Supporting High Rice Yields in Myanmar with Adequate Nutrition

Myanmar's national food security and economy both rely heavily on the agriculture sector. The agriculture industry contributed around 26% of the country's GDP in 2012, 16.4% of its total export earnings and employed some 61% of Myanmar's labour force (MoAI, 2013). Myanmar has a total of 12.25 million hectares of arable land and permanent crops. Improving agricultural productivity and promoting rice exports are top priorities for the government of Myanmar. Despite the country's plan to export four million tons of rice by 2020, the actual annual rice export has reached only 0.7 million tons over the past years (World Bank, 2014).

Currently, rice is the single most important crop in Myanmar and is grown on more than 8 million hectares of land. Rice is a staple crop for Myanmar, which has the highest per capita consumption of rice in the world – more than 210 kg per person per year. Rice production is a source of rural livelihood for about 70% of the entire population. Traditionally, Myanmar farmers have grown local varieties (LVs) such as Nga Kywe and Paw San Hmwe with traditional agronomic practices that end up producing less than 2 tons per ha. The introduction of high yielding varieties (HYVs) such as Ya Gyaw (IR8) in the early 1980s and the encouragement of hybrid rice species such as Pa Le Thwe and Sinn Shweli in the 2000s aimed at increasing production, however, the national average rice yield has stagnated at around 3.5 tons per ha.

Despite Myanmar's five-year plan to reach 33 million tons in rice production and average rice yields of 4.28 tons per ha by 2015-16, the actual annual rice production has only reached 29 million tons with an average yield of 3.8 tons per ha in 2012 (MoAI, 2013). Myanmar has the potential to attain more than its targeted yield and production by using improved rice varieties and good agricultural practices (GAPs) (World Bank, 2014). Lack of appropriate agronomic knowledge is a major constraint. Additionally, fertilizer consumption (N, P and K) in Myanmar is lowest in the Southeast Asia region (15.7 kg per ha of arable land in 2012), while fertilizer consumption in Thailand was 153.2 kg per ha of arable land in 2012.

Supplying adequate nutrition is one of the key GAPs needed to increase rice yields in a sustainable manner as nutrition plays a key role in the increase of yields. In order to keep the rice fields at a high level of productivity, mineral fertilizers should be applied. Growing rice without the adequate application of fertilizers for many years has left many areas of rice soils with relatively low fertility. Therefore, inorganic and organic fertilizers are important in supplementing poor indigenous soil nutrient supply in order to achieve optimum rice yields (Naing et al., 2008). Although rice plant residues (straws and husks) and other organic

sources (farmyard manure and composts) are valuable nutrient sources to replenish soil organic matter and nutrient supply, inorganic fertilizer is required as well. The right source of fertilizers can provide both maximum economic benefit and environmental advantage.

Generally, most of the rice soils in Myanmar respond to phosphorous (P) while the majority of soils require nitrogen (N) and reasonable large area of soils respond to potassium (K) (Naing et al., 2008). Rice plants also need micronutrients such as Zinc (Zn), Iron (Fe), Manganese (Mn) and Copper (Cu) to produce better rice production. High yield varieties are likely more responsive to higher levels of nutrient (i.e. N, P, K, etc.) than what has traditionally been recommended in Myanmar. Additional nutrients must be used to fill the gap between the need of the rice crop and indigenous supply. A combination of 120 kg N plus 60 kg P and 60 kg K per hectare may often be needed for the production of high yielding rice. Levels of available nutrients are maintained at optimum levels in rice soils when the amount of nutrient applied equal crop removal. The source of the nutrients, the rate of application, the timing of that application and the place of application all need to be considered. Fertilizer applications must be properly timed to provide available nutrients for rice plants especially when using mineral fertilizers. The timing of N, P, K fertilizer applications must always be at appropriate times during the various plant growth stages when fertilizer is most required (Aye, 2014).

Nutrient uptake and removal in paddy rice

Rice Crop	Product	Yield t ha^{-1}	Total uptake (above-ground biomass) kg ha^{-1}						Removal (crop yield) Kg t^{-1}					
			N	P	K	Ca	Mg	S	N	P	K	Ca	Mg	S
HYVs	Grain	4	90	13	108	11	10	4	15	2.8	3.8	0.3	1	0.8
LVs	Grain	2	45	7	54	6	5	2	15	2.5	2.5	0.5	1	0.5

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