Chapter 4

Relationship Between Leaf Age and Diffusible IAA

4.1 Introduction

Normally, litchi in northern Thailand has two to three flush cycles each year. Time required for new flush developing from new flush emergence to mature leave, takes around 2-2.5 months depends on weather condition especially temperature (Sethpakdee, 1997). For floral induction in Australia, litchi requires a rest period for one to three months before panicle formation in winter (Menzel and Simpson, 1994). However, when the young leaves are present, the inflorescence is strongly suppressed whether or not the apical bud is removed (Bernier *et al.*, 1981). On the other hand, the opportunity of flowering will be declined if litchi trees flush close to floral induction period. This is generally a serious problem of many litchi orchards (Menzel and Simpson, 1994). This phenomena can be explained based on the effect of hormone signal triggering the apical dominance (Bangerth, 1989), and the high auxin synthetic rate in the young shoot tip (Bangerth, 1989; Baker, 2000; Srivastava, 2002). This explained the significant role of auxin in flowering of fruit tree. However, there has been so far no study on the endogenous auxin level as affected by leaf age in 'Hong Huay' litchi. Therefore this experiment is planned to investigate the level of IAA exported from leaf at different age. It is proposed that diffusible IAA at the young leave stage might be greater than the fully mature leaves, which may influence the floral induction.

4.2 Material and methods

The experiment was conducted on twenty-five year-old 'Hong Huay' litchi trees, grown in the orchard of the Division of Pomology, Department of Horticulture, Faculty of Agricultural Production, Maejo University. Diffusible IAA concentrations were determined in young and old mature leaves. For young leaves, fifteen day-old leaves were collected, to compare to the sixty day-old leaves (Figure 4.1). Based on randomized completely block design six trees were fixed and leaves (blocks) were sampling collected in July, 2002.

The leaf petioles were immediately dip into the cavities of multititer culture plates filled with 3.0 ml 0.1M phosphate buffer, pH 6.2, solidified with 0.8% agar. Samples with multititer culture plates were kept under 100% RH at 25°C, 20 h in the darkness. Then the leaves were removed, the plate of hormones samples were frozen and kept at -20°C until analysis. Six agar blocks were pooled and extracted in 100% MeOH over night. Further IAA partial purification was done by C_{18} Sep-Pak cartridge and analysis was done by radio-immunoassay as same as the procedure of the hormonal analysis in chapter 3.

(A) Young leaves (B) Fully mature leaves

Figure 4.1 Young (A) and fully mature (B) litchi leaves at the stage of field collection

4.3 Results

According to the comparing of the level of diffusible IAA export from young and fully mature litchi leaves, the result showed that the IAA concentrations exported from the young leaves was 5.25 ng IAA $leaf^{-1}$, while those exported from the fully mature leaf was 2.29 ng IAA $leaf^{-1}$ (Figure 4.2).

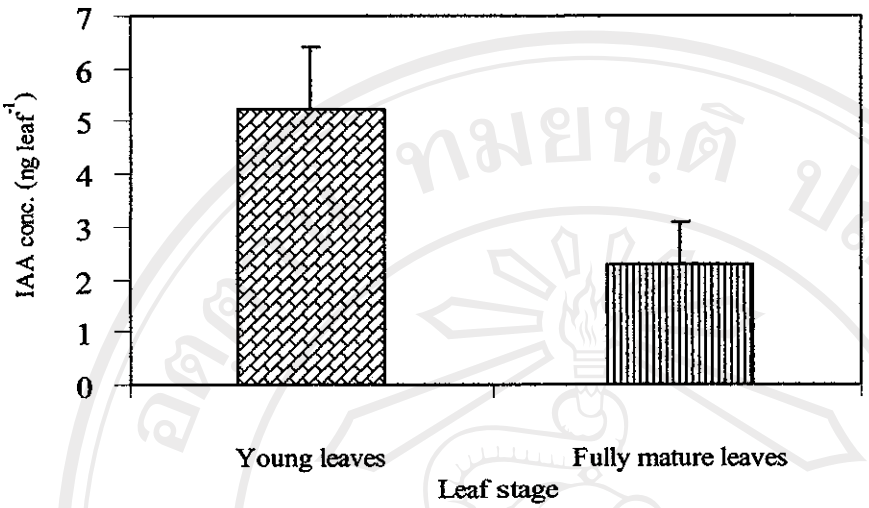

Figure 4.2 Concentrations of diffusible IAA in young and fully mature litchi leaves

4.4 Discussion

The result is similar to the experiment in longan (Hegele *et al.*, 2004) and mango (Naphrom *et al.*, 2004) with using RIA analysis, which showed that endogenous diffusible IAA exported from young leaf was also greater than mature leaf. Baker (2000) and Srivastava (2002) reported the highest endogenous IAA levels in young tissue, shoot tips, young buds and leaves, young fruit and immature seeds, and usually much lower in older, mature tissues. Furthermore, Chen (1987) determined in mango by using physicochemical purification and reported that the highest levels of IAA diffused from developing vegetative shoot tips. The level of auxin diffused from shoot tips during bud rest, early panicle development and full flowering were approximately one quarter of that found during vegetative shoot development. So that IAA level in developing shoot may inhibit the process of floral induction in woody plants.

In litchi, Rankunta (1997) studied on effect of shoot tip pruning on flowering of litchi cv. 'Hong Huay' and 'Brewster' in November which was close to flowering period. The results showed that all the trees with shoot tip pruning had average flowering percentage of more than 50% within 2-2.5 months, whereas non pruning trees produced no flower. Removal of young flush releases the buds on the proximal mature shoot from its apical inhibition. These active buds

response to the inductive regime and are transformed into floral buds (Batten and McConchie, 1995; Rankunta, 1997).

In addition to the study on effects of leaf age in longan, Sruamsiri *et al.* (2003) applied $KClO_3$ by soil drench at mature leaf stage comparing with young leaf stage. The result showed that longan treated at mature leaf age had abundant flowering within four weeks after treatment, while treatment at young leaf stage plant flowers in seven weeks after treatment. In mango, Nunez-Elisea and Davenport (1995) reported the similar result that shoot tip at the leaf age less than 2 weeks could not flower whether it received suitable low temperature for floral induction. Bernier *et al.* (1993) reported that floral stimulus signal transferred from mature leaves *via* the phloem to the apex. This signal promotes flower formation in longan (Sruamsiri *et al.*, 2003) and mango (Nunez-Elisea and Davenport, 1992; Nunez-Elisea *et al.*, 1996). IAA can also be synthesized in leaves and transported with photoassimilates *via* phloem to the shoot meristem (Davies, 1995; Baker, 2000; Srivastava, 2002). Therefore, it may be possible that in 'Hong Huay' litchi, a high concentration of endogenous IAA exports from the young leaves to the terminal shoots may act as inhibitory hormone to floral induction.

4.5 Conclusion

Young litchi leaves exported significantly larger amount of IAA than fully mature leaves.