INTRODUCTION

Maize (*Zea mays* L.) is one of the most important cereal crops grown under rainfed conditions in Thailand. It is normally grown in the areas which are rendered marginal because ,of erratic rainfall distribution during the growing season (Edmeades *et al.*,1990). In recent years, therefore, total maize production in Thailand has increased only an annual rate of two percent, although domestic consumption of maize (mainly for animal feed) has increased rapidly, at an annual rate of 18.4 percent (CIMMYT, 1992). Thus, it can be forecast that in the near future the total maize production will not meet domestic demand.

The paddy field during dry season is one of the new land types available for maize cultivation. Winter maize has been successfully cultivated in several countries in the Asian region, including India (Singh, 1986), Philippines (Gassity and Hermenegildo, 1990) and Vietnam (Tinh *et al.*, 1992). However, economics constraints often restrict farmers from applying fertilizer, particularly N, inadequate amounts, and this situation is often linked to water stress particularly during reproductive growth stage due to water shortage during the dry season. Thus, maize productivity is often limited by the complex interactions between these factors.

Water deficit (Bolaños and Edmeades, 1993a) and insufficient N supply (Uhart and Andrade, 1995) are major factors contributing to the low and unstable yield in maize. Water deficit influence various physiological processes associated with crop growth, development and economic yield (Hsiao, 1973 ; Begg and Turner, 1976). The effects of water stress during specific growth stages on grain yield of maize (Boyer and McPherson, 1976 ; Eck, 1986 ; Grant *et al.*, 1989 ; Rhoads and Bennett, 1990) and genotypic differences under different degrees of water stress (Bolaños and Edmeades, 1993a) have been studied.

The effects of variation in N supply on growth and development of maize have been reported (Muchow, 1988a ; Muchow, 1988b ; Muchow and Davis, 1988 ; McCullough *et al.*,1994 ; Uhart and Andrade, 1995). Although the sole effects of water deficits or of N deficits on growth and yield of maize are well documented but their combined effects have not been studied. For this reason it is unclear what are the patterns of N partitioning and amounts of N remobilized from various plant parts of maize genotypes (i.e., in whole plants with roots) during different growth stages under different degrees of water stress.

Understanding the effects on crop yield of water deficits, N deficits , their combination and identifying genotypes that can withstand such stresses is an important step towards getting high and stable yield. This study, therefore, will focus on the performance of maize genotypes under different levels of N supply and varying intensities of water stress using a line source sprinkler irrigation technique developed by Hanks *et al.* (1976). This system has been successfully used with sorghum (Blad *et al.*, 1980 ; O'Neill *et al.*, 1983) , maize (Blad *et al.*, 1980 ; Sorensen *et al.*, 1980) , cowpea (Turk *et al*, 1980) , mungbean (Pandey *et al.*, 1988), soybean (Senthong *et al.*, 1986) and grain legumes (Pandey *et al.*, 1984a) to impose a water application gradient and enable measurement of various crop physiological, and agronomic characteristics over a wide range of available soil moisture.

The CERES-Maize model (Jones and Kiniry, 1986) could be also used as a tool for predictive capacity of phenological events, crop growth and yield of maize genotypes differing in degree of drought tolerance grown in a particular area. However, this model incorporates coefficients that account for the way in which genotypes differ either in the duration of different developmental phases in their response to specific environmental factors or morphological characteristics (Hunt *et al.*, 1989). These coefficients which are required as model inputs, are referred as genetic coefficients. The genetic coefficients incorporated into the exiting models from variety to variety.

Thus, the approach to estimate the coefficients from field data sets in which dates of phenology events, yield and yield components is likely to be the one most widely applied. Application of this approach requires the collection of sufficient environmental data to run model. The Genotype Coefficient Calculator (GenCalc) was also used to facilitate determination of the genetic coefficients (Hunt and Pararajasingham, 1994). However, there is very little information available in genetic coefficients of Thai maize varieties for validation of the CERES-Maize model under irrigated conditions. Hence, validation of the effectiveness of coefficients currently incorporated is also an essential process to ensure that the model can perform correctly when tested against observed data which provides confidence to users on the capability of the model.