

CHAPTER VIII

CONCLUSION AND RECOMMENDATION

8.1 Conclusion

Litchi is the most preferred and popular fruit tree for the Vietnamese. Nowadays it is grown with expansive areas and considered to be major tree in hunger eradication and poverty reduction program for the farmers in northern mountainous provinces of Vietnam and in Haiduong province in particular. The litchi in Haiduong province is cultivated mainly in two different systems – plain lowland and hilly upland systems. The differences between the two systems were briefed in Table 8.1.

Thanhha was long-aged litchi production district with 2.5 workable people/household, 18.0 years of litchi production experience; meanwhile Chilinh was newly established cultivation district with 2.6 workable people/household and 14.5 years of litchi production experience. Structure of the cropping systems was also quite different between the two systems. Fruit tree area held up to 95.2%, the remaining 4.8% was for rice crop in Thanhha district; meanwhile the fruit tree and rice crop area in Chilinh district were only 80.1 % and 19.9%. Most litchi cultivation area in Thanhha district rose from rice land and garden land, meanwhile it was from inefficient forest and idle hilly land and garden land in Chilinh district. Size of litchi cultivation area in the two systems was relatively different. Size of farms in Thanhha district was smaller than 1.5 ha, in which 77% of the litchi households had a farm size less than 1.0 ha and shared 60% of total surveyed area. Meanwhile farm size in Chilinh district was smaller than 2.0 ha, in which 73% of the litchi households owned a farm size less than 1.0 ha and shared 56% of total surveyed area. Moreover 23% of litchi households had a farm size from 1.0 ha to 1.5 ha and shared 32% of the surveyed area in Chilinh district. In terms of the diversity of the cultivar, there were up to 3 cultivars and 4 cultivars cultivated in Thanhha and Chilinh districts, respectively. However the major cultivar in both systems was “Thieu Thanhha”.

Table 8.1 Main characteristics of the two litchi production systems

Item	Lowland	Upland
District	Thanhha	Chilinh
Elevation (m)	2.2	33.6
Eco-system	Plain	Hill
Position in Haiduong	East-southern	East-northern
Irrigation	Rainfall, surface water	Rainfall, surface water, groundwater
Profile of land	Rice land and gardens	Inefficient forest, hilly land, gardens
Farm size (ha)	< 1.5	< 2.0
Diversity of cultivar	3 cultivars	4 cultivars
Major cultivar	Thieu Thanhha	Thieu Thanhha
Density (trees/ha)	256	304
Age (years)	8.2	9.1
Productivity (tons/ha)	7.1	7.4
Litchi-based cropping systems	Fruit trees + vegetables + annual crops + rice	Fruit trees + annual crops
Caring of the orchard (manday/ha)	198	231
Insect pest management (manday/ha)	From 47 to 80	From 52 to 83

The growers in Thanhha district employed 198 mandays/ha for ground management, watering, fertilizing, and harvesting; meanwhile these were 231 mandays/ha in Chilinh district. There were some activities in insect pest management carried out by the litchi farmers such as spraying, tree pruning, and hand removal. The growers in Thanhha district used from 47 up to 80 mandays/ha, however these were from 52 up to 83 mandays/ha in Chilinh district. The main sources of water for the orchards come from rainfall, and surface water. The litchi farmers also cultivated with a relatively high density, 256 trees/ha with an average tree age of 8.2 years in Thanhha district and 304 trees/ha with an average tree age of 9.1 years. All of the orchards in the two systems were mono-cropped after closing the tree's crown. The orchard was cultivated according to the model of bed planting system in Thanhha district and terrace

planting system in Chilinh district. As a result of production practices, average gross output and productivity were also relatively different between the two systems, 4.6 tons/farm and 7.1 tons/ha in Thanhha district, respectively. These were 5.1 tons/farm and 7.4 tons/ha in Chilinh district, respectively. With these cultivation practices, the litchi tree contributed an important part in the litchi farmers' income in the surveyed area, 68.9% and 68.5% of total household income in Thanhha and Chilinh districts, respectively

With an intensive practice, insect pests have becoming one of key constraints in the litchi production in Vietnam. There were up to 9 insect species attacking in the litchi orchards in both districts. Composition of insect pests in the two systems was alike, however the most important insect pests' orders were slightly different. These orders were the litchi stinkbug, fruit borer, and the looper in Thanhha district; meanwhile these were the fruit borer, the litchi stinkbug, and the looper in Chilinh district. All these top three insect pests attack and damage seriously from early March to late May on reproductive phase of the tree resulting in making yield loss considerably.

The litchi farmers in both districts applied many practices to control the insect pests such as the insecticide spraying, the tree pruning, the hand removal, including capture of the hibernant litchi stinkbug and by urine application, application of the soil trap for the looper. Number of insecticide application times was quite different for each insect pest and in each system. Although number of household applied the insecticide method was the same, but overall of the frequency of insecticide application was 6.6 times in Thanhha district and 7.4 times in Chilinh district. number of household applied the tree pruning and the removal was quite different. These numbers in Thanhha district were 82.1% and 56.4 % of households, meanwhile these number were only 62.5% and 53.9% in Chilinh district applied the pruning and the removal, respectively. Besides those, the litchi farmers were also catching, picking down and killing the larvae and hatches of the litchi stinkbug and looper's egg.

In combination between updated technologies (insecticides) and local knowledge, the litchi farmers applied many insecticide-based insect pest management strategies to keep their damages under economic injury level such as strategy IO

(Insecticide Only), IP (Insecticide and Pruning), IR (Insecticide and Removal), and IPR (Insecticide, Pruning and Removal). Some criteria relating to manage the insect pests were established to identify the effective strategy, including insecticide cost (IC), labor cost (LC), benefit-cost ratio of the strategy (BCR), mutual effects among the methods (ME), sustainability of the strategy (SOS), and farmer's preference (FP). Among these strategies, the IPR proved as a strategy more effective than other strategies in insect pest management in both litchi production systems in Vietnam – lowland and upland systems. This strategy had the highest score with 36 in Thanhha district and 34 in Chilinh district. In terms of technical aspect, the strategy IPR is the combination of three different methods, so these methods would have mutual effects and make the strategy more sustainable and effective than other strategies.

8.2 Recommendation

The ensuring recommendations are drawn from the foregoing discussions and studies, surveys that are targeted to all the relevant stakeholders, including the litchi farmers, extensionists, plant protectioner, researchers, input supplier, customers, local, district, and central administrators and policy makers.

1 - Application of strategy IPR brought about a clear effectiveness and benefit in insect pest management. This is a combination of three different methods to apply in insect pest management in the litchi orchards. However some litchi farmers are still doubt about its effectiveness and effects on the litchi's growth and development when applying the pruning. So the growers in both systems need to understand the cycle of growth of litchi and the periods to apply the IPR. Another side, local government as well as relatives should look for the measures to encourage them to apply these methods in insect pest management by making some demonstrations, and organizing farmer meeting.

2 - There were 3 key insect pests in both systems. These occur and damage mainly on the reproductive cycle of growth of litchi making reduction of remarkable yield. So the growers in both systems should apply strategy IPR to manage the insect pests effectively instead of application of the strategy IP.

3 - The removal is a traditional method in insect pest management. The growers in both systems applied various practices such as capture of the hibernant litchi stinkbug and by urine application, application of the soil trap for the looper, etc. The capture of the hibernant litchi stinkbug is considered as a very significant practice in insect pest management among practices of the hand removal. The method requires the grower more patience and more man-person to apply. Most young generation is irresolute to apply. So key issue the local government should do is to elucidate the benefit of the removal method and its efficiencies in insect pest management strategy.

4 - The pruning method: besides the autumn and winter-spring pruning, the grower should pruned slightly at the time around 20 day after fruit set to keep fruit density reasonably and expose the insect pests that make more condition to enhance insecticide's efficacy on the insect pests.

5 - The removal method: depending on the weather situation, the litchi stinkbug could reactivate from early March to middle March. So the removal should be applied at early March to get more effective than apply at middle March. From the middle March forward, insecticide should be taken more attention.

6 - Nowadays, there are four strategies applying in the litchi orchards in two systems to manage the insect pests and IPR is considered as effective strategy. However the local government and stakeholders should focus to study more details the ways the growers applied in order to build up a comprehensive strategy in insect pest management in the litchi orchards – Integrated Pest Management strategy.

7 - Application of insecticides with long PHI such as fipronil and cartap, especially in last stage of fruit, make more unsafety and dangerous to customers' health in both domestic and foreign markets. This can lead to affect negatively on consumption markets for litchi fruit and of course, affect seriously on litchi production, the litchi farmers' income as well. So local government should look for the new brands with shorter PHI that could control the fruit borer effectively in order to replace the insecticides with long PHI like the fipronil and cartap.