CHAPTER 1

INTRODUCTION

Rice is a major cereal crop in the developing world and an important staple food source for over half of the world's population (Clampett *et al*., 2002). Southeast Asia is the major production area for rice, and inhabitants of this area have long history of consuming purple glutinous rice commonly known as pigmented or black rice. Purple glutinous rice contains anthocyanin-pigmented which has dark purple to black color that located in the aleurone layer of the rice grains. Hu *et al*. (2003) reported that black rice contains pigments, which are located in the aleurone layer as a mixture of anthocyanins. Anthocyanins are subclass of natural phenolic compounds. There are over 250 natural anthocyanins (Kahkonen and Heinonen, 2003; Francis, 1989). It was reported that those colored pigments are naturally occurring compounds that belong to the family of flavonoids in which pelargonidin, cyanidin, delphinidin, peonidin, petunidin, and malvidin represent the most commonly occurring anthocyanin aglycons (Yawadio *et al*., 2006). However Yawadio *et al*. (2006) also reported that two major anthocyanins in the extract from aleurone layer of black rice were cyanidin-3-glucoside and peonidin-3-glucoside. The health benefits of flavonoids are usually linked to two properties i.e. inhibition of certain enzymes and antioxidant activity (Cotlelle, 2001). Many researchers reported about the antioxidative and radical scavenging properties of black rice bran extract, which include the properties to provide prevention of various disease associated with oxidative stress such as cancer (Nam and Kang, 1997; Nam and Kang, 1998; Chen *et al*., 2006; Nam *et al*., 2006) and cardiovascular disease (Jerzy *et al*., 2003). Xia *et al* (2003) showed that supplementation of black rice bran compared with white rice, significantly reduced atherosclerotic plague formation induced by feeding high dietary cholesterol to rabbits. Purple glutinous rice contains more polyphenolic compounds than white rice (Ryu *et al*., 1998; Osawa, 1999; Zhang *et al*., 2006). Additionally, there is a significant positive correlation between phenolic content extracted from purple glutinous rice and their antioxidant potency (Sun *et al*., 2000; Ichikawa *et al*., 2001; Ling *et al*., 2001; Hu *et al*., 2003). This effect related to higher phenolic compounds, vitamin E, selenium, iron and zinc concentrations in black rice (Ling *et al.*, 2002). Black rice comprises a higher content of phenolic compounds than other grains, and it is expected to be utilized as an antioxidant in functional food.

There are large numbers of purple glutinous rice varieties grown in Thailand which adapted to both paddy and upland environment. Among these varieties, there are differences in phenology, growth, yield as well as grain quality in terms of grain phenolic content. It was found that the variation in phenolic content of rice grain was reflected by bran color which is the main factor affecting phenolic concentration in rice kernel (Goffman and Bergman, 2004).

Purple glutinous rice are commonly grown in the northern part of Thailand. Because its grain contain pigment which rich in antioxidant that could provide prevention of various disease associated with oxidative stress such as cancer, more rice consumer are preferred purple glutinous rice. At present, the environments are continuously changing particularly climate which can effect on crop growth, development, yield and their quality. Thus in order to enhance productivity of purple glutinous rice yield as well as its grain quality under the changing environment it is necessary to set good management strategies i.e. planting date as well as nutrient management particularly nitrogen. So understanding relationships between crop development, growth, yield and grain phenolic content in response to climate variation can be used as knowledge to develop crop growth model. Crop simulation models have been successfully used to provide simulations of growth, development and yield (Jone and Ritchie, 1990). They can help to compare experimental research findings across sites, extrapolate experimental field data to wider environments, develop management recommendations and decision support systems, explore effects of climate change, and make yield predictions (Bouman *et al*., 1996; Jones *et al*., 2003).

This study aim to compare and analyze growth and development of purple glutinous rice varieties and their relationship to yield and grain phenolic content under different growing environment. Finally, rice growth model using STELLA (isee systems, inc. 2006) was constructed to determine its growth, yield and phenolic content under differences environmental impact. This model can improve the understanding of the relationship among crop and environment which will facilitate basic knowledge for improve rice yield and quality.