JIRCAS's Climate Change Initiatives for Monsoon Asia

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1. JIRCAS

The Japan International Research Center for Agricultural Sciences (JIRCAS), a National Research and Development Agency under the Ministry of Agriculture, Forestry and Fisheries of Japan (MAFF), is the sole national institute that undertakes comprehensive research on agriculture, forestry and fisheries technology in developing areas of tropical and subtropical regions, as well as domestic research on agriculture, forestry and fisheries, aimed at providing solutions to international food supply and environmental problems through technology development; and collects, analyzes and publishes information to grasp trends relevant to international agriculture, forestry and fisheries as well as farming systems, through international collaboration and cooperation.

At present, JIRCAS implements the following four programs under the Third Medium-Term Plan (FY 2011-2015). Program A's flagship project titled "Development of agricultural technologies in developing countries to respond to climate change" (hereinafter referred to as "Climate Change Project") takes the initiative in carrying out climate change-related research for developing regions including that for Monsoon Asia.

Program A (Environment and Natural Resource Management): Development of agricultural technologies based on sustainable management of environment and natural resources in developing regions
Program B (Stable Food Production): Technology development for increased productivity and stable production of agricultural products in the tropics and other unstable environments
Program C (Rural Livelihood): Technology development for income and livelihood improvement of the rural population in developing regions
Program D (Information Analysis): Collection, analysis and dissemination of information for grasping trends of international agriculture, forestry and fisheries

2. Achievements of JIRCAS's climate change initiatives for Monsoon Asia

The Climate Change Project focuses on impact analyses and the development of adaptation and mitigation technologies to cope with climate change. The project's recent achievements attained in Monsoon Asia are as follows.

The impacts of climate change on agriculture are analyzed using econometric models including climate variables. The effects of meteorological disasters on rice production in Bangladesh were analyzed based on each event, such as cyclones or periodic floods, using a stochastic supply and demand simulation model for rice. During the development of a world food model, a study on the long–term outlook for rice, wheat, maize, and soybeans yields in 126 countries or regions until 2050 was conducted by estimating yield functions incorporating a crop model under various Intergovernmental Panel on Climate Change (IPCC) emission scenarios. The results indicated that crop yields in low-latitude regions will decrease due to climate change [1].

Regarding adaptation measures for climate change, near-isogenic lines (NILs) containing early morning flowering traits and with the genetic background of IR64 were developed. The aim was to mitigate yield reduction caused by heat stress-induced spikelet sterility at flowering. The results of our field and pot experiments in the Philippines and Japan indicated that the time of day of flowering was advanced by two hours in these NILs compared with those with tropical and temperate Indica-type genetic backgrounds [2]. With regard to technologies for adaptation to climate change in rainfed rice production systems, a prototype decision support system based on seasonal weather forecast was developed. The effectiveness of the use of the information on the timing of sowing and fertilizer application provided by the system was confirmed by an on-farm field experiment in Indonesia [3].

Concerning mitigation measures, a monitoring study in Thailand and Viet Nam has demonstrated that methane emission from ruminants can be more effectively mitigated by feeding them with various total mixed rations (TMRs) compared with a forage-only diet [4]. Methane emission from grazing beef cattle has also been monitored in Thailand, and the results indicated higher methane emission intensity during the dry season (when body weight gain is generally lower) than that during rainy season. As to the greenhouse gas (GHG) emission from paddy fields under water-saving irrigation treatment (alternate wetting and drying: AWD), a continuing triple rice cropping experiment

in a farmer's paddy field in Mekong Delta, Viet Nam apparently resulted in not only a yearly decrease in GHG emission but also an increase in rice yield. In line with the Clean Development Mechanism (CDM), an international effort that helps disseminate mitigation measures, a monitoring activity of the biogas digester (BD) program in Mekong Delta, Viet Nam, was carried out for a year, and the amount of reduced GHG emission was verified and certified by a designated operational entity (DOE). The emission reduction achieved resulted in the issuance of Certified Emission Reductions (CERs or carbon credits) by the CDM Executive Board (CDM EB) under the rules of the Kyoto Protocol [5]. The monitoring report also indicated that the amount of gas produced by each small-scale farmer's BD was dependent on the amount of the source, i.e. that of domestic animal wastes, and that stable BD use was realized by utilizing underutilized biomass resources like water hyacinth, which is generally available in the region, as supplementary resource materials [6].

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