

Country Name	Project for the Development of Crop Genotypes for the Midlands and Mountain Areas of North Vietnam
Socialist Republic of Viet Nam	

I. Project Outline

Background	<p>In the midlands and mountain areas of North Viet Nam, as rice cropping could be implemented only once a year in 40% of the area and agricultural infrastructure was not fully developed, agricultural productivity and self-sufficiency rate of rice remained at low level. Development of new rice varieties with short growth duration, high yielding, and disease and insect resistance as well as their dissemination were urgently required. Government research institutes and universities in Viet Nam including Hanoi University of Agriculture (HUA) (current Vietnam National University of Agriculture (VNUA)) worked on rice breeding technologies and brought certain level of results. Since these technologies were conventional ones mainly with hybridization and selection, it took time to develop new rice varieties. Thus, it was required for them to undertake breeding efficiently by introducing advanced breeding technologies using genetic information. (The numerical data is as of the time of ex-ante evaluation.)</p>				
Objectives of the Project	<p>The project aimed to strengthen the rice breeding system to develop promising lines adapting for natural and socio-economic conditions in the midlands and mountain areas of North Viet Nam through (i) improving breeding method using high-throughput genotyping technology, (ii) developing promising lines with short growth duration, high yielding, and disease and insect resistance, and (iii) characterizing eco-physiology of promising lines, thereby contributing to dissemination of the improved rice varieties.</p> <ol style="list-style-type: none"> Expected Overall Goal: N.A. Project Purpose: Rice breeding system is strengthened to develop promising lines adapting for natural and socio-economic conditions in the midlands and mountain areas of North Viet Nam. 				
Activities of the Project	<ol style="list-style-type: none"> Project site: Hanoi, Lao Cai Province, Thai Nguyen Province, Soc Trang Province Main Activities: (i) Conduct genetic survey and identify useful genes; optimize DNA marker assisted selection (MAS) by high-throughput genotyping technology; accelerate generations using high temperature conditions of Mekong Delta. (ii) Develop promising lines; accumulate useful genes (pyramiding) in promising lines; evaluate phenotypical traits of promising lines. (iii) Characterize physiological property of available and newly developed lines; test ecological adaptability of available and newly developed lines; compile information for recommended cultivation methods of promising lines. Inputs (to carry out above activities) <table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> Japanese Side 1) Experts: 13 persons (short-term), 1 person (long-term) 2) Trainees Received: 28 persons (short-term), 4 persons (long-term), 3 persons (group training) 3) Equipment: DNA Genotyping System, a Beads Grinder, Polymerase Chain Reaction (PCR) machines, DNA Extraction System, etc. 4) Operation cost </td> <td style="width: 50%; vertical-align: top;"> Vietnamese Side 1) Staff Allocated: 42 persons 2) Land and facility: Project office, laboratories, net houses, and experimental paddy field in VNUA. Expenses for land lease of experimental paddy fields in Thai Nguyen and Lao Cai, and of paddy field for Soc Trang Breeding Station were shared between VNUA and the Japanese side. 3) Operation cost </td> </tr> </table> 			Japanese Side 1) Experts: 13 persons (short-term), 1 person (long-term) 2) Trainees Received: 28 persons (short-term), 4 persons (long-term), 3 persons (group training) 3) Equipment: DNA Genotyping System, a Beads Grinder, Polymerase Chain Reaction (PCR) machines, DNA Extraction System, etc. 4) Operation cost	Vietnamese Side 1) Staff Allocated: 42 persons 2) Land and facility: Project office, laboratories, net houses, and experimental paddy field in VNUA. Expenses for land lease of experimental paddy fields in Thai Nguyen and Lao Cai, and of paddy field for Soc Trang Breeding Station were shared between VNUA and the Japanese side. 3) Operation cost
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Project Period	December 2010 – December 2015	Project Cost	(ex-ante) 383 million yen, (actual) 463 million yen		
Implementing Agency	Vietnam National University of Agriculture (VNUA)				
Cooperation Agency in Japan	Faculty of Agriculture, Kyushu University; Institute of Tropical Agriculture, Kyushu University; Bioscience and Biotechnology Center, Nagoya University				

II. Result of the Evaluation

< Special Perspectives Considered in the Ex-Post Evaluation >

-The logical framework of this SATREPS project has the Super Goal “Food security is improved, and sustainable rural development is progressed by disseminating improved rice varieties” but does not have the Overall Goal. Although the terminal evaluation report treated this goal as the Overall Goal, the first half of it, namely, “Food security is improved and sustainable rural development is progressed” is considered too high to attain by the time of this ex-post evaluation. Based on the above and the framework of ex-post evaluation of SATREPS projects, this ex-post evaluation regards the following as the Expected Overall Goal, “Improved rice varieties are disseminated”, which is the second part of the above-mentioned goal, and examines whether actions toward dissemination, i.e., preparation for registration of improved varieties, collaboration with seed companies, etc., have been taken as actions for social application of the research outputs/outcomes of this project. The first part of the Super Goal, namely, “Food security is improved and sustainable rural development is progressed” was examined to a possible extent as “other positive impacts”.

¹ SATREPS: Science and Technology Research Partnership for Sustainable Development

1 Relevance

<Consistency with the Development Policy of Viet Nam at the Time of Ex-Ante Evaluation>

At the time of ex-ante evaluation, the project was consistent with “10-Year Strategy for Socio-Economic Development (2001-2010)” and “Agricultural and Rural Development Sector Five-Year Plan (2006-2010)”, which respectively set forth development of appropriate agricultural production structures such as ensuring food security and promoting rice export and scientific research and application in rural areas, including rural and mountainous areas.

<Consistency with the Development Needs of Viet Nam at the Time of Ex-Ante Evaluation >

At the time of ex-ante evaluation, the project was consistent with development needs of Viet Nam for strengthening the rice breeding system to develop promising lines adapting for natural and socio-economic conditions in the midlands and mountain areas of North Viet Nam as stated in “Background”.

<Consistency with Japan’s ODA Policy at the Time of Ex-Ante Evaluation>

The project was consistent with “Country Assistance Program for Viet Nam” (2009), including “Rural Development and Improvements in Livelihood” under “Improvements in Living and Social Conditions and Corrections of Disparities”.

<Evaluation Result>

In light of the above, the relevance of the project is high.

2 Effectiveness/Impact

<Status of Achievement of the Project Purpose at the time of Project Completion>

The Project Purpose was achieved at the time of project completion. Through the project activities, various promising lines for the new variety of rice were developed with the traits of short growth duration, high yield, resistance against insect/disease, and/or low temperature tolerance. Among them, at least 7 lines (target: at least 2 or 3 lines) had at least one of the three target traits. It was found that growing duration of DCG72 was more than 10 days shorter while DCG19 showed growth duration of 5-10 days shorter than that of KD18, a locally adapted rice variety (Trait (a), target-10 days). As for Trait (b), DCG66 was verified to have high grain yield with an increase of 10% compared to that of KD18 (target:5-10%). Grain yield of DCG36 was also increased with application of nitrogen fertilizer, but their achievement status of the target was not verifiable because degree of increase was not mentioned in the existing project related documents. The lines with resistance against bacteria leaf blight (DCG72 mentioned above, DCG83, and DCG86) and brown planthopper (DCG31 and DCG36) were identified (Trait (c)).

<Continuation Status of Project Effects at the time of Ex-post Evaluation>

The project effects continued to the time of ex-post evaluation. VNUA continued 7 researches related to the research outputs of the project, some of which were conducted in collaboration with the relevant government authorities in the project site, and implemented 5 new research projects using the research methods developed by the project, the equipment/facilities provided by the project² and well-skilled human resources/researchers trained by the project. After project completion, total 50 scientific papers, 3 books related to rice field were published by the researchers involved in the project. Regarding DCG72, VNUA collaborated with seed companies, seed centers and farmers in operation of the experimental paddy fields and extended cultivation. As the result, DCG72 was approved as a new national variety by Ministry of Agriculture and Rural Development (MARD) in 2019, which was widely disseminated by the provincial Department of Agriculture and Rural Developments (DARDs), using cultivation guidelines completed by VNUA based on the guideline prepared by the project. Farmers in Red River Delta and North midland and mountainous regions, including Thai Nguyen province, were using DCG72 in late spring to avoid drought at transplanting time, whereas those in North and South Central Viet Nam, including Nghe An province, were utilizing it for flood avoidance in summer-autumn season. Further, DCG66 was recognized as a temporary national variety. VNUA was cooperating with a seed company and some provincial seed centers to provide seeds for farmers to expand the cultivation area of DCG66. When its production area reaches the required area (over 600 ha), VNUA would apply for official recognition as national variety. In addition, the promising lines carrying genes for both high yield and resistance to brown planthopper/bacteria leaf blight were shared/supplied for researchers for breeding new rice varieties in Crop Research and Development Institute (CRDI) under VNUA.

<Status of Achievement for Expected Overall Goal at the time of Ex-post Evaluation>

The Expected Overall Goal was achieved as actions for social application of the research outputs/outcomes of the project were taken. As mentioned above, DCG72 was approved as a new national variety in 2019 and DCG66 was released as temporary national variety in 2018, contributing to dissemination of the improved rice varieties developed by the project. The fact that in a very limited time of project implementation, researchers successfully developed a new rice variety with outstanding traits of very short growth duration and resistance to pest/disease like DCG72 and only few years after the project completion, this research output was officially recognized as national variety, meeting the high requirements of the competent agencies is rather remarkable³. The promising lines carrying genes for both high yield and resistance to brown planthopper/bacteria leaf blight were utilized for breeding new rice varieties as well.

<Other Impacts at the time of Ex-post Evaluation>

Negative impacts were not observed. Meanwhile, various other positive impacts were mentioned by VNUA. For example, research capacity of the researchers involved in the project were improved, which was reflected in promotion of many project participants, including a promoted professor, 5 associated professors and 10 PhD holders in the field of rice science. Among them, 4 associated professors and 5 PhD holders were women. Scientific literacy and awareness of MARD and Ministry of Science and Technology (MOST) were also

² One equipment item (i.e. DNA Genotyping System with accessories) was not utilized since 2018 due to lack of suitable kit/test reagents. In 2012, during the project implementation, the maker decided to discontinue production and sale of test reagents, therefore, the suitable kit/test reagents were available only until 2017. According to VNUA, there were also no similar kit/test reagents produced and sold at the market by other companies suitable to use for the system, thus VNUA was not utilizing the equipment. However, VNUA still utilized the genotyping technology introduced by the project for research activities by using other equipment and applying the knowledge and know-hows learnt from the project.

³ In average, there are about 25-30 new rice varieties to be recognized as national or temporary new national varieties every year, which have to meet the requirements in terms of agronomic characteristic set by the competent agencies including: productivity: 10%-15% higher than productivity of the check variety, growth duration: shorter than that of the check variety and resistance to insect and disease.

So far about 450-500 national rice varieties and about 200 temporary national varieties have been officially recognized in Vietnam. However, among the recognized varieties, the new varieties with a very short growth duration (from 80-100 days) like DCG72 is limited.

improved through the project as VNUA regularly updated and reported the research results. Dissemination and cultivation of DCG72 had a positive impact on food security in the project site since it was a very short growth duration rice variety and was suitable for the North midland and North and South Central regions, where droughts and floods often occurred, seriously affecting rice production.

<Evaluation Result>

Therefore, the effectiveness/impact of the project is high.

Achievement of Project Purpose and Overall Goal

Aim	Indicators	Results
<p>(Project Purpose) Rice breeding system is strengthened to develop promising lines adapting for natural and socio-economic conditions in the midlands and mountain areas of North Viet Nam.</p>	<p>The number of promising lines for the new variety of rice with the following traits (target: at least 2 or 3 lines) (a) Growing duration is shortened by 10 days (current averaging growing duration is 100-110 days in autumn and 115-125 days in spring season) (b) Yield increases by 5-10% compared with the popular (check) variety in the Project area (midland and mountain area = Thai Nguyen and Lao Cai) *to compare figures measured at experimental fields (c) Resistance against insect/disease was introduced</p>	<p>Status of the Achievement: achieved (continued) (Project Completion) -Various promising lines for the new variety of rice were developed with the traits of short growth duration, high yield, resistance against insect/disease, and/or low temperature tolerance. Among them, at least 7 lines with at least one of the 3 target traits were developed. >Trait (a): Growing duration of DCG72 with background of KD18 carrying a gene for short growth duration was more than 10 days shorter than that of KD18 and DCG19 with background of IR24, another locally adapted rice variety, also showed growth duration of 5-10 days shorter than that of KD18. >Trait (b): DCG66 with background of IR24 was verified to have high grain yield with an increase of 10% compared to KD18. In addition, it was also found that grain yield of lines with background of KD18 carrying a gene to increase primary rachis branches, such as DCG36, was increased with application of nitrogen fertilizer, but degree of increase is not mentioned in the available project related documents. >Trait (c): It was verified that the promising lines with background of KD18 carrying genes for bacteria leaf blight resistance (including DCG72, DCG83 and DCG86) and genes for brown planthopper resistance (including DCG31 and DCG36) had resistance against bacteria leaf blight and brown planthopper respectively. Effectiveness of genes for white-backed planthopper resistance was verified on the tested promising line; however, name of tested lines was not mentioned in the available project related documents. (Ex-post evaluation) - The promising lines developed by the project were continuously utilized by VNUA, the related government organizations, and other research institutes. *Also see the results of the Expected Overall Goal.</p>
<p>(Expected Overall Goal) Improved rice varieties are disseminated. *See <Special Perspectives Considered in the Ex-Post Evaluation ></p>		<p>(Ex-post Evaluation) achieved - DCG72 was officially recognized as a new national variety and disseminated to the farmers in both the project site and non-project sites. - DCG66 was recognized as a temporary national variety and VNUA was promoting expansion of its cultivation in collaboration with a seed company and provincial seed centers. VNUA would apply for recognition as a national variety once the cultivation area reaches the required area. -The promising lines with background of KD18, carrying genes for both high yield and resistance to brown planthopper/bacteria leaf blight were shared/supplied for breeding new rice varieties in CRDI under VNUA.</p>

Sources: Terminal Evaluation Report, Final Report, questionnaire and interview survey to VNUA.

3 Efficiency

While the project period was within the plan, the project cost exceeded the plan (ratio against the plan: 100%, 121%). The Outputs of the project were produced as planned. Therefore, the efficiency of the project is fair.

4 Sustainability

<Policy Aspect>

The Government of Viet Nam and MARD issued many policies/plans to promote research and application of science and technology with the aim of increasing productivity, quality, ensuring food security, including disseminating the new rice varieties developed by the project, including MARD's "5-year Agriculture and Rural Development Plan (2016-2020)" and "10-year Strategy for Agriculture and Rural Development (2011-2020)". MARD approved 2 promising lines i.e. DCG72 as national rice variety in 2019 and DCG66 as temporary national rice variety in 2018 as stated in "Effectiveness/Impact".

<Institutional/Organizational Aspect>

International Center of Plant Research, Japan/Vietnam (CIPR) was established in VNUA during the project implementation to exploit the facilities/equipment and human resource of the project. CIPR with 12 officers (6 working in Viet Nam and 6 attending training abroad at the time of ex-post evaluation) was assigned to continue research activities in major fields of genetics and breeding new varieties, crop physiology, nutrition and cultivation techniques. VNUA also established a collaborative network between VNUA and some governmental authorities and/or enterprises with the involvement of scientists/researchers trained by the project, including the seed centers in the project and non-project sites. The related governmental authorities such as MARD and provincial DARDs implemented policies/programs for utilization of the project's research outputs/outcomes in collaboration with VNUA. Almost all the provided equipment/facilities were continuously operated and maintained by VNUA.

<Technical Aspect>

The researchers involved in the project continuously improved their research capacity and sustained their skills and knowledge to properly operate and maintain the provided research facilities/equipment through participating in not only managing and implementing new

research projects but also continuing the related research activities using the research outputs of the project. The related government authorities such as MARD and MOST sustained/improved their scientific literacy through continuously implementing policies/programs on breeding rice varieties and funding new research projects based on the research outputs.

<Financial Aspect>

Governmental authorities, international donors and research organizations/ institutions were continuously providing financial sources of more than 18 billion VND from 2015 to 2020 to VNUA for continuing or starting the related research activities mentioned in “Effectiveness/Impact” as well as for operation and maintenance of the installed research facilities/equipment after the project completion.

<Evaluation Result>

In light of the above, the sustainability of the effects through the project is high.

5 Summary of the Evaluation

The project achieved the Project Purpose (i.e. Rice breeding system is strengthened to develop promising lines adapting for natural and socio-economic conditions in the midlands and mountain areas of North Viet Nam). The effect of the project continued, and the expected Overall Goal (i.e. Improved rice varieties are disseminated) was achieved. Regarding the sustainability, no major problems were observed in terms of the policy, institutional/organizational, technical, and financial aspects. As for the Efficiency, the project cost exceeded the plan. Considering all of the above points, this project is evaluated to be highly satisfactory.

III. Recommendations & Lessons Learned

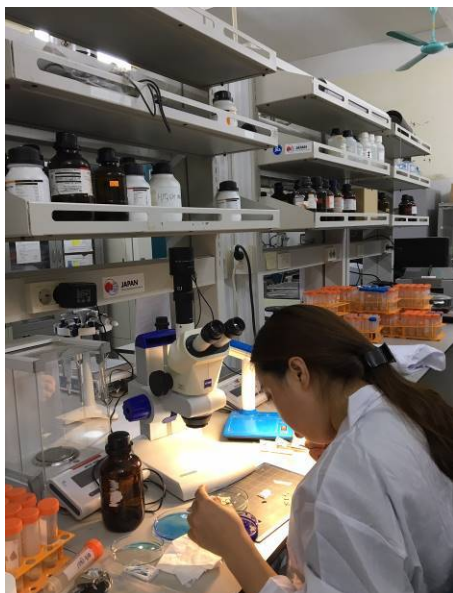
Recommendations for Implementing Agency:

- It is recommended that VNUA continue to collaborate with governmental authorities, local provinces and private companies to supply seeds to farmers, expand cultivation area of DCG66 to confirm the advantage of wide adaptability and high grain yield of the improved rice variety. When DCG66 production area reaches the required area, VNUA should apply for official recognition as a national variety as soon as possible, which will contribute to dissemination of the improved rice varieties nationwide.

Lessons Learned for JICA:

- As stated above, one equipment item (i.e. DNA Genotyping System with accessories) has not been utilized since 2018 due to no availability of suitable kit/test reagents at the market. Before launching the project, it is important for the project formulation team to introduce appropriate equipment, taking considerations of the conditions for research implementation and continuation (availability of chemicals).

- As stated above, two newly-developed rice varieties in the project have been recognized as national variety/temporary national variety and widely disseminated with the collaboration governmental authorities and private companies, which was enhanced during the project implementation and continued after the project completion. In order to facilitate the social application of the SATREPS project’s research output/outcome in Viet Nam, it is important for the project team and Vietnamese counterpart research institute(s) to continuously update and report the results of research activities to the state management agencies and keep the continuous linkage with the relevant administration (both central governmental authorities and local governments) and private sector not only during the project implementation but also after the project completion.



VNUA’s young researcher (graduated student) is conducting research activities at CIPR’s laboratory



Checking rice seeds in CIPR’s cold storage