

Conducting Nutrient Audits at the National Scale in Southeast Asia: Methodology and Preliminary Results

W.F. Sheldrick¹, J.K. Syers², and J. Lingard¹

¹*Department of Agricultural Economics and Food Marketing, University of Newcastle, Newcastle upon Tyne NE1 7RU, United Kingdom*

²*Department of Natural Resources and Environmental Sciences, Naresuan University, Phitsanulok 65000, Thailand*

Nutrient audits have been carried out for China, Indonesia, Malaysia, the Philippines, Thailand, and Vietnam. For comparison, a nutrient audit was also carried out for the Republic of Korea a country, which has reached a nutrient balance. The nutrient audits were carried out using a mathematical model, which incorporates an integrated animal excreta submodel. Agricultural data from the FAO Internet database for the period 1961 to 1998 were downloaded into the model which contains coefficients for estimating nutrient outputs and inputs from these data. The main outputs are a time series of nutrient balances from 1961 to 1998, together with other information on the dynamics of nutrient flow. This type of information is more useful than one-off or snapshot balances, which can be misleading insofar as balances can vary significantly from year to year. It can also help to explain the reasons why nutrient balances vary due to weather, lack of nutrient inputs, and economic factors, such as reduced plantings.

The balances indicate that overall, there is a large deficit of N, P, and K in the region. For each country the size of the nutrient deficit depends upon the types of agricultural production. The N deficits in most countries increased steadily in the 1970s and 1980s but in the last two decades up to 1998 have shown an overall decline. In China and Vietnam a balance for N has been achieved. Deficits of P have increased steadily for most of the countries and although in some countries, such as Thailand and Malaysia, there has recently been some reduction in these deficits, in others, such as Indonesia, the Philippines, and Vietnam, deficits have remained high or have increased. With the exception of Malaysia, K depletion increased steadily between 1961 and 1998. In Malaysia, where relatively large quantities of K are added to commercial plantation crops, annual surplus K has averaged about 30,000 tonnes over the last few years. In regional terms this is small. For example, in 1998, China had a deficit of more than 8 million tonnes, and the deficit in Indonesia was 1.2 million tonnes. Overall, the K deficit in the six countries surveyed amounted to 10.5 million tonnes of K and represented an average annual depletion rate of 60 kg ha⁻¹. In 1998, China had a K fertilizer application rate of 21 kg ha⁻¹ but the other countries in the region had an average of less than 10 kg ha⁻¹. Very large application rates of K will be required to eliminate this deficit, within a reasonable period of time, if declining crop yields and soil degradation are to be averted.

The nutrient audit for the Republic of Korea shows that a major K deficit of 60 kg ha⁻¹ in 1961 had been reduced to a balance in 1993. Annual K application rates were increased from 8 to 102 kg ha⁻¹. This was associated with an increase in total cereal yield from 3,200 to 6,080 kg ha yr⁻¹. Although much attention has been directed towards nutrient depletion in Sub-Saharan Africa, where depletion of K averages about 20 kg ha yr⁻¹, the situation in Southeast Asia with three times this rate of depletion is much more serious.