

## CHAPTER V

### GENERAL CONCLUSION

Coffee is an important world agricultural commodity in terms of value and quantity. Growing coffee under shade where growing conditions are not suitable for coffee production can improve coffee quality. However, the effects of shading on agronomic characters and coffee quality have not been adequately investigated and the information on the quality of shaded coffee after roasting is not well understood. Therefore, the research was undertaken in order to obtain the answers to these questions. The research was divided into two parts. The first part was to investigate the effects of shading on growth, yield and some quality characters in coffee bean (*Coffea arabica* L. cv. Catimor) , and the second part was to determine the effects of shading and roasting degree on color, moisture content, some quality characters and cup test in coffee bean (*Coffea arabica* L. cv. Catimor).

#### **1. Effects of shading on growth, yield and some quality characters in coffee bean (*Coffea arabica* L. cv. Catimor)**

For agronomic investigation of coffee grown under shading conditions, the coffee trees were planted under different shading conditions, and harvest was carried out at maturity. The results revealed that shading which provides the low light intensity and low temperature of coffee plant canopy significantly influenced the physical quality and phenolic compositions as well as antioxidant activity of the coffee beans.

The main benefits from shading were: 1) higher weights of coffee beans; 2) larger beans; 3) higher antioxidant activity and total phenolic content; 4) higher chlorogenic acid content. The coffee beans grown under a canopy of lychee shade had substantially higher quality than those grown under saran coverings. Using artificial shading, antioxidant activity increased as shade level increased until it reached an optimum and then the antioxidant activity was declined. Chlorogenic acid was the most important phenolic acid in all coffee bean samples (approximately 40-77% of total phenolic acids). The beans grown under lychee shade had the highest

chlorogenic acid content, whereas coffee beans grown under full sun had the lowest chlorogenic acid content. In contrast to chlorogenic acid, vanillic acid and caffeic acid were highest in the beans grown under full sun. Ferulic acid and *p*-coumaric acid were detected in coffee beans from plants grown under most shading conditions except for those under lychee shade. Antioxidant activity was significantly correlated (0.828;  $p < 0.01$ ) with the content of chlorogenic acid. Based on the results, we suggest that growing coffee under lychee shade was the most suitable growing conditions for high yield, large beans and high antioxidant activity. The data obtained from our present study have provided useful information for the farmers because growing coffee under tree shade (agro-forestry system) can provide appropriate additional income from both crops to the farmers. Further investigations on shading from other plant species and also the interaction between shade effects and site suitability for coffee are recommended.

## **2. Effects of shading and roasting degree on color, moisture content, some quality characters and cup test in coffee bean (*Coffea arabica* L. cv. Catimor)**

The coffee beans from plants grown under different shading conditions were further roasted at low, medium and high heat conditions in order to investigate the changes in chemical compositions of coffee beans after roasting. The results indicated that roasting degree (light, medium and dark) significantly influenced the color and phenolic compositions as well as antioxidant activity of the coffee beans. The light roasting degree gave rise to higher antioxidant activity and total phenolic content of coffee beans. Non-roasted (green) beans had higher chlorogenic acid content. It is interesting that phenolic acid increased in Catimor coffee beans in the unroasted treatment, suggesting that some phenolic acids increase by heat treatment. The results of the present study suggest that phenolic acid concentration in roasted coffee, which plays an important role in the quality of coffee taste, was influenced by the roasting conditions. The presence of certain levels of phenolic acid in roasted coffee is also important because of their antioxidant properties. Therefore, it is extremely important to prepare coffee in a way that the coffee beans with low enough level of phenolic acid to prevent acid reflux yet a sufficient amount for antioxidant activities purposes. However, more investigation on the toxicity and antioxidant activity of coffee components to clarify the risks and benefits of coffee drinking are needed.