Chapter 1

INTRODUCTION

With the growing ecological concern, and the increasing price of N fertilizer that farmers in developing countries are facing, green manure is an alternative source of N 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 et al., 1983), Thailand (Vejpas et al., 1990), Southern China (Herrera et al., 1990), Sri Lanka (Palm et al., 1987 adapted from Nair, 1988), and Vietnam (Herrera et al., 1990; Kim et al., 1990). This is because it is a fast-growing, drought and flood-tolerant legume. It can produce N_2-fixing nodules on roots as well as on stems (Ladha et al., 1988; Dreyfus et al., 1983).

Several studies have been done on N_2-fixation capacity as well as on temporal and spatial niche of *S. rostrata* in rice-based cropping systems. In addition, studies have also been conducted on the adaptation and the effectiveness of *S. rostrata* in elevating rice yield in farmers' field. The results are positive. However, the practical methods of green manure establishment in the rice field, and the methods of on-farm green manure seed production, which make green manure seeds available for farmers, still need to be developed for most farming systems.

The fact that subsistence farmers with small land holdings can not afford to release their land, which is currently being used for food or forages to grow green manure with no direct benefit, suggests that green manure production must fit into slack periods when it will not compete with other crops (Pandey and Morris, 1983; Abrol and Palaniappan, 1988). If farmers incorporate green manure crop into their cropping systems, they would grow them during the 30-45 day transition period between the dry and wet seasons (Meelu et al., 1988).

However, in present-day intensive agriculture, land and time are the major constraints for many farmers in tropical Asia (Ladha et al., 1988). With good irrigation systems farmers can grow even more than 2 crops per year. This results in no space in their field through the year for green manuring. With 2 crops per year, the insertion of green manure between two value crops in the rain-fed condition has many difficulties with drought. Even when green manure crops are favorable, farmers face yet another problem: they cannot get enough seeds for growing. In short, the availability of water and seeds may pose restrictions on the adoption of green manuring.

One alternative possibility may be intercropping *S. rostrata* as a green manure crop with rice.

In such mixtures, however, the competition between component crops for resources is an important issue that needs to be resolved. The competitions between these 2 species in mixture may vary with different proportions and times of establishment. If the interactions between component crops are known, the competitions can be adjusted to achieve the feasibility of green manuring in intensive cropping systems.

This achievement, in turn, results in simultaneously gaining 2 main goals: maintaining soil fertility through enough green manure biomass and producing seeds of *S. rostrata* available for next season without competing the time and productivity of value crops in the systems.

The objectives of this study are to (1) examine the effects of *S. rostrata* on growth and yield of rice, (2) estimate seed production capacity of *S. rostrata* in different mixtures and at different times of introduction to rice stands, and (3) estimate biomass yield and N-contribution of *S. rostrata* in different mixtures to the systems.