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BENEFITS OF PROMOTING SSNM: EXPERIENCE FROM INDONESIA

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Abstract

Best nutrient management practices for rice based on the site-specific nutrient management (SSNM) approach were developed in Indonesia through a decade of collaborative research with IRRI. The dissemination of SSNM presented an ambitious task meriting facilitation from a team of respected national experts representing key partner organizations of ICATAD, ICALRD, ICFORD, and ICRR. In August 2007, a Technical Team for facilitating SSNM dissemination within the framework of integrated crop management (ICM) for rice was established. By the completion of its mission in December 2008 the Technical Team had developed training and promotional materials, released decision support software enabling extension workers and farmers to quickly determine best nutrient management practices for rice fields, and published the 2007 edition of *Rice: A Practical Guide to Nutrient Management* as an SSNM reference book in the Indonesian language. In 2009, the Technical Team was followed by a national Facilitator Team through a commitment of IAARD and IRRI to facilitate dissemination of rice technologies arising through the Irrigated Rice Research Consortium (IRRC). As of November 2009, the Facilitator Team had largely focused on provinces in Java, but in the future it will expand to additional major rice-growing provinces in Indonesia.

Considerable progress has also been made in the development and promotion of SSNM for maize through collaboration of the International Plant Nutrition Institute (IPNI) with ICFORD and ICATAD. One of the outputs from this collaboration has been the development of computer-based decision support software, entitled *Nutrient Expert for Maize*, which enables researchers and scientists to determine a meaningful yield goal for a growing environment and identify best plant population and best nutrient management practices to attain the yield goal.

Introduction

Rice

Researchers from the Indonesian Center for Rice Research (ICRR) and International Rice Research Institute (IRRI) through collaborative field research during 1996-2002 developed the approach of site-specific nutrient management (SSNM) for rice in Indonesia. In 2002, SSNM was included as a component for further evaluation within integrated crop management (ICM) for rice. During 2003-2004, IRRI worked with the Indonesian Center for Food Crops Research and Development (ICFORD), ICRR, and the Indonesian Center for Agricultural Technology Assessment and Development (ICATAD) to strengthen the implementation of the ICM expansion project. The first workshop of SSNM for rice was conducted at Solo, Central Java, in November 2002. The second workshop was conducted in Medan, North Sumatera in June 2005. The workshop in Medan was instrumental in building a consensus on nutrient management for rice, which led very importantly to the formation of a national Fertilizer Work Group (FWG) on 9 October 2006. The FWG co-chaired by the Director of the Indonesian Center for Agricultural Land Resources Research and Development (ICALRD) and the Director of ICFORD endorsed a standardized SSNM recommendation for rice on 4 May 2007.

The dissemination of SSNM presented an ambitious task meriting facilitation from a team of technical experts. A national SSNM Technical Team was formed in August 2007 to facilitate the dissemination of SSNM for rice in Indonesia. It was composed of seven members representing ICFORD, ICATAD, ICALRD, and ICRR as key organizations with responsibilities for developing and disseminating fertilizer recommendations within the Indonesian Agency for Agricultural Research and Development (IAARD). A main task of the SSNM Technical Team during 2007-2008 was to facilitate the provincial Assessment Institutes for Agricultural Technology (AIAT) by providing training and promotional materials on SSNM for rice within the framework of the national initiative on integrated crop management (ICM) for rice.

The mission of the Technical Team was completed in December 2008. In 2009, a national Facilitator Team comprised of three Indonesian experts was formed through a commitment of IAARD and IRRI to facilitate dissemination of rice technologies arising through the Irrigated Rice Research Consortium (IRRC). The Facilitator Team focused on the development of tools to facilitate widespread dissemination and uptake of new technologies for rice within the framework of ICM and through an existing national Dissemination Team coordinated by ICATAD. As of November 2009, the Facilitator Team had largely focused on provinces in Java, but in the future it will expand to additional major rice-growing provinces in Indonesia.

Maize

In 2004, the Southeast Asia Program of IPNI (previously known as PPI/PPIC/IPI) initiated a three-year collaborative research project with Indonesian partner institutions to improve the productivity and profitability of maize in major agro-ecological zones (AEZ) in Indonesia through site-specific, integrated nutrient and crop management. Specific objectives were (1) to quantify and understand yield potential of maize and existing yield gaps, (2) to develop a scientific approach and practical tool for site-specific nutrient management in key maize production systems, (3) to evaluate the agronomic and economic performance of SSNM, and (4) to disseminate simplified SSNM recommendations. These activities were carried out in partnership with the AIAT in the provinces of North Sumatera, Lampung, Central Java, East Java, and South Sulawesi. Results from the on-farm trials during 2004-2008 were used to develop SSNM recommendations for the four major maize-growing provinces in Indonesia. Findings from these trials have also contributed to the development of the *Nutrient Expert for Maize* software.

On-station experiments on N management using the leaf color chart (LCC) were also established in the Indonesian Cereals Crops Research Institute in Maros during 2005-2009. Results from these trials were used in fine-tuning the N management strategy for SSNM.

What is new with promotion of agriculture technology?

The Technical Team and now the Facilitator Team have helped accelerate harmonization of technologies across national agricultural research and extension systems within Indonesia and spearheaded the development of innovative new tools to facilitate dissemination of rice technologies. Among the tools are videos, decision support software, and quick guides for fertilization.

Videos

Through the leadership of Dr. Adi Widjono, the Facilitator Team produced a video for farmers on implementing field-specific nutrient management rice. This video, which is now available on YouTube and on CD, provides farmers with easy-to-understand principles for nutrient best management practices for rice (IRRI, 2009b). The Facilitator Team also produced a video on ecologically-based rodent management.

Another national team through the International Plant Nutrition Institute (IPNI) completed in late 2009 a film on best management practices in maize. This film was taken in Kediri District, East Java Province and Karo District in North Sumatera Province — main districts for maize production grown under irrigated and rainfed upland conditions, respectively

Decision support software

A partnership of national and IRRI scientists in 2008 used the results from more than a decade of research on SSNM for rice to develop decision support software targeted for extension and farmers. This software follows an approach used with *Nutrient Manager for Rice* software released in the Philippines (IRRI, 2009a), but it is tailored to rice production for Indonesia. It was released on CD in Bahasa Indonesia with the title *Pemupukan Padi Sawah Spesifik Lokasi (Location Specific Rice Fertilization)* in 2008. The software consists of questions readily answered by an extension worker or farmer in 15 minutes. Based on responses to the questions, a fertilizer guideline with amounts of fertilizer required by crop growth stage is provided for the rice field.

Through a partnership of IPNI and national organizations in Indonesia computer-based decision support software entitled *Nutrient Expert for Maize* will soon be released for maize.

Other tools

Following an approach developed for rice in the Philippines, as of November 2009 efforts have begun to use *Pemupukan Padi Sawah Spesifik Lokasi (PuPS 1.0)* software to develop locally adapted fertilizer guidelines for the most common rice-growing conditions (i.e., yield level, duration of rice varieties, and crop residue management) in rice-growing areas. These guidelines are made available to extension and farmers in the local language as one-page quick guides for fertilizing rice (IRRI 2009b). Quick guides for fertilizing maize are also planned in the near future through partnerships of IPNI with national organizations.

The popular book on *Rice: A Practical Guide to Nutrient Management* (Witt et al., 2007) is now available in Bahasa Indonesia: *Padi: Panduan Praktis Pengelolaan Hara*.

Other tools to facilitate dissemination of nutrient management practices are two types of soil test kit developed by Indonesian Soil Research Institute (PUTS — a soil test kit for irrigated area and PUTK — a soil test kit for upland area) and the leaf color chart (LCC). The LCC was originally developed for use with rice, but it can be used for fine tuning the application of fertilizer N to maize.

Strategy to promote SSNM

The promotion of SSNM in Indonesia could be implemented through collaboration between research institutes and provincial Assessment Institutes for Agricultural Technology (AIAT) with either local government at the province and district level or with the central government, such as the Directorate General of Food Crops in the case of Farmer Field School of Integrated Crop Management (FFS-ICM) program. Other strategies for promotion of SSNM are the direct linkage with farmers such as through a demonstration plots in a village in collaboration with farmers group and through local radio programs in provinces.

In line with use of information technology to promote SSNM, decision support software and videos will increasingly be made available on the internet.

Promoting SSNM in Indonesia

In 2008, members of the Technical Team visited five AIATs (West Java, Central Java, East Java, North Sumatera, and South Sulawesi) to socialize and explain the SSNM approach and present the PuPS 1.0 decision support software. Researchers and extension specialists of AIATs subsequently disseminated PuPS on CD to extension at province and district level and directly to farmers group. The following is information gathered from AIAT staff.

North Sumatera

Mrs. Siti Suryani is a Senior Extension Specialist at AIAT North Sumatera. She was involved in various training programs for extension staff organized by the Extension Office at the district level, Agricultural Extension College, and Agriculture Extension Training Center. The last two are in Medan, North Sumatera. She participated in a socialization of PuPS at AIAT North Sumatera on 15 May 2008 followed by field practice in Primatani project area in Sedang Bedagai District in 16 May 2008. The participants received detailed information on how to run PuPS, enter valid data received from farmer into PuPS, and print the output. Her eagerness to promote PuPS to extension staff was based on her judgment that it was a very simple new tool, easily understood by field extension staff.

From 13 August 2008 to 11 June 2009 she promoted SSNM to 161 extension staff and distributed about 200 copies of PuPS on CD to training participants. Extension staff members who participated in the training were anxious to learn PuPS because it was new information for them. Mrs. Suryani admitted that there must be a follow up after training to evaluate the use of PuPS by extension staff in developing a fertilizer recommendation for rice. The main constraint for field extension staff to promotion of PuPS is the unavailability of computers in rural areas, especially remote areas.

East Java

Dr. Dadang Ernawanto is a researcher at AIAT East Java and Pimatani Project Supervisor in Jember District, East Java Province. He observed in 2007 that most farmers in Jember District purchased fertilizer as they wished because of the low price of inorganic fertilizer. Therefore, the rate of fertilizer application for rice and maize is consistently high. As an example, the use of 500-600 kg urea/ha for rice is commonly practiced by farmer in this area. In mid 2008, fertilizers became difficult to purchase due to limited fertilizer supply in a market. Dr. Ernawanto promoted the use of soil test kit (PUTS) and PuPS to extension staff at Jember District and its sub-district to address the limited supply of fertilizer and anticipation increased price of fertilizer.

SSNM in rice was implemented in the Primatani project area in Jember. In 2009, farmers attained rice yield of 7.5 t/ha where farmers previously got only 5.5 t/ha. Dr. Ernawanto trained one farmer to become a skilled technician to operate the soil test kit and PuPS, enabling him to help farmers determine a fertilizer recommendation. A key for success for Dr. Ernawanto in rolling out the use of PuPS is to work closely with staff of the Agriculture Office at the district level.

North Sumatera, Simalungun District

Mrs. Darmawati Nazir is a senior extension specialist of AIAT North Sumatera. She promoted SSNM to a farmer group in Manik Hataran village, Sidak Manik sub-district, Simalungun District, North Sumatera. She introduced the soil test kit and PuPS to farmers in this area because (1) the price of inorganic fertilizer increased and was not always available in a market, (2) analyzing soil in a laboratory is costly, takes time to obtain the result, and difficult to interpret as a fertilizer recommendation, (3) the rate of fertilizer and time of application vary among farmers, and (4) she has an obligation as extension specialist at AIAT to promote innovative technologies.

Response of farmers at Manik Hataran village to the introduction of PuPS was encouraging. It had been a long time since farmers in this village had soil of their field analyzed. The soil was analyzed using a test kit and information of the nutrient status was incorporated into PuPS. The fertilizer recommendation obtained with PuPS for a rice yield of 8.5 t/ha was printed and shown to seven farmers. In the beginning farmer did not believe that yield of 8.5 t/ha could be attained. On the other hand, farmers who had applied a low rate of fertilizer were enthusiastic to see the merit of applying the recommended rate of fertilizer. As an extension specialist, Mrs. Darmawati lacked practical experience to evaluate the SSNM in farmer's field. She was hoping PuPS would provide an accurate recommendation to attain the targeted yield.

With the PuPS recommendation the rice plant grew much better than before. One of the reasons for this success is because farmers improved their application of fertilizer N based on the recommendation derived from PuPS. Farmers formerly applied 75-125 kg ammonium sulfate/ha in every season, while the soil pH was 4.5 based on soil test kit.

Because of the good management practices and performance of the rice crop, 60 visitors from 60 villages in Simalungun District visited farmers who were practicing SSNM through use of PuPS. The visitors consisted of 30 farmer group leaders and 30 field extension workers. Mrs. Darmawati was happy not only because farmers were confident with the output of PuPS but also because many farmers learnt how to improve rice crop management from other farmers. She was pleased when the 250 field extension workers trained in June, July, and August 2009 from all districts in North Sumatera expressed their commitment to practice SSNM in a Field Laboratory of FFS-ICM in their respective areas.

Central Java

Mr. Samijan is a researcher of AIAT Central Java, and he is currently assigned as Field Supervisor for several projects in Klaten, Boyolali, Brebes, and Magelang Districts. He was involved in designing adaptive research on SSNM for maize to be carried out in all of these districts. In rice farming opportunity still exists for farmers to adopt newly released high yielding rice varieties including hybrid rice, but in maize farming all farmers already use hybrid maize except in less intensive areas. There is little opportunity to increase yield by adjusting maize variety. The technologies for maize must rely more on improvements in nutrient management, plant population, and plant spacing.

As has been recognized by Mr. Samijan, the fertilizer recommendation applied in the Field Laboratory of FFS-ICM and in demo plots was not fully based on SSNM for maize. The rate of fertilizer was still too general and only differentiated by agro-ecosystem. The farmers' time of application for N, P, and K fertilizer followed the SSNM principles for maize, but there remained considerable opportunities to improve nutrient management.

A prototype of best management practices for maize could be developed for a district or sub-ecosystem level using *Nutrient Expert for Maize* decision support software developed by IPNI. A fine tuning of this prototype recommendation could then be done through adaptive research or verification trials in a village or sub-district area. Judging from the uniformity of the ecosystem area, a few simpler quick guides could be developed for use in a large region.

Evaluation and dissemination of SSNM for maize

IPNI developed a framework for evaluation and dissemination of SSNM for maize with four key components: strategic assessment, results and feedback, extension campaign, and impact assessment. The introduction of SSNM in a new region begins with a strategic assessment of needs and opportunities for improvement in crop and nutrient management. Management options are developed and evaluated with participating farmers and key stakeholders in the public and/or private sector extension bodies. Once the evaluation is completed (i.e. a new practice has proven to provide sufficient benefits to be of interest to farmers) dissemination begins where guidelines and recommendations are made available to a larger number of farmers using extension campaigns. An impact assessment provides evidence and feedback for further improvement. It may be necessary to step through this cycle more than once to make necessary corrections in the technology or delivery strategy.

The *Nutrient Expert for Maize* software is an important tool in the development and evaluation of a new practice (i.e. SSNM recommendation) for a maize area. A film on best management practices for maize in different growing environments is currently under production and will be used as a tool in the dissemination of a new practice for maize.

Constraints in promotion of SSNM

Constraints identified in the promotion of nutrient management practices for rice and maize include:

1. Lack of harmonious linkages in some cases between research institutions (AIAT) and extension agencies (Agriculture Office and Extension Office at province and district level);
2. Lack of qualified personnel at the Agriculture Office and Extension Office, which deal with promotion strategy;
3. Insufficient awareness of researchers and extension specialists at most AIAT on the SSNM principles;
4. Lack of funds for AIATs to run adaptive research and verification trials.

Future plans for promotion of SSNM

The following tools will be developed in order to accelerate the widespread uptake of SSNM for rice and maize, leading to increased crop production and more efficient use of fertilizers:

1. SSNM videos (films) targeted to farmers and presenting best nutrient management practices for maize and rice;
2. Decision support software (*Nutrient Manager*) on the internet for access by extension workers and farmers through computers and mobile phones;
3. Training tutorials with trainers, which describe how to effectively use decision support tools;
4. A manual on how to develop, evaluate, and promote quick guides for fertilizing maize and rice.

Experiences in dissemination of SSNM and the tools for accelerating uptake of SSNM will be used to

1. Help the FFS-ICM program of the Department of Agriculture fine tune the nutrient and crop management at the Field Laboratory of FFS-ICM;
2. Guide a policy to allocate fertilizer to certain districts based on existing major crops. At present, fertilizers were allocated to a district based upon direction specified in the Ministry Decree, which is valid only for rice;
3. Increase the capacity of researchers and extension specialists of AIAT to develop locally adapted decision tools to facilitate dissemination;
4. Enhance capacity and motivation of local extension workers.

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