CHAPTER 1
INTRODUCTION

1. Rationale and Background

In 2000, Thailand was the third largest sugar exporter in the world trading with 3 million tons sugar produced from sugarcane planted on 0.91 million hectares (Office of Agricultural Economics, 2000). Sugarcane area decreased from 1.02 million hectares in 1992 to 0.88 million hectares in 2001. However, the crop productivity increased with improved technology from 51.8 t ha^{-1} in 1992 to 56.6 t ha^{-1} in 2000. Changes in government policies in permitting location shifting and the capacity expansion of sugar factories resulted in relocation of many sugar factories. The significant one being relocation of many sugar factories from the eastern and the western central regions to the northern, the lower northern, the central-central and the Northeast regions of Thailand. Impact of such location shifting and capacity expansion has resulted in rapid growth of cane planting area in unsuitable area, intensive monoculture, scarcity of cane cutting labor, rising labor wages and unreliability on sugarcane price (Siamwara *et al.*, 1994). These problems can be overcome by appropriate and suitable management practices viz., use of specific variety suitable to the environment and topography, clean seed cane, appropriate cultivation practices, efficiency management of soil improvement, appropriate fertilizer usage, irrigation and plant protection (Field Crops Research Institute, 2001).

Northeast of Thailand covers an area of 16.9 million hectares or about 1/3 of Kingdom and spreads across 19 provinces. The main occupation in this region is farming comprising of 95 per cent in rainfed area and 5 percent under irrigation area. The productivity of this region depends on amount and distribution of rainfall. Nevertheless, land resource efficiency is the most important factor to sustain agriculture. During 2004, cane in northeast was planted on an area of 0.42 million hectares (about 38 percent of Kingdom) with average yield of 57.19 t ha^{-1} while the national average was 57.94 t ha^{-1} (Office of Agricultural Economics, 2004). Agricultural areas were classified by Land Development Department (LDD) in

detailed reconnaissance (1:100,000) and semi-detailed survey of each district on field crop suitability. The suitable area for field crop production was 29.1 percent while more than 80 percent had either low or slightly low capability (Vichaidith, 1987). Unfortunately, 28 per cent of these low capacity areas were planted with sugarcane. Sugarcane was planted in Kalasin province on 12,400 hectares (0.02 per cent), though LDD has classified only 0.001 percent as suitable area for sugarcane planting (Land Development Department, 2002).

The expansion of sugarcane area on unsuitable area and monoculture was main reason for low sugarcane productivity. In addition, many soils in Northeast genesis over deeply weather regolith on diverse rock types or on colluvium origin which resulted in low activity clay mineral content (kaolinite) (Kanket, 2002). The characteristics of kaolinite are inherently very poor in physical properties and soil fertility. Especially in gray podzolic soil with low fertility, acid soil reaction (pH 4.2-6.9), low organic matter (0.27%), total nitrogen (0.02%), phosphorus (165 ppm), potassium (522 ppm), cation exchange capacity (2.06 $cmol_c\ kg^{-1}$), calcium (0.93 $cmol_c\ kg^{-1}$), magnesium (0.24 $cmol_c\ kg^{-1}$) and sodium (0.17 $cmol_c\ kg^{-1}$) (Cholitkul, 1987).

Though, in nature the tropics have high level of crop production, the organic dead plant material is recycled and transformed into humus. If this cycle is interrupted by cultivation and by moving nutritional plants from the fields, the balance is disturbed between inorganic and organic soil constituents leading to decreased soil consistency resulting in erosion. Nevertheless, the new high yield varieties need greater fertilization with inorganic fertilizers which cause higher activity of microorganism in the soil. These need carbon as a source of energy, so the degradation of soil organic matter reduces rapidly and should be supplied with organic materials. An alternative approach to increasing nutrient retention properties where addition and incorporation of high-activity clay has been shown to permanently increase the CEC of the soil and provide positive yield benefits (Noble *et al.*, 2001; Noble *et al.*, 2003 and Noble *et al.*, 2004). Clay soil (smectite) was considered as soil conditioner that has unique cation exchange properties, molecular sieving, and absorption. Consequently, the most important reason of clay material application is

high cation capacity and the capacity to absorb available nutrients with their high permanent charges.

2. Objectives of Study

a) To identify application methods and types of organic and clay soil materials to improve sugarcane production in degraded sandy soil

b) To identify application rate of clay soil to improve sugarcane production in degraded sandy soil

c) To determine rehabilitation capability of organic and clay material amendments in degraded sandy soil