

## CHAPTER 1

### Introduction

A world-wide fossil fuel crisis has been experienced in the past years by reason of shortage and high cost. In agriculture, there is a very high demand for energy to supply its power, machinery, fertilizer, processing and transport. Among the agricultural inputs, nitrogen fertilizer is one of major concerns. (Olson and Kurtz, 1982)

Nitrogen is a vital element essential to living ecosystems. Plants, including commodity field crops, need large amounts of nitrogen to thrive and grow. Soils often do not contain enough nitrogen for plants to attain optimal productivity, but many growers apply far more synthetic nitrogen fertilizer to their soil than what the plants can use. This has a dramatic effect on the global nitrogen cycle, and much of it becomes a pollutant. Excessive application rates cut profits and are bad for soil and the environment (Larson, 2007).

*Curcuma* genus is one of the largest genera in the Zingiberaceae, it is a member of tribe Zingiberaceae (Sirirugsa *et al.*, 2007). *Curcuma alismatifolia* Gagnep. has numerous selected clones which are now widely cultivated in Southeast

Asia, it is known as “Siam tulip” or “Chiang Mai Pink” (Apavatjirut *et al.*, 1999) and can be used as cut flower, pot plant and in landscape gardening. Thailand exports more than 4 million rhizomes per year to Germany, Japan and Portugal. After arrival, rhizomes are planted in temperature-controlled greenhouse and sold as both cut flower and flowering potted plant (Wichailak, 2005).

Nitrogen fertilizer use in *C. alismatifolia* production is important since growth, flower quality and rhizome yield respond to amount of nitrogen supply and N deficiency can substantially reduce yield (Ohtake *et al.*, 2006). Nitrogen is an essential constituent of protein, amino acid, nucleic acid, chlorophyll and numerous secondary substances such as alkaloids (Bergmann, 1992; Cresswell and Weir, 1997). Usually plants are able to uptake N as nitrate ( $\text{NO}_3^-$ ) and ammonium ( $\text{NH}_4^+$ ), but some may prefer one source or another depending on plant species which is generally related to the physiological adaptations of plants to natural ecosystems (Marschner, 1995). In soil-less culture, the major form of N in nutrient solutions is  $\text{NO}_3^-$  but the addition of some  $\text{NH}_4^+$  seems beneficial to plant growth. Modification of the  $\text{NH}_4^+:\text{NO}_3^-$  ratio in the nutrient solution is an important means of controlling the relative uptake of nutrients (Sonneveld, 2002).

In recent years, sustainable agriculture has revitalized the interest in crop rotations and their effects on N utilization efficiency, to promote profitable and efficient agriculture. Therefore, the objective of this study was to evaluate crop N status by developing the evaluation criteria of N requirement to assist growers to apply “the right N fertilizer rate at the right time at the right place”. In addition, N utilization in *Curcuma alismatifolia* Gagnep was also examined. This insight can be

integrated in the development of new fertilizer strategies to decide on the need for supplementary fertilizer N application.

### Objectives

1. To evaluate nitrogen requirement in field-grown *Curcuma alismatifolia* Gagnep. by using the critical N level.
2. To assess nitrogen utilization in *Curcuma alismatifolia* Gagnep.