



e-Agriculture Promising Practice

Rice Crop Manager and RiceAdvice Decision tools for rice crop management



Improving smallholder rice- farmers' yields and income in Asia and sub-Saharan Africa

Key facts

- **Location:** Philippines, India, Indonesia and Bangladesh for Rice Crop Manager and Mali, Nigeria and Senegal for RiceAdvice
- **ICT used:** Rice Crop Manager is a web tool and RiceAdvice an android-based application
- **Area of work:** Rice farming
- **Target group:** Smallholder rice-farmers
- **Stakeholders:** IRRI, AfricaRice, donors, governments, researchers, agro-input dealers, farmer organizations, private sector
- **Timeframe:** Since 2000

Rice Crop Manager and RiceAdvice are two decision support tools that were developed by the International Rice Research Institute (IRRI) and Africa Rice Center (AfricaRice) for rice crop management. The web based tool (Rice Crop Manager) and the android application (RiceAdvice) both aim at providing smallholder rice-farmers with timely field specific guidelines for crop and nutrient management practices. The tools provide information at the start of the season and for in-season practices such as weeding and fertilizer application. The guidelines are generated each new season, in order to remain as accurate as possible. Rice Crop Manager is a free decision-making tool accessible through the web browser for Windows, Android and Linux. It can be used on a smartphone, tablet or computer. RiceAdvice is a free application for Android and an Android-based smartphone or tablet is needed for its use.



© Africa Rice Center/Kokou Ahouanton

Local extension worker in Nigeria interviews farmers to be able to provide them with field-specific crop management options for rice

Context and problems addressed

Rice farming in Asia is a source of livelihood for more than 50 million households. In sub-Saharan Africa, the number of households who grow rice in irrigated and rain fed lowland is estimated at 4.7 million households.

In Asia and sub-Saharan Africa, rice productivity is often low due to sub-optimal crop management practices by smallholder farmers. Traditional blanket recommendations for soil fertility management practices have been introduced to rice farmers. However, these blanket recommendations have not been updated regularly, and are therefore quickly outdated.

Also, farmers have limited access to extension services due to the limited number of public extension workers, which leads to the fact that many rice farmers are not aware of the right combination, dosage, and timing of fertilizer application needed for their rice-fields. Furthermore, fertilizer is costly for smallholder farmers who often have limited financial resources. The combination of these different factors have resulted in soil nutrient depletion, and consequently caused soil degradation. The fields of smallholder farmers are very diverse, when you look at soil type, farmers' management practices, etc. Gains in productivity and input-use efficiency require crop and nutrient management technologies that are more knowledge-intensive and tailored to the specific characteristics of individual farming practices and fields.

These big challenges have led to the development of information and communication technology (ICT)-based innovations for rice. Decision support tools help improve yield and hence the income of smallholder rice farmers. The tools contribute to poverty reduction, food security, and environmental sustainability through improvement of rice yield, efficient use of fertilizers, and addressing soil nutrient depletion.

The **main beneficiaries** of this practice are small-scale rice farmers who grow rice in irrigated and rain fed lowland conditions in Asia and sub-Saharan Africa. In Asia, irrigated and rain fed lowland rice systems account for about 95 percent of the total rice (*Oryza sativa* L.) production.

There are also many **other stakeholders** involved in this process such as:

- (1) IRRI and AfricaRice: development of the decision support tools;
- (2) Donor organizations which support development and dissemination of tools;
- (3) GRiSP (www.grisp.net) and RICE CRP (<http://ricecrp.org>), which have enhanced collaboration between IRRI and AfricaRice;
- (4) Public extension services, NGOs and development projects;
- (5) Other rice-related service provision enterprises;
- (6) Private sector enterprises such as rice mills;
- (7) Input dealers (or agro dealers);
- (8) Private service providers
- (9) Farmers' local organizations.

In case farmers do not have access to the Internet or do not have a smartphone or tablet, other rice value chain actors can use the decision support tools to provide farmers with field-specific guidelines for crop and nutrient management practices. With these tools in hand, public extension services and extension agents now have easy and timely access to information. Due to the introduction to the tools they feel more motivated and valued for the work they are doing and the knowledge they now can provide on a timely basis. An added value is also created for service providers such as agro-input dealers who will receive more clients and have increased sales.

Development of the ICT: Android application and web-based tool

More than 15 years of on-farm agronomic research in the region and recent advances in the development of ICTs for agriculture, allowed scientists to develop two interactive decision tools. The tools are developed for smartphone, tablet or computer with an Internet connection.

Farmers or other users, such as extension officers can enter detailed information in their devices, such as rice-growing condition, variety, typical practices, expected sowing date, fertilizer availability, market price, etc. Filling in the data is fairly easy as the questions are framed in such a way that they are easy to answer. Once the details are filled in, farmers can set yield targets based on their available budget or desired or recommended production level in RiceAdvice while Rice Crop Manager automatically sets the target yield based on Oryza2000 model and farmers' information.

The tools are used before the rice-growing season. In each plot and for each season, one guideline is generated using one of the tools. The tools provide guidelines on crop and nutrient management practices at the start of the season and for in-season practices e.g. fertilizer application. The guidelines are generated each new season, in order to remain as accurate as possible. The fertilizer requirements will change depending on the available rice varieties, farmers' management or previous crop residue management.

Rice Crop Manager

The concept of Site-Specific Nutrient Management (SSNM) was developed based on research conducted between 1996 and 2000. SSNM is a plant-based approach that provides principles that can be used everywhere. SSNM was evaluated and refined with partners across Asia during the period 2000 till 2005. From 2005 to 2007, the emphasis shifted towards the development of country specific SSNM and related dissemination pathways.

From 2008 onwards, the focus shifted to develop innovative tools using ITCs and the **Nutrient Manager for Rice** was developed. The Nutrient Manager for Rice was developed by IRRI through partnerships with national agricultural research organizations in Asia from 2008 till 2010. This provided the SSNM-based, nutrient management component in **Rice Crop Manager** (RCM).

The Rice Crop Manager developed by IRRI in 2013 for the Philippines provided the framework for the crop management decision-making logic used in the subsequent Rice Crop Manager in India and other countries. From 2013, country Specific Rice Crop Manager was evaluated and refined. Rice Crop Manager in India was released in 2015.

Rice Crop Manager (RCM) is updated twice a year, before the start of the season. IRRI works with partners to collect feedback through surveys and focus group discussions. The feedback is incorporated in the system before the next update. The system is also pre-tested before the start of each season.

RiceAdvice

AfricaRice initiated the development of RiceAdvice in 2013 and a first version was developed and tested in 2014. Since then, various improvements have been made to the tool and it was released in Google Play in 2016.

RiceAdvice is updated two or three times a year. Feedback is collected through face-to-face interviews and post-harvest surveys. The results are then used to improve RiceAdvice.

Impact

The availability of better information resulted in yield gains. In India for example, paddy yield gains went up from 0.6 to 1.2 tonnes/ha, and income gains from USD\$ 100 up to USD\$ 170/per ha/per season, either due to increase in yield or reduction in fertilizer use or a combination of both. Similar increases were observed in Nigeria, Senegal and Mali.

The two tools improve farmers' knowledge of good agricultural practices. In the long-term, the use of this tool will reduce soil nutrient depletion and soil pollution caused by unbalanced and overuse of fertilizers.

Innovations and factors of success

Decision support tools on rice crop management practices were not available for the regions before the introduction of RiceAdvice and Rice Crop Manager. A wide range of partners showed interest in the use of the tools, and became scaling partners, which are helping in the deployment of the tools. The tool is handy and provides accurate, scientific and timely information.

Rice Crop Manager and RiceAdvice were developed based on site-specific nutrient management with focus on irrigated rice and favorable rainfed lowland rice. Their basic calculations for nutrient

requirement and fertilizer application rate were similar. Thus, the concept behind these tools was replicated across Asia and sub-Saharan Africa. Modules for flood and drought prone environments are under development and will be integrated in the existing tool.

Constraints

Many farmers do not have their own smartphone or tablet to use the decision support tools by themselves. Furthermore, farmers have limited access to extension services, as the number of public extension workers is limited as mentioned above. The challenge now is to identify suitable and local-specific business models on the use of the tools, and scale out such models and the tools to both farmers and service providers. Once the business model is developed farmers will have to pay for the recommendations.

In the case of Nigeria and Mali, farmers are willing to pay around \$5 for one advice generated by RiceAdvice to service providers. Service providers do not have to pay for the tools at this moment, as they are freely available for download. Different types of rice value chain actors could become service providers and include this service in their businesses. They can provide the service to the farmers who have no access to a smartphone, tablet or Internet or who are illiterate. The introduction of service providers could overcome these two constraints.



Mary Ann Somera, a farmer from Abra, the Philippines holds a printed version of the Rice Crop Manager recommendations.

For India and the Philippines, the governments are enabling the villages with better digital services e.g. improved internet facilities, free android mobiles to the extension workers, investment on youth as entrepreneurs. The farmers are willing to pay a price for the Rice Crop Manager recommendations to the service providers.

To facilitate out-scaling of both of tools, stakeholder meetings were organized to identify major constraints to the use of the tools, local-specific strategies to alleviate these constraints, develop a work plan, and implement the activities planned. Stakeholders' meetings are organized at the start of each season. Each time some existing and some new stakeholders will join and then the area and the targets are divided.

The tools also try to give solutions to other problems such as illiteracy. In India a model is tested that is linked to voice messaging to overcome this constraint.

Lessons learned

Agricultural innovations should be developed together with users and potential scaling partners. They should be involved in initial testing phase, and developers should get their feedback in that phase to enable them to improve the tools.

Sustainability

One of the challenges is farmers' low level of literacy and lack of ICT skills, and their limited access to smartphones or tablets and Internet, which are often common challenges for almost all ICT tools. Only when these global issues are solved, the tools can be truly socially, economically, and environmentally sustainable.

However, extension agents and service providers can help the farmers in case they are experiencing difficulties in accessing and using the tools.

These tools will provide farmers with personal guidelines based on their financial resources, and are affordable innovations for smallholder farmers.

More than 90 percent of farmers, who benefitted from RiceAdvice in Nigeria and Mali in 2016, wish to reuse it in 2017. More than 95 percent of the farmers, who benefitted from Rice Crop Manager in the Philippines and India, wish to reuse it the upcoming season.

In order to become economically sustainable both services will become payable to the farmers after additional evaluation and adaptation.

Replicability and upscaling

As for replicability, there is a need to take into account that where the tools are newly introduced, nutrient omission trials and/or field-based validation are required. Nutrition omission trials might be needed for a period of 1 to 2 years. Field based validation will be needed for about 1 to 2 years. The time needed will depend on how similar or how different the location is from places where the tool is already introduced. In total it will take about 1 to 3 years before large-scale dissemination is possible.

If the tools are introduced to rainfed rice environment, information on weather forecast should be considered. Field-testing of weather-based advisory, developed in collaboration with a weather agency will start in November 2017. Also, if soils have specific nutrient deficiency, application of micronutrients should be considered.

The partners have witnessed the increase of productivity by using the tool and this motivates them to upscale the use of the tools and to increase the capacities of their beneficiaries. In the case of RiceAdvice, the scaling partners include the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)-Competitive African Rice Initiative (CARI) and Syngenta Foundation as well as national agricultural research and extension systems such as the Institut d'économie rurale in Mali, the National Cereals Research Institute, and Ahmadu Bello University in Nigeria.

Rice Crop Manager also has attracted huge interest from government and private partners, who play important role for its out- and up-scaling.

In case for the Philippines, they are the Philippines Department of Agriculture (DA), National Rice Program through the DA Bureau of Agricultural Research (DA-BAR) and the DA Agricultural Training Institute (DA-ATI). In India, Department of Agriculture and Farmers Welfare (DoA & FW) is investing on out-scaling better nutrient management practices using RCM. Other scaling partners include the Odisha University of Agriculture and Technology (OUAT), IFFCO-IKSL, Precision Agriculture for Development and the Indian Council of Agricultural Research (ICAR).

Farmer's story

Testimonies from beneficiaries of Rice Crop Manager in Asia: Kartika Samal (Farmer, Bhadrak, Odisha, India): *"I applied fertilizers as per Rice Crop Manager recommendation in half of my land and in the other half I applied fertilizers as per my usual practice. In the Rice Crop Manager plot, the yield was higher, by 1.2 tonnes and there was a cost saving of Rs 1200 per hectare as less fertilizers were applied."*

Sukanta Nayak (A woman farmer from Sisio village, Puri, Odisha, India): *"I am happy that I do not have to ask anyone else on how much fertilizer I need to add. I will follow the advice and will also recommend other farmers to get personalized advice."*

Shrabani Moharana (Assistant agriculture officer, Gadamanitri, Govt. of Odisha, India): *"Being an extension agent, it is helpful to me to use the tool for recommendation of fertilizer and also for providing advisory service to farmers to increase their rice yield as well as improving their livelihoods in general."*

Testimonies of beneficiaries of RiceAdvice: Mr Murtala Aliyu (Kebbi, Nigeria): *"Before I applied 4 bags of fertilizer and I got 6 bags of paddies from my 0.2 ha farm. But with RiceAdvice, I applied 2 bags of fertilizer and I harvested 18 bags in the same area."*

Mr. Abdullahi Mahari (Jigawa, Nigeria): *"After seeing the increase in yield in my farm with RiceAdvice, I am willing to pay 20 000 Naira for this service because it is profitable to me."*

Mrs. Saha Musa (Jigawa, Nigeria): *"Before I used to have difficulties in buying fuel to irrigate my field in the dry season but with the increase in yield that RiceAdvice has brought to me, I can now afford fuel and will produce rice all year round."*



About the authors



Kazuki Saito is an agronomist with the Africa Rice Center. He has more than 15 years of experience in Asia and sub-Saharan Africa. He is currently leading a multi-institutional proposal writing team for Flagship Project 3: 'Sustainable farming systems' as part of the new RICE CRP led by IRRI. He coordinated the 'Africa-wide Rice Agronomy Task Force' involving scientists from 21 countries in sub-Saharan Africa, aiming to develop and out-scale improved agricultural innovations. He has authored and co-authored more than 70 scientific papers in peer-reviewed journals and was awarded the Louis Malassis International Scientific Prize for Young Promising Scientists in 2015.



Sheetal Sharma is a Soil Scientist with the International Rice Research Institute. She works with the IRRI Rice Crop Manager team and leads the initiatives in South Asia to transform the provision of information to farmers and, to make site-specific recommendations available to small farmers. She majorly works on combining detailed information on crop performance with innovative knowledge transfer approaches and the development of ICT-based decision-support tools suited to extension workers and farmers using mobile applications or computers. She is also actively involved in capacity development of local scientists. She authored and co-authored more than 20 scientific papers in peer-reviewed journals/book chapters and received her PhD degree in Soil Science.

Kazuki Saito
Africa Rice Center - AfricaRice
k.saito@cgiar.org

Sheetal Sharma
International Rice Research Institute (IRRI)
Sheetal.sharma@irri.org

Resources

- Rice Crop Manager website: <http://cropmanager.irri.org/>
- RCM Media: <http://news.irri.org/2016/06/nutrient-management-app-for-better-rice.html>
- RCM Article Rice Today: <http://ricetoday.irri.org/an-app-tailor-made-for-indias-rice-farmers/>
- RCM IRRI Knowledge Bank: <http://www.knowledgebank.irri.org/decision-tools/crop-manager>
- RiceAdvice website: <https://www.riceadvice.info/en/>
- RiceAdvice Googleplay: <https://play.google.com/store/apps/details?id=com.cocapacity.rice>
- RiceAdvice user guide and promotion video: <https://video.riceadvice.info/en/>
- RiceAdvice Article Rice Today: <http://ricetoday.irri.org/riceadvice-an-app-tailor-made-for-african-farmers/>

E-AGRICULTURE CALL FOR GOOD AND PROMISING PRACTICES

This document was developed in the framework of the 2017 e-Agriculture Call for Good and Promising Practices on the use of ICTs for Agriculture and Rural Development in collaboration with the Food and Agriculture Organization of the United Nations (FAO) and the Technical Centre for Agricultural and Rural Cooperation (CTA).

e-Agriculture is always happy to review your good or promising practices! You can submit a proposal, following the sections in this document to e-agriculture@fao.org
Would you like to stay informed? Register to become a member of the e-Agriculture Community of Practice: www.e-agriculture.org/user/register

Good and Promising Practices on the use ICT for agriculture in collaboration with

