

# JIRCAS Newsletter

*for*

INTERNATIONAL COLLABORATION



Building thatched roof panels with cogon grass in Laos (Photo by Dr. Hidetoshi Asai)

Special Feature: JIRCAS's Contribution to the Sustainable Development Goals (SDGs)

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# JIRCAS and the SDGs

The Sustainable Development Goals or SDGs, as has been known since its adoption by the UN General Assembly in 2015, refer to a set of 17 goals that aim to address global issues affecting humankind and solve the problems within the next 15 years (by 2030). JIRCAS's research projects are closely related to these goals and 169 associated targets (see chart below). Even before the adoption of the SDGs, some numerical goals directly related to JIRCAS's activities, such as poverty and malnutrition alleviation mostly in developing regions, had already been specified in the Millennium Development Goals (MDGs: 2000-2015) of the UN. In 1996, one of the earliest numerical targets for achieving the development goals to address common global issues (i.e., aiming to halve the number of malnourished people) was agreed upon at the World Food Summit. The food issue, so to speak, is the origin of the SDGs. The second SDG, titled "Zero Hunger," emphasizes the necessity of agricultural research and technological development, which is accordingly within the scope of JIRCAS's activities.

JIRCAS's mission is to contribute to the improvement of agricultural technologies, including forestry and fisheries technologies, in the tropics and subtropics as well as in developing regions. JIRCAS's vision statement, meanwhile, directs itself to propose optimum technologies for solving difficult global problems by making full use of up-to-date scientific knowledge. The recent activities of JIRCAS, as specified in the Third Medium-term Plan (FY2011-2015) and the Fourth Medium to Long-term Plan (FY2016-2020), have been formulated under the strong influence of international development goals such as the MDGs and SDGs. The outcomes of JIRCAS's research programs directly correspond to these goals, and great importance is placed on having common goals in conducting collaborative projects or promoting cooperation with a wide range of counterpart institutions, including international bodies.

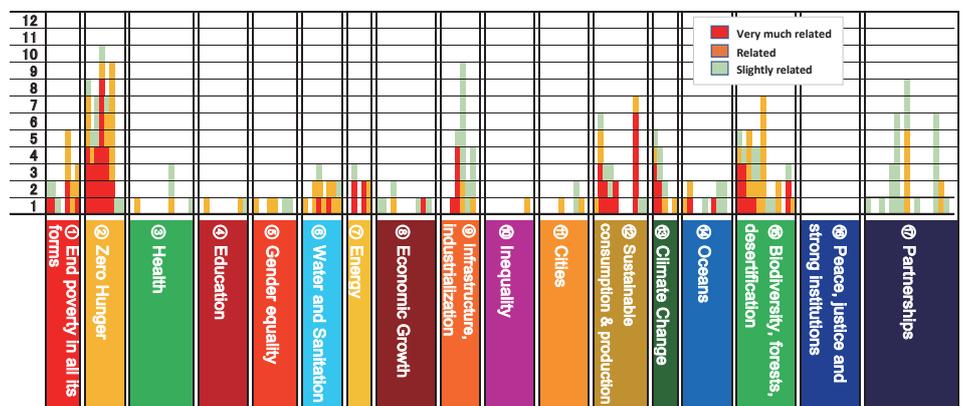
The Fifth Science and Technology Basic Plan of the Japanese government highlighted the importance of making a contribution to find solutions to global issues and promoting inclusive innovation together with emerging and developing countries. It also mentioned the elevation of international presence through science and technology diplomacy. As for the SDGs, a new office headed by the Prime Minister was created, and the office has developed an action plan that includes a major item encouraging Japan to lead "Science, Technology and Innovation for the SDGs" in the



international community. The Association of National Research and Development Agencies, composed of all 27 agencies including JIRCAS, has ensured that its research activities need to be aligned with the SDGs, and discussions related to the necessary budget allocation are ongoing.

JIRCAS is a precious institution because of its continuing activities based on the principle of "contributing to solving global problems through science and technology development" for nearly half a century (including the period of its predecessor, the Tropical Agriculture Research Center). As a member of JIRCAS, I am personally very proud of such an institution for having been ahead of its time. The SDGs cover not only global problems but various domestic issues as well. The adoption of the SDGs was meant to ensure that "no one will be left behind" regardless of status, whether developed or developing countries. Therefore, JIRCAS will continue to make meaningful contributions to the SDGs, leading towards a win-win situation where Japanese and world agriculture become more prosperous together.

**Osamu Koyama**  
**Vice-President**  
**JIRCAS**



Relationship between JIRCAS Projects (14+1) and 169 SDG Targets

# Achieving the SDGs through Development of Agricultural Technologies for Environment and Natural Resource Management



The Environment and Natural Resource Management Program (Program A) under JIRCAS's current five-year Medium to Long-term Plan, which commenced in April 2016, aims at developing agricultural technologies and adaptation measures to mitigate global-level environmental problems such as climate change and environmental degradation, and to cope with abrupt environmental fluctuations especially in developing regions in Asia and Africa. This will be achieved through collaborative research with counterpart institutions and with the participation and consent of local agencies and farmers for the efficient and dependable dissemination of technologies and measures.

In this article, we discuss the activities of Program A and its contributions to achieving the Sustainable Development Goals (SDGs), which was adopted by the General Assembly during the UN Summit in September 2015. Program A aims to develop technology options to combat climate change and environmental degradation, with the research outcomes

expected to contribute chiefly to Goal 13 (**Climate Action**) and Goal 15 (**Life on Land**) (Photo 1), as well as Goal 9 (**Industry, Innovation and Infrastructure**) for scientific innovations in agricultural technology and Goal 12 (**Responsible Consumption and Production**) for the realization of sustainable agricultural production. Moreover, we help towards reaching Goal 17 (**Partnerships for the Goals**) by working with local counterparts for technology development and dissemination. Furthermore, our technology options are to be deployed in agricultural production sites, thus contributing to Goal 2 (**Zero Hunger**).

Below we describe the four projects under Program A and each project's contribution to the SDGs.

First is "Climate Change Measures," Program A's flagship project, which proposes technology options for reducing greenhouse gases (GHGs) from agricultural activities and for promoting adaptation measures to increase the resilience of rural farmers or villages to extreme climate events such as droughts, high temperatures, and floods. The project, obviously,



Photo 1. An experimental field at Lopburi, Thailand, where organic matter has been successively applied to the soil since 1976. The increase in soil carbon contributes to SDG 13 (Climate Action) and SDG 15 (Life on Land).



Photo 2. Measurement of GHG emissions from paddy fields in Mekong Delta, Vietnam. The alternate wetting and drying (AWD) technology for reducing GHGs contributes to SDG 13 (Climate Action).

contributes to Goal 13 (**Climate Action**). It also contributes to Goal 6 (**Clean Water and Sanitation**) as it deals with the “sustainable management of fresh water (Target 6.4),” with water management technology options like AWD (alternate wetting and drying), which reduces methane emissions from paddy fields, and irrigation schemes that help increase water productivity (Photo 2). Moreover, Goal 1 (**No Poverty**), whose targets include “building resilience to reduce vulnerability (Target 1.5)” and Goal 8 (**Decent Work and Economic Growth**), whose targets include “expanding access to insurance service (Target 8.10)”, have been added as the project tries to develop a weather index insurance plan for extreme weather events.

Second is the “Africa Watershed Management” project, which develops technology options to conserve agricultural lands by stopping severe desertification and forest degradation, thereby contributing to several targets under Goal 15 (**Life on Land**). A part of the project’s activities is presented in the book “A Better World, Volume 4: Life on Land,” a book series that introduces the activities of contributing institutions and organizations all over the world toward realizing the SDGs (Photo 3).

Third is the “Resource Management in Asia and Pacific Islands” project, which develops technology options for proper management of water, soil, and fertilizer in areas where such natural resources are not

sustainably managed. An important issue is the compatibility of agricultural development and environmental conservation especially in island ecosystems. The activities contribute toward reaching Target 10.2 (to achieve the sustainable management and efficient use of natural resources) and Target 12.a (to strengthen their scientific and technological capacity to move towards more sustainable patterns) under Goal 12 (**Responsible Consumption and Production**). They are also thought to contribute toward meeting several targets under Goal 14 (**Life below Water**) and Goal 6 (**Clean Water and Sanitation**).

Fourth is the “BNI Utilization” project, which develops technologies associated with the biological nitrification inhibition (BNI) function in plants. BNI deployment in agricultural sites results in more efficient nitrogen (fertilizer) use by crops and a reduction of nitrous oxide (N<sub>2</sub>O) gas from agricultural lands. The former contributes to Goal 12 (**Responsible Consumption and Production**) as it applies to Target 12.a (to strengthen their scientific and technological capacity to move towards more sustainable patterns), while the latter contributes to Goal 13 (**Climate Action**) covering several targets.

*Satoshi Tobita*  
*Program Director*  
*Environment and Natural Resource Management*

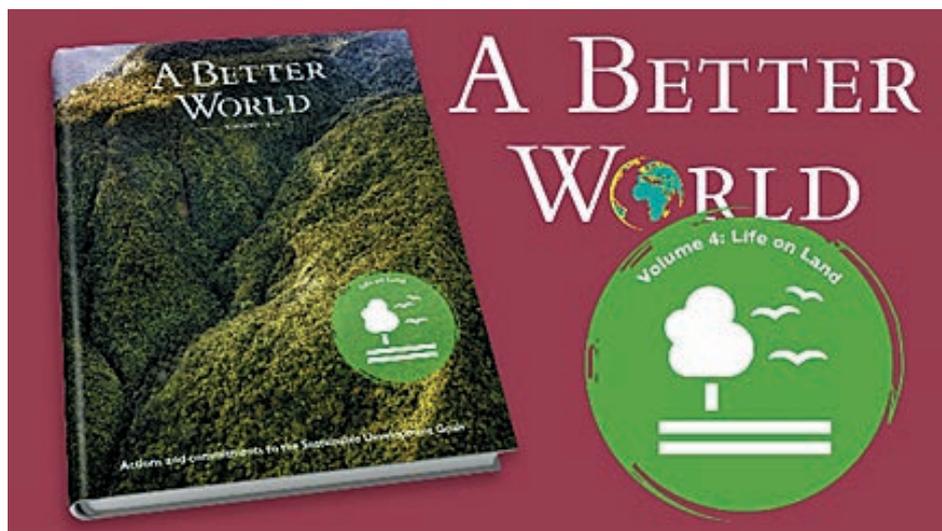


Photo 3. The book “A Better World, Volume 4: Life on Land” introduces the activities of the “Africa Watershed Management” project, which contributes to SDG 15.

# Contribution of the Stable Agricultural Production Program to the SDGs



In 2015, the UN General Assembly adopted the 17 “Sustainable Development Goals” or SDGs, which are international goals aimed at realizing a world where “no one is left behind,” encompassing a wide range of issues affecting the economy, society, and environment. Goal 2 of the SDGs calls on all nations to “end hunger, achieve food security and improved nutrition, and promote sustainable agriculture (**Zero Hunger**).” Finding ways to overcome food shortage in sub-Saharan Africa (SSA), where 215 million people are currently undernourished, would be its contribution toward meeting this challenging goal.

JIRCAS’s Program B seeks to develop technologies for stable agricultural production in the tropics and other climate-sensitive environments where productivity potential has not been maximized because of low fertility or adverse conditions. We verify these technologies in the fields in developing regions including the tropics through collaborative research with local institutions and international research centers. We implement and promote the research activities of the following four projects under the program, with all outputs expected to contribute across multiple goals in the SDGs, especially Goal 2.

(1) Food Security in Africa: Our project researchers work on the development of sustainable technologies to increase agricultural productivity and improve food security in SSA, focusing on three sub-themes: “rice production enhancement,” “regional crop utilization,” and “crop-livestock integration.” In addition to Goal 2 of the SDGs, this project also contributes to Goal 1 (**No Poverty**). Madagascar, one of our project sites, is one of the largest rice producers in

Africa (with a per capita rice consumption twice as high as Japan’s) but its rice productivity has remained stagnant because of the lack of fertilizer input and nutrient-poor soils as occurring in many other areas of Africa. The project, therefore, aims to develop rice production techniques to realize high yield even under low fertility conditions by combining fertilizer application techniques suited to the soil nutrient characteristics of the field and new breeding lines with high nutrient use efficiency. We also evaluate the impact of adopting such techniques on the income and nutritional status of local farmers.

(2) Environmental Stress-Tolerant Crops: For this project, we study the development of breeding materials and basic breeding technologies for highly productive crops adaptable to adverse environments, with the aim of establishing stable and sustainable production of agricultural crops such as rice and soybean in developing countries that are vulnerable to climate change, drought, high



Characterization of nutrient distribution in the field using drones or UAVs (unmanned airborne vehicles). The fertilizer application techniques suited to the soil nutrient characteristics of the field contribute to SDG 2 (Zero Hunger) and SDG 1 (No Poverty).

salinity, and poor soil. In addition to Goal 2 of the SDGs, this project also contributes to Goal 13 (**Climate Action**). We were the first in the world to report the draft genome sequence of quinoa, a food crop with high nutritional value and tolerance to environmental stresses. This achievement furthers the development of crops with excellent environmental adaptability and nutritional characteristics.

- (3) **High-Yielding Biomass Crops:** This project aims to develop breeding technologies and utilize promising high-yielding biomass crops in adverse environments. In addition to Goal 2, this project also contributes to Goal 7 (**Affordable Clean Energy**). We develop new breeding materials that produce high biomass yield in several unstable environments through intergeneric hybridization between sugarcane and *Erianthus*, which is a wild relative of sugarcane tolerant to unstable environmental conditions. We also develop utilization technologies for multi-purpose sugarcane and *Erianthus*. Last year, in cooperation with other organizations including the National Agriculture and Food Research Organization (NARO), we were able to successfully process *Erianthus* into commercial-grade pellet fuel and thus achieve regional self-sufficiency in fuels.
- (4) **Pest and Disease Control:** Finally, we also develop

technologies for the control of migratory plant pests and transboundary diseases. In addition to Goal 2 of the SDGs, this project also contributes to Goal 15 (**Life on Land**). We conduct research studies to develop technologies for the control and prevention of migratory rice planthoppers, which damage rice in Southeast Asia and Japan; desert locusts, which form large swarms and threaten food security; and leafhoppers, which transmit sugarcane white leaf disease, the most devastating disease affecting sugarcane production in Southeast Asia. We also develop rice breeding lines resistant to blast (for Asia) by incorporating field resistance genes, as well as soybean cultivars resistant to rust (for South America) by pyramiding resistant genes through international research networks that we have constructed.

Through these studies, we contribute to multiple SDGs especially Goal 2. Likewise, through stable agricultural production and nutrition improvement in developing regions, we contribute toward achieving global food security in the future.

**Kazuo Nakashima**  
**Program Director**  
**Stable Agricultural Production**



Selection of rice lines with high productivity in phosphorus-deficient fields of Madagascar. The new breeding lines with high nutrient use efficiency contribute to SDG 2 (Zero Hunger) and SDG 1 (No Poverty).

## Contribution to the SDGs through Utilization of Regional Resources and Value-adding Technologies –Lessons from Laos–



The Value-adding Technologies Program (Program C) addresses the utilization of various regional resources in Asia (e.g., traditional food materials, fermented foods, indigenous agricultural products, forestry and fishery resources) and the development of high value-adding technologies in order to increase productivity and deliver products that are economical and have enhanced nutritional values. The program consists of five research projects, namely, (C1) Food value chain, (C2) Asia biomass, (C3) Multiple use of regional resources in semi-mountainous villages, (C4) Higher value forestry, and (C5) Aquatic production in tropical areas. The program covers various fields including agriculture, forestry, fishery, and the food industry, thus our activities are relevant to many Sustainable Development Goals (SDGs). In particular, we directly contribute towards achieving Goal 2 (**Zero Hunger**), Goal 7 (**Affordable and Clean Energy**), Goal 9 (**Industry Innovation and Infrastructure**), Goal 12 (**Responsible Consumption and Production**), Goal 14 (**Life below Water**), and Goal 15 (**Life on Land**).

From within studies closely linking with their life and livelihood in developing regions, we introduce our challenges in Laos which are the representing activities stand by the SDGs emphasize the principles that would guide efforts

to end poverty and protect the environment to ensure peace and prosperity for all people in both developed and developing regions.

Laos is located inland on the Indochina Peninsula. Its principal industry is agriculture, with approximately 70% of the labor population engaged in it. It is classified as among the least developed countries (LDC) and GDP per capita (2400-2500 USD) is still at a low level. Hence, enhancing agricultural productivity is strongly required to improve their livelihoods and nutrition.

JIRCAS's Program C has been implementing dietary investigations to evaluate animal-based protein sources and the nutritional content of rice, freshwater fish, and shellfish in Laos. Through these studies, the variety of food resources and the seasonal patterns in nutritional status are gradually becoming clear. In addition, we have been tackling issues affecting indigenous freshwater fish aquaculture in paddies and small ponds. This should help realize a stable food supply without resorting to fishing from rivers and swamps and disturbing natural ecosystems. Furthermore, we have been doing experiments to improve current fermentation techniques for better food preservation. Whereas food access is restricted by economic and locational factors, our approach to research, i.e., by assessing the value of familiar edible materials, providing guidelines, and promoting techniques for nutrition improvement,

would significantly contribute to SDG2, which intends to “end hunger, achieve food security and improved nutrition, and promote sustainable agriculture.”

Aiming to graduate from its LDC status, the government of Lao PDR launched its national strategy called “the 8th Five-Year National Socio-economic Development Plan (2016-2020),” which focused on ensuring sustainable development and achieving the SDGs through economic growth, social development, and

environment conservation. As JIRCAS’s current 5-year plan enters its latter stage, we hope to further enhance and accelerate our studies in Laos in line with their policies, and contribute toward achieving their national goals and eventually the SDGs.

*Yukiyo Yamamoto*  
*Program Director*  
*Value-adding Technologies*



Meals at a farmer’s house



Fish vendor at a local market



Dietary investigation at the village

# The Food and Nutritional Balance Project: Program D's Contribution to the SDGs



We humans cannot produce all our required nutrients by ourselves. In order to live and to live a healthy life, we need to take appropriate amount of nutrients from plants or animals; however, nutrients are not always easy to obtain from nature. The development of agriculture and fisheries has supported us by promising a more stable and systematic food supply (i.e., nutrient supply). Nevertheless, agriculture depends on weather variables such as temperature and rainfall, so production targets may not be achieved as planned. Moreover, we have been seeing larger production fluctuations in recent years due to unusual weather events such as droughts or floods.

Sustainable Development Goal (SDG) 13 commits UN members to “take urgent action to combat climate change and its impacts.” In Japan, we may feel the threat of climate change these days by the increasing frequency of large-scale typhoons or torrential rains. According to the report of the Intergovernmental Panel on Climate Change (IPCC), the rise in temperature and uneven distribution of rainfall will become more extreme which, in turn, will surely have significant effects on agriculture.

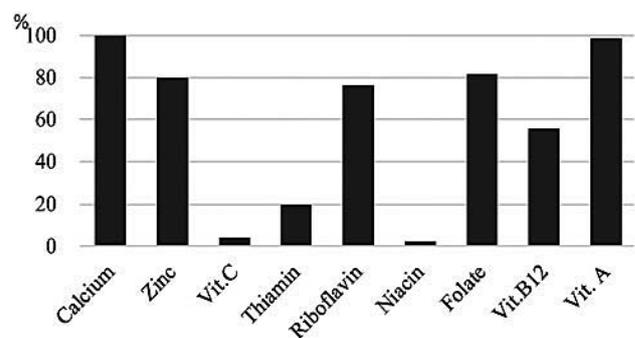
Program D's project, called “Food and Nutritional Balance,” uses our original model (The World Food Model) to simulate how global food production and nutrient supply will change in the 2040s when taking climate change into consideration. We also evaluate the impacts of agricultural technologies that JIRCAS has been developing and examine what kind of technology development is necessary at the global, country, and regional levels. By promoting effective research investment, we contribute to reducing the impact of climate change on agriculture and in our lives.

One of the targets of the Millennium Development Goals (MDGs), the predecessor of SDGs, was “to halve the proportion of people who suffer from hunger.” It became a more expanded target under SDG 2, which seeks “to end hunger, achieve food security and improved nutrition and promote sustainable agriculture.” World hunger is affecting approximately 815 million people, two

billion people are suffering from micronutrient deficiencies (hidden hunger), and there are also other problems such as obesity caused by excessive energy intake. As a result, one-third of the world's population is currently malnourished (Global Nutrition Report 2017). Malnutrition, especially in children, can be harmful in the long run as it has a lifelong impact not only on their health but also on their school performance and economic potential.

In relation to SDG 2, we try to grasp the current nutritional supply situation and show the pathways leading to nutritional improvement for a specific country or region covered by our project. We have analyzed nutritional supply and demand at the national level taking Madagascar, an island country in eastern Africa, as an example. The result showed that the supply of some micronutrients such as vitamin A, calcium, and zinc, was not sufficient because of their rice-oriented diet. It is important to explore how to improve nutritional supply considering incomes and dietary habits as well as how to increase rice production. In addition to rice, we plan to clarify the role of foods (which JIRCAS has been doing research on) from a socioeconomic aspect and will use the findings for developing our future research strategy. Through these efforts, we hope to contribute to the achievement of SDGs.

*Kunihiro Doi and Sakiko Shiratori  
Research Strategy Office*



Estimated population prevalence (%) of micronutrient deficiencies in Madagascar (2009-2013)

## The Radioisotopes Laboratory of the University of Antananarivo, Madagascar

The Radioisotopes Laboratory (Laboratoire des Radio Isotopes, LRI) of the University of Antananarivo in Madagascar is a research and education institute established in 1965 to provide research, education, and public service in the areas of health, agronomy, and environment using isotope techniques. LRI (French-only website at [www.laboradioisotopes.mg](http://www.laboradioisotopes.mg)) currently promotes research activities and education anchored on three key themes — soil and climate change, soil nutrient, and soil biology — with the aim of developing methods that will contribute toward sustainable crop production and environmental conservation.

Despite having relatively few employees (12 researchers and 7 technicians), all members are active and competent in his/her respective research tasks. With its director, Prof. Tantely Razafimbelo, at the helm, LRI has been implementing several international research projects and producing quality research outputs in collaboration with research institutes such as France's IRD (National Research Institute for Sustainable Development), INRA (National Institute of Agricultural Research), and CIRAD (Agricultural Research Centre for International Development), as well as England's Bangor University, Belgium's KU Leuven, and Conservation International (an international NGO).

JIRCAS has extended its research activities to Madagascar and collaborated with LRI at the start of the 4th Medium to Long-term Plan (FY 2016-2020). Subsequently in 2017, JIRCAS and LRI, in collaboration with other Malagasy institutes, established the new international research project entitled "Breakthrough in Nutrient Use Efficiency for Rice by Genetic Improvement and Fertility Sensing Techniques in Africa (<https://www.jircas.go.jp/ja/satreps>)" under the SATREPS (Science and Technology Research Partnership for Sustainable Development) program, a framework for research partnership between Japan and developing countries and funded by Japan International Cooperation Agency (JICA) and Japan Science

and Technology Agency (JST).

This new project aims to develop rice cultivation technologies to efficiently improve rice yield under low-input and poor soil-fertility conditions, as commonly encountered in Madagascar and elsewhere in Africa. The notable roles of LRI in this project include 1) Research on phosphorus (P) use efficiencies for rice production using isotope P (e.g.,  $^{32}\text{P}$ ,  $^{33}\text{P}$ ) techniques and 2) Evaluation of nutrient characteristics of soils and rice canopy by remote sensing using multispectral/hyperspectral sensors and drones.

The isotope technique is often used to trace nutrient dynamics in plant-soil ecosystems and to evaluate fertilizer use efficiency in agricultural research. In this aspect, LRI has been an ideal research partner because it has analytical equipment for isotope (including radioactive P isotope) tracing and its researchers have the know-how to pursue these research outputs. As for the 2nd role of LRI, remote sensing techniques are becoming increasingly important in agriculture research and development; therefore, mutual research capacity in remote sensing is being strengthened by inviting LRI researchers to JIRCAS and by installing equipment relevant to the project at LRI (Photos 1 and 2).

JIRCAS's partnership with LRI has just started but it has already been very active. The research team was also delighted to learn that Dr. Andry Andriamanjara, eminent researcher at LRI, received this year's Japan International Award for Young Agricultural Researchers (<http://www.affrc.maff.go.jp/docs/press/181002.html>), thus providing a welcome boost of inspiration to the group. The partnership's outlook is therefore extremely promising, and it is expected to become strong and long-lasting, producing significant collaborative research outputs.

***Yasuhiro Tsujimoto***  
***Senior Researcher***  
***Crop, Livestock and Environment Division***



Photo 1. Invited LRI researchers practicing unmanned aerial vehicle (UAV) /drone operation at the JIRCAS Experimental Field Station in Tsukuba



Photo 2. JIRCAS and LRI researchers implementing pot experiments at the LRI greenhouse in Antananarivo

## President Iwanaga Pays Courtesy Visit to Mauritanian Minister of Agriculture

On September 2018, JIRCAS President Masa Iwanaga travelled to Mauritania to promote JIRCAS's collaboration with the National Anti-Locust Centre (CNLA), which is under the Agriculture Ministry headed by Minister Lemina Mint El Ghotob Ould Moma. Dr. Iwanaga paid a courtesy visit to Minister Moma, and their discussion touched on the ongoing Pest and Disease Control Project, which aims to develop technologies for the control of migratory pests and transboundary diseases, and on strengthening the collaborative research implementation system.

Regarding the current project, both sides agreed that the development of effective prevention and control strategies against the desert locust would be extremely important for West African countries, including Mauritania. They also looked forward to the possibility of future cooperation on rice research as JIRCAS continues its research on improving rice seed quality and Mauritania aims to increase its own rice production.

The visit was covered by local media, signifying a strong interest on JIRCAS's research activities in the country.



Participants at the meeting. From left: Director Sid'Ahmed Ould Mohamed (CNLA), President Masa Iwanaga (JIRCAS), Minister Lemina Mint El Ghotob Ould Moma (Ministry of Agriculture), Program Director Kazuo Nakashima (JIRCAS), and Dr. Kotaro Maeno (JIRCAS)



JIRCAS President Masa Iwanaga with Mauritanian Agriculture Minister Lemina Mint El Ghotob Ould Moma

## JIRCAS Website's Open Data Portal

JIRCAS is pleased to announce that information published on its website may now be downloaded in CSV or JSON-LD formats, in accordance with the Basic Act for the Advancement of Public and Private Data Utilization (Act No. 103 of 2016). The following data are currently available: JIRCAS Reports, Conference Summaries and Events/Symposiums, Business Trip Reports, Research Highlights, Publications, and Public Notices.

As stated in Article 11, Paragraph 2 of Act No.103, this measure will contribute to enhancing public interest and enable citizens to easily use the relevant data via the Internet. Please download and use the data, which are updated regularly, through our Open Data portal (<https://www.jircas.go.jp/en/opendata>).

### JIRCAS Mail Magazine (English) Registration Guidance

JIRCAS Mail Magazine, the online quarterly publication of JIRCAS, provides information on the latest topics, events, seminars and workshops, as well as new technologies, research highlights, and guidance publications. To subscribe online, please use the following link. Thank you very much in advance.

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