CHAPTER VIII

CONCLUSION AND RECOMMENDATIONS

8.1 Conclusion

The study showed that the farmers at Ban Phadeng who were traditional *miang* growers were in the process of changing their land use patterns to include more diversified fruit tree species as the sustainability of *miang* system was in question. Among the non-*miang* commodities that being introduced, rhetsa, a non-fruit tree species had shown potential to be important economic crop in the area.

By taking advantage of environmentally influenced high quality *miang*, and with the credit support from the financial institutions, a few farmers were able to seek and secure *miang* markets at the nearby districts and other provinces, thus improving the prices in recent years. As a result, the studied farmers had planted new *miang* with improved management practices.

The two main constraints which might be the limitation for *miang* production at Ban Phadeng were labour and fuelwood.

Three land use stages were seen as the representation of change that inevitably going to occur at Ban Phadeng and were selected for biophysical and financial assessments.

The financial assessment indicated that mature stage and middle stage had similar financial return and better than early stage. However, all stages had B.C. ratio more than one. Therefore the *miang*-based agroforestry system proved

attractive to the farmer. Both mature stage and middle stage were dominated by rhetsa, mango and *miang*, while early stage had more in fruit trees and *miang*. The main income of mature stage and middle stage came from rhetsa. The cost of all stages were similar items, and *miang* used high labour cost in picking leaf. Labour is the major production cost in every stage. Therefore, the labour might be a constraint in *miang* production in the near future for the farm. The overall income of *miang*-based agroforestry system was high (265,600 baht household^{-1} yr^{-1}).

The literature suggested that the above-ground biomass of the top storey and middle storey related with the micro-climate. As the top storey was rhetsa which its phenological characteristics offers less light interception, less rainfall redistribution and less modified temperature especially in dry season. So that rhetsa is suited in *miang*-based agroforestry system by above-ground criteria.

The root system of rhetsa was exploitative, explorative, and required higher carbon input for maintenance and investment. But its root occupied the deeper soil zone.

The fruit trees occupied the middle storey. By above-ground criteria, pomelo and mango were more suitable than peach and jack fruit. Between pomelo and mango, mango had bigger crown width but shorter crown depth than pomelo. Both had similar root system, but root of pomelo penetrated at the upper layer while mango penetrated deeper soil zone.

The direct seedling and marcotting mango, had different canopy structure and root architecture. The direct seedling mango was greater in height, crown

depth and crown width. The root of direct seedling mango was more exploitative and explorative as well as needed higher carbon cost than the marcotting mango.

The canopy structure of different ages of mango were different. The crown closure of mango when planted at 4 m apart would reach each other at year ninth. The root dry weight of mango increased when the age of mango increased. The root of the younger mango had the finer root system than 8 and 10 years old. However the size of root between 8 and 10 year of mango was not different. The shallow rootedness of mango showed consistency in value.

Mango when planted at 4*4 m and 4*8 m spacing showed different total root dry weight and shallow rootedness. The wider spacing gave heavier root dry weight but shallower in root system.

The randomly-and-wide-planted *miang* and the row-planted *miang* showed different in exploitation, exploration, carbon cost and size of main root. The randomly-and-wide-planted *miang* gave higher values of those parameters. But the size of root and the shallow rootedness of the two planted *miang* systems were the same.

The overall interaction of each stage indicated that mature stage showed the highest in interaction both from above ground and below ground. Early stage was the least interaction from both above ground and below ground.

Every stage was located in slopping land, therefore, it was expected to have less significant canopy and root interactions. The non-terrace practice would have to less interaction than terrace practice. The sloping land had widen

the canopy and root gap as well as prolonged the closure time. The narrow spacing led to more interaction.

The woody roots in 4 directions, i.e., north, south, east and west were not different across the species. Therefore, woody roots in upslope and downslope did not show the difference in all parameters.

Miang grown in hedgerow showed lesser interaction with the other trees than the randomly-and-wide-planted. Growing mango in rectangular arrangement led to more interaction than growing in triangular arrangement.

Within all patterns, there were many sub-systems namely rhetsa-direct seedling mango-*miang*, rhetsa-pomelo-*miang*, rhetsa-marcotting mango-*miang*, etc. The system of rhetsa-marcotting mango-*miang* showed similar in above ground interaction with rhetsa-pomelo-*miang*. But the below ground interaction, the system with pomelo had lesser interaction.

8.2 Recommendations

8.2.1 Technological Recommendations

Forest trees which had coppicing ability is recommended to add to the farm which had less tree for the use of fuelwood and shading.

The *miang*-based agroforestry system is suitable land use practice in the upland-highland interface sloping area where a *miang* orchard was established. More efficient use of land which could yield more annual products could be developed.

The practice of rhetsa-fruit trees-*miang* harmonises tree-crop relationship and also provides stable income. Rhetsa is recommended for the top storey, while *miang* is recommended for under storey crop.

On the sloping hills, the row arrangement of *miang*, fruit tree and rhetsa in either contour line or north-south direction are most appropriated. Rhetsa plants in row can avoid the root interaction with fruit tree and *miang*. The spacing of fruit trees should be 4 m inter-row and 8 m intra-row.

In rhetsa-mango-*miang* system, the pruning of mango is not only help to enhance mango growth but also to improve micro-environment for *miang*.

The erosion control with terracing practice is not recommended in the *miang*-based agroforestry system, the natural grass cover practice is better in term of interaction reduction.

8.2.2 Research Recommendations

The field study has shown some researchable area for further confirmation of the findings. The following recommendations are made for further researches.

(1) The experimental finding shows the production performance via financial return between pomelo, mango and other possibility fruit tree species in the hilly area where rhetsa is the top storey.

(2) The B.C. ratio by considering production and cost, above-ground growth, root growth and expansion of different density and different commodity should be studied in the long term until the plant reach the mature stage.

(3) Many experiments pointed out that *miang* is shade-loving plant, but the minimum light requirement should be worked out. Therefore, further research in minimum light which would be enough for *miang* economic production would be related to the canopy structure.

(4) Since the relationship between roots, and water and nutrients uptake is studied by indirect method. Therefore, the direct measurement method of water uptake related with root fractal model is necessary.

(5) The consistency of root parameters by fractal model method such as shallow rootedness, total root length, root weight, etc. to soil types, rainfall, pruning and spacing have to be re-assessed.