate because of the technical difficulty in merging the data. Based on the reviewers comment on a draft of this 2nd technical report, we will next synthesize the most important findings of the baseline analysis and discuss what implications they have on some of the activities for the project. This report will be submitted as addendum to this report by July 2016. In the addendum, we will focus on educational level of farmers, land acquisition, land area under vegetable cultivation, current use of fertilizers by farmers and use irrigation to cultivate during the dry season. Given that these are important components of the strategies to scale up production of vegetables, it is important to have this data in the baseline to allow proper comparison with what the project will achieve through its lifespan. The highlights of the finding of the baseline survey are discussed under Section 4 below.

b. Report on field studies on fertilizer Microdosing:

Field studies were conducted at five locations in Nigeria while one intensive researcher managed trial was conducted at the experimental field of the National Institute of Agricultural Research of Benin INRAB Ina CRA North in Benin. The joint report of Nigeria and Benin teams on agronomic field trials is attached as Appendix 3. We presented the fresh leaf yield data in this report while the data on the water management studies are still being analysed in the laboratory and results will be presented during the next reporting period. We will do some economic analysis to demonstrate the profitability or otherwise of using fertilizers. We will also be able to give a good financial argument for farmers to or not to invest in fertilizers. The results of the studies are highlighted in Section 4 below.

c. Establishment of young vegetables scientists club(YVSC) in secondary schools:

In our first technical report, we promised to submit comprehensive report on our efforts at establishing YVSC in secondary schools. In Nigeria, the project secured approval of four States (Appendix 9) to participate in the project. We produced a training manual for the training of teachers and students (Appendix 10). All this schools raised the awareness of

about 1400 school children and student in northern Benin and 2110 in Nigeria (Total 3510 YVSC members). We organized several training on agronomic package of traditional leafy vegetable to achieve the following objectives:

- Promote the interest of the students studying agriculture, by empowering them with inputs and skills necessary
- Harvests secured during the activities belongs solely to the students and their school and is expected to be disposed in the best way possible
- To boost production, postharvest and marketing of vegetables through young students and show them how valuable they can become in the agricultural food value chain.
- To inspire them to take conscious efforts to seek careers in agriculture and be positioned to tackle challenges of our national food security.
- To breed a generation of YOUNG Vegetable Scientists and create green champions for the future

Full reports of the YVSC are attached as Appendices 11 and 12. Highlights of the achievements of the programme are discussed in Section 4 below.

d. Formation and registration of 51 cooperative groups for vegetables production and marketing and 10 cooperatives for seed producers:

At our scaling up workshop, our team agreed to jettison the Cooperative Society approach because it does not give room for the inclusion of all value chain actors. Therefore, we decided to use the Innovations Platform Approach (IPA) and Satellite Dissemination Approach (SDA). The full report of our approaches is attached as Appendix 4. It must be noted that low number of farmers (390) reported for SDA is due to the fact that we have just commenced demonstration plot setup. By next reporting period we will be able to give full information on the integration of significantly more farmers into the platform. The results of the SDA are highlighted in Section 4 below.

e. Radio and TV programmes to create awareness on the project:

In Nigeria, we launched four daily radio programmes called *Ramo Elefo* (Ramo the Vegetable Seller), in local language, which is aired on four (4) FM Radio Stations which have signals that reach the inner communities of the savannah in Osun, Ondo, Oyo, Ogun, Ekiti and Kwara States as well as the rainforest of Lagos State. We placed the project advert in the popular early morning programmes (8.00am-10.00am) that majority of the population listen to. An estimated 7.0 million people in southwest Nigeria listen to these programmes on daily basis. Our project was featured on the Nigerian National Television (NTA) and local TV stations during the period under review. We also had series of media publications in the most popular Nigeria newspapers including the Punch, This Day, The

Nation and Daily Trust. In Benin we organized 12 radio events, 5 TV programmes, produced one Video, and published information on project and technical notes in 4 newspapers and bulletins. We targeted nationwide FM Radios (Radio Fraternité), nationwide newspapers (Journal Fraternité), international TV channels (Canal 3 Monde) and also local FM radios broadcasting in local languages. For instance, Canal 3 Monde TV is on satellite Canal+ system and has the highest audience and reaches almost of the whole population of Benin (8.0 million) and the Francophone audience in Africa outside the country. We participated in the Cooperation and Professional Insertion day of the University of Parakou in Nov 2015 to inform the public on importance, opportunities of traditional leafy vegetables.

Our project will measure the impact of these awareness creation programmes during the endline survey which is scheduled for November 2017. The endline survey will answer the question: What change in behavior has been observed as a result of the awareness creation programmes? Are new people involved in the production, commercialisation, input providing etc?

f. Report of the International Scientific and Impact Advisory Board(ISIAB):

Because of the large volume of strategic project activities, we have not been able to organize another meeting of the Scientific Advisory Board. The only ISIAB meeting held so far was in May 2015 at the Osun State University, Osogbo. Our Project will organize a meeting of ISIAB during the month of August 2016. The planned August 2016 meeting will specially analyze the timelines and targets set for the project. We will solicit input from board members on strategies; particularly with objective four of the project on informing policies in Nigeria and Benin. Highlights are given in Section 4 below.

g. Annual meeting to review the progress of first year activities.

The MicroVeg Project held a project review meeting at the Sun Beach Hotel, Cotonou, Benin Republic from October 10-13, 2015. A meeting was scheduled for March 2016 at UofS Canada could not hold due to logistic problems, especially since the meeting was to be held simultaneously with a CIFSRF project workshop. The meeting is now scheduled to hold in October 2016 at UofS.

The meeting of October 2016 in Cotonou was coordinated by the Benin Team (University of Parakou) of MicroVeg Project. A total of 16 participants, including, the Principal Investigators from the University of Saskatchewan, Obafemi Awolowo University, Ile-Ife, Osun State University, the Green Generation and Sahel Group were present at the meeting. The former IDRC Supervisor for our project-Dr Pascal Sanginga led the discussions on the different aspects of project implementation, management and challenges. Details of the issues discussed are provided in Section 4 below.

h. Some pending strategic documents: Communication, Gender Strategy and Logic model:

We attach to this report the following comprehensive strategic documents which we carried over from the last reporting period.

- Communication strategy (Appendix 6)
- Gender strategy (Appendix 7)
- Logic model (Appendix 8)

The milestones and the level of achievements are discussed below:

Milestone	Achievement (in %)	Evidence/Indicator	Comment
Comprehensive report on pre-project impact assessment/baseline survey:	100% achievement. Baseline surveys were conducted in Nigeria and Benin with 2678 respondents (1198 men and 1480 women) made up of 1357 producers, 583 marketers and 738 consumers. FGD was also conducted at 38 locations with 252 respondents.	The reports of Benin and Nigeria attached as Appendices 1 and 2, are separate because of the technical difficulty in merging the data.	Reports ready.
Report on field studies on fertilizer Microdosing:	80% achievement. Field studies were conducted at five locations in Nigeria while one intensive researcher managed trial was conducted at the experimental field of the National Institute of Agricultural Research of Benin INRAB Ina CRA North in Benin.	The joint report of Nigeria and Benin teams on agronomic field trials is attached as Appendix 3. We presented the fresh leaf yield data in this report while the data on the water management studies are still being analysed in the laboratory and results will be presented during the next reporting period.	Preliminary report is attached
Formation and registration of 51 cooperative groups for vegetables production and marketing and 10 cooperatives for seed producers:	75% achievement. In Benin Republic, we established 15 operational Innovative Platforms and 5 strategic IPs. One (01) national level strategic IP is being established. In Nigeria, we have established 34 operational IPs at village level and 15 IPs at district level with an	The full report of our approaches is attached as Appendix 4.	Report is attached.

	operational central IP at the Southwest level. In Benin Republic, the Satellite Dissemination Approach(SDA) is being implemented in 3 districts with a total of 90 demonstrations established in 9 villages while in Nigeria SDA is being implemented in 7 States consisting of 12 districts and 125 demonstrations and meetings with stakeholders. The direct beneficiaries of our project are 390 farmers (65% women) in Benin while in Nigeria, the direct beneficiaries are now 5116 farmers (47.7% women). These numbers are rising very fast because recent entrants into the project are not captured in this report. The land area under cultivation in Benin across the project locations is 97.5 ha while in Nigeria, the total land area under cultivation is 331.7 ha across the project locations.		
Radio and TV programmes to create awareness on the project:	90% achievement. In Nigeria, we launched four daily radio programmes called *Ramo Elefo* (Ramo the Vegetable Seller) in local language which is aired on four (4) FM Radio Stations daily while in Benin we launched 15 radio programmes on Fraternité and Nato FM Radio, Canal 3Monde TV which have signals that reach the remote communities. We placed the project advert in the popular early morning programmes	Radio programmes are being aired daily.	Programmes are on air.

	(8.00am-10.00am) that majority of the population listen to. An estimated 7.0 million people in southwest Nigeria listen to these programmes on daily basis while an estimated 8.0 million people listen to the awareness programmes in Benin and outside. Other communication platforms include: • We launched a project website (www.microveg.org) which is being updated regularly • Print media reports in Nigeria and Benin on the project • Dr. Peak gave an invited talk about his CIFSRF-IDRC project to the Canadian Science Writers' Association workshop in Saskatoon SK • Alexis Adams and Dr. Peak's research on the sustainability of fertilizer microdosing were highlighted in a newspaper (Saskatoon StarPhoenix) and in an industry magazine (AgKnowledge). • We have formed a yahoo group account for effective exchange of information and communication with(in) the Microveg Team. • The PIs are also on monthly Skype conference calls to enhance team cohesion and understanding.		

Report of the International Scientific and Impact Advisory Board(ISIAB):	70% achievement. Because of the large volume of strategic project activities, we have not been able to organize another meeting of the Scientific Advisory Board. The only meeting they held so far was in May 2015 at the Osun State University, Osogbo. Therefore, to keep the Board members informed, we produced a document on activities that we had undertaken in the first year of our project which we sent to all the Board members. They are all impressed with the status of our project and the level of implementation.	See the email endorsements in the body of this report.	Members of ISIAB are impressed.
Annual meeting to review the progress of first year activities.	100% achievement. The MicroVeg Project held a project review meeting at the Sun Beach Hotel, Cotonou, Benin Republic from October 10-13, 2015. A total of 16 participants, including, the Principal Investigators and NGOs were present. The former IDRC Supervisor for our project-Dr Pascal Sanginga led the discussions.	The full report is attached as Appendix 5	Report attached
Some pending strategic documents: Communication, Gender Strategy and Logic model:	100% achievement. We attach to this report the following comprehensive strategic documents which we carried over from the last reporting period. • Communication strategy • Gender strategy • Logic model	The list is attached as Appendices 6,7 and 8).	Document attached.

4. Synthesis of research results to date(5-6 pages maximum):

a. <u>Highlights of findings from baseline survey:</u>

Highlights of the baseline survey findings in Benin and Nigeria are:

- In Nigeria, the per capita consumption/annum of *Solanum macrocarpon* (Igbagba) is about 25 kg while that of *Telfairia occidentalis* (ugu) and *Amaranthus viridis* (tete) are 37.5 kg and 44.7 kg, respectively while in Benin the per capita consumption is about 25 kg for *A. viridis* and 30 kg each for *S. macrocarpon* and *Ocimum gratissimum* (Tchiayo).

- In Nigeria, the average farm size/farmer committed to indigenous vegetable cultivation in the seven States of Nigeria was about 880 ft^2 (81.8 m^2) ranging from 309.9ft^2 (28.8 m^2) in Lagos state to 1425.5ft^2 (132.6 m^2) in Osun State. The largest farm sizes were recorded in the States that participated in the NiCanVeg project that was implemented earlier.
- In Benin Republic, more than 50% of producers using the compost do not use mineral fertilizers. However, the use of mineral fertilizers (NPK and urea) is an increasingly practice adopted by leafy vegetables producers

- Inversely, in Benin, the compost is used by the majority of producers (78%) who mentioned that the compost is better than fertilizer for leafy vegetable production and more so compost is almost free at poultry houses (80% of producers).

- In Nigeria, there exists different business models for different types of vegetables. For instance in Ilisan axis of Ogun State, there exists a form of business cartel for *Ugu* marketing. This business cartel regulates the volume of fresh vegetables taken to the market on each day. You cannot sell *Ugu* in the market except you belong to the association. Whereas in Lagos State the market is demand driven with export focus.

- In Nigeria, whereas women are more involved in the downstream sector of the indigenous vegetables value chain, the actual extent of involvement of both gender depends on ethno-religious inclination. For instance, in Kwara State where more Hausa-moslems are involved in the indigenous vegetables, the composition is more of men (over 95%) all along the value chain, unlike the situation in Ogun State or Oyo State where women (over 70%) are more involved in the downstream sector.
- The leafy vegetable producers are older than traders/marketers and young men are more interested in the production of leafy vegetables than young women while the proportion of men who produce leafy vegetable decreases with age, that of women increases with age.

- Producers of leafy vegetables in combination with the cash crop seems to have an annual income better than the exclusive vegetable producers. At the producer level, leafy vegetables are more expensive in the dry season than rainy season.

- In most cases, leafy vegetables are supplied primarily to market by retailers. The leafy vegetables are more expensive in urban markets than rural markets.

- In Nigeria *Ugu* is the most consumed and demanded vegetable in the study area. This is followed by *Amaranthus* which is the control vegetable.
- In Benin Amaranthus is the most consumed and demanded vegetable in the study area. This is followed by *Solanum and Ocimum*. This suggests that the commercialization potential of Ugu and Amaranthus, respectively, compares with that of conventional vegetable in Nigeria and Benin.
- There seems to be a threshold household size that determines the welfare level of the respondents. Once the threshold is exceeded the likelihood is that the household will be food insecure.
- Female who are living with their husbands are more likely to be food secure than other categories of women – all along the value chain.

b. <u>Results of fertilizer microdosing trials:</u>

The highlights of the findings are:

- In Nigeria, an optimum of 40-60 kg urea-N rate was established for the three vegetables during two cycles of planting, resulting in fresh leaf yields of about 40 tons/ha for *Amaranthus*, 83 tons/ha for *S. macrocarpon* and about 74 tons/ha for *Telfairia occidentalis*. Control (no fertilizer application) gave fresh leaf yield of about 25 tons/ha for *Amaranthus*, 32 tons/ha for *S. macrocarpon* and about 38 tons/ha for *Telfairia occidentalis*.

- In Benin, *Amaranth* 40 kg Urea-N/ha applied at 10 DAT showed the highest yield (16.34 t/ha) followed by of 40 kg Urea-N/ha applied at 20 DAT (14.5 tons/ha) for *Amaranthus*. For *S. macrocarpon* the highest yield was obtained for 60 kg Urea-N/ha applied at 10 DAT (5.6 tons/ha at first harvest only). Control (no fertilizer application) gave about 13.9 tons/ha for *Amaranthus* and 4.3 tons/ha for *S. macrocarpon*.

- These results are to be confirmed by trials during rainy season and a second year time replication

- The *Amaranthus* leaf yields at both the Nigerian rainforest and savanna locations (25-40 tons/ha) significantly out-yielded the *Amaranthus* planted in Benin Republic (maximum of 16.34 tons/ha). For *S. macrocarpon*, the leaf yield in Nigeria

is 32-83 tons/ha during three successive harvests, across the urea-N rates while in Benin the leaf yield is 5.62 tons/ha.

- Vegetables that received N application were significantly greener than the control vegetables across locations and seasons. It is also noted that the vegetables grown in the savanna were greener than in the forest zones in Nigeria.

- The P contents of the vegetables did not respond to the different rates of urea-N application while the Fe contents of *Igbagba* was significantly higher compared to *Tete* but did not significantly vary with rates of applied urea-N. The Zn contents in plant tissues however did not differ significantly between *Igbagba* and *Tete* and also did not respond to rates of urea-N treatment.

- Using multi-dimensional matrix, for the rainforest and savanna ecologies of Nigeria, the 40 kg/ha urea-N rate significantly favored leaf yield, greenness and nutrient contents of the three vegetables while timing of application had no significant influence on leaf yield.

c. Establishment of young vegetables scientists club(YVSC) in secondary schools:

In our first technical report, we promised to submit comprehensive report on our efforts at establishing YVSC in secondary schools. In Nigeria, the project secured official approval of four States governments (Appendix 9) to participate in the project. We produced a training manual for the training of teachers and students (Appendix 10). All this schools raised the awareness of about 1400 school children and student in northern Benin and 2110 in Nigeria. We organized several training on agronomic package of traditional leafy vegetable to achieve the following objectives:

- Promote the interest of the students studying agriculture, by empowering them with inputs and skills necessary

- Harvests secured during the activities belongs solely to the students and their school and is expected to be disposed in the best way possible

- To boost production, postharvest and marketing of vegetables through young students and show them how valuable they can become in the agricultural food value chain.

- To inspire them to take conscious efforts to seek careers in agriculture and be positioned to tackle challenges of our national food security.

- To breed a generation of YOUNG Vegetable Scientists and create green champions for the future

Full reports of the YVSC are attached as Appendices 11 and 12. Highlights of the achievements of the programme are:

- Trainings were conducted for technicians and teachers in Nigeria and Benin. We trained in Nigeria and Benin 73 and 24 agricultural science teachers, respectively, on research proven techniques on vegetable production, harvesting and marketing
- In Bénin we established 5 Young Vegetable Scientists Clubs (YVSC) in secondary schools with 1400 students as members while in Nigeria we established YVSC clubs in 27 schools with 2110 students as members.
- Supply of farming implements to support effective vegetable production at the level of secondary school education
- Developed, printed and distributed "How-to-do manuals" for vegetable production schools
- Mainstreamed gender into the project and have already >35% women inclusion at levels of students and teachers participating in the project.

d. **Formation and registration of 51 cooperative groups for vegetables production and marketing and 10 cooperatives for seed producers:**
    - In Benin Republic, we established 15 operational Innovative Platforms and 5 strategic IPs. One (01) national level strategic IP is being established. In Nigeria, we have established 34 operational IPs at village level and 15 IPs at district level with an operational central IP at the Southwest level.

    - In Benin Republic, the Satellite Dissemination Approach(SDA) is being implemented in 3 districts with a total of 90 demonstrations established in 9 villages while in Nigeria SDA is being implemented in 7 States consisting of 12 districts and 125 demonstrations and meetings with stakeholders.

    - The direct beneficiaries of our project are 390 farmers (65% women) in Benin while in Nigeria, the direct beneficiaries are now 5116 farmers (47.7% women). These numbers are rising very fast because recent entrants into the project are not captured in this report.

    - The land area under cultivation in Benin across the project locations is 97.5 ha ha while in Nigeria, the total land area under cultivation is 331.7 ha across the project locations.

e. Radio and TV programmes to create awareness on the project:
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Ekiti and Kwara States as well as the rainforest of Lagos State. We placed the project advert in the popular early morning programmes (8.00am-10.00am) that majority of the population listen to. An estimated 7.0 million people in southwest Nigeria listen to these programmes on daily basis. Our project was featured on the Nigerian National Television (NTA) and local TV stations during the period under review. We also had series of media publications in the most popular Nigeria newspapers including the Punch, This Day, The Nation and Daily Trust. In Benin we organized 12 radio events, 5 TV programmes, produced one Video, and published information on project and technical notes in 4 newspapers and bulletins. We targeted nationwide FM Radios (Radio Fraternité), nationwide newspapers (Journal Fraternité), international TV channels (Canal 3 Monde) and also local FM radios broadcasting in local languages. For instance Canal 3 Monde TV is on satellite Canal+ system and has the highest audience and reaches almost of the whole population of Benin (8.0 million) and the Francophone audience in Africa outside the country. We participated in the Cooperation and Professional Insertion day of the University of Parakou in Nov 2015 to inform the public on importance, opportunities of traditional leafy vegetables. All supporting documents (audio files, video, and newspaper copies are available on our dropbox sharing medium.

Our project will measure the impact of these awareness creation programmes during the endline survey which is scheduled for November 2017. The endline survey will answer the question: What change in behavior has been observed as a result of the awareness creation programmes? Are new people involved in the production, commercialisation, input providing etc?

f. Report of the International Scientific and Impact Advisory Board(ISIAB):

Because of the large volume of strategic project activities, we have not been able to organize another meeting of the Scientific Advisory Board. The only ISIAB meeting held so far was in May 2015 at the Osun State University, Osogbo. Our Project will organize a meeting of ISIAB during the month of August 2016. The planned August 2016 meeting will specially analyze the timelines and targets set for the project. We will harvest members inputs on strategies to advance particularly with the objective four (4) of the project of informing policies in Nigeria and Benin.

In order to have an impression of ISIAB members on the status of project implementation, we produced a document on activities that we had undertaken in the first year of our project which we sent to all the Board members. They are all impressed with the status of our project and the level of implementation. Three of the email messages sent to us by three Board members are reproduced below:

- Dear Professor Adebooye,
  Thank you for sending me the progress report of the Indigenous Vegetables project. I wish to congratulate the team for the volume of quality work carried out in one year. I am satisfied with what has been done so far but will contact you if I have questions on any specific issue. Best regards.
  Prof Simi Afonja

- Dear Prof. Adebooye,

Thanks a lot for sharing this informative progress report on the project activities. I am happy to also learn that project implementation is well on course. I would have wished to join you for the field trip but would have to be at IITA Ibadan for another engagement around the same time and then also head to our HQ for our board meeting. Hopefully, I will be able to join you at another time/opportunity. All the best for the upcoming field trip and subsequent project implementation plans. With kind regards,
Victor Afari-Sefa, Ph.D.
Agricultural Economist and Global Theme Leader – Consumption

- Hello Clement,
  Greetings to you and hope this mail meets you healthy and great. Thanks for the wonderful report summary of all that has been going on with your project. I believe you have made great progress and congratulations. However, I have included in the report attached herewith my comments and reactions to some issues. Please, feel free to get back to me if need be with some explanations. I am sure we will see soon and i can be updated with new information. Pls. pencil my name down as one of the persons who will be traveling with it you. But will suggest you send the itinerary so we may see.
  Warm regards,
  Prof. Victor Okoruwa

g. Annual meeting to review the progress of first year activities.

The MicroVeg Project held a project review meeting at the Sun Beach Hotel, Cotonou, Benin Republic from October 10-13, 2015. A meeting was scheduled for March 2016 at UofS Canada could not hold due to logistic problems, especially since the meeting was to be held simultaneously with a CIFSRF project workshop. The meeting is now scheduled to hold in October 2016 at UofS.

The meeting of October 2016 in Cotonou was coordinated by the Benin Team (University of Parakou) of MicroVeg Project. A total of 16 participants, including, the Principal Investigators from the University of Saskatchewan, Obafemi Awolowo University, Ile-Ife, Osun State University, the Green Generation and Sahel Group were present at the meeting. The former IDRC Supervisor for our project-Dr Pascal Sanginga led the discussions on the different aspects of project implementation, management and challenges. He also provided the tools that guided the different aspects of our discussions. After exhaustive discussion on the following under-listed issues, some far-reaching decisions were taken and the full report is attached as Appendix 5. One major decision taken was the appointment of Prof Clement Adebooye as the Regional Project Coordinator for MicroVeg Project 107983.

The Issues Discussed:

- Review of first interim technical report with special focus on the content, strategic documents and finances.
- Refinement of strategy and implementation modalities with special emphasis on the gender framework, logic model and communication plan. Special discussions were also held and clear decisions were taken on the operationalisation of Innovation Platforms and Satellite Dissemination Approach , District Knowledge centres and young vegetable scientists club
- Formation of task teams and allocation of responsibilities in the area of agronomy, value addition, scaling up and policy, and communication and partnership.
- Planning for scientific publications
- Project coordination and management issues and appointment of Regional Project Coordinator.

5. Synthesis towards AFS themes:

a. Increasing agricultural productivity (Availability)

- Our project is leading to new and improved solutions to increase indigenous vegetables production and utilization in Benin and Nigeria. We have succeeded in determining the optimum fertilizer microdose rate that has assisted the farmers in improving vegetable yield significantly, cost-saving on fertilizer and enhanced income from sales of vegetables. Instead of the old practise of broadcasting fertilizer haphazardly resulting in the use of 4-5 bags of fertilizer/ha, our project has changed the orientation of farmers to using one bag/ha with precision microdose application. Our work on water management has shown that farmers could regulate water use for irrigation in a way that will optimize water use and bring enhanced income. Our project also supplied improved seeds of vegetables to farmers.
- Our project is addressing gender specific constraints to agricultural productivity by developing fertilizer microdosing application technique that is gender-friendly. This is with a view to reducing women's drudgery or time spent in agriculture. We are also involving both men and women in the development and evaluation of our project's innovations.
- Through our fertilizer microdosing and water management studies, we are contributing to environmental sustainability, and considering the potential environmental impacts, both positive and negative. Further studies on the environmental impact are still on-going.

b. Improving access to resources, and/or markets and income (Accessibility)

- Our project has made giant strides in the area of enabling farmers' access to resources. The 5,506 participating farmers have been organized into groups with women

included in top executive positions. These organized groups now have the capacity to negotiate for agricultural inputs such as fertilizer, seeds, land etc. Through our projects the farmers have taken delivery of inputs such as irrigation pumps, fertilizer, improved seeds, wheel barrows, irrigation hoses, etc.

- We are addressing the need to produce future champions in vegetable production through the inclusion of young school boys and girls in farming. We call them Young Vegetable Scientists Club(YVSC).
- Our project is contributing to successful partnership through the NGOs and government in our scaling up strategies through the innovation platform.

c. *Improving nutrition (Utilization)*

- In addition to improving and increasing the quantity of vegetables food production, we are also investigating the nutritional quality and nutrient composition of selected vegetables. Food processing studies are being conducted to enhance maximum nutrient retention in processed vegetables.
- Our next phase of studies includes, production of new innovative recipes for snacks and cookies fortified with *Telfairia, Ocimum and Solanum.* The studies will involve determination of the nutritional value of the cookies after which rural women farmers will be trained on how to produce these as an alternative source of income. Production of "vegetable-fortified cookies" represents a potential new economic income option for commercialization, and job creation either directly on the farm or in the local communities.

d. *Informing policy*

- Our project functions by working directly with government, policymakers and decision-makers at different levels e.g. ministries of agriculture, local governments, senior government officials, advisors, technocrats. We are bound to engage the policy makers because, the farmers must be registered at different levels before they can participate in our project.

6. Project implementation and management:

a. Workplan/priority activity for the next reporting period:

- Detailed and comprehensive report on fertilizer micro-dosing and water management studies for indigenous vegetables
- Comprehensive report on value addition for indigenous vegetables through food fortification studies, processing and preservation and utilization.
- Specialized training of Nigerian and Benin staff through visits to the University of Manitoba and University of Saskatchewan.
- Writing of at least one high impact papers for publication in reputable journals.
- Preliminary report on the efficiency of the scaling up models(Innovations Platform and Satellite Dissemination Approach)

b. Financial and administrative challenges. No administrative problem are anticipated with fund release and processing of financial reports.

c. **Research partnership:** During the period of this report, Canadian colleagues from the UofM and UofS visited Nigeria and Benin two times (May 2015, October 2015) while the African partners met three times (May 2015, October 2015, January 2016). The different meetings were held to discuss the project, organize trainings on scaling up models and strategy, and capacity building for project implementation. The meetings have also fostered closer relationship between Canadian colleagues and the African colleagues. In fact the Anglophone-francophone 'marriage is being strengthened every moment in the project.

d. **Budget summary**: The partnering Institutions, have been working within the budgets that were originally proposed. We are grateful to IDRC-GAC for allowing UofM to make adjustments to the budgets.

7. Challenges encountered/ Actions taken

Identify and analyze 2 - 3 key challenges faced by the project team. Describe the action taken by the project to address each one of them.

(i) The scaling up approaches gave us serious challenge especially in the area of context, concept, framework and implementation. We surmounted this challenge by organizing a ToTs workshop which brought experts on the theory and practicality of scaling up approaches. The workshop provided our team members the opportunity to gain full understanding of the approaches.

(ii) In Benin Republic, the production of *Telfairia occidentalis* was not produced/consumed in all districts (only in the south); it has then been replaced by a more widely consumed and more demanded alternative in the target area (African basil/Scent leaf- *Ocimum gratissimum* (tchayio).

(iii) Team building and communication challenges which we resolved through mutual understanding. Necessary logistics have been put in place to enhance more robust within-project communication and interaction.

8. Linkages with Global Affairs Canada:

Mention here if you had any interaction/meetings with DFATD/Canadian Embassy during the reporting period. Explain briefly (max. 2 sentences) the outcomes of those exchanges.

(i) Dr. Peak was an invited speaker at Canadian Fertilizer Institute's 2nd annual Sustainability conference and panel member for "***8 Great Ideas for Access to Inputs for***

Smallholders in Africa" panel. Attendees included government, academic, and agriculture industry executives.

(ii) Dr. Peak gave an invited talk about his CIFSRF-IDRC project to the Canadian Science Writers' Association workshop in Saskatoon SK

(iii) Research on the sustainability of fertilizer microdosing were highlighted in a newspaper (Saskatoon StarPhoenix) and in an industry magazine (AgKnowledge).

(iv) Collaboration with University of Saskatchewan Spatial Initiative program of Social Science Research Lab formalized. This will provide our project with professional quality mapping and visualization tools (both online and offline) for survey results and soil science data.

(v) Our project established a steering committee with the Ethiopia legume team and the VIDO-INTERVAC vaccine team to host a joint scaling up workshop in Saskatoon. We could not find a suitable time that worked for all the projects in summer 2016, so we now are planning an October 2016 workshop.

9. Publications from previous projects:

Our team has continued to publish the results of NiCanVeg and INuWaM Projects. Listed below are some new publications at acceptance stage from the two projects:

- David Natcher, Erika Bachmann, Jeremy Pittman, Suren Kulshreshtha, Mohamed Nasser Baco, Pierre B Irenikatche Akponikpe & Derek Peak. 2016. "Knowledge Diffusion and the Adoption of Fertilizer Microdosing in Northwest Benin" In Sustainable Agricultural Research. Accepted March 14, 2016

- Erika Bachman[n], David Natcher, Suren Kulshreshtha, Mohamed Nasser Baco, Pierre B Irenikatche Akponikpe & Derek Peak. 2016. "Profitability and Institutional Constraints to the Adoption of Fertilizer Microdosing in Northwest Benin" in Sustainable Agricultural Research. Accepted March 14, 2016.

- Adebooye O.C., M. Schmitz-Eiberger, M. Hunsche, C. Lankes and G.J. Noga 2016. Micro-structure, photosynthetic profile and oxidative stress response of *Amaranthus cruentus* L. to phased salinity. Journal of Plant Physiology (Springer). Accepted March 18, 2016.

10. Six Africa-Based CIFSRF Projects Hold Scaling Up Workshop In Cotonou (October 7-10, 2015)

The six projects that are being implemented under CIFSRF programme (MicroVeg in Benin and Nigeria, CBPP Vaccine in Kenya, Single Dose Vaccine in South Africa, Sunflower in Tanzania and Pulses Innovation in Ethiopia) held a workshop on scaling up and business plans from October 7-10, 2015 at the Sun Beach Hotel, Cotonou,

Benin Republic. A total of 38 participants including the Principal Investigators, Associate Researchers and third party partners were present at the workshop.
The workshop trainer-Dr Alvaro Paz Mendez of IDRC and the former IDRC supervisor for MicroVeg Project-Dr Pascal Sanginga , with the assistance of Dr Latifou Idrissou of Humitropics programme at IITA led the discussions, training and practical aspects of the workshop. The workshop was highly rewarding and also an eye opener on the theory, practical and operationalization of scaling up and business plans for the different CIFSRF projects that are being implemented in Africa. Each project designed the preliminary template for the scaling up of their innovations and followed up with development of the business plan.

11. **Regional Project Coordinator visited project sites in Benin and Nigeria.**

The MicroVeg project team IN Nigeria and Benin played host to the Project's Regional Coordinator(RPC)-Prof Clement Adebooye from December 8-11 and from December 15-18 2015, respectively. In the two countries, the RPC to interact with the teams, farmers and young vegetable scientists club. In Nigeria, the RPC together with OAU and UNIOSUN teams visited (Dec 8&9) Ogbomosho, Akanran, Ilesha, Ile-Ife, Lagos and Ilorin and seed production site at IART, Ibadan and some secondary schools. The team also used a full day (Dec 10) to develop the pending strategic documents: Communication, Gender, Scaling up protocol and Logic Model. The visit ended (Dec 11) with a general project meeting held at the OAU, Ile-Ife where issues of project implementation, postgraduate students and logistics were discussed. In Parakou-Benin, the RPC and Benin team paid a courtesy visit (Dec 16) to the leadership of the Faculty of Agronomy, University of Parakou where the strategic issues of the Project 107983 were discussed. The RPC and the Benin team engaged in strategic documents review (Dec 16) where the Communication Strategy, Gender Protocol, Logic Model and Scaling up Protocol were reviewed preparatory to the full implementation of the strategies. On December 17, the team visited the experimental sites at National Institute of Agricultural Research of Benin INRAB Ina CRA North in Benin, a secondary school vegetable farm, office of one of the coordinating NGO in Benin (AR2PI) and the irrigation facility for vegetable production at Parakou South (Sokounon women TLV producers' field). As a result of the visits to both teams, a training of the West African teams on the necessary ingredients for scaling up strategy was planned and held from January 17-20, 2016 in Cotonou. Participants at the training included: 3 PhD students who are working on scaling up experiment, 3 NGOs, 11 project team members and 3 African PIs.

12. Key numbers to be used for infographics

Those are <u>cumulative</u> numbers since the beginning of the project, please update only if the numbers have changed from the previous reporting period.

Number of farmers (women/men)	**5506 farmers (who are participating in all our demonstrations and meetings).**

	810+1400 young vegetables scientist club members **73 agricultural science teachers.**
Number of innovations/solutions	Capsule technology for microdosing of indigenous vegetables Seed production systems Value addition and processing
Number of Masters and PhD students	11 PhD and 15 M.Sc. students Six Bachelor students in food technology
Number of publications	Project Brochure published by MicroVeg Team. Available at www.microveg.org
Other key numbers	Over 1500 women marketers and 200,000 consumers are directly linked to our project in terms of asking questions and attending our talkshops.