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Canada-Africa 4R Solution and Precision Nutrient Management – Online Series

Webinar I | Monday, 15 June 2020

The 15 June 2020 panel was the first in a series of webinars aimed at increasing the visibility of the 4R Solution Project, creating a network of African and Canadian scientists in its support, and increasing the engagement by African universities in 4R Nutrient Stewardship. The following report highlights the key points made by each speaker, and describes the discussions in response to questions. For more detail, see the recorded two-hour presentation and the presentation slide deck.

Session 1. Introducing the Webinar Series

Three speakers introduced the online series.

Clyde Graham, Fertilizer Canada, recognized the sponsors and introduced the 4R Solution project, a public-private sponsorship that is working to improve socio-economic well-being and resilience of 80,000 smallholder farmers, particularly women, in Ethiopia, Ghana and Senegal. He also introduced Ed Rege, founder and CEO of ECI-Africa and Emerge Africa, as webinar moderator.

Ed Rege welcomed participants, and noted procedures for dealing with questions in the chat box.

Mario Tenuta provided an introduction to the role of the University of Manitoba in 4R Nutrient Stewardship and in the 4R Solution project. He noted the new five-year Senior Industrial Research Chair program focusing on 4R Nutrient Management for farmers. The program has six components supporting better nitrogen fertilizer use for crop and environmental health. It is supported by Canada's Natural Sciences and Engineering Research Council (NSERC), the Western Grains Research Foundation, and Fertilizer Canada.

Leonardus Vergütz spoke on the Mohammed VI Polytechnic University (UM6P) efforts towards the 4R solutions project. He noted that the university was inaugurated in



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2016 by His Majesty the King Mohamed VI to foster academic entrepreneurship and innovation, tackling real African challenges with strong connection continentwide. He briefly reviewed eight examples of UM6P projects supporting 4R. UM6P has projects in all three 4R Solution countries, Ethiopia, Ghana and Senegal.

Ed Rege noted the webinar goal of facilitating broader networking with those participating in today's webinar, exposing opportunities for working together.

Questions on the impact of no-till on soil organic matter and fertilizer management, and on dealing with fragmentation and small scale of smallholder farms were noted for later consideration. In response to the question as to whether the 4R Solution project was open for more partnerships, Mario answered that while the project is already underway, its purpose is to encourage collaboration, so absolutely yes it is open for more partnerships.

Session 2. Introducing the 4R Nutrient Stewardship (4R Solution) project

Tom Bruulsema, IPNI Canada, spoke on the scientific foundation for relating 4R practices to outcomes. He described how the sciences of soil fertility and plant nutrition contributed the principles for applying the right nutrient source at the right rate, right time, and right place. He described how principles for setting sustainability goals were incorporated into the 4R Nutrient Stewardship concept. He also noted the important role of certification programs, such as the American Society of Agronomy Certified Crop Adviser (CCA) Program and the Lake Erie Watershed 4R Certification Program, in the implementation of 4R in North America.

Clyde Graham, Fertilizer Canada, spoke on the 4R Champion program, noting it applied to anyone from sub-Saharan Africa. Applicants can request either a \$500 or a \$1000 grant, to start or support a 4R micro project related to agricultural extension, demonstration plots, or communication. Clyde also noted the 4R Essentials short course in 4R Nutrient Stewardship, which can be completed online. Opportunities for Collaboration and Partnership were outlined, and participants were encouraged to subscribe to the [4R Solution Newsletter](#).



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Benoit Andre, Cooperative Development Foundation (CDF) Canada noted that CDF was founded in 1947 by Canadian co-operatives. Currently it operates more than 130 projects in more than 40 countries. The goal of the 4R Solution project is improved well-being and resilience for 80,000 farmers, with special attention paid to gender: women and girls. This is year one of a 5 year project. One hundred twenty nine women are identified to be trained leaders in the program, training women to be trainers as well. Another 4,527 women are registered to form gender model families, working with savings and loans associations. The gender model family is an interesting concept already implemented in Ghana, achieving gender transformative results. The project has also identified 130 women to be trained as community volunteer trainers agricultural extension.

Questions: Clyde answered a question on whether one could become a Certified Crop Adviser in Africa. He noted this is a North American program, but some of the training materials may be relevant, and available online. There is currently no CCA program for Africa, but developing a program for Africa would be a good idea.

Ed noted a question on transformational 4R innovation in Africa, and the deadline for the 4R Champion application.

Shamie responded to a question on transformational 4R innovation in Africa, noting that previous 4R projects raised awareness of scientific knowledge among those responsible for fertilizer recommendations within several countries. Traditionally, such recommendations were based on commodity N and P fertilizers only. The transformation resulted in revised site-specific recommendations that improve productivity and sustain the fertility of soils. These revised recommendations have had much impact.

Tom responded to a number of questions on 4R Certification, noting the high level of interest. He stated that the most successful programs are those that address key issues, are specific to the cropping systems of a region, and engage the the key stakeholders with interests in transformative change. One example he cited was that in the Lake Erie Watershed, where the concern for the quality of the water in the lake was shared by farmers, agri-business, environmental organizations, governmental



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agencies and the general public. Representatives of these multiple stakeholders got together to agree on standards for 4R practices for phosphorus and nutrient application that supporting continued increase in crop productivity while reducing losses of phosphorus that could harm water quality. Bringing together organizations with common interests in the success of farmers is key. They need to agree on standards. The priorities will differ in Ethiopia, Ghana and Senegal. Stakeholders representing those priorities need to be engaged in the development of certification programs specific to each country.

Clyde responded to a question on the Champions program, noting no firm deadline. While the intent is to support microprojects, Clyde encouraged those without a specific field project to contact Fertilizer Canada and explore alternative possibilities as well, for serving as a 4R Champion.

Session 3. Looking Forward from Year I of the 4R Solution project.

Frewengel Wolde-Michael (Fre) spoke on *Implementation modalities, progress and way forward* and noted this is a complex multi-layer project, and listed the multiple partners with which CDF works in each country. One component of the project enhances sustainable production through engagement of men and women farmers with agricultural extension agents at 4R demonstration sites. These farmers will be linked to value chain actors and high end markets through their cooperatives as well. Training includes production skills, post-harvest management skills and marketing skills. Another project component will demonstrate the site- and soil-specific impacts of the 4R practices to government agencies to increase integration of 4R principles in national standards, guidelines and policies. The third component involves recognition of the enhanced representation and influence of women in leadership. This component involves training in literacy, confidence building, and public speaking skills. The CDF field offices in Ethiopia and Ghana are fully operational, and 4R demo sites and Nutrient Omission Trials have been established.

Shamie Zingore spoke on *Implementation process and progress review*. He gave highlights on the processes being used, progress and outlook for the coming year. He pointed



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out that while poor soil fertility, low fertilizer use, and suboptimal fertilizer management practices are key factors holding yields back to less than 30% of those attainable, other constraints including limited land availability, water, biotic, climate change and post-harvest losses also need to be addressed at the same time, and are being addressed in the implementation of 4R in this project. The Nutrient Omission Trials (NOTs) are important for diagnosing nutrient deficiencies, and include both macro- and micro-nutrients. The NOTs form the basis for continuously improving 4R recommendations. Sites for NOTs have been selected in both countries, and the trials will be started this month. Extension to farmers includes a learning site model, where practices implemented on one farm are used to exchange knowledge with neighbouring farmers. Learning protocols have been established. Training and capacity building has begun at three levels: for researchers, extension and partners, and learning-site-based farmer training. Noted the opportunity for more partnering on developing technical skills for nutrient management in small holder systems.

Questions

Ed expressed appreciation to Shamie for the level of detail of the last four slides. They highlight a sustainability strategy with local ownership and capacity building. The sustainability component is well thought through.

Shamie addressed a question as to why the past decades of an agribusiness push to increase fertilizer use has not succeeded in increasing crop productivity or human nutrition. Shamie noted that the drive to increase fertilizer use missed the opportunity for balancing among nutrients and the requirement for better management of other farm practices. He believes that what is different today is the **thinking on sustainability and assuring access to fertilizers suitable for each context**.

Shamie also addressed a question on climate change, noting that **flexible rate and time** of application is important for adapting. In season application of nutrients, as the crop conditions progress, ensures better success. Management to improve soil organic matter using conservation agriculture practices is also an important part of adapting to climate change.



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In response to a question as to how to maintain principles of 4R with unpredictable weather, particularly rainfall in West Africa, Shamie noted that the key entry point to deal with weather risks is to **characterize variability and risk from past data**. From there, one can adapt by building on forecasting technologies, using in-season fertilizer management practices, and using other practices including crop genetic selection for adaptation, water conservation and management to improve water use efficiency. Fre also noted that in this project, **the 4R principle is not stand alone**; it is intermarried with climate change adaption strategies as well.

In response to a question on the business model for delivering 4R outcomes, Shamie noted the the 4R project includes a **full value chain process**. The project is working with cooperatives to improve farmer access to inputs, and also interfacing with the private sector.

Closing Remarks

Mario Tenuta noted he was pleased to see a good number of technical questions, many of which will be addressed further along in the webinar series. He noted the importance of dealing with smallholders, and their specific needs. He thought it interesting to see the comments on certification; these relate to a “train the trainers” approach. Fundamental development issues were raised, but Mario felt they were outside the scope of the webinar series. He also noted questions about application to areas beyond Africa – for example, Indonesia – but stressed the need to tailor to suit specific cropping systems. Mario outlined the four topics and speakers proposed for the next webinar in the series, to be held on the 13th of July 13th. Sessions for the following months are to be announced, and some will include content on Canada and North America. Planning eventually to hold in person meetings at both the University of Manitoba and at UM6P.

Ed noted that we had up to 104 participants in today's webinar. Some questions were not answered. We will look at them and upload. Clyde also thanked the speakers and listeners, and noted the intent to set up a FAQ page on the [4R Solution website](#) in



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days to come. He noted that Labonya Nirjan would send a link to survey for feedback and for topics to cover in upcoming meetings.

Leonardus noted that the webinar was a great opening, with great discussions, and that he looks forward to more technical discussions in the next webinar in the series. He is interested in the topic of increasing soil organic matter, and his experience with Brazilian soils relates well to the soils of sub-Saharan Africa. Regarding the question why fertilizer inputs do not show their effects, he agreed with Shamie on the need to find the main problem specific to each site. Such problems could include aluminium toxicity or limitation of nutrients other than N and P, or other soil and crop management factors. He has interests in helping farmers build more resilient systems, for better fertilizer efficiency. He noted that in poor soils, 4R is much more important to crop productivity. He closed with a welcome to UM6P in Morocco, where the faculty are very open to 4R, and look forward to your visit.

Questions from Audiences

4R Stewardship Implementation

1. Are you focusing only on mineral fertilizers in 4Rs? or are you considering manure into the systems? and how do you do that?

Response: The 4R solution project is adopting a farming systems approach to developing nutrient management recommendations for enhancing crop productivity in smallholder farming systems on SSA. With the recognition that key role of manure as a source of nutrients in smallholder farming systems in SSA, the interventions of 4R Solution project will therefore be inclusive of both mineral and organic nutrient sources (including manure) that are available to farmers in different farming systems. We recognize the importance of integrated soil fertility management, which encompasses combined use of manure and mineral fertilizers, for sustainable nutrient management. We have conducted detailed panel and agronomic surveys to document current farmer practices in the various study areas so as to identify locally





available nutrient resources. Fertilizer recommendations will subsequently consider the contribution of any manure applied by farmers.

2. Do you have any plans of rolling out CCA programs in Africa? If so, when and which regions in Africa will be of main priority? If not, how can we in Africa gain access to registration centres to become certified crop agronomists?

Response: The project does not have plans to roll out the CCA program in the implementing countries or in Africa. However, the project would definitely start the conversation around CCA among key policy makers and stakeholders, so that in the long run the CCA program is customised for each region and incorporated into relevant policies/action plans etc.

3. What is the appropriate Business Model to support 4R implementation for smallholders in Africa taking into account constraints to access, climatic risks, and quality issues?

Response: The 4R Solution project would strive to address issues across the value chain including production issues, post-harvest management, marketing and access to inputs, technologies. The model would also engage key stakeholder across the value chain to ensure sustainability (Agric research institutions, policy holder, Agric financing etc)

4. Could Ben expand on the role of the women extension agents?

Response: In the Sub Saharan Africa, women extension agents are not common as a result women farmers don't get their specific needs addressed. Hence, 4R Solution will recruit and train women agricultural extension agents to address women needs in agriculture.

5. How to apply the 4R Solution for farmers applying traditional methods (farmers in Indonesia)





Response: The 4R Nutrient Stewardship is based on global scientific principles for effective use of nutrients that can be universally adapted to a wide range of cropping systems and farm sizes. This also applies to traditional smallholder farms in Indonesia. An important entry point for farmers practicing traditional methods of agriculture will be the characterization of local farming practices to identify opportunities for improvements in nutrient management. Participatory approaches for 4R implementation with the active involvement of farmers will be necessary to effectively integrate local famers' knowledge and scientific information so as to address complex constraints and develop relevant 4R recommendations.

6. Who are the loan agents? Are there any in Tamale, Ejura, Boltanga, Ghana?

Response: Yes, there are. The project is currently conducting due diligence to establish integrity and management capacity of the loan agents/ institutions.

7. Is soil fertility mapping (nutrient status mapping) mandatory so as to effectively meet the benefits or precision farming of the 4R NS approach?

Response: Soil fertility mapping is an important component of assessing site-specific nutrient requirements as it helps to inform on the potential supply of essential nutrients from the soil in specific locations. Soil information is also valuable for assessing other constraints, such as soil acidity, that may limit the effectiveness of 4R recommendations. Soil information in Africa is mostly available at high spatial scales that limits its value for precision nutrient management at the farm-scale. Soil fertility mapping at the farm level is valuable for determining variations in soil fertility within sections of a farm, allowing for the development of site-specific nutrient use recommendations.

8. What are some of the transformational 4R innovations relevant for African farmers?





Response: A major gap for 4Rs in Africa is the outdated, blanket and unbalanced fertilizer recommendations that are commonly used in many countries. Soil mapping programs supported by adaptive nutrient response trials instrumental in developing improved fertilizer recommendations. Other transformational 4R innovations relevant for African farmers include simple 4R tools that allow farmers in Africa apply fertilizer at the right rate and uniformly, resulting in improved yields and fertilizer use efficiency. Other simple tools for 4R knowledge dissemination products, such as the Maize Doctor and crop scouting booklets, have supported capacity building for farmers in applying 4Rs. Another relevant 4R innovation for African farmers is the Nutrient Expert, a tool that helps farmers develop farm/site specific fertilizer recommendations based on individual yield targets and locally available organic and mineral nutrient resources.

9. Dr Shamie Zingore Can you explain why decades of fertilizer input agribusiness has not corresponded to nutrition?

Response: It is true that in the past few decades, a lot of efforts have been put in the fertilizer input agribusiness within countries in Africa. These efforts have helped to significantly improved the accessibility of fertilizers by farmers, by reducing the distance that between farms and fertilizer outlets, but also by offering farmers access to different types and quantities of fertilizers. However, fertilizer use in sub-Saharan Africa remains low at an average on about 20 kg nutrient per ha, and this remains a major limiting factor. Fertilizer prices accessed by farmers in most African countries have also remained very high compared to prices in other parts of the world mainly due to very high inland transport costs. This limits the ability of majority of farmers to apply recommended amounts of fertilizers to meet plants nutrition requirements. The lack of information and awareness of farmers on the best management practices to optimize fertilizer use and crop yields is also a key challenge. This is mostly as a result of inadequate extension services in most African countries, which limits the dissemination of information on best crop and nutrient management practices.





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Investments in fertilizer agribusiness therefore need to be accompanied by investments in extension services, and addressing some of the bottlenecks in the fertilizer supply chain so as to make fertilizers more accessible and affordable to farmers.

10. Dr. Zingore mentioned response to climate change. Is there anything more specific that is being recommended, ie. timing, no-till, etc.?

Response: As part of the 4R adaptive research that the 4R Solutions Project is undertaking, options for addressing challenges related to climate change will be recommended to farmers based on local farming systems. These options will include aspects related to timing of planting and fertilizer application in line with changes in rainfall given the increasing variability in rainfall patterns as a result of climate change. For example, past 4R research in Zimbabwe has shown that in cropping seasons which suffer from prolonged dry spells from the middle of the cropping season, it is advisable not to apply any planned topdressing fertilizer N due to high chances of crop failure, with the remaining fertilizer best reserved and used in the subsequent cropping system. Practices that enhance the ability of soils to conserve moisture and improve the soil's physical and chemical fertility such as no-till will also be evaluated through 4R adaptive research prior to recommendation based on local farming systems.

11. Does 4R program accept the use of organic fertilizer (Cover crops, crop residues and/application of manure in the demonstration plots/sites)?

Response: The 4R project is focusing on farming-systems approach for technological development and dissemination. We use soil analysis and nutrient omission trials as an entry point to determine the soil fertility status and potential nutrient supply potential in fields representative of the area of intervention. We are also conducting detailed agronomic and panel surveys aimed at detailed understanding of local



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farming systems and practices. Results from soil analysis and nutrient omission trials will be integrated with information on the characterization of the farming systems to develop and demonstrate 4R practices that account for use of mineral and locally available organic nutrient sources as well as crop rotations.

12. The project emphasized that it wants to impact women farmers. However, I have not heard any strategy on how this will be achieved?

Response: Out of the three result areas of the project one is particularly on gender equality and economic empowerment of women smallholder farmerst. This will be achieved through massive community sensitization on gender equality though formation of Gender Model Family in each community. Specific activities will also include, literacy training, leadership skill training, entrepreneurial skills, loan facilities for women.

13. Are there local universities in Ethiopia, and Ghana involved in the program?

Response: Currently only local research institutions are involved, However, there is definitely potential for collaboration as we move forward. One way university students and professors could get involved is by applying for the [4R Champion](#) program.

14. How practically measured GHG emitted and sequestered in the course of 4R project implementation?

Response: The 4R Solution Project is currently working on a framework for the detailed study of the potential of 4R practices in mitigating GHG emissions of gases. The planned study will involve post-graduate students who will conduct detailed measurements in on-station and on-farm locations, resulting in an improved understanding of the contribution of 4R nutrient stewardship to mitigating GHG emissions. Other indirect assessment will also be conducted based on nutrient balance assessment functions.



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15. Is there any strong agreement or relationships between the government of the countries where the projects are going on as per policy is concerned to enhance adoption of the 4R BMPs?

Response: The 4R Solution project is working in close relation with Ministry of Food and Agriculture in Ghana and Ministry of Natural Resources in Ethiopia and Ethiopian Agricultural Transformation Agency (ATA). As we enter into Year 2 of the project, more collaboration will be in place, specially once we launch the 4R Solution National Advisory Committee in Ethiopia and Ghana. The committee will play a key role in engaging national level policy makers to increase awareness and integration of 4Rs into relevant policies in Ethiopia and Ghana.

Challenges of Implementing 4R Stewardship

1. What are the challenges of implementing 4R Nutrient Stewardship in Africa?

Response: The high diversity of farming systems due to differences in climate, topography, farming objectives, socio-economic backgrounds, among other factors poses a unique challenge in the implementation of 4Rs in Africa, as a set of farmers in the same locality may have varying crop and nutrient management issues. Subsequently, a key challenge in implementing 4R Nutrient Stewardship in Africa is ensuring that 4R options developed are cognizant of the diversity in farms and farm conditions.

2. How can we meet the 4R NS approach in a small-scale farmers where they have very fragmented farms?

Response: Agriculture in most of Africa is indeed primarily practices by small-scale farmers in small fragmented farms. This presents unique challenges in implementing the 4R NS approach as 4R options such as mechanized precision fertilizer application that work in other parts of the world are not feasible under such small-scale settings. To address this, the 4R NS approach includes a strong aspect of local adaption of



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4R practices developed, with adaptive 4R research serving as a key entry point to 4R NS work. Through this, detailed farm surveys are conducted to characterize farms and farming systems, with an aim of ensuring that 4R options developed are in line with the reality of farm sizes in these farming systems. Working with cooperatives will provide opportunities for consolidated training activities and procurement of inputs.

3. how do we maintain the principles of 4R in the face of unpredictable rainfall patterns, particularly in west Africa where we have too heavy rainfalls and periods of drought?

Response: In cognizance of the unpredictable rainfall patterns in west Africa, the 4R solution project is undertaking detailed adaptive on-farm and on-station research to assess the risk of seasonal rainfall variability on fertilizer use efficiency and crop yields. This will allow for the development of climate-smart 4R recommendations that are responsive to the rainfall variability. We will also develop simple fertilizer decision support tools that help farmers in deciding on fertilizer application at the farm level based on in-season growing conditions. Opportunities for integrating early warming weather and climate advisory information in setting yield targeted and nutrient management recommendations will also be explored.

4. For traditional farmers, the implementation of the certification system is not yet understood by them. What is the solution for this?

Response: The 4R certification system is mostly be targeted at extension systems, which will have responsibility of disseminating information on locally adapted 4R practices to farmers in their region.

5. is there a link that we could share on this critical initiative?



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Response: Please visit www.4RSolution.org to learn more about the project and to stay up to date through our [News](#) and [Documents](#) section. To subscribe to our Newsletter, please click [here](#).

4R Champion

- I. To apply 4R champion, Is it necessary for someone who has already gotten the certificate of 4R Nutrient Stewardship Training - Part 1,2 and 3 to get again 4R Essentials Certificate?

Response: No, you do not need to do the 4R Essentials course if you completed all the parts of the Fertilizer Canada's 4R Nutrient Stewardship Training course. However, you will need to submit certificates of the Part 1-3 with your application.

2. I study fertilizer science at UM6P, now I have successfully completed the 4R essentials certificate. It's possible to get internship of 4R topics, to accuracy my knowledge maybe in IPNI? How can apply?

Response: Currently, IPNI is going through an organizational restructure and not accepting interns.

3. When is the deadline for the 4R champion application?

Response: Currently, the application program for the 4R Champion program is open and ongoing; with no deadline. Depending on the volume and quality of the applications we receive, we will be able to decide if we want to keep it open. If a deadline is set at any time, it will be announced in our webpage and social media.

4. Apart from the project (i.e. demo, extension), are there other means of one becoming a 4R champion?



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Response: You are very welcome to share/ submit your proposal outside of what the 4R Champion asked for. The Selection committee will definitely review and get back to you with their decision.

5. Is it possible for Africa Agronomist to get Crop Adviser Certificate?

Response: The Crop Adviser Certification program is currently in North America. Africa can definitely adopt similar practices as relevant to each country's context. The 4R Solution project could be a conversation starter on this.

General Qs

1. The smallholder farmers issues has been in discussions for many years:
 - Could highlight some of the significant improvements that have been made?
 - Do you have plans in merging some smallholder farmers into a huge commercial entity to tackle the poverty situation among smallholders?

Response: From a 4R technological perspective in sub Saharan Africa, there has been significant progress in the past two decades in understanding the complex heterogeneity of smallholder farming systems due to differences in cropping history, landscape position, farming practices, among other factors. This diversity results in strong differences in soil fertility and in the observed crop yield response to fertilizer application between farms even at very small scales. An important outcome of this is investments now in place to shift from blanket application of regional fertilizer use recommendations, to site-specific fertilizer recommendations and equipping farmers with skills and decision support tools that allow them to fine tune fertilizer recommendations at the farm level based the conditions and needs of each individual farm.

2. This is Ahmed Elnaggar from ICBA. Many projects have been implemented in Africa but unfortunately without sustainability after the project end or after





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funds stops. What are you planning to do to ensure the sustainability of the project outcomes?

Response: To ensure sustainability, 4R Solution team is working directly with local institutions, including crop research, financial services providers, input dealers and produce buyers. The project also work with Farmers' cooperative to help them grow as business enterprise so that they continue to render same service to their members when the project ends. The project is highly focused on sensitization of national policy makers in respective countries as well as international policy makers such as FAO and UN. In fact, the project is in the process of forming a National Advisory Committee in each country to advice and guide on the policy influence as relevant to each country.

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Appendix I

Post Webinar Feedback from Attendees

[Post webinar feedback.pdf](#)



Post webinar
feedback.pdf

Appendix 2

Attendee Report

[Webinar 1 Attendee report.xlsx](#)



Webinar 1 Attendee
report.xlsx

Appendix 3

Webinar Agenda

[Webinar 1 Agenda.pdf](#)



Webinar 1
Agenda.pdf

Appendix 4

Webinar Recording

[Webinar Recording - June 15](#)



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