

Country Name	Flood- and drought-adaptive cropping systems to conserve water environments in semi-arid regions
Republic of Namibia	

I. Project Outline

Background	<p>North central area of Namibia is semi-arid land with annual average rainfalls of 400 mm. However, flood water pouring from Angola Plateau in the rainy season forms vast seasonal wetlands. For the last decades, the annual rainfalls in the area had been volatile for the range from 200 mm to 1,000 mm and such volatility of rainfalls had induced catastrophic flood and drought in the same area. On the other hand, the people were engaged in subsistence farming based on pearl-millet and stock raising which generated limited cash income. Although pearl millet is dryness-resistant crop, the unforeseen catastrophic floods and extreme drought lowered the productivity. Under such situation, the farmers in the area expected to introduce rice cultivation, which has the highest flood-resistance. Therefore, research to develop locally appropriate farming method was necessary in order to realize food security and economic independence of the subsistence farmers in the area forming the seasonal wetlands as well as to conserve water environment which is often affected caused by natural environment in the north central Namibia.</p>												
Project Objectives	<p>Through i) researches and proposal on rice-based mixed cropping systems, ii) establishment of methods to disseminate the proposed mixed cropping systems, iii) estimation of possible areas for the proposed mixed cropping systems and integration of the proposed mixed cropping systems, the project aimed at developing “Flood- and drought-adaptive cropping systems”, thereby contributing to dissemination of the developed cropping system in the north-central Namibia and to consideration of the developed cropping system in the northeastern areas of the country.</p> <ol style="list-style-type: none"> Expected Overall Goal: <ol style="list-style-type: none"> “Flood- and drought-adaptive cropping systems” are disseminated in the north-central Namibia to contribute to the food security and cash income of local farmers. “Flood- and drought-adaptive cropping systems” are considered for the north-eastern areas of Namibia where high rainfall occurs as well as in neighbouring countries. Project Purpose: “Flood- and drought-adaptive cropping systems” are developed which can sustainably preserve the water environment of the semi-arid region. 												
Project Activities	<ol style="list-style-type: none"> Project Site: The Faculty of Agriculture and Natural Resources, Ogongo Campus of the University of Namibia (UNAM) and seasonal wetlands in north-central Namibia. Main Activities: 1) Examination of appropriate cultivation methods and techniques as well as measures for establishing rice-based mixed cropping systems with resilience against environmental stress such as flood and drought, 2) Examination of sustainability of the proposed mixed cropping systems from the socio-economic viewpoints, 3) Estimation of change of flood water and analysis of the water balance of the seasonal wetland, 4) Implementation of field day and participatory research and extension activities on the rice-based mixed cropping systems, and so on. Inputs (to carry out above activities) <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">Japanese Side</td> <td style="width: 50%;">Namibian Side</td> </tr> <tr> <td>1) Experts: 22 persons</td> <td>1) Staff allocated: 25 persons</td> </tr> <tr> <td>2) Trainees received: 50 persons</td> <td>2) Facilities and land: Office space for Japanese researchers and experts, laboratories, a greenhouse, crop experiment fields, seed room, rice packing room and storage room</td> </tr> <tr> <td>3) Equipment: Vehicles, Water pump, Greenhouse, Rice milling, Climate monitoring equipment, Portable photosynthesis system, Porometer, Automatic area meter, Tractor, and so on.</td> <td>3) Local operation cost: travel allowances, utility cost, cost for tractor and disc harrow</td> </tr> <tr> <td>4) Local operation cost: travel expenses, meeting cost and other general expenses.</td> <td></td> </tr> </table> 			Japanese Side	Namibian Side	1) Experts: 22 persons	1) Staff allocated: 25 persons	2) Trainees received: 50 persons	2) Facilities and land: Office space for Japanese researchers and experts, laboratories, a greenhouse, crop experiment fields, seed room, rice packing room and storage room	3) Equipment: Vehicles, Water pump, Greenhouse, Rice milling, Climate monitoring equipment, Portable photosynthesis system, Porometer, Automatic area meter, Tractor, and so on.	3) Local operation cost: travel allowances, utility cost, cost for tractor and disc harrow	4) Local operation cost: travel expenses, meeting cost and other general expenses.	
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Project Period	February 2012 – February 2017	Project Cost	Ex-ante: 516 million yen Actual: 434 million yen										
Implementing Agencies	Directorate of National Research, Science, Technology and Innovation, Ministry of Education Faculty of Agriculture and Natural Resources, University of Namibia (UNAM)												
Cooperation Agency in Japan	Kinki University, Nagoya University, Tohoku University, Ryukoku University and University of Shiga Prefecture												

II. Result of the Evaluation

I Relevance
<p><Consistency with the Development Policy of Namibia at the Time of Ex-Ante Evaluation ></p> <p>The Project was consistent with Republic of Namibia’s policy aiming at agricultural production to contribute to ensure food and to increase income at household level and national level as well as improvement of land productivity set in the “Vision 2030” (2004).</p> <p><Consistency with the Development Needs of Namibia at the Time of Ex-Ante Evaluation></p> <p>The Project was consistent with Namibia’s development needs for farmers in north-central area with willingness to practice adoptive</p>

¹ SATREPS: Science and Technology Research Partnership for Sustainable Development

crop cultivation against unstable climate (drought and flood situations) because annual production of pearl millet, which is the traditional crop in the north-central area, was unstable and the degree of fluctuation was large.

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

The Project was consistent with Japan’s ODA Policy for Namibia, which prioritized the following two areas of i) development of economic and industrial base and ii) improvement of basic life, based on the Namibia’s National Development Plan².

<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. Two types of “Guidelines for Flood- and Drought- adaptive cropping systems” covering the results of research activities including i) crop science, ii) development studies, iii) hydrology, and iv) integrated study of agricultural and social science were compiled (Indicator 1).

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

The project effects have continued since project completion. University of Namibia (UNAM) together with Directorate of Agricultural Production Extension Engineering Services (DAPEES) of Ministry of Agriculture and Water and Land Reform (MAWLR), based on the guidelines, have continued to promote the integration of rice cultivation into the pearl millet-dominated local cropping system by encouraging local farmers to cultivate rice in small seasonal wetlands in the pearl millet fields in north-central Namibian regions, despite recurrent droughts.

In addition, UNAM has continued related research activities, including i) Ridge formation with strip tillage alleviates excess moisture stress for drought-tolerant crops, ii) The effects of soil tillage methods and fertilizer application on the yield and growth of pearl millet in seasonal wetland in northern Namibia, iii) Productivity assessment of short-duration rice (*Oryza sativa* L. and Upland NERICA) genotypes in semi-arid North-central Namibia, iv) A study on the effect of fertilizer application on growth and yield components of pearl millet (*Pennisetum glaucum* L.) subjected to field flooding, and v) Mitigation of flood stress for pearl millet (*Pennisetum glaucum* L.) through fertilizer application. Also, UNAM has continued to use the research equipment provided by the SATREPS project for monitoring weather data at UNAM-Ogongo Campus and north-central regions of Namibia for the abovementioned research.

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

The Expected Overall Goals have been achieved. The Overall Goal 1 for dissemination of the “Flood and drought- adaptive cropping systems” proposed by the SATREPS project was achieved through continuous implementation of the field day. Although the field day had been regularly held for the period from 2017 to 2019, no field day was held in 2020 due to the COVID 19 pandemic. The Overall Goal 2 for sharing the research results of the SATREPS project has been also achieved. UNAM and the Japanese experts have initiated collaborative research with the University of Botswana and UNAM presented the results on the new cropping systems at Maun Campus in 2019. Also, UNAM shared rice seeds with the Maun Campus to initiate the new cropping system and the research on rice. Although it was arranged for counterpart researchers from Botswana to visit UNAM and learn the techniques, it was not able to be realized due to the COVID 19 pandemic.

For the utilization of research outcomes, DAPEES has promoted to share the guidelines on the new cropping systems proposed by the SATREPS project through the field visits as a part of the extension activities. The driving force is the motivated farmers by the SATREPS project to utilize the knowledge and skills on the new cropping system for better livelihood.

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

There are some other positive impacts of the Project confirmed at the time of the ex-post evaluation. The mixed cropping of pearl millet and rice proposed by the SATREPS project mitigated the negative impacts of low rainfalls and the lack of floodwaters from Angola. Even though rice was not be able to harvested due to the lack of adequate volume of water in the local seasonal wetlands caused by the drought after the project completion, pearl millet, which is a drought resistant crop, was able to survive and to provide the grains for the farmers. The fact verified that the mixed cropping of pearl millet and rice improved moisture resistance of pearl millet as the research output of the SATREPS project and showed that the practice of the proposed cropping brought about the effect. In addition, the SATREPS project has successfully made more involvement of local women in the project activities, in particular, in the cropping activities. It can be because of the fact that women are traditionally associated with the cropping activities and they have interests in the cropping activities.. Also, the other reason might be that local women derive most of their farm income from the sales of crops rather than from livestock.

Another positive impact from the aspect of research capacity was confirmed. The researchers of UNAM involved in the SATREPS project improved their scientific capacity to publish their research paper in international journals and their technical capacity to utilize various equipment and to forge collaboration with other researchers in Namibia and abroad. In addition, the researchers became able to write proposal for funding of other projects within DAPEES and to conduct research trials, record good quality of data and interpret of research data. Furthermore, the scientific literacy of the staff of MAWLR has been improved through the SATREPS project in order to promote the guidelines for the dissemination of the mixed cropping systems proposed by the SATREPS project.

No negative impact by the SATREPS project was confirmed at the time of ex-post evaluation.

<Evaluation Result>

Therefore, both the effectiveness and impact of the project is high.

Achievement of Project Purpose

Aim	Indicators	Results
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² Ministry of Foreign Affairs, “ODA Country Databook 2011”.

<p>(Project Purpose) “Flood- and drought-adaptive cropping systems” are developed which can sustainably preserve the water environment of the semi-arid region.</p>	<p>Indicator 1: Guideline for “Flood- and drought-adaptive cropping systems” is compiled.</p>	<p>Achievement Status: Achieved (Continued) (Project Completion) ● Two types of “Guidelines for “Flood- and drought- adaptive cropping systems” covering the results of research activities including i) crop science, ii) development studies, iii) hydrology, and iv) integrated study of agricultural and social science were compiled. (Ex-Post Evaluation) ● UNAM together with DAPEES/MAWLR, based on the guideline, have continued to promote the integration of rice cultivation into the pearl millet-dominated local cropping system by encouraging local farmers to cultivate rice in small seasonal wetlands in the pearl millet fields in north-central Namibian regions, despite recurrent droughts.</p>								
<p>(Overall Goal 1) “Flood- and drought-adaptive cropping systems” are disseminated in the north-central Namibia to contribute to the food security and cash income of local farmers.</p>	<p>(Indicator 1-1) Field Day held regularly on the cropping systems.</p>	<p>Achievement Status: Achieved (Ex-post evaluation) [No. of field day held]</p> <table border="1" data-bbox="775 533 1374 600"> <tr> <td>2017</td> <td>2018</td> <td>2019</td> <td>2020</td> </tr> <tr> <td>1</td> <td>2</td> <td>2</td> <td>0</td> </tr> </table> <p>In 2020, due to the COVID 19 pandemic, no field day was organized.</p>	2017	2018	2019	2020	1	2	2	0
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<p>(Overall Goal 2) “Flood- and drought-adaptive cropping systems” are considered for the north-eastern areas of Namibia where high rainfall occurs as well as in neighbouring countries.</p>	<p>(Indicator 2-1) Information on research results of cropping systems is shared with neighbouring countries.</p>	<p>Achievement Status: Achieved. (Ex-post evaluation) ● UNAM and Japanese experts have initiated collaborative research with the University of Botswana. In 2019, UNAM presented the research results on the new cropping systems at Maun Campus and also share rice seeds with the Campus to initiate the cropping system and rice research. It was arranged for counterparts from Botswana to come and learn the techniques at UNAM in 2019; however, this could not happen due to the covid-19 pandemic.</p>								

Source : Terminal Evaluation Report, JST Terminal Report, Questionnaires survey with UNAM and MAWLR

3 Efficiency

The project cost and the project period were within the plan (the ratio against the planned: 83%, 100%, respectively). The project outputs were produced as planned.

Therefore, the efficiency of the project is high.

4 Sustainability

<Policy Aspects>

The government of Namibia announced “The 5th National Development Plan” (2017/18-2021/22) in May, 2017 for realization of “the Vision 2030”. The National Development Plan aims at “improvement of small farmers’ productivity” as one of five Key Changer. Thus, the dissemination of the “flood and drought- adaptive cropping systems”, as utilization of the research outcomes of the SATREPS project, has been backed up by the government policy.

<Institutional/Organizational Aspects>

UNAM has maintained a research team that continues the research activities related to the outputs produced by the SATREPS project. The team consists of five researchers, three technicians and three labors. UNAM has continuously utilized the research facilities provided by the SATREPS project and has been fully responsible for the maintenance services of such facilities.

MAWLR has plan to continue research activities but the Division of Crop Research and Production does not have staff for research. Since UNAM conducts all project activities with full collaboration with the government, MAWLR and UNAM have always collaborated in research activities related to crop systems in order to create better knowledge and skills and come up with new technologies that best fit the end users.

<Technical Aspects>

As mentioned above, the research capacity of UNAM on cropping system has been improved as they have been able to continue their research activities, including implementing research trials, recording good quality of data and interpreting research data into the research articles. Also, the researchers of UNAM became capable to write proposals for funding of other projects within MAWLR through DAPEES. They also have continued to conduct both scientific and academic research using the research facilities provided by the SATREPS project. Research capacity has improved as MAWLR staff prepares proposal for funding, at national level, and conducts research trials, of which research articles are produced.

<Financial Aspects>

UNAM has annual budget commitment (300,000-500,000 Namibian dollars (NAD)) for the activities related to the SATREPS project.

UNAM has initiated an annual event of rice harvest day, aiming at promoting not only rice production activities but also dissemination of the information on the various flood- and drought-adaptive cropping systems developed by the research activities related to the SATREPS project. In addition, UNAM has made efforts to obtain other sources of fund for their research activities. For example, in 2019/2020 financial year, a team of researchers from various departments of the entire Faculty of Agriculture and Natural Resources submitted a proposal on rice value chain to UNAM for internal funding, which was funded to the total of 400,000 NAD. These search activities are currently underway and were going to run until 2021.

MAWLR has availed its human resources in terms of extension personnel to disseminate the technologies. However, since the government budget has been limited due to the effect of global economic depression caused by the COVID 19 pandemic, MAWLR has not be able to ensure the sufficient research staff for crop research and production as mentioned above.

<Evaluation Result>

In the light above, there has been concerns about the institutional/organizational and financial aspects. Therefore, the sustainability of the effects through the Project is fair.

5 Summary of the Evaluation

The project achieved the Project Purpose and the expected Overall Goal for development and dissemination of the improved cropping system against floods and droughts. As for sustainability, while there is a slight concern about the government budget to ensure the sufficient staff for crop research and production, UNAM has sustained the research team with sufficient skills and knowledge to continue the research activities related to the cropping systems. Considering all of the above points, this project is evaluated to be highly satisfactory.

III Recommendations & Lessons Learnt

Lessons Learnt for JICA :

- Under the coordination and cooperation between UNAM as a research institute and MAWLR as a government organization responsible for extension of farming methods, the flood and drought adaptive cropping system developed by the SATREPS project has been disseminated to the farmers in the target area as expected and the activities for utilization of the research outcomes have been realized. In addition, the activities promoting the local farmers to introduce the new cropping system during the implementation of the SATREPS project contributed to motivating the farmers to use the mixed cropping system after the project completion. Therefore, in case of research and development projects to directly benefit to farmers such as this SATREPS project, the project design to promote coordination between research institutes and government organizations which are responsible for extension activities and to incorporate activities to address direct beneficiaries will facilitate activities to utilize research outcomes for extension of new farming technologies even after the project completion.



Field Day



Assembling Gauge Rainfall by the research members