

Selected themes for JIRCAS Fellowship Program FY2024

Theme 1: A comprehensive analysis of the genes affected by high sugar accumulation in microbial saccharification technology.

Host Scientist: UKE Ayaka

Location: Tsukuba, Japan

Microbial saccharification is one of the key technologies in the Carbon Cycling Project, and corporate collaboration is underway. In the proposed theme, we will conduct a comprehensive genetic analysis of the effects of high sugar concentration on saccharification bacteria. In other words, we aim to establish an advanced microbial saccharification technology by identifying relevant genes that negatively affect saccharification bacteria and elucidating the mechanism of the phenomenon in which the sugar in the culture medium reaches a plateau at a certain concentration. We are inviting researchers who have experience in biomass utilization and microbial experiments and are highly engaged in environmental sciences. Our purpose is to broaden the base of researchers in developing countries in this field and to link this to the dissemination of microbial saccharification technology and research networks.

Theme 2: BNI characterization of parental Maize CIMMYT Maize inbred Lines (CMLs) used in the development of DHL populations.

Host Scientist: G.V. Subbarao and YOSHIHASHI Tadashi

Location: Tsukuba, Japan

Maize is the world's largest cereal crop. Huge amounts of nitrogen fertilizer are applied to maintain its yield, thus necessitating the establishment of BNI-enabled maize. Although we have identified the lines with high- and low- BNI capacity lines in CMLs, we are still far from demonstrating or establishing the BNI-enabled maize line in the field. In this context, the doubled haploid line (DHL) population using these CML lines is being prepared for further genetic exploration for BNI capacity. The purpose of this proposal is to clarify the BNI capacity of the parental lines for the DHL population in field trials in order to prepare for further analysis of the DHL population.

Theme 3: Empirical analysis of factors related to food production and consumption of

farmers in Madagascar.

Host Scientist: SHIRATORI Sakiko

Location: Tsukuba, Japan

In this project, we will explore how to contribute to food security and nutrition by analyzing rural farmers' food environments, their responses food production, and the impact on nutritional supply amidst the rising prices of chemical fertilizers and other products. The panel dataset we use consists of 14 rounds of interview surveys over a five-year period from 2018 to 2023, targeting 600 rice-farming households in the central highlands of Madagascar. It includes a wide range of information, such as household composition, agricultural production, land use, labor, income, consumption, diet, height, and weight in the same households over the period.

Theme 4: Species identification and functional analysis of indigenous N-fixing bacteria for improving the production of common bean (*Phaseolus vulgaris* L.) in Madagascar.

Host Scientist: Papa Saliou Sarr

Location: Tsukuba, Japan

In this Project, we aim to identify useful strains and their combinations of nitrogen-fixing bacteria at the genomic level that were isolated from root nodules of common bean (*Phaseolus vulgaris* L.) cultivated in farmer fields in Madagascar. We will conduct DNA sequencing and functional evaluations, including nitrogen fixation activity, to determine the effectiveness of these strains and their combinations. Additionally, we will investigate the effects of inoculating or co-inoculating these strains on the growth of common bean in nutrient-poor soils. The findings will contribute to the exploration of microbial resources and their utilizations for enhancing the productivity of leguminous crops under low-fertilizer-use and nutrient-poor soils, thus benefiting agricultural systems in Africa.

Theme 5: Elucidation of Iron dynamics in rice possessing different tolerance mechanisms to iron toxicity.

Host Scientist: UEDA Yoshiaki

Location: Madagascar

A key to improve rice production in regions suffering from iron toxicity, such as Madagascar, is developing rice varieties with improved tolerance. To achieve this goal, the project aims to elucidate tolerance mechanisms and search for genes that can be utilized for breeding. In this research, changes in iron concentrations of various tissues and xylem sap will be investigated to reveal spatial dynamics of iron and identify key physiological mechanisms, using lines with contrasting tolerance to iron toxicity in the field. Also, gene expression analysis will be conducted to reveal the expression patterns of key genes that may be associated with these physiological phenomena.