# LOW-COST TECHNOLOGIES FOR PADDY FIELD INFRASTRUCTURE DEVELOPMENT IN AFRICA

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**ABSTRACT**

**Background**

JIRCAS is implementing the activity “Low-cost technologies for paddy infrastructure development” as one of three sub-projects under “Development of rice production technologies in Africa (DeriptA)” which is the flagship project of the JIRCAS program “Stable Food Production”. DeriptA aims to contribute to the reduction in current food shortages and poverty in African countries, corresponding to the goal of the Coalition for African Rice Development (CARD), which was established to realize the Yokohama Statement, in 2008 at the Tokyo International Conference on African Development IV (TICAD IV), saying “African rice production will need to be doubled in the next decade”.

The sub-project “Low-cost technologies for paddy infrastructure development” aims to develop a low life-cycle cost of paddy-infrastructure technology, an Asian-type rice cultivation system and a paddy field model suitable to African conditions. The sub-project is expected to enables African local farmers to easily recreate irrigated paddy fields of Asian-type that are bunded, levelled and puddled; and to carry out paddy rice cultivation with farmers-affordable local materials.

**Components of the sub-project**

The sub-project is composed of three components and the each component has three or four sub-components; the content of each sub-component is as follows:

1. Component 1 (Development of low-cost irrigation infrastructure)
   - Sub-component 1-a : Evaluation of existing irrigation technologies
   - Sub-component 1-b : Development and selection of low cost irrigation facilities
   - Sub-component 1-c : Evaluation of farming improvement and selection of optimum structures

2. Component 2 (Development of paddy infrastructure model for intensively farming in precedent paddy farming areas)
   - Sub-component 2-a : Development of Improved Infrastructure and Technology for Rice Production in Africa (DIITRPA) (in Ghana)
   - Sub-component 2-b : Improvement of soil fertility with use of indigenous resources in rice systems of Sub Sahara Africa (in Ghana)
   - Sub-component 2-c : Formulation of guideline for paddy infrastructure design criteria
   - Sub-component 2-d : Research for promotion conditions of farm mechanization

3. Component 3 (Development of dissemination method of paddy infrastructure technologies through application of south-south cooperation)

Sub-component 3-a : DIITRPA (in Ethiopia)

Sub-component 3-b : Research of water resource management

Sub-component 3-c : Research of condition for formation of south-south cooperation

**How does the sub-project achieve its aims?**

Ten sub-components of the sub-project cover most of the major “hardware” elements of paddy cultivation, i.e. irrigation, farm land, soil, water resouces and Farming Related to “Hardware” Improvement (FRHI). For example, the research field of sub-component 1-a is irrigation infrastructure, the research fields of sub-component 2-a and sub-component 3-a are irrigation, farm land and FRHI and the research field of sub-component 2-d is FRHI (farm mechanization). Sub-components also produce manuals/giuidelines which are related to the research field(s) of each sub-component. Thus, the sub-project, is expected to achieve its aim “increase rice production in Africa” as output and to contribute to CARD, together with other research activities related to paddy cultivation in Africa.

**Current Situation of the progress of sub-components**

Each sub-component has presently been at different reaserch stage.
For example, sub-component 2-a and sub-component 3-a are in the 4th year of 4-year implementation plan of research in Ghana and Ethiopia. A technical manual for DIITRPA has been twice drafted after various on-farm research activities, and it will be finalised within this Japanese fiscal year (FY).
Sub-component 2-b is now 3rd year of 5-year implementation plan of research in Ghana. Effective applications of various local organic matters and phosphate rock has been investigated (with different scales of experiments in laboratory, glasshouse, on-station and on-farm). Farmers’ affordability to these "low-cost" technologies has been socioeconomically surveyed and analyzed.
Other sub-components, except sub-component 2-c, were commenced in this FY and sub-component 2-c would be commenced in FY 2012.

**KEYWORDS**
Paddy, low-cost irrigation, machanization, soil fertility, manual

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## Contents

- Structure of all JIRCAS Research program & position of a research for "Low-cost technologies for paddy field infrastructure development"
- Aim of the research
- Current progress of the research
- How the research achieves its aim

## JIRCAS's 4 Research Programs

- Environment and Natural Resource Management
- **Stable Food Production**
- Rural Livelihood Improvement
- Information Analysis

## Stable Food Production program

**Technology development for increased productivity and stable production of agricultural products in the tropics and other unstable environments;**
The program consists of following 6 projects.

- **Development of rice production technologies in Africa**
- Development of genetic engineering technologies of crops with environmental stress tolerance
- Development of breeding technologies toward improved production and stable supply of upland crops
- Evaluation and utilization of diverse genetic materials in tropical field crops
- Rice innovation for environmentally sustainable production systems
- Development of integrated pest management techniques for stabilization of agricultural and livestock production in developing areas

## Project: Development of rice production technologies in Africa

The project consists of following 3 sub-projects.

- Sub-Project #1: Development of Technology Adaptable to Africa for Evaluation of upland and lowland Germplasm and Improving Stability in Rice Production (Stable Rice Production in Africa, SRPA)
- **Sub-Project #2: Formulating a low-cost Asian-type reclamation model in Rain-fed lowland in Africa (Low-cost Paddy field Model, LPM)**
- Sub-project #3: Development of low-input rice cultivation system in flood-plains in Africa (Flood-Plains Rice, FPR)

## Aims of the sub-project #2 (LPM)

**Target:**
**Rice production in Africa to be increased**

The sub-project "Formulating a low-cost Asian-type reclamation model in Rain-fed lowland in Africa" focuses on hardware of rice cultivation to develop a low life-cycle cost of paddy-infrastructure technology, an Asian-type rice cultivation system and a paddy field model suitable to African conditions.

- cost including construction, O&M for in-service period
- such as irrigated paddy fields which are bunded, levelled and puddled
- such as heavy rainfall and availability of materials & tools

## Sub-Project #2 "Formulating a low-cost Asian-type reclamation model in Rain-fed lowland in Africa (LPM)" 1/3

The sub-project consists of following 10 sub-components.

1. Component 1 (Development of low-cost irrigation infrastructure)
   - Sub-component 1-a :
     **Evaluation of existing irrigation technologies**
   - Sub-component 1-b :
     **Development and selection of low cost irrigation facilities**
   - Sub-component 1-c :
     **Evaluation of farming improvement and selection of optimum structures**

## Sub-Project #2 "Formulating a low-cost Asian-type reclamation model in Rain-fed lowland in Africa (LPM)" 2/3

2. Component 2 (Development of paddy infrastructure model for intensively farming in precedent paddy farming areas)
   - Sub-component 2-a :
     **Development of Improved Infrastructure and Technology for Rice Production in Africa (DIITRPA) (in Ghana)**
   - Sub-component 2-b :
     **Improvement of soil fertility with use of indigenous resources in rice systems of Sub Sahara Africa (in Ghana)**
   - Sub-component 2-c :
     **Formulation of guideline for paddy infrastructure design criteria**
   - Sub-component 2-d :
     **Research for promotion conditions of farm mechanization**

## Sub-Project #2 "Formulating a low-cost Asian-type reclamation model in Rain-fed lowland in Africa (LPM)" 3/3

3. Component 3 (Development of dissemination method of paddy infrastructure technologies through application of south-south cooperation)
   - Sub-component 3-a :
     **Development of Improved Infrastructure and Technology for Rice Production in Africa (DIITRPA) (in Ethiopia)**
   - Sub-component 3-b :
     **Research of water resource management**
   - Sub-component 3-c :
     **Research of condition for formation of south-south cooperation**

## Current progress of the research (1)

**Title**

"Development of Improved Infrastructure and Technology for Rice Production in Africa (DIITRPA)" (funded by Ministry of Agriculture, Forestry & Fisheries, Japan (MAFF))

**Counterparts**

- Ministry of Food and Agriculture (MOFA), Soil Research Institute (SRI) and Crops Research Institute (CRI) in Kumasi, Ghana
- Ministry of Agriculture in Bahir Dar, Ethiopia
- Other research and development organizations are also involved

**Stage at this moment**

In the 4th year of the 4-year plan of research

**Activities / Outputs**

- A technical manual for DIITRPA has been twice drafted after various on-farm research activities concerning paddy land, farming and rice variety, including OJT for extension officers and farmers, and the manual will be finalized within this Japanese fiscal year.
- After the OJT, the extension officers by themselves can instruct farmers and the farmers (including farmers nearby the research field) by themselves can reclaim land

## Some activities of DIITRPA (1)

Before development

Constructing bunds

Photos by Crops Research Institute (CRI), Ghana

## Some activities of DIITRPA (2)

Constructing drainage

Leveling

Photos by CRI, Ghana

## Some activities of DIITRPA (3)

Transplanting

Paddy planted

Photos by CRI, Ghana

## Current progress of the research (2)

**Title**

"Improvement of soil fertility with use of indigenous resources in rice systems of Sub Sahara Africa" (funded by MAFF)

**Counterparts**

- Soil Research Institute (SRI) in Kumasi, Ghana
- University for Development Studies (UDS) in Tamale, Ghana

**Stage at this moment**

In the middle of the 5-year plan of research.

**Activities**

- Effective application of various local organic matters and rock phosphate has been investigated (with different scales of experiments in laboratory, glasshouse, on-station and on-farm).
- Farmers affordability to these "low-cost" technologies has been socioeconomically surveyed and analyzed.

## Some activities of "Improvement of soil fertility with use of indigenous resources in rice systems of SSA"

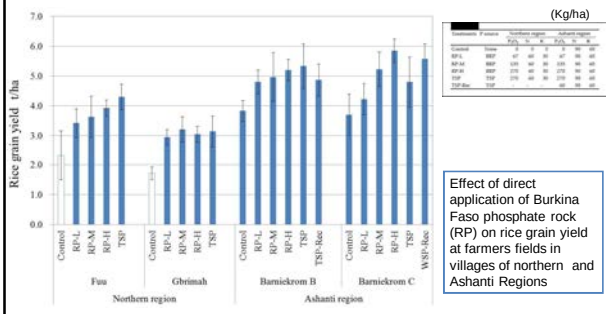
Farmers workshop at a village for affordability of local resources

Carbonization of rice straw with a simple apparatus

On-farm trial around Tamale

Photos by JIRCAS

## An output of "Improvement of soil fertility with use of indigenous resources in rice systems of SSA"




Effect of direct application of Burkina Faso phosphate rock (RP) on rice grain yield at farmers fields in villages of northern and Ashanti Regions

Data by Dr. Satoshi Nakamura, JIRCAS

## How does the sub-project achieve its aims?

- Ten sub-components of the sub-project cover most of the major "hardware" elements of rice cultivation, i.e. irrigation, farm land, soil, water resources and "Farming Related to Hardware Improvement" (FRHI).

## Major "Hardware" elements of rice cultivation

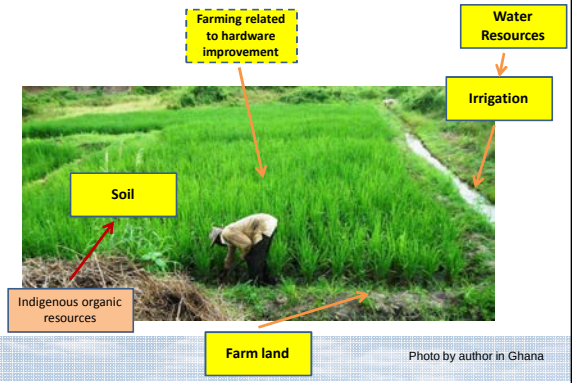


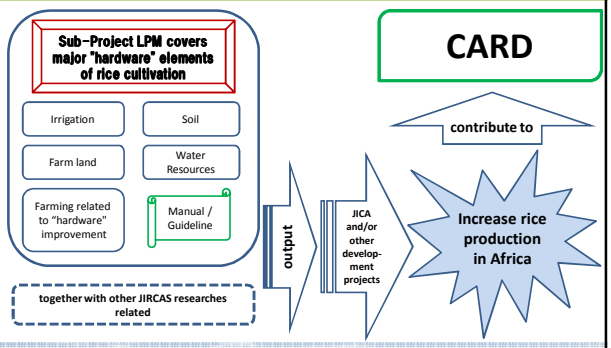

Photo by author in Ghana

## Matrix of Research Sub-components and their target/output in the Sub-project LPM

| Sub-component | Target / Output | | | | | | |
|---|---|---|---|---|---|---|---|
| | Irrigation | Farm land | Soil | FRHI | Water resources | Knowledge dissemination | Manual / Guideline |
| 1-a Evaluation of existing irrigation technologies | O | | | | | | |
| 1-b Development and selection of low cost irrigation facilities | O | | | | | | |
| 1-c Evaluation of farming improvement and selection of optimum structures | O | | | | | | |
| 2-a Development of Improved Infrastructure and Technology for Rice Production in Africa (DIITRPA) (in Ghana) | O | O | | O | | | O |
| 2-b Improvement of soil fertility with use of indigenous resources in rice systems of Sub Sahara Africa (SSA) | | | O | O | | | |
| 2-c Formulation of Guideline for paddy infrastructure design criteria | | | | | | | O |
| 2-d Research for promotion conditions of farm mechanization | | | | O | | | O |
| 3-a DIITRPA (in Ethiopia) | O | O | | O | | | O |
| 3-b Research of water resource management | | | | | O | | |
| 3-c Research of condition for formation of south-south cooperation | | | | | | O | O |

Source: author

## Fruits of Sub-Project #2 "Formulating a low-cost Asian-type reclamation model in Rain-fed lowland in Africa (LPM)"




Source: author

## Thank you for your attention!

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