

Summary of the Results of Evaluation Study

I. Outline of the Project		
Country: Sudan	Project Title: The Project on Improvement of Food Security in Semi-arid Regions of Sudan through Management of Root Parasitic Weeds	
Issues/Sector: Agricultural Development (Biotic Resources)	Cooperation Scheme: Technical Cooperation Project	
Division in Charge: Rural Development Department	Total Cost : 350,000,000 Yen	
Period of Cooperation	March 2010 – February 2015	Partner Country's Implementing Organization: Sudan University of Science and Technology (SUST), Ministry of Higher Education and Scientific Research (MHESR), Ministry of Agriculture and Irrigation (MoAI), Ministry of Science and Communications (MSC), Gedaref State Ministry of Agriculture and Irrigation (GSMAI), Agriculture Research Cooperation (ARC)
		Supporting Organizations in Japan: Kobe University, Osaka Prefecture University, Tottori University
Related Cooperation: Technical Cooperation Projects None in particular		
<p>1. Background of the Project</p> <p>Root parasitic weed which is known as “Striga” is one of the most serious biological factors that harm production of gramineous species such as sorghum, millet and rice within semi-arid regions of Sub-Saharan Africa including Sudan. Sorghum and millet, the main hosts of the parasite and the main staple food for Sudanese populace, are planted in millions ha. It is said that 300 million people's lives are affected by the weed; as a result, Sudanese government has faced serious food security issues. The need for simple, inexpensive methods which control Striga at the early development stage and suit for resource poor mostly illiterate, subsistence farmers is imperative.</p> <p>In order to exploit preventive methods against Striga, Sudan University of Science and Technology (SUST) and Kobe University, Japan have collaborated since 1994 and contributed to clarification of Striga's biological and ecological characteristics. Having said that, various aspects for controlling Striga have not yet scientifically been clarified; therefore, it is strongly required to develop innovative techniques to prevent damage by Striga for strengthening food security and poverty reduction in Sudan.</p> <p>To this end, “Project on Improvement of Food Security in Semi-Arid Regions of Sudan through Management of Root Parasitic Weeds” (hereafter referred to as “the Project”) under the scheme of SATREPS (Science and Technology Research Partnership for Sustainable Development) has been implemented for five years from March 2010 to February 2015, following the signing of the Record of Discussions (R/D) on 10th November 2009.</p>		
<p>2. Project Overview</p> <p>(1) Overall Goal Extension of new Striga control measures progresses.</p> <p>(2) Project Purpose</p>		

Research, development and extension (RDE) capacity of Sudan University of Science and Technology (SUST) to manage *Striga* is improved.

(3) Outputs:

Output 1: Innovative technologies to control *Striga* are developed.

Output 2: Farmers' practice to manage *Striga* is ameliorated.

(4) Inputs (by the end of August 2014)

Japanese Side:

Dispatch of Experts: Long-term Experts (Coordinator): 2 persons

Short-term Experts : Total of 57.6M/M

Provision of Equipment: 1.06 million US Dollars

Bearing of Local Operation Cost: 0.2 million US Dollars

Training and Research Activities participated by Counterpart Personnel in Japan: 11 persons

Sudanese Side:

Counterpart personnel: 23 persons (SUST: 13 persons, ARC: 5 persons, GSMAI :3 persons, MSC: 1 person, MFNE: 1 person)

Operational Expenses: 159,000 US Dollars

Land and Facilities: Office spaces with office furniture and electricity at SUST

Facilities and experimental fields of the *Striga* Research Laboratory

II. Evaluation Team

Members of the Evaluation Team	<Japanese Team>	
	Leader	Mr. Shiro NABEYA Senior Advisor to the Director General, Rural Development Department, JICA
	Project Planning	Mr. Hiroyuki HANADA Project Officer, Rural Development Department, Team 4, JICA
	Evaluation	Ms. Keiko ITAGAKI
	Analysis	Senior consultant, International Development Associates Ltd.
	<Sudanese Team>	
Leader	Prof. Migdam E. Abdelgani Director, The National Center for Research, Ministry of Science and Communications	

Period of Evaluation: 6 – 22 September 2014

Type of Evaluation: Terminal Evaluation

III. Results of Evaluation

1. Achievements

1-1. Achievement of Outputs

(1) Output 1: Innovative technologies to control *Striga* are developed. (Most likely to be achieved)

To attain the output 1, the Project has carried out the researches on the six subjects. Experiments and verifications were conducted mainly at the *Striga* Research Laboratory in SUST. Achievements of each subject are as follows.

Subject 1: The Project has worked on the structural determination of strigolactone, and a *Striga* germination stimulant, T-010, was synthesized to induce suicidal germination.

Subject 2: The Project has isolated and identified microorganisms which have the potential to interfere and/or arrest early developmental stages of *Striga* through laboratory and pot experiments.

Subject 3: Based on the metabolic analysis, carbon and nitrogen sources for the germination of root parasitic weeds were identified and inhibition of sugar metabolisms was confirmed to have preventive effects on seed germination.

Subject 4: The differences in photosynthetic capacity, stomatal conductance and transpiration rate between *Striga* and host plants were analysed in terms of translocation mechanisms.

Subject 5: The *Striga* resistance of the selected varieties was examined through pot experiments two varieties (Umgar and NERICA 5) indicated high resistance.

Subject 6: A sesame variety with suppression effects on *Striga* was selected through evaluation using rhizotron method and hydroponic culture. Varieties of sunflower, wheat, cowpeas have also been evaluated as potential crop for rotation or mix cropping to mitigate *Striga* damage

(2) Output 2: Farmers' practice to manage *Striga* is ameliorated. (Most likely to be achieved)

Subject 7: Economical and technical capacities among the farmers were identified as factors that affect the degree of acceptance of the new technologies such as application of herbicide to control *Striga*. As for the preferences of sorghum varieties, data have already been collected from about seventy samples, which are at the final stage of processing and analysis.

Subject 8: The Project has organized 24 Farmer's Field Schools in 3 localities in Gedaref. Weekly meetings were conducted throughout the cropping season, and supervised by the extension department of GSMAI. The techniques to control *Striga*, together with other basic cultural management practices, are taught in these FFS.

1-2. Measures taken to address the Recommendations made at the Mid-term Review

(1) Revision of Master Plan

The revised Master Plan as summarized as PDMe was duly approved as PDM version 2 at the JCC meeting held on December 25, 2012.

(2) Utilization and maintenance of equipment for research

The Project has provided guidance on the basic operations and maintenance of the equipment. In addition to the researchers, one of the technicians of the Striga Research Laboratory participated in the training in Japan in 2013, which contributed to the further technology transfer particularly in this regard. These training in Japan were effectively augmented by the dispatch of a Japanese expert at three and six months after the training to provide follow-up guidance in the Striga Research Laboratory.

(3) Capacity Development for Output 1

One young researcher per year participated in the JICA training course on Integrated Pest Management (IMP) over the years from 2010 to 2013, upon which the young scholars had opportunities to be guided by the Japanese researchers in Japan. In Sudan, at the Striga Research Laboratory, many graduate students were also involved in the Project who could also be guided by the Project team members. By the time of the Study, 17 research papers were published and 17 presentations were made

by the Sudanese researchers. Unfortunately, two young researchers have left *Striga* Research Laboratory in 2012.

(4) Enhancement of smooth implementation of the activities for Output 2

There has been a Japanese researcher joined the research on Subject 7 since 2012, in close collaboration with the Sudanese researchers who had worked on the subject since the beginning of the Project. However, it should unfortunately be admitted that the activities on Subject 8 were mostly carried out by the Sudanese team members while the Japanese researcher who has been stationed in SUST for longer period of assignment occasionally took part in a part of the monitoring.

1-3. Prospect for Achievement of the Project Purpose

The *Striga* Research Laboratory of SUST is a formal institution of *Striga* research at SUST. There are two researchers and three technicians permanently assigned and some researchers from the National Center for Research (NCR) and ARC also participate in the activities. The annual budget planning has been exercised by *Striga* Research Laboratory, but no longer-term plan has yet been formulated. However, the College of Agricultural Studies (CAS) is planning to establish a new and independent research center on weed science, of which the current *Striga* research laboratory would become an essential part. A committee to discuss the detailed plan of the new center, composed of the researchers from relevant departments of the college and some representatives from ARC, has been organized and it is expected the mid- or long-term comprehensive plan would be formulated. By the time of the Study, 15 research papers were published and 17 presentations were made by the SUST researchers in various seminars, conferences and workshops. Hence the Team foresees a fair prospect for the achievement of the Project purpose.

2. Summary of Evaluation Results

2-1. Relevance: High

The Project is consistent to the policies of the Sudanese government, as well as to the ODA programs of Japanese government. The focus of the Project is appropriate response to the needs of beneficiaries.

2-2 Effectiveness: High

All of the expected outputs are steadily being achieved and most likely be attained by the end of the cooperation period. There is positive prospect for attainment of the Project purpose.

2-3 Efficiency: High

The inputs from both Japanese and Sudanese sides have duly been provided to produce the intended outputs. It should be noted with appreciation that the Sudanese government has provided considerable amount of “local component” which were utilized to renovate the existing laboratory facilities and to construct new building to be the base for future research activities.

2-4 Impacts: High positive impacts

There are many graduate students were also involved in the research activities, whose experiences to work in the Project would be transferred to the relevant institutions in the future. GSMAI has started to apply FFS as effective extension tool to its own programs with a manual that they produce themselves. At the field level, positive impacts on the agricultural production and income are reported, though not all of the farmers could apply all of the techniques due to the affordability of some inputs. Some farmers have organized themselves into formal groupings to help each other as well as to obtain better access to external resources such as support from government programs and loans from banks. Farmers also enjoy closer relationship with extension officers, and some lead farmers have already disseminated what they have learned through the Project to other farmers in and around their communities.

2-5 Sustainability: Moderate

Current policy directions that emphasize the importance of increase of agricultural productivity and food security are likely to continue. Organizational structures for research and extension may not change but financial sustainability would largely depend on the future efforts, to realize the Weed Research Center at SUST, as well as to secure resources for extension activities in Gedaref. A fair prospect is expected in terms of technical capacities of researchers and extension officers, while there may be financial and organizational constraints for continuous adoption of *Striga* control techniques among the farmers.

3. Factors that Promoted Realization of Effects

3-1 Factors Concerning the Planning N/A.

3-2 Factors Concerning the Implementation Process

Some research team members could avail additional fund from external sources. Also, additional financial supports were provided to conduct FFS in the field by the Sudan Bank and Agricultural Bank. These supports were found to have contributed to the smooth and effective implementation of the Project.

4. Factors that Inhibited Realization of Effects

4-1 Factors Concerning the Planning N/A.

4-2 Factors Concerning the Implementation Process

The drought in the cropping season of 2013 negatively affected the yield performances in some of the FFS demonstration plots. The incidence caused negative influences in terms of the effects of technology dissemination, although the Project could manage to proceed with its originally planned activities through the efforts of the relevant personnel.

5. Conclusion

The Team confirmed that the technical capability of staff of SUST as well as cooperating institutions for *Striga* research has surely been improved. Most of the recommendations by the Mid-Term Review Team have been addressed, and the necessary steps to continue *Striga* research activities are being taken through the plan of a special *Striga* research center or “the Weed Research Center”.

In accordance with the results of the comprehensive evaluation, it is concluded that the Project would be completed in February 2015 as planned. There are still several important issues to be addressed in order to have better outcomes of the Project. These issues are explained as recommendations in the following chapter.

6. Recommendations

6-1 Recommendations for the remaining period of the Project

6-1-1 Support for planning of the proposed Weed Research Center of SUST

As previously discussed in the section 4-5-2, the CAS is currently planning to establish a Weed Research Center, which would further enhance the research activities on Striga as well. The details of the plan are to be discussed from now on among the designated members of the planning committee that includes some research team members of the Project. This center would be one of the good ways to continue and further expand the achievement of the Project. It is thus important for the Project to monitor the progress of the formulation of the concrete plan, and to provide information and supports to the efforts to facilitate their planning activities by CAS.

6-1-2 Preparation of operation manuals on equipment

The Striga Research Laboratory of SUST has well been managed by virtue of efforts of the Project personnel with support of Japanese experts. It was observed by the Team that some operation manuals on usage of the laboratory equipment are indicated at the Laboratory, and operational manuals for GC (Gas Chromatography) and HPLC (High Performance Liquid Chromatography) are under preparation by a Japanese expert. However, for long-term technical sustainability, the Team recommends preparation of operational manuals for other equipment.

6-2 Recommendation for the Sudanese government for future (after completion of the Project)

6-2-1 Official Recognition of SUST as Center of Excellence

The MHESR has been working to officially recognize the Striga Research Laboratory / CAS as the Center of Excellence (COE). As the authorization as COE may help SUST to further develop and enhance its research and educational capacities, it is recommended for the MHESR to accelerate the procedure to realize the authorization in an official manner.

6-2-2 Efforts to secure financial support

Along with the termination of the Project, the financial support such as local component from the MFNE and local expense borne by the Japanese side would cease. It is generally assumed that the fund allocation afterwards would inevitably been of much smaller scale. Thus the Team requests the participating institutions to continuously make their efforts to secure resources necessary to continue, further expand and scale up the accomplishments brought about by the Project, not only in terms of research activities at SUST, but also of the extension and demonstration activities by ARC and GSMAI.

7. Lessons Learned

7-1 Open access to research facilities

Universities and national research institutions are strongly expected to conduct research in order to solve the important problems in improving agricultural development. Universities are supposed to educate young students and researchers through research.

SUST has allowed Striga researchers from other institutions to utilize the Striga Research Laboratory equipment provided through the Project. This policy seems to have been very effective.

As most developing countries are not capable to furnish relevant institutions with necessary instruments for all research, it is desirable for universities and national research institutions to play a central role in generating wider impacts on the society by providing open access for academia and other stakeholders.

7-2 Proper coordination among institutions

The Project was implemented in collaboration among several research institutions, who shared the common interests and commitment in Striga research. Efforts have been made to ensure close communications, and proper coordination made among these participating institutions seems to have contributed to smooth implementation of the Project, thus led to the success and fruitful achievement of the Project.

7-3 Trust relationship

Representatives of the Striga research from both Sudanese and Japanese sides have been working for more than 20 years and there is a decisive confidential relationship between them. Such relationship is essential for not only a research project but also others to conduct sustainable activities with counterparts.