

CONTRIBUTION OF LEGUMES TO SMALLHOLDER AGRICULTURE AND LIVELIHOOD SUSTENANCE IN SUB-SAHARAN AFRICA: EVIDENCE FROM MALAWI, GHANA AND GUINEA

**^{1*}Yaw Agyeman Boafo, ²Linda Chinangwa,
¹Boubacar Siddighi Balde**

1- Integrated Research System for Sustainability Science,
The University of Tokyo, Tokyo, Japan

2- United Nations University Institute for the Advanced Study of Sustainability

Emails:

*yboafo@gmail.com

lindachinangwa@yahoo.com

siddighilonsin@hotmail.com

YAW AGYEMAN BOAFO holds a PhD in Sustainability Science from United Nations University Institute for the Advanced Study of Sustainability (Japan) and is currently a Project Researcher at the the Integrated Research System for Sustainability Science (IR3S), The University of Tokyo. Yaw's research interest is broadly within the field of ecosystem services and resilience in socio-ecological systems, food security, climate change vulnerability and adaptive capacities and rural development.



Yaw Agyeman Boafo

LINDA CHINANGWA holds a PhD in Conservation Biology from Bangor University (Wales). She has been a JSPS-UNU Postdoctoral Fellow at the Institute for the Advanced Study of Sustainability, United Nations University (UNU-IAS) since August 2016. Her research and career interests are primarily in forestry, natural resources management, ecosystem services, agriculture, livelihoods and sustainable development viewed from the social and economic perspective of rural communities.

BOUBACAR SIDDIGHI BALDE holds a PhD in Managerial Economics from the United Graduate School of Agricultural Sciences (UGSAS), Tottori University, Japan, and is currently a Project Researcher at the Integrated Research System for Sustainability Science (IR3S), University of Tokyo, where he explores the food security impacts of industrial crop expansion in Sub-Saharan Africa. He conducted research related to food security, poverty alleviation, land use change analysis, etc.

ABSTRACT

Leguminous crops, including cowpea (*Vigna unguiculata* L. Walp.), groundnut (*Arachis hypogaea*), soybean (*Glycine max* L. Merrill) and common bean (*Phaseolus vulgaris* L.), are among the most important and widely grown crops in Sub-Saharan Africa's (SSA) diverse ecological zones. These legumes are multipurpose, hence their production is crucial for the African population especially smallholder households, in terms of food security, nutrition, generation of income, and maintenance of local agroecosystems (i.e., improving soil health and fertility). Characteristically, legumes are known to thrive under low rainfall and poor soil conditions and require minimum capital investment in comparison with other crops. In the face of rapid and unprecedented population growth being experienced in SSA, where the majority is engaged in smallholder agriculture, coupled with the effects of climate variability and change on agriculture, maintaining agronomic practices that help maintain high crop yields and at the same time enhance soil productivity is imperative towards enhancing sustainable development. The promotion of legume production among smallholder farmers in SSA is, therefore, plausible. Against this backdrop, the objective of this study is to further highlight and discuss the role of legume production among smallholder agriculture and livelihood sustenance in SSA by drawing evidence from three African countries namely Ghana, Malawi, and Guinea. Using examples from these countries, elements such as major types of legumes cultivated, area harvested in comparison with other major crops, production quantity, and contribution to global production are examined. The study further assesses some of the country level utilization forms as well as the major challenges impacting on the sustainable promotion and production of legumes. Additionally, we underscore the opportunities associated with upscaling practices associated with legume production among smallholder farmers.

KEYWORDS

Rural households, Legumes, Smallholder agriculture, Climate change

CONTRIBUTION OF LEGUMES TO SMALLHOLDER AGRICULTURE AND LIVELIHOOD SUSTENANCE IN SUB-SAHARAN AFRICA:


EVIDENCE FROM MALAWI, GHANA AND GUINEA

BY

¹Yaw Agyeman Bofo, ²Linda Chinangwa, ¹Balde Boubacar Siddighi

*1- Integrated Research System for Sustainability Science, The University of Tokyo, Tokyo, Japan
2- United Nations University Institute for the Advanced Study of Sustainability*

Presented at JIRCAS International Symposium
'Legumes Improve Our Livelihood' Legumes improve our livelihood? -beyond the IYP2016'
United Nations University, Tokyo, Japan



1

CONTENT



1. Key facts about Agriculture in Africa
2. Legumes contribution to agriculture and livelihood sustenance:
 - i. Ghana
 - ii. Malawi
 - iii. Guinea
3. Challenges and Opportunities in Legume Production
4. Recommendation and Way Forward

2

KEY FACTS ABOUT AGRICULTURE IN AFRICA



1

3

- 58.8% of total workforce and mostly on smallholder production systems (FAO, 2012)
- Done under rain-fed conditions
- Women dominate the agriculture workforce.
- Food crops are mainly for subsistence and cash crops exported without much value addition
- Inadequate production to feed general population

16% of Africa's land is arable, the largest share in the world


79% of Africa's arable land remains uncultivated

7 of **17** countries that had the highest agricultural growth from 2000-2008 are in Africa

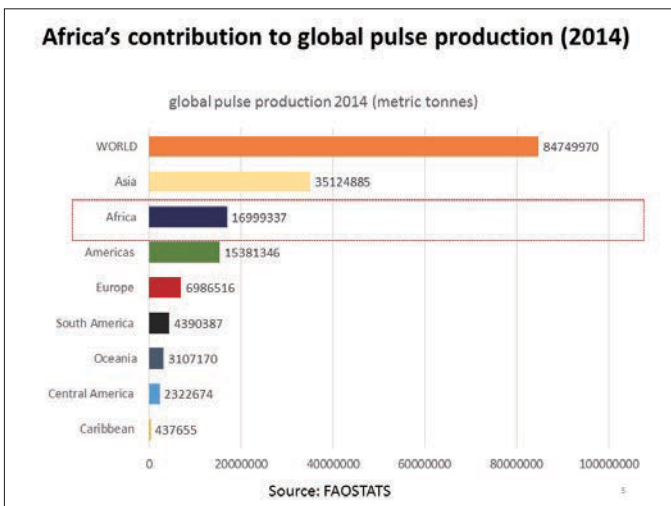
17 of **20** countries whose economies relied most on agriculture in 2010 are in Africa

* According to projection of ICP, World Bank Africa 2012

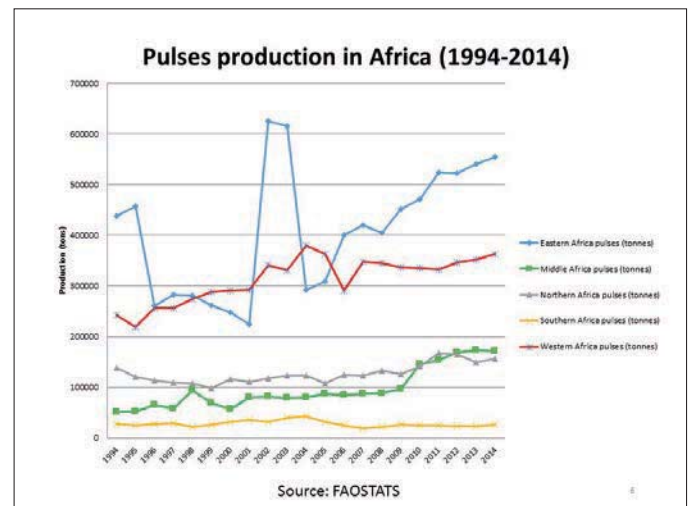
By 2050, 7% OF AFRICA'S LAND will no longer be able to grow maize and will transition to livestock farming systems.



4



5



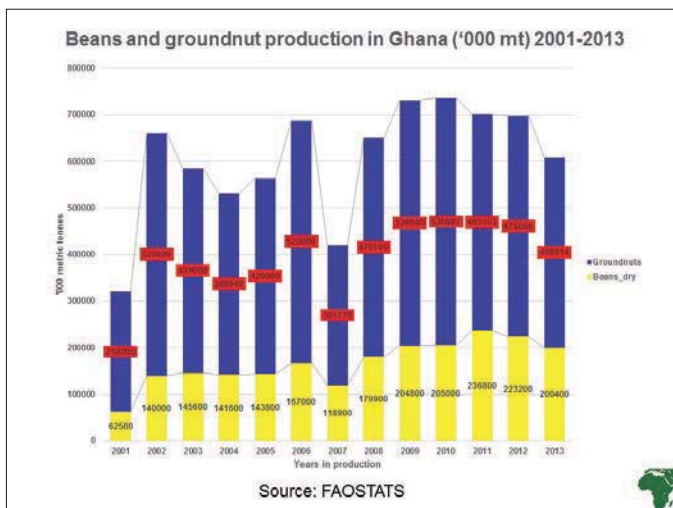
6



7



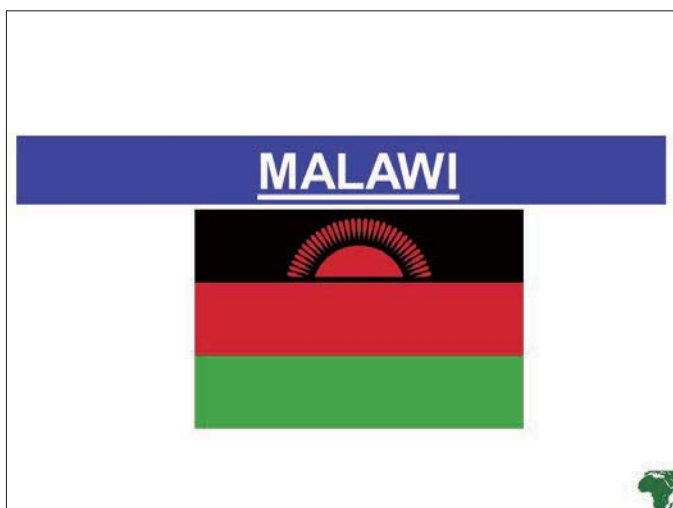
8



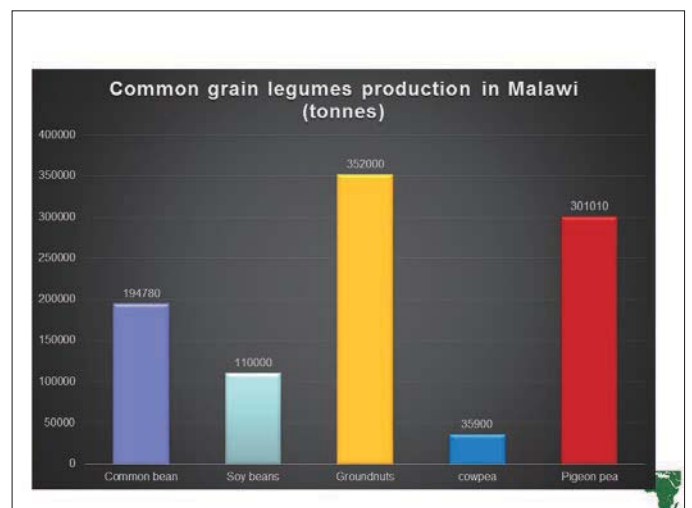
9

- ### The Ghana Grains and Legumes Board
- Set up under the Ministry of Food and Agriculture (MOFA)
 - Production of Foundation Seeds of Cereals and Legumes.
 - Production and Supply of Vegetatively Propagated Planting Materials
 - Provision of Agro-processing Services.
 - Management of Farmers Certified Seeds and the National Seed Security Stocks.

10



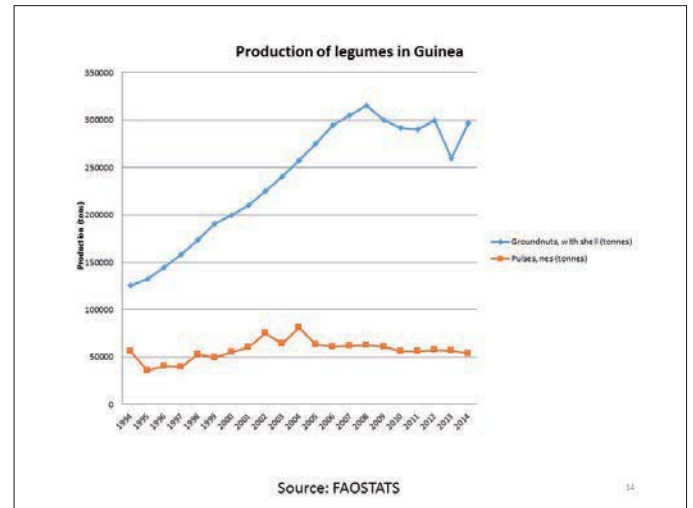
11



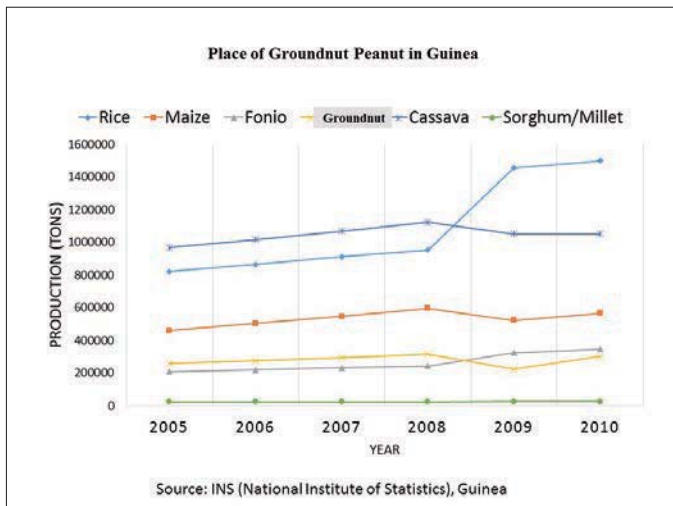
12



13



14



15

Direct and Indirect Contribution of legumes livelihood sustenance

- Peanut crop has the unique characteristics of **being both food crop and cash crop in smallholder** production systems.
- Potential for **income generation**
- It is also an important commercial crop, since peanut is the **basic commodity for a wide range of commercial products** such as oil, snack food and animal feed and other by products use.
- Peanut is also a **key ingredient in culinary preparations.**

16

- Utilization of groundnut **by-products**
 - ✓ Making **soap** from rotten groundnuts
 - ✓ The extraction of groundnut oil
 - ✓ Groundnuts shells are used as **fertilizer** by farmers.
 - ✓ Groundnuts shells are also used by farmers as a **mulch** to trap moisture into soil.

17

CHALLENGES AND OPPORTUNITIES

3

18


Challenges to Legumes production in Sub-Saharan Africa

Demand greater than supply - Low production	Low adoption and underutilization of indigenous varieties	Unclear or undefined policies and institutions	Breeding and research challenges
<p>Poor quality seed;</p> <p>Improved Seed varieties is overpriced and Inaccessible;</p> <p>Abiotic factors e.g. drought, low soil fertility and poor agronomic practices</p>	<p>Lack of awareness indigenous legumes;</p> <p>Lack of seed;</p> <p>High labour requirement e.g. Bambara nuts</p>	<ul style="list-style-type: none"> Lack of clear policies on marketing and associated regulatory frameworks; Limited domestic and International marketing opportunities. Extension problems 	<ul style="list-style-type: none"> Increased incidences and severity of pests and diseases pose new breeding challenges; Climate change effect e.g. drought, require increased continued breeding effort; Multiple, at times conflicting, demands on legume variety attributes by farm families


Reference: Mtambanengwe and Mapfumo 2009; Odendo et al., 2004; Beebe et al., 2008

19


Examples of biophysical challenges



Drought effect on soybean





Striga effect on cowpea



Alectra effect on cowpea


20

Opportunities: Legumes production in Sub-Saharan Africa

Increased private sector interest e.g. High demand for soybean due to expansion of the poultry and fish industry

- Participatory breeding and research programs: legume variety traits suited to local demands e.g. ICRISAT in Malawi;
- Breeders continue to develop new multiple stress resistant varieties

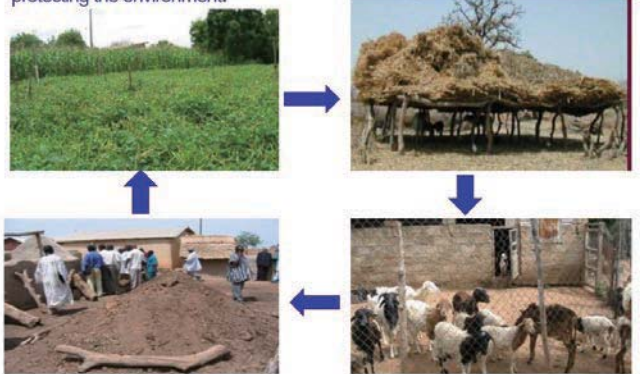


Investment in extension services and on farm experimentation by Governments, research institutions and development partners

Reference: Ceccarelli and Grando (2007); Bloom, Trytsman and Smith (2009)


21

Integrating crop and livestock production offers ways to increase production while protecting the environment.



22

RECOMMENDATION & WAY FOWARD



4

23

- Legume breeding programs should aim to adapt, improve and widely test under-utilized varieties
- Increase communication between breeders, researchers, extension service and farmers to improve utilization of indigenous under utilized legumes
- Mechanization of production activities to reduce drudgery and labor costs.
- Enhancement of market information flow and value chain coordination to enable farmers respond to market signals and demands is recommended
- Enhance public-private partnership at all level legume production including breeding and marketing
- Creation of favorable institutional and policy environment for development, variety release and seed production to ensure quick delivery of technology to end- users is required

Reference: Abete et al., 2011; Katungi et al., 2009; Mtambanengwe and Mapfumo 2009; Odendo et al., 2004; Beebe et al., 2008

24

Thank you!

25

25

Chair Yamamoto

Good afternoon, ladies and gentlemen. My name is Yukiyo Yamamoto, Program Director of JIRCAS. I will chair the Session 3, 'Livelihood with legumes: Value addition and nutritional enhancement.' In the Session 1 and Session 2, we reviewed the cropping system production and the diversity of legumes from the viewpoint of agriculture and science. In this Session 3, we would like to consider how legumes are utilized in our life by some examples in Africa and other countries.

In this session, we will provide three presentations. The first topic is contribution of legumes to smallholder agriculture and livelihood sustenance in sub-Saharan Africa: Evidence from Ghana, Malawi, and Guinea by Dr. Yaw Agyeman Boafo, Dr. Linda Chinangwa, and Dr. Boubacar Siddighi Balde. On behalf of all, Dr. Yaw Boafo will present today. So, Dr. Boafo, please come to the stage. I will briefly introduce our speakers. Dr. Boafo is a project researcher at the Integrated Research System for Sustainability Science at the University of Tokyo. His research interests are ecosystem services and resilience in socioecological systems, food security, climate change vulnerability and rural development. So, when you are ready, please give your presentation.

Dr. Yaw Agyeman Boafo

Right. Thank you very much, Yamamoto-san. As she elaborated, I will be speaking on behalf of my team. My name is Yaw Agyeman Boafo and my colleagues are Linda and Boubacar. We are all postdocs. Boubacar is with me at the University of Tokyo whiles Linda operates right here from at UNU.

Our talk today will be on the contribution of legumes to smallholder agriculture and livelihood sustenance in sub-Saharan Africa. Unlike most of the other presentations, ours will be more generic, not very technical because we will give a very good overview of what's happening in Africa in terms of agriculture and legumes based on secondary data. So, I will start by just giving a few facts about agriculture in Africa, then I will highlight some key leguminous produce in Africa with reference to Ghana, Malawi, and then Guinea. From there we will talk about some of the challenges and opportunities in legume production across Africa with reference to the case study countries. We will end with the recommendations and some issues moving forward.

Until now, we have had opportunities to listen to some presentations already this morning. One of the key ones was by David Bergvinson. He highlighted some of the issues that has to do with legumes in Africa, but I just want to say that in Africa, when it comes to agriculture, it's a very important livelihood and also economic activity, and some of the facts show that almost about 60% of people are involved in this activity. Then, most of the agriculture in Africa is done under rainfed conditions, meaning that majority of farmers rely on nature for any sort of water to support the agriculture systems. And then another interesting fact is that women dominate the agriculture sector in Africa. That's something that also has not been ignored. Then, most of the crops are food crops that are produced for subsistence. That means that they are produced for consumption in the households and then a little bit of it sold, then some of the cash crops that are produced in terms of agriculture, much value is not added, most of them are sent abroad for value addition. Examples include cocoa, cotton, and coffee. One of the keys as I highlighted earlier, there is inadequate production of staple crops when it comes to agriculture or with reference to our food production for consumption.

I found this also very interesting when it comes to percentage of arable farmlands in Africa, some of the latest data shows that about 60% of Africa's farmland is arable. Then, out of that, 79% is uncultivated, even though agriculture has the most important livelihood activity there. The one that we also have to take note is that by 2050, 3% of Africa's land will no longer be able to grow maize as they will transition to livestock. Maize is a very important staple crop across Africa. It's actually one of the most important staple crops across Africa. It may be opportunities and challenges for households and communities.

Within the context of the topic, when it comes to pulse production in Africa, based on some of the latest stats from the FAO, we found out that Africa in 2014 produced about 20% of the global pulse production. That is 84 million 749, 970,000 thousand tonnes. Africa made about 17 million tonnes of our own. That means about 20% compared to Asia which was about 40%. So, Africa still contributes a very substantial amount to global pulse production in you pull out this in context. Within Africa also, if you look at the sub-regions in Africa, we can think of very different sort of production patterns across the sub-regions. With emphasis of West Africa, for example, which is in the red, Western Africa produces great at the moment, but the most important region as you can see is the Eastern part of Africa, and I think the last presentation highlighted some places like Malawi, Kenya as important areas of production. The rise and falls actually reflect the combined impact of human and natural factors including unstable political and governance systems on the production system. In terms of natural factors, rainfall unpredictability and drought are major concerns across Africa.

Going forward, I will just try and highlight briefly a few issues when it comes to the chosen countries for this presentation. There are Guinea, Ghana, and Malawi. Starting with Ghana, I came up with this data from Food and Agricultural Organisation online database (FAOSTAT) together with Ghana's Ministry of Food and Agriculture and it showed that in Ghana, beans and groundnut are two of the most important legumes that is produced in Ghana. And if you look at over the last 10 years, we can see that in the year 2000, for instance, there is a bit of an increase, then there is a decrease as well. So, the trends fluctuate and I think it is similar to global trends. It is fair to say that production mimics global volatility as was implied in the presentations this morning. It's all because of a number of factors. Clear amongst them is the issue of rainfall and also issues of lack of inputs such as fertilizer and pesticides. This can also be as a result of the high poverty levels of rural farmers in Ghana. Considering widespread cultivation of legumes couple with the numerous challenges in production, the government through the Ministry of Food and Agriculture has what we call the Ghana Grains and Legumes Board. It has very important purpose because you understand that it's an important contribution to livelihoods. The main aim is that they are supposed to be in charge of production of foundation seeds of cereals and legumes so that it can be accessible to farmers across board. Also, production and supply of vegetatively propagated planting materials in this sort of context, and these are done with other agencies, then provision of agro-processing services, then also the management of Farmers Certified Seeds and the National Seed Security Stocks. This board is very important because the government understands the importance of this produce or these products for national food security and also livelihood systems.

In Malawi, my colleagues and I came up with this graph to highlight the most important legume that is cultivated in a country. And we can highlight groundnuts as the most important leguminous crop, similar to Ghana. Groundnuts is very important especially in meeting Malawian rural households' food and income needs. Pigeonpea is also highly cultivated. The trends in production for these crops are shown on the graph with data from 2014 FAOSTATS.

With reference to Guinea, groundnuts is also a very important legume that is produced. That's the trend that we found across the whole of Africa, and then if you compare it to pulses overall, groundnut actually weighs highly when it is compared to all other pulses that are grown in Guinea. If you also want to put it into context and look at the production of groundnut with respect to in comparison with other food crops, groundnut doesn't really rank highly. You can see from here that groundnut is not really highly ranked but it's normal to food crops like maize, fonio and rice are very important in Guinea, but groundnuts still contribute significantly to household diet.

I want to highlight some of the direct and indirect contributions that these legumes made across Africa as far as livelihood systems are concerned. So, peanut or groundnut, as we know, is very important for food, and some of the photos here, this is made in different countries. So, in Ghana, you can also look at this one from Guinea that was highlighted, and like I said, women play an important role in the cultivation, production, and processing of these sort of legumes, most of the time manually done. Of course, it contributes a lot to income. In Northern Ghana, for instance, where I do a lot of research in rural northern Ghana, groundnut production has been found to be very important because it's one of the main crops that fetches a lot of income for households and also because they don't need to apply a lot of fertilizer and is often cultivated even during the long dry season. It's also an important commercial crop in some countries, especially like Guinea, and then also groundnut is also an important ingredient for some other forms of food as I highlighted earlier on. In terms of the use of byproduct for groundnut, we wanted to say that in many households in the rural parts of Africa, actually groundnut byproduct is used for soap and it's something that contributes a lot to some households who do not have other sources or diversified sources of income. So, they make soap for the household use and other things like that. Groundnut oil is also very important for household food security. Then, we also have it's been used for fertilizer, some of the byproducts are very important for fertilizer and mulch.

So, in terms of challenges, I want to highlight much of what I have here in my presentation have being talked about in the earlier presentations not just in Africa but in India and South America. It tells of the common issues we face. But in Africa, more specifically, I think I have mentioned that the demand for legumes for diverse uses especially consumption is actually greater than supply. That is something that we have in terms of many people across Sub-Saharan Africa not being able to have access to leguminous crops for various reasons. Other challenges include poor quality of seeds and issues of low adoption. Underutilization of indigenous varieties is also very common because big companies or multinational companies like Monsanto introduce some of the hybrid varieties and some of these ones can have some side effects on the soil. Others

may be too expensive to acquire. Some of them also require the use of a lot of fertilizer which people might not be able to afford.

Then, there's also unclear and undefined policies and institutions on legumes as a crop. This is one of the biggest challenges that we face in Africa when it comes to production of not just legumes but in most of our food crops, because even though Ministry of Food and Agriculture does a lot of work across the countries in Africa, there are a lot of challenges that they face when it comes to directly providing support like input or extension services to farmers to produce these crops. So, sometimes change in trends or change in knowledge of the use of some of these crops is a big problem. We can highlight extension services because one of the biggest challenges when it comes to production of legumes in Africa, there is less extension available to many people. Then, I will talk about climate change which I highlighted early on as a big impact on that.

These photos here are from my research field in Northern Ghana as well as from some published work. So, I come across a lot of these when I am doing my research with low crop farmers. Droughts impacting on soybean production is a huge issue in many parts of Northern Ghana. Then, I want to talk about *Striga* effect and also *Alectra*. These sorts of prostrate weeds are very, very harmful to most of the crops that are grown, and a lot of farmers do not have enough money to be able to buy pesticides which also has its own effect. So, you find the whole acre of legumes being destroyed by these biophysical challenges. In Ghana, the Savanna Agricultural Research Institute (SARI) is working hard to research on improved legumes for use by poor rural farmers.

In terms of opportunities, I am also happy to hear most of the presentations that were made by the Director from ICRISAT and he talked about some of the genomes and some of the many attempts that have been made to promote different varieties and that is something that I am excited about. I think most of the information available shows that there is a lot of work ongoing when it comes to promotion and also investments into that. So, in Northern Ghana, for instance, there is this project that MEDA is running in collaboration with the Canadian Development Agency, it's called GROW, Greater Rural Opportunity for Women, where women are being encouraged to grow soybean and are being aided with ready market. This approach is helping boost not just their income but also their diets as a whole. These are very important things that I think we should keep promoting across board.

Legumes can also be critical as far as the integration of crops and animal production is concerned. I highlight the ways that some of the byproducts can contribute to when it comes to feeding not just animal, but since the animal droppings or cow dung can be used and then processed into some sort of humus and fertilizer. That can be processed. So, that whole cycle is very important and it should be encouraged. There is also the opportunity for using community knowledge and also using the local knowledge to promote people's awareness of the importance of – instead of always using knowledge systems that are maybe more friendly to people. So, this is important in many ways.

There's a few things that my team would like to highlight in this presentation when it comes to recommendation and way forward. There is an issue of legume breeding programs which aims to adopt and improve and use widely tested under-utilized varieties, and like I said, it's very good to keep up with this sort of ongoing activities. We can also highlight the issue of increase communication between breeders, researchers, extension service, and farmers. My personal experience in Northern Ghana says that it's very important to have most access to extension and advisory services. That's one of the biggest complaint by local farmers in Northern Ghana, and I think that is something that needs a lot of attention. Enhancing of market information flow and value chain coordination to enable farmers respond to market signals and demands is recommended. This is also a very big challenge, and I think that is important because we realized that most of the time value is not added to the produce that is done that is done by local people. So, we need to look at the value chain of most of these important legumes and then see how we can support farmers or give them the needed knowledge to enhance their productivity and also provide market access for them so that you can have that sort of desire to continue production. Enhancing public-private partnership is important and in this sense, even research institutions, universities or other relevant entities need to collaborate. We should out ways to engage the local people at the inception of research projects, also find more practical ways to lead their research results to be practical and also be send to the local communities.

So, as a whole, these are the things that we wanted to share in this presentation. I hope I have been able to at least make some relevant inputs to this symposium. Thank you.

Chair Yamamoto

Thank you very much. So, the floor is open. Are there any questions or comments on his presentation? Yes, please.

Male Questioner

Thank you for very informative presentation. I would like to ask perspective of production of soybean as a food crop. So, you mentioned about GROW Africa project, they are concerned about this, but I want to know your perspective.

Dr. Yaw Agyeman Bofo

Okay. All right. Thank you very much. In the last 5 years, I have had opportunity to work with farmers in Northern Ghana, and they talk about the continued decline of the fertility of their soil, meaning that most of their staple food crops that they grow like maize and millet are not as productive as it was in the past. But at the same time, we are talking about soybean as a crop that does very well even within that sort of poor and infertile environment. So, the hope is that the GROW project need to be sustainable. I think it is very important because a lot of women consider the soybean to be a female crop, something that they can easily produce without having access to fertile land. In many parts of Africa, women are also limited in terms of the access to the “good land”, due social inhibitions and hierarchical systems So, I think it is very important that projects like GROW are active in this direction. I hope that this project can continue to promote such activities as it has the potential to help improve livelihood and food security of households.

Chair Yamamoto

Thank you very much. Are there questions or comments? Dr. Boubacar Balde, do you have any additional information or comments as one of the co-authors, if you have. Just a moment, please use the microphone.

Dr. Boubacar Balde

So, as Dr. Yaw mentioned earlier that our research relies purely on secondary data, so we don't have much to tell about primary data. So, if any questions, we would like to answer. But at the moment, I don't have any comment to add.

Chair Yamamoto

Okay, thank you very much. Are there any questions or comments? Okay. Thank you very much, Yaw.

Dr. Yaw Agyeman Bofo

Thank you, Yamamoto,-san.