

CHAPTER I

INTRODUCTION

1. Rationale

Coffee (*Coffea arabica* L. cv. Catimor) is an attractive beverage crop providing for health benefits due to its antioxidant properties. Regular drinking of coffee has been reported to improve psychoactive responses, neurological conditions (Dorea and Costa, 2005) and metabolic disorders (Singleton and Rossi, 1965), reduce the oxidation of human low-density lipoprotein (LDL) and the oxidation of LDL, thus decreasing the risk of atherosclerosis (Geromel et al., 2006). Coffee (*Coffea arabica* L.) originates from the Ethiopian tropical forests (latitude of 6-9 north, altitude of 1600-2800 m.) with average annual temperatures of 20 °C, well-distributed annual rainfall (1500-2500 mm.) and a dry season of 2-3 months. Originally, this plant was grown under permanent shade in Central America. In the lower areas (altitude <700 m), *Coffea arabica* was grown under the trees shade which improved micro-climatic conditions, soil fertility and sustainability of the coffee plantation. Moreover, the condition not only affects on growth rate and yield but also leads to coffee quality. Methodologies for quality evaluation are cup test and chemical composition analysis.

Phenolic compounds are directly related to beverage quality of coffee. They are secondary metabolites that generally, involved in plant adaptation to environmental conditions. Low light intensity increases the concentrations of chlorogenic acids, sugar and fat during different stages of coffee-bean development. Shaded coffee is superior to sun coffee for several aspects that leads to the better quality. Artificial shade or shade trees reduced coffee fruit yield because of longer internodes, fewer fruiting nodes, lower flower induction and larger bean size. It has been well documented that phenolic acids give significant contribution to antioxidant activity. The studies conducted so far have been related to the effects of shading on growth and yield of coffee. To date the information about the effect of shading on antioxidant activity and the phenolic composition is limited. Sucrose is an essential for the control of sink-source mechanisms in coffee and one of the main compounds in coffee beans (Knopp et al., 2006). It is also the main contributor of reducing sugars

which are implicated in Maillard reactions that occurred during the roasting process. The higher sucrose contents in Arabica green bean could partially explain its better cup quality. Coffee beverage quality also depends on various environmental factors, including shade and canopy temperature. Artificial shade or shade trees reduce coffee fruit load through their effects on coffee physiology, such as longer internodes, fewer fruiting nodes, lower flower induction and larger beans size. Altogether, this leads to the higher coffee quality (Ky et al., 2001; Muschler, 2001; Geromel et al., 2006). Shading influences both physical and biochemical processes and therefore determines the concentration of biochemical compounds such as chlorogenic acids, trigonelline, sugar and fat matter in coffee beans during their developmental stages (Avelino et al., 2005; Franca et al., 2005 ; Vaast et al., 2006). The chemistry of flavor development during coffee roasting is highly complex. These chemical reactions include Maillard and Strecker reactions, degradation of proteins, polysaccharides, and chlorogenic acids (Farah et al., 2006). Sugars, particularly sucrose will act as aroma precursors, originating as several substances (furans, aldehydes, carboxylic acids) that will affect on both flavor and aroma of the beverage. Trigonelline is a pyridine derivative, known to contribute indirectly to the formation of desirable aromas during roasting (Ky et al., 2001). Caffeine, a xanthine derivative, giving a bitter taste characteristic, was reported to be important for coffee flavor (Belay et al., 2008). Chlorogenic acids (CGA), a group of phenolic compounds, representing 6-12% of coffee constituents in mass, are known to be responsible for coffee pigmentation, aroma formation and astringency. Furthermore, thermal degradation of chlorogenic acids during roasting process will affect on the phenolic substances in contributing to the bitterness of coffee (Farah et al., 2005).

Coffee is a major source of high cash income for Thailand. This country becomes the third largest producer in Asia (after Vietnam and Indonesia) Two cultivars, namely, *Coffea arabica* (Arabica coffee) and *C. robusta* (robusta coffee) have the major economic significance. Robusta coffee (*Coffea canefora*) is mostly grown in southern part, while Arabica coffee (*Coffea arabica*) is mostly grown in the cooler highland areas of the northern part of Thailand (Angkasith and Warrit, 1999). Among many varieties of Arabica coffee, the Catimor cultivar is recommended as it is rust resistant and suitable for Thailand climate conditions (Angkasith and Warrit,

1999). Recently, there has been an attempt to expand the coffee production to the other parts of Thailand such as the northeastern area which has similar climate to the northern part of Thailand. Agro-forest systems have been introduced for Arabica coffee. These systems involve coffee inter-planted with fruit trees and /or forest trees which not only can provide appropriate additional income to farmer but may also provide the higher yield of coffee bean (Vaast et al. 2006).

2. Objectives

2.1. To determine the influence of shading on the physical characteristics, biochemical composition and organoleptic quality of coffee (*Coffea arabica* L. cv. Catimor).

2.2 To evaluate some quality characters of coffee beans harvested from the coffee trees grown under different shading conditions (light intensity and temperature) and different degrees of roasting.

3. Expected results

To obtain useful information for the most suitable growing conditions that would provide good quality of coffee beans.