CHAPTER 1

INTRODUCTION

In Asia, Thailand is a major rice-growing country. It now produces rice in excess of local consumption needs and it is thus a major exporter of milled rice (Supapoj *et al.*, 1998). Thailand's rice production in 1995-96 was estimated at 2,242 million tons, with an average yield in rainy and dry season of 2.14 and 4.36 t ha^{-1}, respectively. Among the four regions in Thailand, the North covers about 22 percent of the total area of the country, in which roughly 2.43 million hectares are devoted to rice production (OAE, 1995).

Chiang Mai, one of provinces of the Northern region, has the total rice production area of about 14.8 thousand hectares (OAE, 1995). Based on water regime, Chiang Mai's lowland rice-growing areas are characterized with two types of systems: the rainfed and irrigated lowland rice system. The rainfed lowland system occupies about 20% of lowland rice growing area, while the irrigated lowland system, facilitated by either or both traditionally communal and governmental irrigation systems, occupies the remaining 80% (Gypmantasiri *et al.*, 1999).

The rainfed lowland rice system, planted to a single crop of glutinous rice for self-sufficiency, is generally known as a low-input system. Traditionally, farmers hardly apply chemical fertilizers in their rice production (Gypmantasiri *et al.*, 1999). The cultivation of rainfed lowland rice is often carried out during the last week of July to first week of August when rainfall is more reliable. Unlike the rainfed lowland system, the irrigated lowland rice system is the most intensified and diversified land use system. It is characterized by multiple cropping systems, with sequential planting after the rainy season rice. The cropping systems are resource and labor intensive. The pattern of cropping system including double cropping system such as rice-soybean and triple cropping system such as rice-potato-sweet corn (Gypmantasiri *et al.*, 1999). Due to favorable growing environment, Chiang Mai's average rice yield in rainy season is 3.21 t ha^{-1} and dry season 3.9 t ha^{-1}, respectively (Phrek *et al.*, 1999). However, it is possible to foresee that these rice yields may subject to gradual decline in the long run as soil fertility becomes exhausted and nutrients, especially nitrogen, are not sufficiently replenished. This is most likely true for both the rainfed lowland rice, where farmers are not willing to use external inputs, and the irrigated lowland rice, where farmers are forced to reduce the levels of fertilizer application due to increased price of chemical fertilizers.

To cope with these worse case scenarios and sustain rice productivity in Chiang Mai, viable alternative source for soil fertility management must be sought out. This may be achieved through the integration of green manures into the systems. Because, green manure is an alternative source of nitrogen for sustaining the productivity of lowland rice and reducing the dependence of resource-poor farmers on mineral N fertilizers (Becker *et al.* 1988). Of these, *Sesbania rostrata* has shown a high potential as a leguminous green manure for lowland rice fields in many countries such as Senegal (Dreyfus, 1983), Thailand (Vejpas, 1990), Southern China (Herrera *et al.*, 1990), and Vietnam (Herrera *et al.*, 1990; Kim *et al.*, 1990) (in Nguyen, 1992). It has been the most prominently successful green manure used before cultivating of rainy season rice in the lowland ecosystem (Becker *et al.*, 1995). According to Morris *et al.* (1989), Herrera *et al.* (1988), Baquiravan *et al.* (1988), and Rinaudo *et al.* (1983), result of a field experiment conducted at rice research station in Khon Kaen, Thailand, revealed that *S. rostrata* accumulated N at 104 kg ha^{-1} in 58 days to 267 kg ha^{-1} in 93 days (in Hamman, 1991). Therefore, *S. rostrata* is a promising green manure that can be chosen for improving soil fertility and increasing rice yield in Chiang Mai's lowland rice.

The objectives of this study are (1) to investigate farmers' fertilizer management in rice production in the Chiang Mai lowlands (2) to measure the agronomic effect and economic benefit of *S. rostrata* on rice production. (3) to measure the nitrogen dynamics in *the S. rostrata*-rice system.