Maize Yield Returns on Fertilizer Investment

The adoption of new technology such as 4R Nutrient Stewardship consistent with site-specific nutrient management (SSNM) depends greatly on its observed risks as well as financial advantages. The SSNM approach for maize has been demonstrated to increase farmers' yields and profits across sites compared to farmers fertilizer practice (FFP). However, the adoption of SSNM would often require additional investment in fertilizer.

To assess the variability of expected incremental profit from the adoption of SSNM, a scenario analysis based on gross profit was run for different price scenarios and production environments (irrigated, favorable rainfed, less favorable rainfed). Data on yield and fertilizer N, P, K from on-farm trials with SSNM and FFP were used as input variables. The simulations were run for three maize grain and fertilizer price scenarios: (1) average price scenario using regional prices, (2) low price scenario, i.e., 25% lower than average prices, (3) high price scenario, i.e., 25% higher than average prices.

Figure 1.Probability of higher incremental profit with SSNM (ΔGRF, US$/ha) at three levels of maize grain and fertilizer price scenarios and three production environments. L, M, H refers to low, average, and high prices, respectively.

The probabilities of achieving higher incremental profit (ΔGRF) from the adoption of SSNM under different production environments and price scenarios are shown in Figure 1. The greatest opportunity for attaining high ΔGRF with SSNM was in the favorable rainfed areas. Regardless of fertilizer prices, the likelihood of earning >US$100 over the FFP in this production environment ranged from 60%, when grain price was low, to almost 70%, when grain price was high. Regardless of grain and fertilizer prices, the risk of income loss from SSNM (i.e., ΔGRF < $0) was <30%. In the irrigated and less favorable rainfed areas, there was about 40% probability of earning less than the FFP. Despite the favorable production environment in irrigated sites, there was only about

a 50% chance of earning >US$100 over the FFP due to the small yield gap between SSNM and FFP (Figure 2). Unfavorable fertilizer prices improved the probability of having higher incremental gain from SSNM because of the higher fertilizer application rates in the FFP. In less favorable rainfed areas, grain and fertilizer prices had a marked effect on the profitability of SSNM. There was a 45% chance of income loss from SSNM when maize grain price was low and fertilizer prices were high. On the other hand, given favorable grain and fertilizer prices, the probability of earning significantly more than the FFP in this environment was almost 60%.

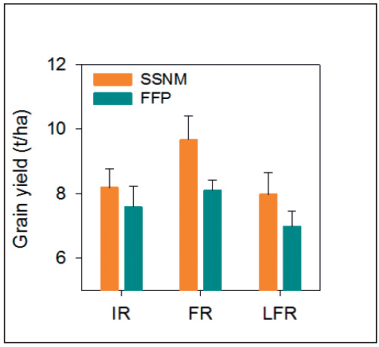

Figure 2. Maize grain yield using SSNM and FFP in SE Asia, 2004-2008. Error bars show the standard error of the mean.

Scenario analysis suggests that grain yield is the driving factor in the profitability of SSNM. In highly favorable rainfed production environments, fertilizer prices do not affect the profitability of SSNM because the yield gap between SSNM and FFP is large. In irrigated environments, the yield gap between FFP and SSNM is relatively small; hence, opportunities for incremental gains from SSNM are also limited. In less favorable rainfed environments, the yield gap between SSNM and FFP may be larger than at irrigated sites, but variable rainfall conditions pose high risks to farmers not attaining their target yields for the season. In this production environment, tactical N management involving both anticipatory (pre-planting) and responsive (during the growing season) decisions is important.

While there could be risks of income loss from SSNM due to unfavorable weather and market prices, opportunities for income gains are larger, particularly in highly favorable rainfed regions.

This information is derived from: Pasuquin, J.M., M.F. Pampolino, C. Witt, A. Dobermann, T. Oberthür, M.J. Fisher, and K. Inubushi. 2014. Closing yield gaps in maize production in Southeast Asia through site-specific nutrient management. Field Crops Research 156:219-230.