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SITE-SPECIFIC NUTRIENT MANAGEMENT (SSNM): PROFITABILITY TO FARMERS, CURRENT LEVEL OF ADOPTION, AND CONSTRAINTS TO WIDER ADOPTION IN ILOILO PROVINCE, PHILIPPINES

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Site-Specific Nutrient Management (SSNM): Profitability to farmers, current level of adoption, and constraints to wider adoption in Iloilo Province, Philippines

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Abstract

Site-specific nutrient management (SSNM) is an approach that enables farmers to dynamically apply fertilizer to the rice crop as and when needed. On-farm field experiments were conducted in Iloilo Province in the Philippines in 2006 to develop an SSNM recommendation. In 2007, on-farm trials were conducted on 22 farms in seven municipalities in the province to verify and refine the SSNM guidelines. The use of SSNM resulted in positive added net benefits, significantly higher yields, and higher gross return above fertilizer cost for farmers. Good crop management and assured availability of irrigation water helped to achieve targeted yields. The on-farm research resulted in refined SSNM guidelines that were further verified in 2008 and are now promoted and disseminated widely in the province and beyond.

The research to impact pathway for the SSNM technology involved the following steps: development and validation of SSNM-based principles for nutrient management, establishment of confidence and consensus on guidelines derived from SSNM principles, development of locally-adapted decision tools and aids for dissemination, establishment of partnerships enabling contact with numerous farmers, and ensuring farmers receive and understand guidelines for their fields. Constraints for adoption were lack of motivation among Municipal Agriculturists and Agricultural Technicians to disseminate the SSNM technology, lack of confidence among Municipal Agriculturists and Agriculturists and Agriculturists and Agriculturists of Local Government Units, high cost of fertilizers preventing farmers from buying needed fertilizers, and poor irrigation services.

Introduction

Iloilo is the major rice-producing province in the Western Visayas region with about 37% of the total agricultural land area devoted to rice production. Rice production in the irrigated lowland rice ecosystem, where two rice crops are grown annually, covers 44% of the total rice area. Under favorable conditions, the first crop is in the wet season (April/May to Aug/Sept), and the second crop is during the dry season (Sept/Oct to Dec/Jan).

In some locations the first rice crop is established by direct dry seeding of non-germinated seed on non-puddled soil, but in most cases rice is established by direct wet seeding of germinated seeds on puddled soil. High-yielding, short-duration rice varieties are commonly grown with relatively high seeding rates. Despite relatively high soil fertility, yields of irrigated rice are typically only 4 to 5 t ha⁻¹ in farmers' fields. Rates and times of fertilizer application are often not optimal and contribute to the low yields.

Development of locally adapted fertilizer practice

In an attempt to improve the province's rice production through improved nutrient management, the site-specific nutrient management (SSNM) approach (Witt et al., 2007) was used to develop fertilizer management practices tailored to local conditions in Iloilo Province. Initial studies in 2005 and 2006 used the nutrient omission plot technique to determine the indigenous N, P, and K supply (Gabinete, 2006). Results from this study led to the development of SSNM guidelines for irrigated direct wet-seeded rice for the wet and dry seasons (Gabinete, 2006). Fertilizer guidelines were provided for two attainable yield targets (5 and 6 t ha⁻¹), which can depend upon variety, cropping season, and management. Fertilizer N rates were adjusted within the season to match crop needs. The P_2O_5 rates ranged from 20 to 30 kg ha⁻¹.

Initial evaluation of the SSNM guideline was conducted in 2006 with a yield target of 5 t ha⁻¹. The highest yield with SSNM was 4.6 t ha⁻¹ using seed rates of 100 to 120 kg ha⁻¹. This was significantly higher by almost 1 t ha⁻¹ than the farmer's practice with seed rates of 110 to 200 kg ha⁻¹. A 27% increase on gross returns over fertilizer cost was realized using SSNM coupled with reduced seed rate, even though SSNM had higher fertilizer cost than farmer's practice.

Refinement of locally adapted fertilizer practice

Results of research conducted in 2007-2008 confirmed that grain yields can be increased with improved nutrient management using SSNM and lower seed rates than currently used by many farmers. Improved nutrient management through SSNM was particularly beneficial for farmers attaining yields lower than 5 t ha⁻¹ with their current management. Some of these farmers could make immediate improvement in the timing of fertilizer N applications.

The use of the SSNM approach rather than the farmer's fertilizer practice with the farmer's seed rate provided an added financial benefit to most farmers despite added fertilizer cost. When the cost of seed was not considered, SSNM provided added net benefit to 68% of the farmers using a seed rate of 120 kg ha⁻¹. At the seed rate of 80 kg ha⁻¹, 50% of the farmers had a positive added benefit. A follow-up verification trial on SSNM was conducted for two seasons in 2008-2009. During the dry season, SSNM significant increased yield by 1.1 t ha⁻¹ and gross return above fertilizer cost by 280 USD ha⁻¹.

Research to impact pathway for SSNM

The dissemination of SSNM in Iloilo follows the steps below:

- 1. Development and validation of SSNM-based principles;
- 2. Establishment of confidence and consensus on guidelines derived from SSNM principles;
- 3. Development of locally-adapted decision tools and aids for dissemination;
- 4. Establishment of partnerships enabling contact with numerous farmers;
- 5. Ensuring farmers receive and understand guidelines for their fields.

1. Development and validation of SSNM-based principles

On-farm experiments were conducted for two seasons during the crop year 2007-2008. There were 22 farmer cooperators distributed in seven municipalities in the province. The experiment compared the SSNM recommendation with farmer's fertilizer practice. Results from the 2007-2008 research showed that SSNM provided an added financial benefit to most farmers despite added fertilizer cost. An added benefit per hectare was realized due to an increase in yield of about 1.0 t/ha. In addition the experiment resulted in the refinement of the SSNM guidelines based on a more realistic yield target of 4.5 to 5.5 t/ha (expressed at 14% grain moisture content), as determined from nutrient omission plot studies and yield potential analysis for common varieties and climate conditions of Iloilo. Moreover, the refined guidelines express the yield targets on the basis of fresh weight at harvest, as done by farmers, rather than at 14% grain moisture content.

2. Establishment of confidence and consensus on guidelines derived from SSNM principle

Confidence and consensus building on the developed SSNM technology are vital, especially considering that different agricultural institutions (government, non-government, and private) are creating and promoting their own technologies. It is important then that a common research-based and workable technology should be agreed upon for dissemination. This will help focus dissemination efforts aiming to make an impact on farmers' lives.

In order to come up with a consensus on SSNM technology, a meeting with key organizations was held on 14 May 2008. Organizations represented were the West Visayas State University (WVSU), Ginintuang Masaganang Ani (GMA) Rice Program of the Department of Agriculture, Western Visayas Agricultural Resources Research Center (WESVIARRC), AFC Fertilizer and Chemical (Atlas Fertilizer Corporation), and International Rice Research Institute (IRRI). The meeting formulated a plan for implementing dissemination of a new fertilizer guideline based on SSNM for Iloilo. As a follow up of the 14 May meeting, the Office of Iloilo Provincial Agriculturist arranged the training of Municipal Agricultural Officers (MAO) on new nutrient management guideline on 28 May 2008. The resources persons coming from WVSU, PhilRice, and IRRI trained 57 participants. These trainees were expected to train Agricultural Technicians who would in turn train farmers.

3. Development of locally adapted decision tools and aids for dissemination

To fast track dissemination, a computer-based decision tool entitled *Nutrient Manager for Rice* (IRRI, 2009a) was used to develop field-specific nutrient recommendations. The software was translated in the local dialect to facilitate easy understanding by extension workers and farmers. Moreover, the *Nutrient Manager for Rice* was used to develop onepage quick guides on fertilizing rice in Iloilo and five other provinces in the region. They targeted farmers not directly reached by the *Nutrient Manager for Rice* software. A video for farmers entitled *Proper Nutrition Makes Healthy Rice Plants* (IRRI, 2009b) was developed and used to facilitate dissemination. All dissemination tools are totally consistent with SSNM principles.

4. Establishment of partnerships enabling contact with numerous farmers.

From June to December 2008, Agricultural Technicians in twenty municipalities were trained by experts from WVSU and Department of Agriculture. The Municipal Agricultural Officers facilitated the trainings. The SSNM technology was presented through regional orientation training in September 2008 on the use of *Nutrient Manager for Rice*, which was a follow up of the national Training of Trainers held earlier at PhilRice Headquarters in Nueva Ecija, the Philippines. Demonstration plots with the new fertilizer guideline were conducted in farmers' fields in the 20 municipalities. Field days were conducted at harvest to show neighboring farmers how the technology worked. Quick guides for fertilizing rice were distributed to farmers. Lectures on the new fertilizer guideline were conducted.

5. Ensuring farmers receive and understand guidelines for their fields

In a technology transfer activity, it is important that farmers fully grasp and understand the technology. This implies that extension agents and farmer leaders are fully equipped with necessary knowledge and skills. Moreover, it is important that these extension agents are highly motivated to transfer the technology to farmers. Motivation can be in terms of continuous capability building activities, access to available tools, recognition by local government units (e.g. awards), and entitlement to updated technology tools via text messaging and web sites. In order to fast track dissemination using the developed tools (software, quick guides, and video), there is a need to expand the partnership to include farmers' cooperatives, farmers' associations, and Farmers' Information and Technology Services (FITS) Centers.

Current status of dissemination

The SSNM technology provides farmers with ready to use nutrient management guidelines tailored to their local conditions. The original concept of dissemination in the province was to train Municipal Agriculturists (MA) who in turn would train their respective Agricultural Technicians (AT). The Agricultural Technicians would then train farmers and farmers would then train other farmers.

As of October 2009, after a year of dissemination, all Local Government Units (LGUs) in Iloilo Province were given the quick guide for fertilizing rice, *Nutrient Manager for Rice* on CD, and the video *Proper Nutrition Makes Healthy Rice Plants* on CD. Municipal Agriculturists and Agricultural Technicians were trained on the use of these tools. However, not all Local Government Units initiated dissemination activities, thus only a limited number of farmers were reached by the technology. As of October 2009, about 4,000 farmers were reached after a year of training programs, lectures, and demonstration plots. A follow up is currently underway to verify whether these farmers practice the technology. More capability building and dissemination activities are planned in order to reach 25,000 farmers in 2010 and 100,000 farmers by 2012. This will require motivated extension workers proficient on the use of dissemination tools.

Constraints to wider adoption

One of the major reasons why few farmers were reached by the technology was the lack of motivation among Municipal Agriculturists and Agricultural Technicians to disseminate the technology. The Municipal Agriculturists tended to lack confidence to train their Agricultural Technicians despite having been trained on the dissemination tools. The Agricultural Technicians similarly lacked confidence. As a result, experts were called upon to join Agricultural Technicians in training activities for farmers, which were enthusiastically received by farmers. Farmers consider it an honor to be visited and trained by experts.

The current Local Government Units organizational setup places the extension workers under the direct supervision of the local government head (i.e., Municipal Mayor). Most Local Government Units are deficient in manpower resulting in the multitasking of Agricultural Technicians covering large areas. In addition, some Local Government Unit heads do not place priority on agriculture or support for dissemination of agricultural technologies.

When technology reaches the farmers through training and demonstration plots, the choice on adoption rests on the farmers and factors of rice production. The SSNM technology depends highly on the capacity of the farmers to purchase fertilizer inputs on time with the assumption that other production factors are favorable. In general, farmers in lloilo do not apply fertilizers based on the critical growth stages of rice. Many farmers don't have the financial capacity to buy fertilizers as needed. They apply fertilizer based on availability of money to purchase fertilizer, which can result in earlier or later application times than the recommended and lower or higher application rates than the recommended. This leads to 'hit or miss' nutrient management for rice. This practice was predominant in the recent past when fertilizer costs were high.

For well-off farmers, those financially able to buy farm inputs, constraints may be in terms of untimely and insufficient delivery of irrigation water. The delivery of irrigation water can be inefficient in the province.

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