CHAPTER 1

INTRODUCTION

Rice (*Oryza sativa L.*) production area in Northern Thailand accounts for 22% of the country total production areas. Over 6.3 million tons of paddy are produced annually in this region which accounts for 30% of the national production (OAE, 1990). Majority of rice grown in these areas is rainfed lowland rice. Since 1980 rice growers in this region have been facing the problems of instability of grain yield (Figure 1). One possible reason for unstable rice yield is due to erratic rainfall in this region. Therefore, high risk and uncertainties of the expected outcomes resulted in low incentive in adopting high yielding technologies for rice growers. Hence, an evaluation needs to be carried out experimentally to determine those conditions but it would require high financial resources and time consuming (Pannangpetch et al., 1991). In addition, the results may become outdated before the evaluation process is completed (Jintrawet, 1991). Alternatively, simulator of crop growth may be used to provide a guideline to set up the priority of the problems and subsequent experiment which could accelerate the improvement of crop management.

The CERES-Rice model (Ritchie et al., 1986) could be used in assessing risk as well as determining management strategies. This is because its predictive capability of crop growth and yield. The model has been tested over a wide range of environment by the International Benchmark Site Network for Agrotechnology Transfer (IBSNAT) (Singh et al., 1988). However, CERES-Rice model incorporates coefficients that account for the way in which genotypes differ either in the duration of

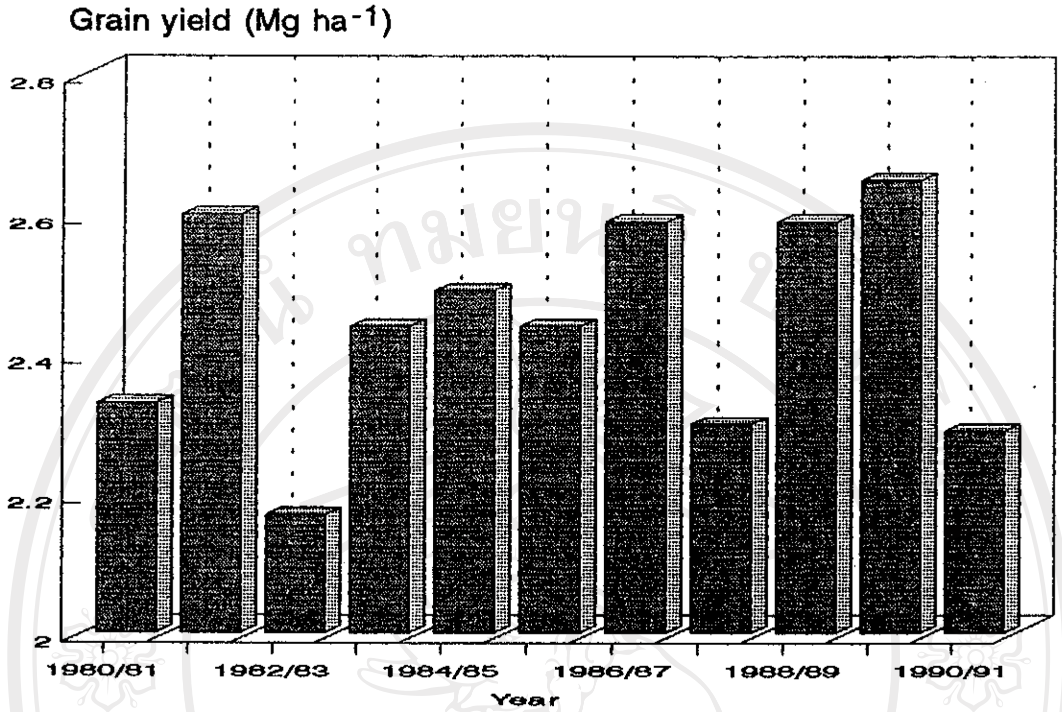

Figure 1. Grain yield during 1980/81-1990/91 growing season in the North region (OAE, 1991)

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 existing models vary from variety to variety. Determination of suitable genetic coefficients for specific variety in a given region must be taken into account before model outputs can be used directly. Generally, genetic coefficients can be determined in a controlled environments setting indoors or outdoors. In a controlled environment chamber the factors of interest such as daylength or temperature can be varied while all other factors are kept constant. Photoperiod and juvenile stage coefficients can be obtained in such way. However, plant growth in a controlled environment chamber often differs markedly from growth in the field (Acock and Acock, 1991; Hunt et al., 1989). In addition, growth chambers are very expensive to maintain and the facilities are unavailable to most researchers. Thus, the approach to estimate the coefficients from field data sets in which dates of phenology events and yield components such as grain number and weight is likely to be the one most widely applied. Application of this approach requires the collection of sufficient environmental data to run the model. This is accomplished iteratively by running the model with: 1). approximate coefficients, 2). comparing model output with actual data, 3). adjust coefficients. These steps are repeating until acceptable fits are obtained.

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. The objectives of this study are:

1. To calibrate the genetic coefficients of three Thai rice varieties i.e., RD7, Niaw San Pa Tong, Kaow Dawk Mali 105 which are commonly grown in Northern Thailand as an input for the CERES-Rice model.

2. To validate the CERES-Rice model with field experiment data conducted on photoperiod sensitive and photoperiod insensitive varieties.