

# The Role of Economic Trees<sup>1</sup> in the Mountain Farm Economy: A Case Study of Apple Cultivation in Maoxian County, Sichuan Province, China

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## Introduction

Apple is one of the most important fruits in China and around 3.3 million ha are currently under apple cultivation, accounting for over half the apple cultivation area in the world. Apple is one of the most important economic trees in the mountains of China. Although apple yield in Sichuan Province accounts for only 3-5% of the country's production, it has been a very important source of livelihood for people in the apple cultivation areas, mainly the Hengduan Mountains, where Maoxian County accounts for 18% of the province's apple crop area and 16% of its yield. Until the mid-1990s apple farmers in Maoxian had benefited considerably from converting cereal crop lands to apple farming, but since then have been suffering from low prices and reduced incomes. This paper will analyse the development process, identify existing problems of apple cultivation in Maoxian, and expound its role in the rural economy and possible ways to maximise its benefits.

## Biophysical and Socioeconomic Backgrounds

Maoxian, a Qiang-nationality autonomous county, is located on the south-eastern fringe of the eastern Tibetan Plateau. It lies in the transitional zone from the Sichuan Basin to the high and cold Northwest Sichuan Plateau, between 102° 56' and 104° 10'E longitude and 31° 25' and 32° 16'N latitude, covering an area of 4,064 km<sup>2</sup>. The population is about 105,000, of whom around 88% are engaging in various agricultural activities. Agricultural land totals only 10,607 ha, or 2.61% of the total land area. The per capita agricultural land is 0.1 ha, and each farming household has, on average, around 0.45 ha of crop land. The agricultural lands are mainly distributed in the valleys of the Minjiang River and its tributaries.

The warm temperate climate is characterised by low rainfall and a long dry season. The mean annual temperature is 11°C. The annual sunshine duration exceeds 1557 hours, and the annual solar radiation is 100,900 cal cm<sup>2</sup>. The mean annual precipitation is about 495 mm but the annual open evaporation is 1,356 mm. Drought is a major factor affecting agricultural production, especially in valleys.

The main food crops include maize, potato, naked barley, winter wheat, and so on, but crop farming has been minimised in the valleys. Maoxian is also an important vegetable production base for Chengdu, the capital city of Sichuan. The main vegetables include Chinese cabbage, cabbage, tomato, green and red pepper, lettuce, and garlic. The main economic trees include apple, walnut, huajiao (*Zanthoxylum bungeanum*), pear, and plum.

<sup>1</sup>Economic trees are defined as those that produce a cash crop other than timber.

Because most of the former crop lands in valleys have been converted to cultivation of economic trees or vegetables, grains are imported, mainly from the Sichuan Basin.

## **Impact of Apple Farming on the Rural Economy and Land use**

Apple trees were introduced to Maoxian for the first time in 1935. Though Maoxian was identified in 1963 as China's most suitable area for apples, it was after 1985 that apple cultivation extended to a large area, as a result of rural reform. Most of the agricultural land along river valleys has now been converted to apple cultivation. From 1996 onwards the area and yield have been more or less constant.

A survey of 80 households in five villages indicated that expected high income from apples was the reason for 64% of households to convert initial to apple farming. Another 15% of households followed this first group in adopting apple farming, meaning that around 80% of the farmers eventually converted their land to apple growing in order to gain more cash income. Though the income from maize in Maoxian is highest among food crops, exclusive cultivation of apple yields 5-10 times more income per hectare than maize (Bao et al. 1999a).

Transformation from cereal crop farming to apple cultivation has contributed considerably to livelihood improvement. Increased cash income has been the key factor contributing to this. Both survey and statistical data reveal that farmer's per capita income increased with the expansion of apple cultivation. Apple income contributed 60-70% of the household income, which clearly indicated the important economic role of apple cultivation.

The extension of apple cultivation has caused obvious changes in crop patterns. Most of the crop land in river valleys has now been planted with apples. Because it takes at least five years to get benefit from apple trees, maize, potatoes, and vegetables were also planted on the crop land, forming apple-based intercropping systems. By the late 1990s at least 20 apple-based intercropping types were identified (Bao et al., 1999a, 1999b). Because more income is obtained from apple-vegetable intercropping than from either monocropping of cereal crops or combined fruit tree and cereal crop intercropping, apple-vegetable intercropping has replaced most of the other models. According to the Maoxian Agricultural Bureau, the area under apple-vegetable intercropping increased fourfold from 1980 to 1992. As a result, the cultivation of wheat, rapeseed, maize, and potato had decreased considerably. Another change resulting from the development of apple cultivation is increased cultivation of green manure; while cultivation of green manure has decreased in other areas of Sichuan, in Maoxian it increased by 30% between 1980 and 1992.

## **The Roles of Different Institutions in Developing Apple Cultivation**

Education has played a role in apple cultivation. The survey indicated that families having less education had difficulty both in adopting new technologies and practices and in modifying existing technologies and practices, and the apple yield and cash income were therefore lower than for more educated families. Differences in management were also observed in the field, and these differences affected production in terms of both quantity and quality.

Surveys and interviews of farmers and government officials revealed that although the development of apple cultivation in Maoxian had been largely the result of individual initiative, national policy nevertheless played a crucial role. The rural reform characterised by the household responsibility system was the key contributing factor influencing large-scale apple cultivation, because it allowed farmers to decide what to plant on their own land. The slow development of apple cultivation in the 1960s and 1970s has been attributed to prevalent agricultural policy that only allowed cultivation of cereal crops.

However, the role of local government, research institutions, and extension agencies has been limited since the start of large-scale apple cultivation in the 1980s. Although in the 1960s extension services played an important role in introducing various apple varieties to the region, in the past 40 years significant extension services have not been available to apple farmers, although a fruit tree station was established in 1978. Research institutions have contributed to apple development in identifying Maoxian as a suitable area for apple cultivation, and devising the master plan for apple development, pest control, promoting apple-vegetable intercropping systems, modifying crop-apple cultivation systems, and improving the management of apple orchards. The apple-vegetable and crop-apple intercropping systems have been widely adopted by local people and have proven to be important in sustaining their incomes since the late 1990s, when income from apple declined considerably.

To build on these successes, the services of these institutions need to be improved greatly. Lack of access to information about markets and improved varieties has led to declining incomes among apple farmers as prices have declined and better apple varieties from other parts of China and abroad have become available in markets. Government, extension, and research institutions should have played a crucial role in advising the apple farmers to change to new varieties with better market potential. Nevertheless, despite declining incomes farmers are continuing to plant apples and in some cases using this to replace old varieties with new varieties. No farmers have planned to return to food crop farming because of the low income from cereal crops. Most apple farmers have started growing vegetables in apple orchards, which has become another important income source for local people.

### **Existing Problems and Strategies for Improving Apple Farming**

The most important problem has been the declining price. On average, the percentage of household income attributable to apples declined from 70-80% in 1997 to around 30% in 2000, although the area under apple cultivation has remained constant. Declining income removes incentives for improving crop management, which has led to reduced yield, and in some cases the uprooting of apple trees. The most important contributing factor for this has been the failure to replace old varieties with better ones in a timely manner. In the past decades, neither farmers, government, research, or extension institutions regarded the replacement of old varieties with newer ones to be important, and it was too late to react when the existing varieties had already lost their markets. Large-scale apple cultivation in China took place in 1987 and introduced improved varieties with better marketing potentials. Improved apple varieties have been available in the market since 1992 and more production is expected in the near future. As a result, the demand for Maoxian apple

has been decreasing sharply since 1992. Another problem in Maoxian is lack of an appropriate marketing mechanism and development of fruit processing capacity. No marketing network has been established in the past 30 years. As a result, apple farmers have been forced to sell their products at low prices. The farmgate price in 2000, for example, was only 0.4-0.6 RMB<sup>1</sup> per kg although apples sold at 2-3 RMB per kg in markets within about 120 km, implying a huge profit for middlemen. Lack of appropriate management was the third problem. Apples in the region are entirely hand pollinated and over fruiting is common, but farmers are unwilling to thin fruits, which leads to poor quality and low market potential. As a result of the above, the Maoxian apple has been excluded from the mainstream market.

Mountains are rich in different niches, and many niches may not be suitable for food crop cultivation. Evidence has shown that economic trees like apple may be among those crops to suit local niches and provide good income sources. Cultivation of cash crops suitable to local conditions can improve rural economies and livelihoods in mountains considerably. Compared to cultivation of annual crops, cultivation of perennial economic trees also has other positive effects on local agricultural environments, including acting as windbreaks, microenvironment mitigation, increased efficiency in utilising solar radiation, and soil and water conservation (Bao 1998,1999). However, the transformation from food crop farming to economic tree farming provides not only opportunities for income generation but also risks and challenges. The potential risks in such transformations have been largely neglected by research institutions, extension institutions, local government, and local farmers. The opportunities of today may become the constraints and risks of tomorrow. This case study indicates that with the gradual saturation of markets, new ideas, improved technologies and management, and improved quality become crucial for sustainable development of economic trees. There is an urgent need to change from concentrating on improving productivity to improving quality. Both improved and traditional technologies must be used to achieve this goal. More important, varieties with good market potential should be introduced to replace the present varieties. A market network should be established to help achieve a satisfactory selling price.

## References

- Bao W. K. (1998) 'Energy Balancing in Fruit Tree Interplanting Crops Systems in the Upper Reaches of Minjiang River'. In *Eco-Agriculture Research*, 6 (3):39-42
- Bao W. K. (1999) 'Optimal Adjustment on Fruit Tree-crop Intercropping System (IV): Nutrition Management and Adjustment Measures'. In *Chinese Journal of Ecology*, 18(4): 31-35
- Bao W.K.; Chen Q.H.; Liu Z.G. (1999a) 'Productivity Dynamics and Optimal Adjustment of Nine Interplanting Communities in Dry Valley in the Upper Reaches of the Minjiang River'. In *Chinese Journal of Applied and Environmental Biology*, 5(2): 136-141
- Bao W.K.; Chen J.Z.; Qiao Y.K. (1999b) 'Eco-agricultural Construction at Dry Valley in the Upper Reaches of the Minjiang River'. In *Eco-Agriculture Research*, 7(2):66-68

<sup>1</sup>In 2000, US \$ 1 = RMB (Yuan) 8.28 approx.