



Food and Agriculture
Organization of the
United Nations

IMPACT OF PRODUCING TOMATOES UNDER MALAYSIA-GAP CERTIFICATION ON FARMING PRACTICES

Cameron Highlands

Alias Radam
Gazi Md. Nurul Islam
Ng Keng Yap
Fatimah Mohamed Arshad
Emmy Farha Alias



This background paper is made available without further edits to the version presented by its authors.

The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations (FAO) concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The mention of specific companies or products of manufacturers, whether or not these have been patented, does not imply that these have been endorsed or recommended by FAO in preference to others of a similar nature that are not mentioned.

The views expressed in this information product are those of the author(s) and do not necessarily reflect the views or policies of FAO.

© FAO, 2015

FAO encourages the use, reproduction and dissemination of material in this information product. Except where otherwise indicated, material may be copied, downloaded and printed for private study, research and teaching purposes, or for use in non-commercial products or services, provided that appropriate acknowledgement of FAO as the source and copyright holder is given and that FAO's endorsement of users' views, products or services is not implied in any way. All requests for translation and adaptation rights and for resale and other commercial use rights should be made via www.fao.org/contact-us/licence-request or addressed to copyright@fao.org. FAO information products are available on the FAO website (www.fao.org/publications) and can be purchased through publications-sales@fao.org.

CONTENTS

Summary	ii
1. Introduction.....	1
2. Cameron Highlands: geophysical characteristics.....	2
3. Vegetable area and farm size.....	3
4. GAP in malaysia	4
5. Methodology	5
6. Production systems.....	7
6.1. Farmers' characteristics	7
6.2. Understanding of GAP.....	8
6.3. Growing season for tomatoes.....	9
6.4. Production cost	10
6.5. Land.....	10
6.6. Labour	10
6.7. Seeds and seedlings	10
7. Marketing chain	14
8. Network with foreign buyers	16
9. Price Variation	17
10. Quality and food safety	18
10.1. Environment.....	18
10.2. Food safety.....	18
11. Workers' health and welfare	19
12. GAP implementation at farm level	20
13. Risk management.....	21
14. Lessons learned.....	22
15. Recommendations and implications	23
References.....	24

LIST OF TABLES, FIGURES, AND PHOTOS

Tables

Table 1: Number of farmers in Cameron Highlands (2002)	3
Table 2: Profile of farms and farmers studied.....	7
Table 3: Average cost of tomato production (MYR/ha/year)	12
Table 4: Costs and returns of tomato farming cycle	12
Table 5: Farmers' opinion on the extent of risk factors on farming	21

Figures

Figure 1: Location of Cameron Highlands in Pahang State, Malaysia	2
Figure 2: Marketing chain of tomato from the GAP practicing farmers in Cameron Highlands...	14
Figure 3: Average tomato prices at farmgate, 2006–2007 (MYR/kg)	17

Photos

Photo 1: Tomato farm with fertigation and mulching	11
Photo 2: Carton with SALM certificate logo	18
Photo 3: Tomato sorting and packaging by female worker	19

SUMMARY

This study intends to investigate and compare the farming practices of selected farms where tomatoes are grown under Good Agricultural Practices (GAP) certification and those that practice a traditional farming system. A case study method was employed to solicit the relevant information on the farming practices, perceptions on the Farm Accreditation Scheme (SALM) and its economic impact and implications. Three GAP-certified tomato farmers and three conventional farmers were selected for analysis. The level of awareness of SALM among the conventional farmers is low due to a lack of promotional campaigns by the government at the farm level as well as limited support and infrastructure to implement the scheme. The traditional farmers have fewer incentives to implement GAP on their farms because of low financial capacity as well as a lack of information on the scheme. As far as farming practices are concerned, like most commercial farms in Malaysia, the conventional farmers rely on imported inputs such as fertilizers, pesticides and seeds. They appear to be aware of the detrimental effects of excessive use of pesticides and other agricultural chemicals but put priority on the immediate protection of their crops. GAP certification in Malaysia appears to be skewed towards the large-scale farmers as they are able to internalize the additional cost of new technologies of producing high-quality and safe produce. Very little monitoring is carried out at the farm level. Hence, to improve its effectiveness and coverage, a number of strategies are recommended. These include aggressive promotional campaigns, technical training and extension to farmers, infrastructure to facilitate quality monitoring and assurance, and adequate support and incentives to encourage farmers to adopt GAP.

1. INTRODUCTION

This case study presents the impact of good agricultural practices (GAP) on tomato farming in Cameron Highlands, Malaysia. The objective of the case study is to investigate and compare the farming practices of selected farms where tomatoes are grown with GAP certification and those that practice a traditional farming system. The report also highlights the lessons learned from the implementation and compliance of GAP rules on tomato cultivation in Cameron Highlands. The study focuses on the selected tomato farmers in the major tomato growing areas in Cameron Highlands.

2. CAMERON HIGHLANDS: GEOPHYSICAL CHARACTERISTICS

Malaysia has two geographic regions: West or Peninsular Malaysia and East Malaysia; these two regions are separated by the South China Sea. The Cameron Highlands is located in the state of Pahang, Peninsular Malaysia (Figure 1). The district of Cameron Highlands covers an area of 71 000 ha. It is the second most important vegetable growing region in Malaysia after Johor State. The total area under vegetable cultivation in Cameron Highlands was 7 050 ha (Department of Agriculture, 2003). Generally, the terrain is mountainous and strongly dissected with 10–35° slopes. Soils in Cameron Highlands are mainly derived from granite, with sandy to sandy clayey loamy textures (Lim et al., 1996). The agro-ecological environment in the Cameron Highlands differs between regions.

Figure 1: Location of Cameron Highlands in Pahang State, Malaysia



3. VEGETABLE AREA AND FARM SIZE

The area under vegetable cultivation in Malaysia decreased from 40 000 to 38 000 hectares over the period 2000–2005. However, the tomato-planted area increased from 516 to 1 554 hectares during the period 1998 to 2004. Vegetable production has generally increased from 512 000 tonnes to 682 000 tonnes over the period 2000–2005 (MOA, 2006a).

The average farm size reported in other surveys of Cameron Highlands vegetable farmers are: 0.71 hectares in 1981 (Ding *et al.*, 1981), 0.59 hectares in 1988 (GOM-ADB, 1988), 0.85 hectares in 1992 (Ghazali *et al.*, 1994). According to FAMA's estimate, in 2002, there were 200 farmers in Cameron Highlands. Out of this total, 89 growers were from the Northern Zone, 54 in the Central Zone, and 57 in the Southern Zone (Table 1).

Table 1: Number of farmers in Cameron Highlands (2002)

Zone	Numbers	Percentage
North	89	44.5
Central	54	27.0
South	57	28.5
Total	200	100

Source: FAMA, 2002

The demand for tomatoes both in the local and export markets has shown an increasing trend in the last decade. The increase is attributed to a number of factors such as increases in population, level of income, changes in lifestyle and dietary intakes of the consumers, and various government promotional programmes. On the supply side, the production of vegetables has increased as a result of improvements in farming management and technology (MOA, 2006b).

The overall yield has improved due to the introduction of improved hybrid varieties, most of which are disease resistant, application of drip irrigation, usage of plastic mulches, and row covers, contact-based pesticides, fungicide, insect repellent, and high-density planting. According to FAMA, Cameron Highlands produces an average of 1 530 tonnes of tomato per month. This is about 19.2 percent from the total vegetable production of 7 961 tonnes per month in the area for the year 2000.

4. GAP IN MALAYSIA

In the last three decades the Malaysian vegetable trade balance has been consistently in the red. This has prompted the government to implement strategies to increase local vegetable production to meet local demand while increasing farmers' income and reducing outflow of foreign exchange. One of the strategies is the introduction of the farm accreditation scheme called *Skim Amalan Ladang Baik Malaysia* (SALM) in 2002 to ensure safe and quality produce that can effectively compete in both the domestic and international markets. The basic references used in developing the SALM scheme include the *FAO Draft document on GAP*, the *GLOBALGAP Protocol for fruits and vegetables* and the *WHO/FAO Code of hygienic practice for the primary production and packaging of fresh fruits and vegetables*.

The goal of the scheme is to encourage farmers to adopt and practice GAP on their farms. SALM incorporates field inspection, observations, auditing and interviews with the farmers and analysis of harvested produce for pesticide residues and heavy metals. Farmers have to fulfill the following 17 major conditions to receive the SALM certificate:

1. Farm is a legal entity;
2. Farm has soil inspection report;
3. Soil and terrain is suitable for the intended crop;
4. Farm is located at an elevation < 1000 meters above sea level (exemption given to those operated before 2002);
5. Farm practices compatible with soil conservation;
6. Farm maintains up-to-date records of activities (17 types);
7. Sewage or industrial sludge is not permitted for fertilization;
8. Use of non-genetically modified planting materials for pest control;
9. Pesticides used are legally registered by the Pesticides Board;
10. Farm practices integrated pest management (IPM);
11. Farm has proper storage area for pesticides and fertilizers;
12. Farm workers must use personal protective clothing;
13. Farm possesses a proper waste disposal plan;
14. Farm practices the good harvesting management system;
15. Farm employs legal workers (above 16 years of age);
16. Pesticide residues on farm produce are reduced; and
17. Heavy metal contents should be below permissible levels.

Out of 930 farmers who applied for SALM certificates since its introduction in 2002, only 150 farmers or 16.1 percent have received the certificates as of November 2005. Information from FAMA shows that the number of SALM certificate holders has increased to 168 throughout the country in 2007. In the Cameron Highlands area, only 10 out of 200 farmers (or 5 percent) have received the SALM certificates for vegetable farming since 2002.

5. METHODOLOGY

The Cameron Highlands comprises three zones according to the elevation level. The central zone which is the highest at 1 400–1 500 metres above mean sea level, is cooler compared with the northern and southern zones, the elevations of which are approximately 300–500 metres less than that of the central zone (Lim, 1996; Syed *et al.*, 1996). In the central region, daily temperatures range from 14°C to 23°C, while in the southern and northern zones, the temperatures are relatively higher (with daily temperatures ranging from a minimum of 16°C to a maximum of 26°C). Rainfall is well distributed and highly variable both within and between different months of the year, ranging from 60 to 500 mm per month and averaging about 2 650 mm per year. However, the wet months generally occur in April, May, October, November and December, while the other months are relatively drier (Ghazali *et. al.*, 1994; and Syed *et. al.*, 1996).

The southern zone consists of areas around Ringlet, Boh Road and Bertam Valley (ca. 1 000–1 100 m), the central zone includes areas around Tanah Rata, Brinchang, Mensum Valley, Kea Farm and Sungai Palas (ca. 1 200–1 400 m), and the northern zone comprises areas in Kuala Terla, Kampong Raja and Blue Valley (ca. 1 350–1 450 m) (Ghazali *et. al.*, 1992; Syed *et. al.*, 1996). The study took place in the northern zone of Cameron Highlands, which is the most important area for tomato cultivation.

The list of farmers was obtained from the local FAMA office, containing their names, addresses and contact telephone numbers. Most of the farm lands are leased from the government under the Temporary Occupying License (TOL scheme) for longer term usage.

There are a few large farmers who supply their tomatoes to Singapore, which is the major destination for Malaysia's vegetables. These farmers are exposed to rigid export requirements and found to be aware of GAP. They have also received SALM certificates and adhere to the GAP requirements consistently. The majority of farmers from Cameron Highlands does not export their produce and has less incentive to follow GAP on their farms.

This study adopted the case study method to obtain the necessary data on the farming system of both GAP-practicing tomato producers and those of conventional farmers who practice traditional farming systems. The study has identified three GAP-practicing tomato producers in the northern region of the area. The farm size of these producers ranges from 10 to 24 hectares. Another three farmers who practice traditional farming (*i.e.*, they have not adopted GAP and hence have not obtained SALM certificates) were also selected as a basis for comparison. These producers are working on a smaller farm size, ranging from 1.2 to 1.6 ha.

The research was not able to locate farmers with similar landholding sizes to those that practice GAP as samples for comparison. According to FAMA, it is probable that there are no similar size of non-practicing GAP tomato farms available in the area. Hence, the study had to select three unconventional farms as a basis for comparison.

An unstructured questionnaire was used to capture the information on the farmers' farm practices, costs and returns of tomato production, marketing channels and farming risks. The sampled farmers were interviewed by the research team at their farms. Other responsible staff working on the farms also provided production- and management-related information during

the interview. Interviews were carried out in the appropriate languages (English, Mandarin and Bahasa Melayu) and each session lasted around two hours. Tape recorders were used to record conversations and later transcribed into English. Farmers were asked about personal details, their farming practices, marketing channels and other issues of environmental concerns. The interviewers had to ask some leading questions to capture in-depth and detailed information on selected issues such as their perceptions on food safety and other environmental concerns. After the interview, the research team visited the farms to observe the method of inputs applications, harvesting and processing to have a clear understanding of the farming practices. Discussions were also held with the labourers who were working at the farms for further clarifications and verifications. The case study was conducted during the last week of August 2007.

6. PRODUCTION SYSTEMS

6.1. Farmers' characteristics

The majority of the populations in this area are Chinese and farming is the major economic activity. They have a long tradition of vegetable farming passed on by their forefathers. Due to the structural change in the country's agricultural sector and an increase in demand for high-quality fresh vegetables, some farmers have shifted their farming techniques from conventional farming to a more environmentally sustainable and high-yielding farming practices in accordance to consumers' preferences.

All the respondents interviewed report that their farms are run by family members who are responsible largely in the management aspects while imported workers are employed to carry out menial farm duties. We observe that the farmers who obtained SALM certificates and followed GAP are highly experienced in farming technologies. All three of them have over ten years of practical experience in tomato cultivation (see Table 2).

Other family members (wife, sons and daughters) are found to be involved in the farm management. One of the interviewee's son, is well educated and works in the family farm actively. The sample farmer B is relatively younger (32 years of age) and well educated (see Table 2). This indicates that young and educated individuals are still attracted to participate in the tomato cultivation in contrast to the general belief that young professionals are not inclined to go into farming.

The farmers practicing GAP are also involved in other activities such as wholesaling, transporting and exporting. They are able to perform these multi-tasking functions as they own transport facilities and a packaging house besides other communication facilities. In other words, their production and marketing activities are integrated, which is in stark contrast to the conventional farmers who specialize only in production activities.

Table 2: Profile of farms and farmers studied

Characteristic	Farmers with SALM			Conventional farmers		
	A	B	C	X	Y	Z
Age (years)	65	32	50	40	48	72
Education (years)	10	14	5	7	5	2
Experience (years)	40	10	10	22	10	40
Area cultivated (ha)	15	24	10	3.2	2	2.4
Number of varieties grown	4	4	6	3	4	3

Farmer A is 65 years old, has 40 years of farming experience and started tomato farming in 1996. He has 15 hectares of tomato farms in seven different plots. His wife and son are involved in the farming. He has only reached primary level of education but his son is an industrial engineer, who previously worked with a company for one year. He is now involved in the overall management of the farms and is well paid. He is happy to work with his parents and planning to expand the farms in the near future.

6.2. Understanding of GAP

The farmers believe that the high demand for Cameron Highlands tomato is attributed to its perceived high quality due to the soil characteristics and environmental conditions in the highlands. Improvement in farming technology allows the farmers to adopt different varieties of high-yield tomatoes to increase income. The majority of the farmers have small farm sizes and they produce tomatoes both for their own consumption and for sale. The commercial farmers occupy a considerable area of land to grow tomato for the market. These farmers are market-oriented in their farming practices particularly in ensuring consistent supply of high-quality tomatoes to the market.

It is observed that the farmers have acquired farming experience through learning by doing over a long period of time. The major sources of information have been personal communication with the local agricultural extension agencies, exchange visits to overseas farms, neighbouring farmers, relatives or friends, and input suppliers. Among the sources, exchange visits to other farms are reported to be the most useful as these helped them to understand various new farming strategies and technologies, as well as food quality and safety issues.

The vegetables grown in Cameron Highlands are of good quality and popular in domestic as well as overseas markets. Their trading relationships and networks with the local and Singaporean markets provide the signals on consumers' taste and preferences. Singapore is the nearest export market for Cameron Highlands' tomatoes and the farmers are always in close contacts with their buyers either through telephone or email. This close relationship enables the farmers to be in touch with the consumer market, particularly in terms of taste and preferences. Direct marketing to buyers in Singapore enables the producers to minimize transaction costs and earn better returns on their produce. The advent of hypermarkets in Malaysia has somewhat increased the demand for high-quality and safe food catering to the affluent consumers in the urban areas. This development has also contributed to the increase in demand for high-quality tomatoes from this area.

According to the GAP-practicing farmers, they have started to apply good agricultural practise in Cameron Highlands ten years ago. This was prompted by the growing awareness of food safety issues among consumers in the export markets as well as stiff competition among farmers to capture overseas markets where quality is one of the major determinants of competitiveness.

Farmer C is a large scale farmer who has a relative, who is also a large-scale farmer in Chiangmai, Thailand. During his visit to his relative's farm in Thailand, he met a Japanese professor who was working on a project there. The professor advised him to try growing Japanese tomato on his farm in Cameron Highlands. He agreed and was given seeds and other inputs from Japan. He has successfully planted those different varieties of Japanese tomatoes on his farms and was able to command high price for these tomatoes. The Japanese tomatoes are of very high quality and their prices are twice that of the Holland variety which made up the majority of the local supply. He utilizes organic fertilizers and has his own space for preparing compost. He carefully applies pesticides that will not affect the quality of the tomatoes. He has vast experience and understanding on the harmful effects of pesticides and residues. "I have to maintain quality to ensure safe and healthy produce to my customers while improving the goodwill of my international buyers", he added.

The GAP-practicing farmers have been successful in introducing new technologies such as hydroponics, fertigation or mulching on their farms. As a result they are able to produce high-quality tomatoes. New farming technologies are learned and adopted by the farmers through long trials and experiments on the farms. The main purpose of these experiments is to seek the optimum application of organic inputs and other environmentally friendly measures to ensure safe and quality produce. Their efforts proved fruitful as their exports passed the strict quality rulings of the Singaporean market. This gave them the confidence and incentives to improve their tomatoes further. However, the farmers complained of not getting enough support from the local agencies in their efforts to look for better farming technologies to improve their productivity further.

On the other hand, the conventional farmers have no direct access to the export markets. They have no direct contact with the overseas buyers. Hence, they rely on selling their produce to the local wholesalers. They also sell their tomatoes to the collectors, transporters and other wholesale markets. They are unable to adopt the new technologies because of lack of access to information on production and marketing of tomatoes as well as limited credit facilities. Under the conventional farming system, most of the tomatoes are grown in the open field without any shelter. The plants are easily affected by fungus and insect outbreaks as a result of heavy rainfall, particularly at the end of the year. Farmers have to use relatively high amounts of pesticides and fungicide regularly. These farmers perceive that GAP demands higher costs of production as they have to invest in shelters and other inputs. This perception has discouraged them to adopt GAP on their farms.

Some large-scale farmers have received more than one SALM certificate for different plots of lands from the authority. For each plot, the farmers have established a company to manage the farm. The produce from each plot will be labelled with certificate numbers as specified by the SALM certificate, the company's name and logo.

It was reported that at times, the farmers fail to supply certain amount of tomatoes to the buyers (particularly for the export market). We were informed that during shortage of supply, the exporter-cum-farmers usually buy tomatoes from conventional farmers (who do not practice GAP) to fulfill the market requirement. In this regard, the SALM-certified farmers do not fully comply with the rules to maintain the quality of produce. According to the locals, there is no laboratory available to investigate the quality of the produce and the buyers at large are perceived as being indifferent to quality. The physical appearance is the main consideration for the buyers in choosing the produce. This practice of outsourcing from the traditional farmers proved to be costly as these tomatoes were rejected by the Singaporean authority due to excessive chemical residues.

6.3. Growing season for tomatoes

Tomatoes can be grown throughout the year under plastic roof and with fertigation. The duration of one cycle is about seven months. About one week after harvesting, the farms are ready for the next planting. The tomato seeds take two weeks' time to grow to a suitable size of seedling for plantation. The plant starts to bear fruits after 75 days of plantation. The harvesting period of tomatoes lasts about 3–4 months. In this type of farm, constant nursing is essential at every stage; from plantation to the last harvests. In the traditional farming system, most of the tomato cultivation is done in the open field once in a year and the duration of the tomato production cycle is about five months. The farmers have to complete harvesting before the wet

months, which are in the months of October to January. During the wet season, the traditional farmers use increased amounts of pesticides as they are washed off more quickly by the rain and also plants are easily destroyed by frequent pest infestations. However, in the last eight to ten years, the farmers have observed some irregularities in the pattern of rainfalls and temperature in the area, which make farming and harvesting plans difficult.

6.4. Production cost

The production cost of tomatoes includes land rental, crop field structure, manure, fertilizer, pesticides, irrigation, tractor use and labour. The growers are reluctant to provide detailed information on each individual factor cost. Therefore, total cost of production was estimated based on the information available from the discussions.

6.5. Land

The farmers obtained their land for vegetable farms from the government under leasing arrangements (Temporary Occupation License -TOL) for 40 years. They have to pay a fixed amount of lease fees for the land annually. Due to scarcity of land for farming, farmers are moving towards new lands available for farming at Lojing in Kelantan State located at the border of Cameron Highlands. Some farmers from this area have already started cultivation in the new area.

Modern farming methods such as hydroponics and fertigation require large initial investments. Under these techniques, tomato plants are covered with a plastic roof, they are grown in plastic bags filled with compost, water pipes are channeled into the bags for irrigation. Some of the plots are fixed with paved floor; the cost per acre of such infrastructure is about MYR160 000 (US\$47 059). However, the costs per acre of fertigation with plastic-covered floor are about MYR90 000 (US\$26 500). This indicates that under the TOL, farmers perceive that they are given a long-term security to use the land and hence incentives to invest heavily to obtain higher returns. The plastic roof structure generally lasts about 10–20 years. However, they need minor repairs and maintenance every year due to the problems of algae grown on the plastic shield that blocks sunlight to the tomato plants and sometimes the plastic sheds are damaged by strong winds.

6.6. Labour

The farmers interviewed in Cameron Highlands rely fully on foreign labourers for farming activities. The labourers are employed for long term and are paid on a monthly basis. They have been working with particular farms over a long period of time and have gathered practical experiences in tomato cultivation. The farmers pay an average salary of MYR800 per month per worker; however, some experienced labourers are paid more than MYR1 000 monthly. They are provided with minimum shelter within the farm compound and basic medical benefits. The farmers prefer to employ foreign labourers as they usually work hard and demand lesser fringe benefits such as insurance and proper accommodation.

6.7. Seeds and seedlings

The farmers rely on imported seeds, mostly from the Netherlands and Taiwan (Province of China). Different varieties of tomatoes are grown in Cameron Highlands. Recently seeds from Japan have been available. The cost of the Japanese variety is relatively high compared with that of other varieties. According to one respondent who is currently growing a Japanese variety, it is

the best quality in terms of taste and shelf life. The tomato seeds are available from the local suppliers. The farmers in general complain about the increase in input prices during the last decade. For instance, the cost of seeds has increased by 50 percent over the last ten years while chemical fertilizer and pesticide prices are also on an increasing trend.

Irrigation costs are minimal, as natural water supply from upper catchments in the areas is used as irrigation for farming. The farmers use water pumps to irrigate different levels of plots on the highlands. Under the fertigation technique, the initial investments are relatively high to install water pipes for irrigation.

Photo 1: Tomato farm with fertigation and mulching



The production cost is higher for GAP practicing farmers compared with conventional farmers (Table 3). The GAP practicing farmers spend relatively higher costs on fertilizers, while the traditional farmers spend more on labour. The labour cost is estimated from the total annual labour days spent for tomato cultivation in one production cycle.

Under the fertigation system, the fertilizers are diluted through the irrigation pipes and fed to the plants. Under the plastic shield, the plants are less susceptible to pests and insects. However, in the open fields, the non-GAP practicing farmers have to apply more pesticides to protect their crops from insects and diseases, particularly during the wet season. About 15 percent of total costs are spent on maintenance of plastic shields in the GAP-certified farms. On the other hand, bamboo sticks are used to hold the plants in the open traditional farm and the costs of its maintenance is about 2 percent of total production cost.

Table 3: Average cost of tomato production (MYR/ha/year)

Input	GAP practicing farmers		Conventional farmers	
	MYR	%	MYR	%
Labour cost	20 261	21	16 555	39
Seed	5 782	6	5 337	8
Irrigation	6 177	7	4 447	13
Fertilizer (fertigation)	28 416	30	11 119	11
Pesticides	8 648	9	13 590	20
Compost (in plastic bag)	11 119	12	-	-
Depreciation or maintenance	13 590	15	3 706	2
Fencing or bamboo stick	-	-	-	7
Total cost of production	93 995		67 111	
Cost per plant	3.50		2.30	

About 27 180 seedlings are planted per hectare in the protected fields, while in the open field conventional farmers grow more plants (29 651 plants/ha). Conventional farmers usually grow other vegetables in the tomato fields as subsidiary crops to earn extra income. However, the costs and production of other crops grown in the tomato farms are not included here.

The average yield of tomatoes under the protected environment is around 4 kg to 4.5 kg per plants while it is about 2.5 kg to 3 kg in the open environment. In the protected environment (under plastic shield), the duration of tomato production cycle is longer (7 months) while in the open environment the duration of tomato cycle is only 5 months.

The well-off farmers have their own machines for grading and packing, which is done at their farms. Only three privately owned big sorting and packaging machines are available in the whole of Cameron Highlands. The cost of each machine is about MYR30 000 (US\$8 824). There are also a few small-size processing machines available which cost MYR7 000 (US\$2 000) each. The farmers use cartons for packaging. The capacity of each carton is 10 kg of tomatoes and the cost of the carton is about MYR1. The cost of packaging per kg of tomatoes is 10 sen for the GAP practicing farmers who send their produce to Singapore. The traditional farmers also use cartons to send their produce to the local markets but the packaging cost per kg is 6 sen. Most of the farmers have their own transport means to carry goods to Singapore, Thailand and other selling destinations. The transport costs per kg of tomato to Singapore and Thailand is 17 sen while the average cost of transportation is about 12 sen to local wholesale markets (Table 4).

Table 4: Costs and returns of tomato farming cycle

Cost and return	GAP practicing farmers	Conventional farmers
Packaging (MYR/kg)	0.10	0.06
Transport costs (MYR/kg)	0.17	0.12
Overall management cost (MYR/kg)	0.45	0.10
Yield per plant (kg)	4.00	2.50
Value of production per plant (MYR)	9.00	4.40
Other costs per plant (MYR)	2.88	0.70
Total costs per plant (production and other costs) (MYR)	6.38	3.00

The average yield of tomatoes is estimated based on the farmers' experiences. The farmers inform that tomatoes are highly perishable produce and very sensitive to temperature and weather. The yield of the tomatoes varies between the GAP-certified and traditional farms. With a longer harvesting period, the GAP practicing farmers are able to obtain higher a yield (4 kg per plant) compared with the traditional farms (2.5 kg per plant). The market price of a tomato from GAP-certified farms is always higher due to its size, appearance and quality. The average price for GAP tomatoes is MYR2.50/kg and MYR1.75/kg for conventional tomatoes.

The post-harvest costs which include sorting, packaging and transport are 72 sen per kg for GAP practicing farmers and 28 sen for the traditional farmers (Table 4). Considering the value of production per plant and total production costs per plant shown in Table 4, the net profit per plant for GAP-practicing farmers is MYR2.62 and MYR1.40 per plant for traditional farmers. Given the number of plants per area referred to above, the profit for GAP-certified farms is MYR71 211/ha/cycle and MYR41 511/ha/cycle for the traditional farms.

The certification done by the Department of Agriculture (DOA) is free of charge to tomato farmers. Despite the high cost of investments, the GAP practicing farmers are happy with the new improved technologies as they increase productivity and return. Tomatoes are sorted and graded based on size and ripeness. Higher grades fetch better prices. The physical appearance of tomatoes grown in the traditional farms is not so attractive and the market price for these products is lower compared with the tomatoes from GAP-certified farms.

The traditional farmers face greater risks of pest and disease outbreaks on their crops. Sometimes farmers get lower yields of tomatoes due to continuous rain and cloudy weather, fungus attack and poor seed quality. The farmers have no means of insuring this production risk but leave it to nature to take its course. According to them, the losses in certain planting seasons are sometimes compensated or offset with good harvests in the other seasons.

"I wanted to try a new variety of tomato in my field, but most of the seedlings died after few days of plantation. I had to replant, hence, I lost money and three weeks of working time" – Farmer C (a large-scale farmer)

"When I found most of my young tomato plants were affected by disease, I sought support from our local farmers and agricultural office, but nobody came. I lost my crop. Later, I visited my relative in Thailand and learned about the enzyme that overcomes the fungus problem"- Farmer Z (a conventional farmer).

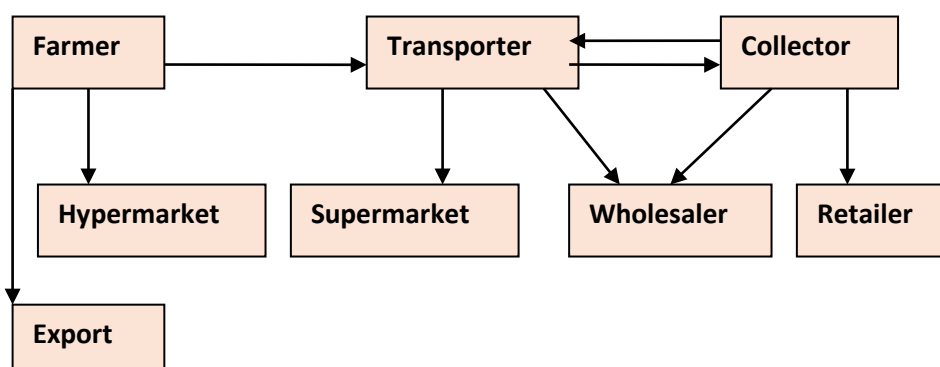
7. MARKETING CHAIN

The growers were asked to whom they usually sold their produce. It was found that the transporters played an important role in the marketing chain of tomatoes in Cameron Highlands. A number of small old jeeps (Land Rovers) owned by farmers are available in this area. They use the jeeps to carry inputs to the farms as well as transporting the produce to the processing house for sorting and packaging. A number of trucks and lorries (owned by the transporters) are also available for transportation of produce to different destinations including Selayang wholesale market in Kuala Lumpur, Singapore and Thailand. The local private transport association is efficient in managing the distribution of tomatoes in the region.

Most of the farmers we interviewed own trucks. They use the trucks to send their produce to the buyers as well as renting them out to others for additional income. Each truck has been assigned specific destinations to avoid overlapping. The transport association fixes up the rates for carrying goods to different places through a mutual agreement with the local farmers. Some transport owners act as collectors or assemblers for distant farmers. They play the role of an intermediary between the conventional farmers and the wholesalers. Normally, the collectors are able to buy produce at a relatively lower price from these farmers as they have less access to market information. The collectors then sell to the wholesalers at the market prices and earn higher margins than the transporters who sell direct to the buyers.

Figure 2 shows the marketing chain of tomatoes in Cameron Highlands. The GAP-practicing farmers sell as high as 60 percent of their produce to Singapore supermarkets (National Trades Union Congress (NTUC) and Giants hypermarkets), Thailand, Hong Kong and Japan. These farmers also assemble, sort and package the tomatoes on the farm and they send the produce using their own transport to the buyers.

Figure 2: Marketing chain of tomato from the GAP practicing farmers in Cameron Highlands



The GAP practicing farmers export their produce directly to their overseas buyers. In other words, the marketing chain for these farmers is shorter compared with that of the conventional farmers. The farmers who export their produce state that about 60 percent of their produce is destined to overseas markets, while the rest of their produce is sent to local hypermarkets such as The Store, Tesco, Pacific, Makro and other supermarkets. They use their own transport means to deliver their produce to local hypermarkets. Again, no intermediary is involved in this marketing chain. Although they receive a higher margin through this channel, the farmers have

less incentive to supply to the local hypermarkets because their high quality produce are not given due recognition.

In contrast, the conventional farmers rely on the transporters or collectors to sell around 75 percent of their tomatoes to the wholesalers and supermarkets. They receive lower margins due to the involvement of the transporters and collectors. They sell the remaining 25 percent of their tomatoes directly to the hypermarkets. As for the price of their produce, they are determined by the wholesalers based on the supply–demand situation in the market. No contract (formal or informal) is made between the farmers and their buyers regarding the supply arrangement. As a result, the farmers are generally sceptical on the “reasonableness” of the price received from the wholesalers.

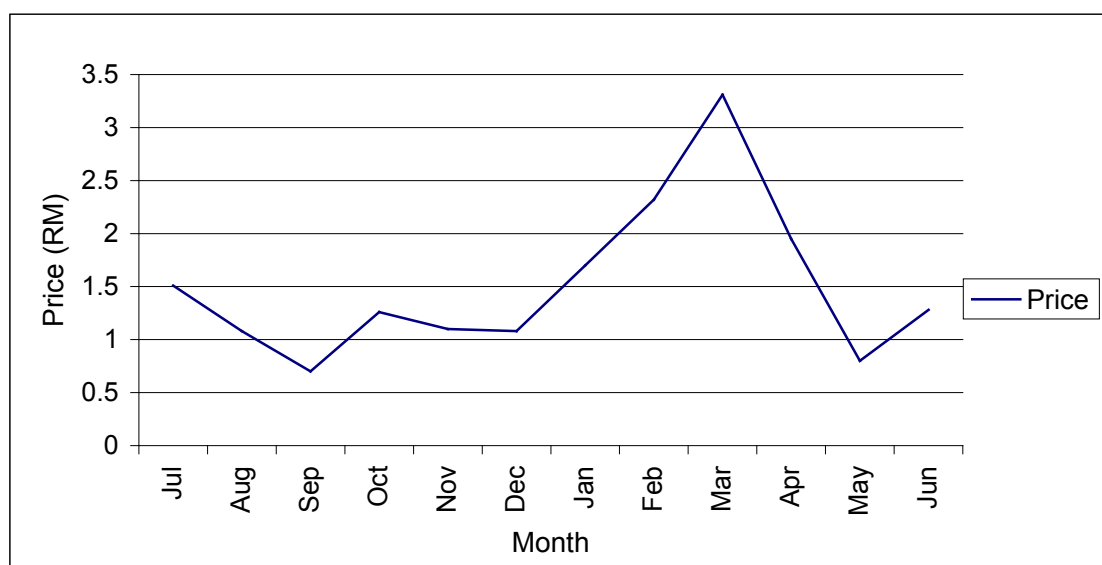
8. NETWORK WITH FOREIGN BUYERS

The farmers maintain a close linkage with the foreign buying agencies like the NTUC and Giants in Singapore, supermarkets in Japan in the last ten years or more. They have relatives and friends in China, Singapore and Thailand. They visit each other and learn about vegetable farming technologies. Farmer A has a satellite dish installed at his office by the farm to receive agricultural programmes from the Chinese Agricultural Institute. They also use telephones and emails as communication channels to update information on tomato production and marketing in Asia and other countries. The knowledge acquired is disseminated to the farmers in their area.

9. PRICE VARIATION

The price of tomatoes is highly volatile throughout the year. No records on prices of tomatoes are maintained at the farm levels. Tomato is a highly perishable commodity in that it deteriorates fast in an open environment. Therefore, tomatoes require delicate handling to preserve quality as little blemishes or imperfections will reduce the price significantly. On the other hand, price of tomatoes is closely dependent on the volume of supply in relation to demand. Generally, tomato farmers are price takers in the international as well as local markets. Figure 4 shows the average farmgate price of tomato throughout the country for 12 months. It shows that the price fluctuates between the months and they remain below one Ringgit during May and September and high during the dry season from February to March. The lower price may be due to excess supply of produce and also due to forced harvesting during bad weather. Excess amount of harvests may cause a “distress sale” of produce which results in lower prices.

Figure 3: Average tomato prices at farmgate, 2006–2007 (MYR/kg)



Source: FAMA (www.famaxchange.com)

10. QUALITY AND FOOD SAFETY

10.1. Environment

Half of the respondents seem to be knowledgeable on the quality of their produce and its safety for consumption. The commercial farmers who are competing in the international market are very concerned about the quality of their produce. Their farms are clean and we did not find any serious pollution problem. The farms are on the highlands, hence, rain or excess water is drained quickly. The tomato farms under fertigation method are relatively cleaner compared with other farms. In the conventional farms, plants are grown in the open environment. One of the GAP farmers uses fully organic compost and fertilizer in his farm to reduce fertilizer costs and to ensure quality produce. He uses different organic manures to make compost fertilizers which are not available locally. He obtains the manure from Perak State. A dedicated space at the farm is used for making compost and fertilizer.

10.2. Food safety

The quality assurance system for food safety is provided by FAMA, which allows farmers to use the FAMA logo on their vegetable packages. However, the farmers and marketers do not seem to practice quality assurance. No quality check of tomatoes is done either at the farm level or at the local markets.

Photo 2: Carton with SALM certificate logo



The knowledgeable farmers seem to be very confident about using the chemicals as their tomatoes thus far have not been rejected by the Singaporean buyers. Very few farmers practice Integrated Pest Management (IPM) on their farms. The traditional farmers apply different types of chemicals to reduce pest and fungus problems. They claim that the residuals of these chemicals are low and not harmful to human health. Traditional farmers are reluctant to follow IPM because IPM farms require higher weeding costs.

11. WORKERS' HEALTH AND WELFARE

Almost all of the labourers working in the farms were from other countries, i.e. Indonesia, Bangladesh, Nepal and Myanmar. They are employed as full-time workers and are provided with shelter and medical treatment. The advantage of hiring the labourers permanently is that the farmers are able to improve their farming skills over time. Some workers have been working at the same farm for the past ten years and have developed their farming skills. They indicate that they are careful in fertilizer and pesticide applications. The workers in the field do not report any serious health problems during their tenure.

We observe that the workers are very careful in carrying out harvesting and post-harvest activities. Workers are not allowed to smoke in the farm area. After harvesting, the tomatoes are washed with clean water and wiped properly before packaging by the workers. Most of the labourers are male; only a few farms employed women workers mainly for sorting, cleaning and packaging work. The workers wear clean dress and use hand gloves for sorting and cleaning. However, packaging and sorting in the traditional farms are not being done safely. The workers do not wear clean dress and gloves during sorting and packaging of tomatoes.

Photo 3: Tomato sorting and packaging by female worker



12. GAP IMPLEMENTATION AT FARM LEVEL

The commercial farmers who have their own established markets (overseas and local) applied for SALM certification to have better market access. It is found that SALM-registered farms received priority in the local hypermarkets and supermarkets as preferred suppliers. SALM-certified firms are eligible and qualified to use the SALM logo on their cartons.

The SALM certification scheme has not yet received the required recognition in the overseas markets with the exception of Singapore. It has been agreed through a bilateral arrangement with Singapore that the produce of SALM-certified farms are allowed to proceed to retail distribution centres without detention at the Singapore customs. However, sometimes the produce is checked at the point of entry to test whether any pesticide residues can be detected on tomatoes.

“We always pass the audit and inspections done by SALM authority. We are not worried about the SALM, but we are more concerned about the inspection by the Agriculture, Food and Veterinary Authority of Singapore (AVA) at the entry point. Two years ago, my whole consignment was once rejected by AVA due to excessive chemical residue in my produce. As a result, my company has been banned from exporting to Singapore for 3 months.”- Farmer C (a large-scale farmer).

One of the farmers interviewed did not renew his SALM certificate last year, but he is still using his expired SALM logo for supplying his produce to Singapore and local hypermarkets. The international recognition of the GAP used on their farms is necessary to secure a place for their produce in the export market.

It appears that the quality demand and pressure from the export markets have forced the commercial farmers to adopt GAP in vegetable production. Small farmers are not able to expand their farms to take advantage of the economies of scale because of limited support from the government. On the contrary, the GAP farmers state that they need at least two years to experiment with any new technology before adoption. They also mentioned the problems of getting the right inputs as well as market access.

“Farming has become very expensive and competitive, the input costs have increased significantly, land is not available and modern technologies require a lot of investment. Besides, we find it difficult to obtain credit at favourable terms”- Farmer X (a conventional farmer).

13. RISK MANAGEMENT

The farmers were asked about their perception on farming risks in undertaking good farming practices. Their opinions on various points are presented in Table 5. Both SALM-certified farmers and traditional farmers inform that they face some risks and uncertainties in implementing farming practices.

Unfavourable weather, high prices of inputs and price fluctuation of the produce are the key problems for tomato farming. The rainy and windy weather in the months from September to January results in low tomato yields in Cameron Highlands. The traditional farmers who cultivate in the open farms have higher risk for their produce. They have to finish their harvesting before the rainy seasons. However, the farmers who have plastic roofs can keep on harvesting from the farms for a longer period. The plants are affected by fungus that kills the standing plants during bad weather and low sunlight. The farmers are able to control the fungus problem by using more pesticide spray but still they get below-average yields. They face these problems almost every year, but the extent of these problems varies between farmers.

Table 5: Farmers' opinion on the extent of risk factors on farming

Actions	Extent (high, medium, low)	How often
Lack of land	High	Recently
Price of inputs	High	Over the years
Price variation of produce	High	Every week
Rain or wind problems	High	Wet season every year
Lack of credit support	High	Always
Lack of access to information	High	Always
Lack of government support	High	Always
Lack of storage problems	High	Always
Pest or disease attack	Medium	Every year
Land fertility reduced	Medium	Over the years
Low yield	Medium	Once in two years
Lack of available inputs	Medium	Throughout the year
Lack of reliable inputs	Medium	Every year
Rejected produce by buyers	Low	Once in two years
Shortage of labourers	Low	Seasonal
Erosion of top soil	Low	Over the years

Tomato seeds are imported from other countries. The farmers acquire the tomato seeds from local input suppliers. A reasonable time is required to try out the new variety before extensive cultivation. The farmers rely on foreign labourers for farming. We observe that the top management responsibilities are always shared by family members or relatives. In view of the high wage rate for local labour, it is probable that the farmers also assign overall farm management to the foreign workers.

Lack of access to information on the quality of inputs and marketing of outputs is the biggest barrier facing the farmers. The traditional farmers are generally relying on the transporters or collectors for price and other marketing information. Compliance to the SALM certification rules at the farm level is rather low as the government has no provision to conduct any spot check at the farm level for assessing tomato quality.

14. LESSONS LEARNED

The quality of tomatoes in Cameron Highlands is relatively better compared with the tomatoes from other areas in Malaysia due to its suitable environment. The farmers have improved their knowledge in farming practices through their trading linkages over a long period of time with Singapore and other countries. The relatively rich farmers who communicate with other farmers overseas and who have a strong financial capacity are able to introduce GAP successfully on their farms. They play an important role in contributing to the local economy and are able to bring in valuable foreign exchange. The effect of the SALM certification since 2004 has given them an added advantage to compete with other foreign suppliers in the Singapore market and to secure a place in the premium section of the local hypermarkets.

Although the SALM programme is recognized within the country, it does not receive international recognition with the exception of Singapore. GAP is mainly practiced by the large-scale farmers who have the financial means to do so. GAP is yet to penetrate to the small-scale farmers who practice conventional farming.

The commercial and relatively large farmers have access to the export markets and have introduced better technology in their farm practices while the traditional farmers still depend on the wholesalers, collectors and transporters to sell their produce at local markets with a lower margin. In the local markets, the wholesalers dictate the price of tomatoes and pay lower prices to the traditional farmers. In the medium term, it appears that the poor farmers will not be able to adopt GAP due to various economic constraints.

Environmental awareness has increased in the agricultural farming community in Cameron Highlands. The workers in the field have experience and knowledge in farm management through working over a long period of time. The conventional farmers are not under pressure to supply quality products and receive no incentive to do so.

The marketing chains for the GAP-certified tomatoes are efficient. This is made possible by adequate logistics available on the farms such as transportation to carry inputs into the farms as well as output to the markets. Besides, value adding activities such as sorting, grading and packaging are done at the farm level.

15. RECOMMENDATIONS AND IMPLICATIONS

The study shows that SALM certification has been effective in promoting quality tomatoes in the export markets, particularly to Singapore. The GAP-certified farms are able to penetrate the Singaporean consumer market under the banner of SALM. However, there are a number of problems observed in SALM implementation at the farm level, particularly the lack of quality monitoring mechanism at the production point. There is no laboratory established to monitor tomato quality or to settle disputes on quality. There is no body or institution empowered to verify the GAP practices at the farm level. In this regard, a third party certification is deemed necessary to ensure proper implementation. Besides, the study shows that SALM, with the exception of Singapore, has not received recognition from other international markets. This would mean that efforts should be made to promote SALM aggressively in other markets to make way for high-quality Malaysian produce.

Generally, the level of awareness on GAP among the conventional farmers in the Cameron Highlands is low. Hence, promotional campaigns have to be intensified to increase awareness. Besides, training and extension services have to be conducted on an extensive scale to ensure a larger farming community will benefit from the scheme. Technical support should be provided to the farmers by the quality control authority in coordination with the local government agencies.

Due to lack of quality control arrangements, the farmers are reluctant to have formal contracts with the hypermarkets for their tomatoes. A private quality control system should be developed to improve trust between the farmers and the buyers.

The farmers utilize imported inputs for their farms. The applications of inputs, particularly pesticides and chemicals, are not monitored. The farmers rely on their own experiences and personal judgment as to what is “harmful” and “not harmful” to human health. No proper training or guidance are provided to the farmers on good agricultural practices. Clearly, an extension programme is needed here to train the farmers on the correct agricultural practices to ensure safety of the produce for consumption. Strict control over selling of banned pesticides should be taken by the authority.

Expansion of the markets for organic produce worldwide may encourage the producers to apply organic principles on their farms. In order to encourage farmers into organic farming, adequate market incentives should be provided to the farmers in the form of cheaper credit, better market infrastructure, technical support and adequate fiscal incentives.

REFERENCES

Department of Agriculture. 2003. Department of Agriculture website, Malaysia (available at <http://agrolink.moa.my/doa/indexBl.html>).

Ding, T.H., Vimala, P. & Yusof Salleh. 1981. Vegetable farming in the highlands of Peninsular Malaysia. *In An agro-economic survey of vegetable farming in Peninsular Malaysia.*

Ghazali, M., Nasir, M.S., Eddie, C., Zainal, A.M. & Donald. 1994. *Sustainability of English cabbage production practices in Cameron Highlands.* Universiti Putra Malaysia. Serdang, Selangor.

GOM-ADB. 1988. *Agricultural marketing project: case study of vegetable production and marketing in the Cameron Highlands.* Government of Malaysia and Asian Development Bank, Kuala Lumpur.

Lim, G.S., Sivaprasagam, A. & Loke, W.H. 1996. Crucifer insect pest problems: trends, issues and management strategies. *In The management of diamondback moth and other crucifer pest. Proceedings of the Third International Workshop, Kuala Lumpur, Malaysia,* pp.3–16. MARDI, Kuala Lumpur.

MOA. 2006a. *Government of Malaysia, Agricultural statistical handbook 2006.* Ministry of Agriculture and Agro-Based Industry. Putrajaya.

MOA. 2006b. *Vegetable, spices and cash crop statistics, Malaysia, 2004.* Ministry of Agriculture and Agro-Based Industry. Putrajaya.

Syed, A.R., Sivaprasagam, A., Loke, W.H. & Fauziah, I. 1996. Classical biological control of diamondback moth: the Malaysian experience. *In The management of diamondback moth and other crucifer pest. Proceedings of the Third International Workshop, Kuala Lumpur, Malaysia,* pp. 71–77. MARDI, Kuala Lumpur.