



AfricaRice

# PROCEEDINGS OF THE FIRST INTERNATIONAL WORKSHOP



## ON "SAWAH" ECO-TECHNOLOGY AND RICE FARMING IN SUB-SAHARAN AFRICA

22nd - 24th NOV. 2011  
KUMASI, GHANA

Editors: M. M. Buri, T. Wakatsuki, R. N. Issaka & S. Abe



# **PROCEEDINGS OF THE FIRST INTERNATIONAL WORKSHOP**

## **ON “SAWAH” ECO-TECHNOLOGY AND RICE FARMING IN SUB-SAHARAN AFRICA**

**22<sup>nd</sup>-24<sup>th</sup> NOV. 2011  
KUMASI, GHANA**

June, 2012

ISBN: 978 - 9988 - 1 - 6778 - 3

**Published By:**

Faculty of Agriculture,  
Kinki University, Nara 631-8505, Japan

and

Soil Research Institute  
Academy Post Office, PMB,  
Kwadaso, Kumasi, Ghana

All rights reserved. No part of this proceedings may be  
reproduced or transmitted in any form or by any  
means, electronic or mechanical including photocopy  
for commercial purposes

Designed & Printed in Ghana by:

**NII NAI CREATIONS**

233-24-333-9936

e-mail: fennts\_nii@live.com



## SPONSORS



KINKI UNIV. JAPAN

FACULTY OF AGRICULTURE,  
KINKI UNIVERSITY, NARA 631-8505, JAPAN



CSIR - SOIL RESEARCH INSTITUTE, ACADEMY  
POST OFFICE, KWADASSO - KUMASI, GHANA



JAPAN INTERNATIONAL RESEARCH CENTRE  
FOR AGRICULTURAL SCIENCES (JIRCAS),  
TSUKUBA, JAPAN



AfricaRice

AFRICA RICE CENTRE 01 B. P. 2031, COTONOU  
BENIN

## FOREWORD

The first international workshop on 'Sawah' eco-technology and rice farming in sub-Saharan Africa took place in Ghana under the auspices of the Kinki University of Japan and CSIR-Soil Research Institute. The workshop was a historic event as it brought together various players, not only in rice production but also environmental management as well. Major stakeholders that attended the workshop included policy makers, scientists, extensionists, environmentalist, farmers, opinion leaders and the media from seven (7) different countries.

Many papers were presented which covered major aspects of the 'sawah' system such as (i) Overview of 'sawah' eco-technology and (ii) Fundamentals and principles of the 'Sawah' Eco-technology such as site selection, system design, development, agronomy, and farmers' empowerment. Selected and reviewed papers are being published as proceedings. Participants had the opportunity to go on a field trip where the major aspects of 'sawah' development and management were demonstrated and observed. The general context of papers presented covered both research findings and case studies on sustainable rice production techniques under the 'sawah' system and environmental management.

After lengthy deliberations on how to chart the way forward, the workshop has come out with recommendations which are also included in the proceedings. It is the humble hope of the organizers of the workshop that for sustainable rice production and effective environmental preservation, information and results generated under the 'sawah' systems will be effectively disseminated for the benefit of all stakeholders. It is our further hope that information shared at the workshop will open the necessary avenues for the rapid transformation of rice production and the realization of the rice green revolution in sub-Saharan Africa. The 'sawah' system can serve as a gate way for this revolution.

We are very grateful to the organizations which helped in sponsoring this workshop: Kinki University, Nara, Japan; CSIR-Soil Research Institute, Kumasi, Ghana; Japan International Research Centre for Agricultural Sciences (JIRCAS) Tsukuba, Japan and Africa Rice Centre, Cotonou, Benin.

Prof. Toshiyuki Wakatsuki  
(Chairman, Organizing Committee)

## **SECTION I**

<b>Opening Ceremony .....</b>	<b>1 - 12</b>
-------------------------------	---------------

## **SECTION II**

<b>Scientific Presentations.....</b>	<b>13 - 200</b>
--------------------------------------	-----------------

## **SECTION III**

<b>Workshop Recommendation and Way Forward .....</b>	<b>201 - 207</b>
--	------------------

**SECTION ONE**  
**OPENING CEREMONY**

## TABLE OF CONTENT

1.	Welcome Address by Director General, Council for Scientific and Industrial Research .....	1
2.	Introduction of Sawah Eco-Technology by Leader of Sawah Project.....	4
3.	Address by JIRCAS Representative.....	6
4.	Address by Africa Rice Representative .....	7
5.	Address by Nigeria Representative.....	8
6.	Objectives of Workshop by Director, Soil Research Institute.....	9
7.	Keynote Address by the Honourable Minister for Environment Science and Technology.....	10



**WELCOME ADDRESS BY DIRECTOR-GENERAL OF THE COUNCIL FOR  
SCIENTIFIC AND INDUSTRIAL RESEARCH (CSIR-GHANA).**

**Alhaji Dr. ABDULAI B. SALIFU**

Mr. Chairman, Honorable minister of Environment, Science and Technology, Executive Director of JIRCAS, Visiting Directors Scientists from Japan and sister West African Countries, Representative of Africa Rice, Renowned Scientists and Research Fellows, Policymakers, Stakeholders and Industrialists, Directors of CSIR Institutes, Farmers, Members of the Press,

It is a great pleasure from me to you all to the international workshop on "SAWAH" Eco-technology and Rice Farming (SERIF) in Ghana, Nigeria and sub-Saharan Africa. We are honored this morning to have our Honorable Minister of Food and Agriculture, Honorable Mr. Kwesi Ahwoi, who chairs this function, the Honorable Minister of Environment, Science and Technology, Honorable Sherry Ayitey, and other dignitaries, policymakers, renowned researchers and scientists from Japan, Nigeria, Benin, Togo and Ghana. On behalf of the Council for Scientific and Industrial Research (CSIR-Ghana) and my own behalf, I welcome you all to this very important workshop. I have no doubt that your presence and contribution at this workshop will impact positively on rice farming in sub-Saharan Africa.

Mr. Chairman: Rice production in West Africa is outstripped by consumption. No country in West Africa is self-sufficient in rice production. Per capita rice consumption continues to show an upward trend, especially in urban areas. In the decade 1979-81 to 1989-91, the demand for rice in West Africa almost doubled, growing from five million tons in 1979-81 to over nine million tons in 1989-91. In Ghana, commercial rice imports accounted for about 61% of rice consumption per annum over the four years 2000 to 2003. Current estimate indicate that imported rice accounted for about 70% of rice consumed in Ghana averaging about 7 million metric tons in 2007, 2008, and 2009. The self-sufficiency rate in rice production in Ghana is about 30% leaving a short fall of 70%, estimated at about 450 million dollars, to be imported annually to augment local rice supply. Several efforts have been made in the past and present to boost production but we are still challenged by issues such as lack of good quality seed and inappropriate processing technology which does not allow domestically processed rice to match the quality of imported rice in terms of homogeneity and cleanliness. Ghanaian rice consumers are very choosy and are ready to pay a higher price for imported and well packaged rice.

CSIR-Ghana is the largest scientific research organization in the country, with thirteen (13) research institutes strategically spread nation-wide; each of which has a mandate covering specialized areas of importance for growth and development of the nation. Through its institutes the CSIR has contributed immensely to national socio-economic development.

CSIR technologies underline varieties deployed originate almost exclusively from CSIR institutes of the Crops Research and Savannah Agricultural Research Institutes respectively. In recent times these Institutes have in addition to several lowlands rice varieties, released at least NERICA varieties destined for upland production, which are being grown by more than 25,000 farmers country-wide.

The huge expenditure encumbered by West African countries on rice importation is worrying for its negative socio-economic effects. It means countries with largely poor households spend millions of scarce foreign exchange on rice imports only to crowd out local farmers and processors from the domestic market, resulting in job losses and increased poverty and food insecurity, especially among rice and other-chain actors.

There is therefore an urgent need for technical innovation to promote efficiency in local rice production through the dissemination of new technologies, in collaboration with rice farmers to increase productivity in local rice production, generate employment, improve incomes, reduce poverty, increase food security and ensure environmental sustainability. Ladies and gentlemen the *Sawah* eco-technology has the capacity to assist in the achievement of these goals.

Mr. Chairman, Honorable Minister; The *Sawah* eco-technology provides a boost to lowland rice production by effectively managing land, water control and nutrients. *Sawah* in brief refers to a system in which a rice field is demarcated, bundled with water inlet and outlet, puddled and leveled. It is developed using a power tiller and simple farm tools, all which can be within the means of small holder rice farmers. The *Sawah* system improves the productivity of rice by reducing weed incidence and increasing rice yields. On the whole *Sawah* Eco-technology has been observed to improve fertilizers and irrigation efficiency, improve water shortage, soil nutrition, especially nitrogen and phosphorus supply, neutralizes acidity and alkalinity and improves micronutrients supply. The system is also environmentally friendly, minimizes erosion, reduces land degradation and increases nutrient-use-efficiency.

Mr. Chairman, Distinguished Ladies and Gentlemen: Much as we will have wished to see this productivity-enhancing technology up-scaled across a wider catchment, there are a couple of teething challenges that need to be overcome. Some of the major challenges to the adoption of the technology are funding, lack of institutional support by ministries, departments and agencies, lack of credit to purchase machinery to facilitate ready, faster, and effective land preparation and cultural constraints, including land tenure systems.

Mr. Chairman: Fortunately this workshop provides us with an opportunity for our policymakers, industrialists, research scientists, research fellows and farmers to discuss and exchange information and experiences towards the scaling-up and dissemination of the *Sawah* Eco-technology. On a personal note I wish to underline emphatically that the drive towards self-sufficiency in domestic rice production in African countries is possible with the *Sawah* Eco-technology.

Finally, Mr. Chairman and Distinguished Ladies and Gentlemen: on behalf of the Council for Scientific and Industrial Research (CSIR-Ghana), the organizers of this workshop and on own behalf; I once again welcome you all to this important workshop. Hopefully the outcome will lead to the development of strategies to enhance the application of the *Sawah* Eco-technology across a wider agro-ecology and other rice growing regions in the West African sub-region and sub-Saharan Africa.

I wish you successful deliberations. Thank you very much.

**INTRODUCTION OF SAWAH ECO-TECHNOLOGY BY THE LEADER OF  
THE SAWAH PROJECT AND PROFESSOR AT SCHOOL OF  
AGRICULTURE, KINKI UNIVERSITY, JAPAN:  
Prof. T. WAKATSUKI**

Honourable Minister for Environment, Science and Technology, Director General of the Council for Scientific and Industrial Research (CSIR), Mr. Chairman from the Ministry of Food and Agriculture, Distinguished Guests, Ladies and Gentlemen,

I am very delighted that we are gathered here today with the sole purpose of improving, promoting and enhancing rice production for ensured food security, under the *Sawah* system. What is a *Sawah*? *Sawah* is farmers' made structures and systems to control water and conserve soils in order to maximize and sustain rice yield. *Sawah* is like a factory to produce paddy rice. If we have good *Sawah*, we can produce more paddy rice.

What is a *Sawah* eco-technology? *Sawah* ecotechnology offers farmers skills and technology on how to improve their agricultural land, in terms of water and soil conditions. Thus good high yielding rice varieties will perform well under proper fertilization and effective use of agrochemicals. Governments' irrigation and drainage projects can only be effective under farmers' *Sawah* eco-technology and skills. The most important thing is that *Sawah* eco-technology empowers farmers. Farmers can develop their own personal irrigated rice fields by themselves without necessarily waiting for government support. Thus the *Sawah* ecotechnology has the potential for the realization of the long awaited green revolution in Ghana, Nigeria, Togo, Benin, and West Africa as a whole.

Ladies and Gentlemen, What is eco-technology?

The target of eco-technology is to improve rice growing environment to maximize the potential of rice varieties. Biotechnology can improve rice variety, while ecotechnology will improve rice environment. During the last 40 years, major research on rice development has mainly focused on varietal improvement and largely neglected ecosystem improvement. Agriculture must integrate biological science and technology as well as ecological/environmental science and technology. Therefore both biotechnology and ecotechnology have to be developed in a balance way so as to be able to increase and sustain rice production.

Ladies and gentlemen! Finally I would like to thank sincerely and deeply the

following people: the late Dr. Ernest Otoo of Crops Research Institute, late Dr. R. D. Asiamah of Soil Research Institute, and late Dr. J. Cobbina of Forest Research Institute of Ghana. The *Sawah* eco-technology research started with them in 1994 and officially ended in 1997 as JICA/CSIR *Sawah* Project. The three of them, I believe are in heaven now and I am confident they would be congratulating themselves and we all gathered here, on this 1<sup>st</sup> International *Sawah* eco-technology workshop. I thank you all and wish you a successful workshop.



**ADDRESS BY JAPAN INTERNATIONAL RESEARCH CENTER FOR  
AGRICULTURAL SCIENCES (JIRCAS) LAISON OFFICER FOR AFRICA.  
Dr. TETSUJI OYA.**

Honorable Minister of Environment, Science, and Technology, Director General of CSIR, Distinguished guests, distinguished farmers, Ladies and Gentlemen,

It is my great pleasure to be here to participate in this workshop on "Sawah" eco technology and rice farming in Sub-Saharan Africa'. With increasing demand for rice in Africa, it has become more important to increase rice production. This workshop is important to understand how we can increase rice production in Africa. This year, JIRCAS started a new mid-term plan for 5 years. We have three research programs, namely 'Environment and natural resource management', 'Stable food production', and 'Rural livelihood improvement'. Under the 'Stable food production' program, we have one flagship project, namely 'Development of rice production technologies in Africa'.

As you may know, the main project site is Ghana, collaboration with CSIR, MoFA, and Universities. This month, there were several meetings focusing on rice production in Africa. One is the 4<sup>th</sup> CARD general meeting held in Kampala, Uganda on 8<sup>th</sup> and 9<sup>th</sup> November, 2011. At the CARD meeting, it was shown that small scale mechanization is more effective and more efficient compared to large scale mechanization. We should carefully consider it. I hope we can get relevant information from this workshop.

Another is JIRCAS symposium held in Tsukuba, Japan last week on 14<sup>th</sup> and 15<sup>th</sup> November, 2011. The title of the JIRCAS symposium is, 'Trends of international rice research and Japanese contribution -Support to GRiSP (Global Rice Science Partnership) and CARD (Coalition for African Rice Development). I would like to share with you some of the key discussion at the symposium: (i). Monitoring system and feedback is important, (ii). Weed is one of the most serious problems in rice production and (iii). Not only breeding and genetics, but also ecological and environmental improvements for rice production are important.

I hope this workshop will bring us some suggestions on those discussions. I further hope the outcome and results of this workshop will be shared and disseminated among all stakeholders to increase rice production in Africa.

Thank you very much.

**ADDRESS BY AFRICA RICE REPRESENTATIVE**  
**Dr. SANDER ZWART**  
**PROJECT COORDINATOR, SMART-IV**

Ladies and Gentlemen,

On behalf of the Director General of the Africa Rice Center in Cotonou, Benin, I wish you a warm welcome to the first international workshop on 'Sawah' System Development.

The Africa Rice Center or Africa Rice in short, was created in 1971 by 11 African countries and is a true African organization. It started as the West African Rice Development Organization (WARDA). It has become a leading pan-African research organization working to contribute to poverty alleviation and food security in Africa through research, development and partnership activities. It is one of the 15 international agricultural research centers supported by the Consultative Group on International Agricultural Research (CGIAR). Three years ago, the institute changed its name to the current Africa Rice Center following the membership of countries not located in West-Africa. Today its membership comprises 24 countries, covering West, Central, East and North African regions, namely, Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Côte d'Ivoire, Democratic Republic of Congo, Egypt, Gabon, the Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Madagascar, Mali, Mauritania, Niger, Nigeria, Republic of Congo, Senegal, Sierra Leone, Togo and Uganda.

Since 2009 Africa Rice is involved in 'Sawah' System Development. The SMART-IV Project, which is supported financially by Japan's Ministry of Agriculture, Forestry and Fisheries (MAFF), started in October 2009 to examine the potential of 'sawah' technology transfer and 'sawah' system development (SSD) in inland valleys in African environments. In Nigeria and Ghana, 'Sawah' System Development was initiated in the 90's. The SMART-IV project closes the geographical gap between both countries by focusing on Togo and Benin. It is expected to benefit from the experiences from researchers and developers in these countries. This workshop is part of this process of knowledge transfer. Currently 10 employees of the extension services in Benin and Togo are present here in Kumasi to follow and train on 'Sawah' System Development. The training is organized by the Soil Research institute of Ghana.

Ladies and gentlemen, Africa Rice is happy to be part of this workshop and it is a great pleasure to be here. I wish you a very productive workshop.

**ADDRESS BY A REPRESENTATIVE OF NIGERIA  
SENIOR AGRIC. SERVICES ADVISER, NATIONAL THIRD  
FADAMA PROJECT  
Dr. AYODELE A. ADENIYI,**

Mr. Chairman, Honorable Minister of Environment, Science, and Technology, Director General of CSIR, Directors of CSIR and MoFA, Scientists, distinguished guests, distinguished farmers, Ladies and Gentlemen,

The Federal government of Nigeria will like to be associated with the 1st International workshop on "*Sawah*" Eco-technology and Rice Farming in sub-Saharan Africa taking place in Kumasi, Ghana.

Rice is one of the pilot crops of Nigeria Incentive Risk Sharing Coordination Agriculture Lending (NIRSAR) program designed to increase food production and stop importation. Ghana is similar to what obtains in Nigeria. In a recent ministerial briefing in Nigeria, it was mentioned that the country is second largest importer of rice and as such, conscious efforts be made to change the scenario.

At the moment, average yield of rice on farmer's field is between 1.5 - 2.0 tons per hectare. The introduction of *Sawah* technology will go a long way in yield increases under a proper water and land management regime. *Sawah* technology in Nigeria is anchored in the National Centre for Agricultural Mechanism (NCAM) in partnership with Kinki University of Japan with collaborative effort with the National Fadama Office. The technology is being demonstrated in 13 pilot states (out of 36 states and Federal Capital Territory of Nigeria). Reports received indicate high increases in yield are being achieved. Reports coming in from the States show 7.2 tons per hectare in the north-west, 6.5 tons per hectare in the south-east and 3.5 tons per hectare in the south-west.

The institutional arrangements for scaling up the "*Sawah*" technology exist in the country through the network of the National Fadama Coordination Office. The Fadama III Project is being implemented in all the states of the country. Because of the importance we attach to this workshop, the Nigerian team this workshop comprises technocrats and farmers. On behalf of the team, I wish you all happy and fruitful deliberations.

**OBJECTIVES OF WORKSHOP BY  
DIRECTOR, CSIR - SOIL RESEARCH INSTITUTE  
Dr. J. O. FENING**

Mr. Chairman, Director General of CSIR, Prof. Wakatsuki of Kinki University, Representative of Africa Rice, JIRCAS Liaison Officer for Africa, Directors of CSIR Institutes, Directors of MoFA, Distinguished Scientists, Farmers, Members of the Press, Ladies and Gentlemen,

The *Sawah* technology for rice production advocates for effective nutrient utilization and water management for increased rice production in lowlands. The system embraces research and extension to conserve soil fertility depletion and improve the livelihood of farmers through the use of local and affordable resources. The system is also environmentally friendly as soil disturbance is very minimal during land preparation. Over 2000 farmers have been beneficiaries to the system and are currently enjoying higher yields of > 6.0 tons per hectare. This is a significant improvement in yield when compared to the traditional system where average yields hardly exceeded 1.0 ton per hectare.

Research in the sawah system has been on-going in close collaboration with a wide range of partners including: extension, farmer-groups, researchers in Nigeria and the private sector who are gathered here with the following objectives among others:

- (i) to showcase the principles and practices of the sawah system,
- (ii) to share knowledge and experiences from research and farmers view point and identify gaps for re-dress,
- (iii) to promote the technology as the best option currently for lowland rice production in the sub-region and
- (iv) to effect government policy directives in the promotion and adoption strategies of improved technologies such as sawah, if self sufficiency in rice production and guaranteed food security are to be achieved.

The yield between actual and achievable is very wide currently and I am convinced that with a wider adoption of sawah, this gap will very soon be closed significantly. I thank you all very much.

**KEYNOTE ADDRESS DELIVERED BY THE MINISTER OF  
ENVIRONMENT, SCIENCE AND TECHNOLOGY (MEST), GHANA.  
Hon. SHERRY AYITTEY**

Mr. Chairman, Director- General of CSIR, Representative of Kinki University (Prof. Wakatsuki), Representative of Africa Rice, Representative of JIRCAS, Representative of JICA, Directors of CSIR Institutes, Directors of MOFA, Distinguished Research Scientists, Dear Farmers, Members of the Press, Ladies and Gentlemen,

It is a pleasure for me to join you in the first ever international workshop to be held on the "Sawah" eco-technology. I wish to sincerely thank the Kinki University and the CSIR for making it possible for me to be part of this important program. I have no doubt in my mind that this workshop will mark yet another milestone in the research and development activities of the CSIR of Ghana, Africa Rice, Kinki University, JIRCAS and the collaborative partners in Nigeria and other countries within the sub-region.

Mr. Chairman, since the success of green revolution in Latin America and in Tropical Asia in the 1970s, similar research oriented activities for a green revolution has intensively and extensively been conducted in sub-Saharan Africa (SSA). However, up to date, the green revolution is yet to be realized. Rice is an important staple food for all parts of SSA and instead of the crop being grown in these countries where people can be employed, rural incomes raised, poverty reduced and food security ensued, rice is rather mainly imported into these countries, even though many countries in the sub-Saharan Africa have suitable environments for its' production. While International research organizations like Africa Rice in collaboration with NARS of various countries have developed innovative technologies for rice production, a successful path to a green revolution is still not clear to SSA.

Mr. Chairman, even though there have been several research concepts to improve natural resource management, there seem to be no clear research concept on how to improve resources such as soil and water conditions at the farmers field level. The "Sawah" eco-technology is one of such missing concepts designed to improve natural resource management in majority of African rice farms.

Ladies and Gentlemen, I am reliably informed that the "Sawah" eco-technology concepts can accelerate improvements in effective natural resource management,



minimize environmental degradation and increase soil productivity under African conditions. Under uneven distribution of rainfall due to climatic conditions, the "Sawah" technology has simple but effective ways of harvesting water for use at farm level. SSA has an abundance of inland valleys, where "Sawah" eco-technology can be easily practiced. I am concerned that increase in severity of the loss of biodiversity, desertification and land degradation, exacerbated by the effects of climate change are major problems that countries have to address with respect to food security.

I note that the intensity of desertification of most Africa's arable land is a serious challenge for sustainable development in Africa. Most of the land in Africa is prone to land degradation and suffers the worst impacts of drought, desertification and deforestation, with 65 percent of the population affected. In this regard it is important to recognize the economic and social significance of land, particularly, its contribution to growth, food security, and poverty eradication, and step up efforts to effectively implement initiatives at local, sub regional, regional and nation levels to combat these problems, in order to promote sustainable land management and to reinforce north-south and south-south cooperation.

Mr. Chairman, Africa is characterized by highly variable rainfall and an uneven distribution of water resources, which is exacerbated by the effects of climatic change.

Mr. Chairman, drought in grain-producing countries, reduced crop yields, depleting cereal stocks and the multiple demands on existing stocks for human and animal consumption have resulted in persistent high food prices in many African countries. While the interventions undertaken jointly with affected communities and the international community have boosted food output, am concerned about the high cost of food in Africa. It is, therefore important, to take measures to ensure that the benefits derived from such efforts and initiatives trickle down and contribute positively to reducing hunger and poverty. We invite developed countries to provide developing countries with sound technologies, particularly biotechnologies, bearing in mind the precautionary principles, to increase production in the agricultural sector.

Mr. Chairman, ladies and Gentlemen, African lowlands are quite diverse with different environmental settings. It is my hope therefore that, this workshop will come out with suitable site-specific development and management technologies which can be easily disseminated for their effective and sustainable utilization. The development of such technologies and their management by local farmers through

self propelled efforts and the use of small-scale equipment such as power tillers are needed under African conditions, to help mitigate the effect of climate change on our natural resources particularly the soil. It is therefore prudent that for sustainable agricultural production and the realization of the green revolution in the sub-region, there is the urgent need for a balance between technology development and its application. There needs to be a balance between varietal improvement through biotechnology and environment improvement through eco-technology. For quite some time now, more emphasis has been laid on bio-technological research and technology development, to the neglect of eco-technological research and technology development in sub-Saharan Africa.

The "Sawah" eco-technology has been observed to improve fertilizer use efficiency, irrigation efficiency, improved nutrient supply especially nitrogen and phosphorus, neutralize acidity as well as alkalinity, and improve micronutrients supply. The "Sawah" system of rice production therefore seeks to improve on lowland rice production by helping to effectively manage land, control water and nutrients to boost local rice production. Results have been very good so far, with average yields of 5-7tons/ha being very common among "Sawah" farmers across locations. I hope this workshop will critically examine its applicability within a wider agro-ecology as well as scaling it up to cover the sub region.

Mr. chairman, the government and people of Ghana are very grateful to Japan Society for Promotion of Science; Ministry of Education; Culture; Science and Technology; Ministry of Agriculture; Fisheries and Forestry and Japan International Cooperation Agency, for providing funding that led to the development of the "Sawah" technology. We are also grateful to all other research organizations and scientists who collaborated with their colleagues in Ghana to make this dream come true. I have been informed that some of the major challenges of the adoption of the technology are lack of funding, lacking of institutional support, cultural constraints (land tenure) and lack of credit lines to purchase machinery.

The Ministry of Environment, Science and Technology(MEST) and the Ministry of Food and Agriculture will work closely together to accelerate rice production while also protecting the environment by putting in place the necessary legislative and policy frameworks geared towards a faster adoption of environmentally friendly technologies like "Sawah".

I thank you very much and wish you a successful workshop.