ADB

Completion Report

Project Number: 47163-001
Technical Assistance Number: 8441
September 2017

Development and Dissemination of Climate-Resilient Rice Varieties for Water-Short Areas of South Asia and Southeast Asia

Asian Development Bank

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<table>
<tr><td colspan="3">TA Number, Country, and Name:

TA 8441-REG: Development and Dissemination of Climate-Resilient Rice Varieties for Water-Short Areas of South Asia and Southeast Asia</td><td colspan="2">Amount Approved: $1,370,000

Revised Amount: n.a.</td></tr>
<tr><td colspan="2">Executing Agency:
Asian Development Bank</td><td>Source of Funding:
Climate Change Fund (Grant): $750,000
Government of Finland (Grant): $620,000</td><td>Amount Undisbursed:
$30,560 (2%)</td><td>Amount Utilized:
$1,339, 440 (98%)</td></tr>
<tr><td>TA Approval Date:

5 September 2013</td><td>TA Signing Date:

5 September 2013</td><td>Fielding of First Consultants:</td><td colspan="2">TA Completion Date
Original: 31 December 2016 Actual: 31 December 2016
Account Closing Date
Original: 31 December 2016 Actual: 30 June 2017</td></tr>
<tr><td colspan="5">Description
The research and development technical assistance (RDTA) was approved on 5 September 2013 for $1,370,000, financed by the Climate Change Fund and the Government of Finland. The RDTA was developed at the request of national rice research institutions in order to support the dissemination of promising rice varieties developed under the regional TA 6276-REG: Development and Dissemination of Water-Saving Rice Technologies in South Asia, and to continue developing breeding lines tolerant to water stress with the participation of Cambodia and Lao People's Democratic Republic (Lao PDR) in addition to Bangladesh, India, and Nepal. Apart from developing high-yielding climate resilient rice varieties, the RDTA aimed to develop and disseminate site-specific crop management packages for aerobic cultivation, alternate wet and dry (AWD) water management, soil nutrient management and crop diversification, building up on earlier research carried out by the International Rice Research Institute (IRRI) and national agricultural resource institutions and their collaborative national and provincial seed multiplication agencies, public and private sector institutes, and nongovernment organizations for large-scale seed production and distribution.

Expected Impact, Outcome, and Outputs
The expected impact was sustainable rice production with climate-resilient varieties in South Asia and Southeast Asia. The expected outcome was increased rice yield and water efficiency in water-short irrigated and drought-prone rain-fed areas. The TA outputs included development and dissemination of (i) high-yielding varieties suitable for water-short climates and (ii) site-specific crop management packages for aerobic cultivation in water-short areas. The TA design was highly relevant, considering that droughts and water shortages have become prevalent and climate-resilient varieties dissemination was a critical climate change adaptation measure in many areas in DMCs. The TA concept was formulated based on consultation with participating DMCs and ADB's knowledge workshops on water-saving rice technologies.

Delivery of Inputs and Conduct of Activities
ADB was the executing agency (EA) for the RDTA, and participated in three regional workshops in Hyderabad, Kathmandu, and Los Baños during the inception and review missions. The RDTA planned for the engagement of 121.2 person-months of international consulting services and 120 person-months of national consulting services. ADB engaged IRRI to hire a total of 121.2 person-months of international consultants and 72 person-months of national consultants based on single-source selection in accordance with the Consulting Guidelines, for breeding and screening of climate-resilient varieties, country-specific seed multiplication, dissemination, varietal evaluation and survey, soil nutrient analysis, crop diversification studies and impact assessment. All the consultants' performances were rated satisfactory. The terms of reference were adequate as the new varieties and beneficial outputs of the previous RETAs were together applied and disseminated in water shortage areas in participating DMCs. The three country workshops were well attended by national breeders and seed multiplication and dissemination experts/ practitioners of all participating countries (Bangladesh, Cambodia, India, Lao PDR, Nepal). Director, SAER attended the midterm workshop in Hyderabad and discussed the dissemination strategies of the varieties developed under the RETA in South Asia. ADB has successfully managed the TA implementation within the set timeframe and its overall performance as the EA is</td></tr>
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considered satisfactory. The TA is assessed as efficient as the various inputs are delivered as planned utilizing 98% of the TA allocation. In addition, the RDTA has initiated a pilot testing of developed climate-resilient rice variety in Bangladesh as a part of climate-smart farming practices under Loan 3135-BAN: Irrigation Management Improvement Project. The pilot has resulted in promising outcomes for saving water, increasing production and reducing GHG emission during boro season (dry).

Evaluation of Outputs and Achievement of Outcome

The delivery of outputs varies across participating countries, and the quality of outputs generated under Outputs 1 and 2 so far were high: Under Output 1, seed multiplications in Bangladesh and Nepal have over-achieved the target volume of seed production (1,000 tons) and the target beneficiaries (5,000 farmers), while Cambodia, India, and Lao PDR could not meet the target scale. This reflects the fact that Bangladesh and Nepal have well developed institutional linkages between public research institutions and private seed companies, NGOs and farmers seed production groups for seed multiplication and wider dissemination of new variety seeds.[1] The breeding programs for third generation nematode-resistant and water efficient varieties at IRRI has shown good progress but has not reached to the stage of replicated trials and disseminations to participating DMCs. Under the RDTA, various generations of complex crosses evaluation, selection of promising plants, evaluation of one complex mapping population under observational yield trial, and identification of a grain yield advantage observed over the conventional biparental cross have been achieved.

Under Output 2 site-specific fertilizer, weed, water, and soil management and mechanization technique have been analyzed in all participating countries, based on which training tools in local languages have been produced and training of extension workers and farmers have been carried out. A manual on sustainable aerobic rice farming practices have been prepared. Notable achievements for training material development and farmers' training are found in (i) Bangladesh, where 10,624 farmers and 375 extension workers benefited from training and field demonstration and 50,000 copies of technical advisory bulletin were disseminated; and (ii) Nepal, where 1,500 copies of fact sheets and technical information on improved rice cultivation and AWD were distributed and 203 farmers were trained on water-saving technologies. Together with IRRI and national research institutions, ADB published the ADB Brief 60: Developing and Disseminating Water-Saving Rice Technologies in Asia and 17 associated technical papers online. To date, the publication website records 592 pageviews and 296 downloads.

The expected outcome is partially achieved during the RDTA implementation and is to be realized over the next few years when the RDTA outputs are further developed[2] and released by respective national systems and widely disseminated:

Bangladesh: Nine aerobic rice varieties with yield ranging from 5.39 to 6.12 t/ha developed are promising in saving water and labor, while maintaining rice yield and allowing timely planting of the second crop. Twelve AWD varieties with 5.1–6.62 t/ha showed good adaptability and good rain yield, are instrumental in widely disseminating water saving practices. Irrigation water saving of 6–17% were tested (-10kPa, -20kPa and -30kPa), and two varieties IR83140-B36-B-B and IR83142-B-71-B-B) are identified as best water efficient varieties.
Cambodia (2015-16)**:** a total of 18 AWD gentotypes are identified for further trials in multi locations.
India: Identified two aerobic early maturity varieties (IR14L521 and IR98976-20-1-2-2) with substantial yield gain of 5.9 t/ha. And one AWD variety with high yield (over 6.0t/ha) with substantial water-saving of 25% compared with the AWD control has been developed.
Lao PDR: 12 aerobic rice varieties with more than 3t/ha yield for rain fed condition are identified for further study. These varieties are found promising in saving labor cost, preventing loss from water shortages while maintaining yield. And 11 AWD varieties with more than 3t/ha yield were identified for further study. These

[1] Bangladesh: 1,326 tons of seeds were produced by private seed companies, benefiting more than 110,000 farmers; Cambodia: 623 kg. of one variety were produced; India: a total of 5,621 kg. of 6 rice varieties were produced and distributed to 1,156 farmers in Odisha and 400 kg. of 3 rice varieties were distributed to 100 farmers in Haryana; Lao PDR: 4,974 kg. of 7 rice varieties were produced and distributed to 60 farmers; and Nepal: 800 tons of 7 rice varieties were produced and distributed to 6,150 farmers.

[2] The national release and seed multiplication processes are ongoing under partner institutions and programs, CSOs and private seed companies. Cambodia and Lao PDR continue the climate-resilient varieties development and field trials. Continued and expanded work in Cambodia and Nepal to develop climate-smart agriculture packages for rice systems is ongoing with the support of RETA 9218-REG: Investment Assessment and Application of High-Level Technology for Food Security in Asia and the Pacific.

varieties are promising in saving irrigation water and irrigation fee while maintaining crop yield and preventing crop loss from water shortages.
Nepal: 18 aerobic varieties are found to be high yielding (more than 4.5t/ha) with good grain quality, resistant to diseases (bacterial leaf blight, blast and false smut) and insects (brown hopper and stem borer). 14 AWD varieties are found to be high yielding with resistance to diseases and pests and acceptable grain quality. These varieties can help increase rice production with 20% less water.

The achievement of outcome is less than effective because ambitious output targets have not yet been fully achieved within the RETA implementation duration.

Overall Assessment and Rating
Overall, the RDTA was successful. Against the ambitious targets set for the RDTA, satisfactory levels of output targets have been met (Output 1: all three targets partially and Output 2: all three targets achieved). The RDTA outputs produced so far are of good quality, which can be instrumental in improving the development impacts of ADB's future agriculture and natural resources investments by adding climate resilience to rice production system. The outputs of the RDTA are being multiplied and utilized in respective national system of participating DMCs, hence considered likely sustainable.

Major Lessons
A major lesson learned is that the national administrative process for releasing new varieties takes a long time, while agricultural research to develop new varieties that have ideal set of productivity and resilience properties can be done quickly thanks to advanced breeding technologies. While newly developed varieties under the RDTA are currently being processed for national release, it may take another 2–3 more years until farmers in participating DMCs can utilize them. According to IRRI, this process can be halved through carrying out multilocation trials per season and advancing the start of the national release process to match with the start of variety development research in partnership with breeder institutions. In addition, further expansion of the regional seed distribution agreement among Bangladesh, India, Nepal and some Southeast Asian countries that are being convened by IRRI can help quickly avail essential varieties to water shortages areas from participating countries. These administrative and legislative system reform appears critical for generating an enabling environment to widely and efficiently disseminate climate-resilient rice varieties in DMCs. Considering substantial adverse climate change impacts expected on irrigated and rained rice in Asia, such enhanced seed system development both at the national and regional levels can be an essential climate adaptation intervention.

In addition, a careful and realistic planning is required for the production and dissemination of outputs, which involves multiple institutions other than national research institutions, within the given timeframe.

Recommendations and Follow-Up Actions
The RDTA identified and produced the foundation seeds of various climate resilient rice varieties for water shortage areas in Bangladesh, Cambodia, India, Lao PDR, and Nepal. It is recommended that future ADB sector projects, such as irrigation and natural resources management projects consider investing in disseminating these varieties as an adaptation investment to enhance climate resilience of rice system in the DMCs. In addition, ADB should support to expand the regional seed trade system under regional cooperation programs, and consider investing in institutional, legislative and administrative reforms of national seed release administrations as a critical climate change adaptation action for building climate resilience of the food system in Asia. Some of the RDTA outputs are already being applied to ADB investments in participating DMCs: Bangladesh Rice Research Institute dhan 28 has been disseminated under the pilot climate-smart agriculture practices (alternate wet and dry and efficient soil nutrient management) tested with 5,000 beneficiary farmers of Loan 3135-BAN: Irrigation Management Improvement Project, which achieved over 6t/ha crop yields, 25–30% water saving compared to the conventional flooded method and a reduction of 40% CH_4 or 35% Global Warming Potential. Continued and expanded works for availing climate-smart agriculture packages for rice systems in Cambodia is being carried out under RETA 9218-REG: Investment Assessment and Application of High-Level Technology for Food Security in Asia and the Pacific.

Prepared by: Michiko Katagami
Designation and Division: Principal Natural Resources and Agriculture Specialist, SDCC-AR