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SEQUENTIAL RISK MANAGEMENT STRATEGIES OF VEGETABLE AND
FLOWER GROWERS IN CAMERON HIGHLANDS, MALAYSIA

Eddie F.C. Chiew and Zainal Abidin Mohamad
Agricultural Economics Department,
Faculty of Economics and Management,
Malaysian Agricultural University,
43400 UPM Serdang, Malaysia

ABSTRACT

This paper is concerned with farm decision-making under risk. It deals with the behaviour of agricultural producers with respect to the production and marketing of their produce, in particular the temperate vegetable and flower growers of Cameron Highlands, Malaysia. This study would firstly, after a brief overview of the study area, examine and compare the sequential farm decisions of producers in respect of what, when, how much and selling options available to the growers. The risk management strategies would be examined in three phases, ie., pre-planting, post-planting and post-harvest. A second part of this paper would examine the effects of development on agricultural production and producer perceptions of such development on their livelihood. Finally, we would explore the implications of the introduction of sustainable farming practices to some of the farmers on decision making in terms of the impact of such practices on productivity, profitability and risk.

I. INTRODUCTION

Risk is a pervasive element in agriculture. Stochastic environment factors strongly influence the agricultural production process, thereby creating uncertain financial outcomes. There are many sources of risk and uncertainty in agriculture. These can be conveniently categorised into the three management areas of production, marketing and finance (Calkins & DiPietre; Boehlje & Eidman). The first source pertains to technical and production risks as affected by climate and biological factors which cause variability in physical production. The second concerns variability of input and product prices. The last is associated with borrowing. Farmers vary greatly in their willingness to take risks and in their abilities to survive any unfavourable outcomes. As such, the level of risk which a farmer would accept is therefore very much an individual decision. The ability to bear risk is influenced to a varying degree by factors such as income, wealth, leverage and cash commitments. The willingness to bear risk is contingent on the farmers' attitudes to risk irrespective of their ability to take risk.

II. AGRICULTURAL PRODUCTION AND MARKETING IN CAMERON HIGHLANDS

Cameron Highlands, Malaysia's oldest and single most important vegetable growing area, produces 24.9% of total domestic production. It is located in the Main Range which traverses the length of Peninsular Malaysia. The production areas can be found along river basins, valley floors, wide (platform) terraces on gentle slopes at base of valleys as

well as narrow terraces on steep slopes, and on flattened hill tops. The peak rainy season is generally from September to November and January-February whilst June-July are drier months. Rainfall can vary from 60 mm. to as much to 500mm. per month.

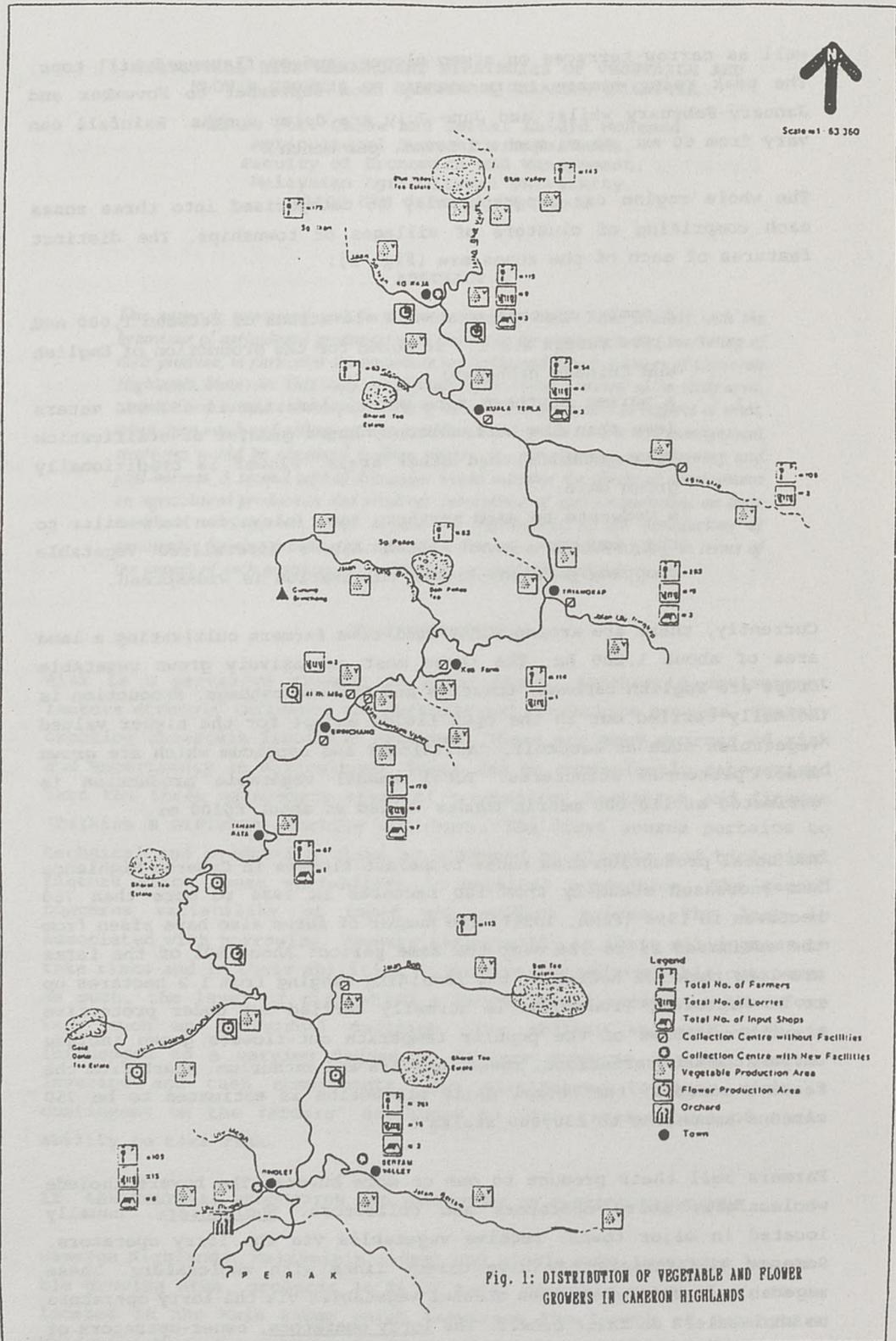
The whole region can geographically be categorised into three zones each comprising of clusters of villages or townships. The distinct features of each of the zones are (Fig. 1):

- a cooler central zone with elevations of between 1,000 and 1,500 meters a.s.l., is noted for the production of English and Chinese cabbages;
- a warmer southern zone whose elevation is 350-450 meters less than the central zone, has a greater diversification of vegetables than other areas. Flower is traditionally grown here;
- a moderate to warm northern zone (elevation is similar to the southern zone) which has a diversified vegetable cropping pattern. Flower cultivation is widespread.

Currently, there are around 1,500 full-time farmers cultivating a land area of about 1,200 ha. The three most extensively grown vegetable crops are English cabbage, tomatoes and Chinese cabbage. Production is normally carried out in the open fields except for the higher valued vegetables such as broccoli, cauliflower and capsicum which are grown under protected structures. Total annual vegetable production is estimated at 110,000 metric tonnes valued at about R\$100 mi.

The total production area under temperate flowers in Cameron Highlands has increased steadily from 100 hectares in 1984 to more than 750 hectares in 1993 (FAMA, 1994). The number of farms also have risen from the estimated 25 to 324 over the same period. About 80% of the farms are less than 1.2 hectares, the remaining ranging from 1.2 hectares up to 25 hectares. Production is normally carried out under protective structures. Some of the popular temperate cut-flowers grown include chrysanthemum, carnations, roses, gerbera and anthurium. Apart from the festive seasons, the normal daily production is estimated to be 750 cartons amounting to 230,000 stalks.

Farmers sell their produce to one or more buyers. The buyers include wholesalers, lorry operators and collectors. Wholesalers, usually located in major towns, receive vegetables via the lorry operators. Some of the farmers may have direct links with wholesalers. These vegetable farmers would then channel vegetables via the lorry operators to wholesalers on their behalf. The lorry operators, owner-operators of trucks moving between Cameron Highlands and major wholesale markets,



Adapted from GOM-ADD (1988). Agricultural Marketing Project: Case Study of Vegetable Production and Marketing in the Cameron Highlands.

transport vegetables belonging to farmers for a fee and deliver to the buyers specified or of their choice. Collectors are owner-operators of smaller capacity trucks from small towns outside of Cameron Highlands. They buy direct from farmers, normally at a higher price, on a cash basis. On hard-to-access farms, the vegetables may initially be hauled for a small fee from the farm to road sides or collection centers by army surplus Land rovers. The drivers may be independents or employed by market intermediaries.

Of the total highland vegetable production, roughly 50% is transported to Kuala Lumpur, 20% exported to Singapore and the remaining 30% to Ipoh, Johor Baru, Penang and other smaller towns. In terms of distribution, most of the produce are still marketed on a consignment basis through traditional marketing channels. Studies have shown that as much as 80% of the highland vegetables pass through these channels. Among the reasons for the continued reliance and dominance of the traditional marketing channels include credit, long standing business ties or the convenience factor whereby the buyer usually takes all vegetables available. The price received by farmers is determined by wholesalers after deducting all marketing costs including contingency costs such as traffic summons, vehicle breakdowns and wholesaler profit of between 15-30%. The trading risks, exacerbated by farmers' lack of market information, are essentially borne by the consignors. As a result of the excessive market power exercised by the wholesalers and of late the transport operators (the farmers become indebted to these intermediaries when they take production inputs on credit), the farmers essentially become price takers in the transactions.

For floricultural products, the existing distribution system is characterised by the strong role played by the producers themselves, unlike the vegetable producers. The larger producers have the clout and economies of size to market their own flowers. The smaller ones may group together to form a company supplemented by production from other contract farmers. Most have direct links with importers in overseas markets. Some of these however are dependent on marketing agents or middlemen in Singapore to distribute their flowers in overseas markets such as Hongkong. With the establishment of the Highland Growers' Association, the producers are better placed to take a stronger role in marketing their own produce. The short marketing chain has its obvious advantages in that, it not only increases producer margins but also cuts down on post-harvest losses.

III. SEQUENTIAL FARM DECISION-MAKING AND RISK MANAGEMENT STRATEGIES

In this study, a total of 41 farmers were interviewed on a single visit using a structured questionnaire, comprising 21 vegetable and 20 flower growers. The flower growers in turn were made up of equal numbers of temperate-cut flower and orchid farmers. The majority (70.7%) of the farmers were of Chinese origin. The average farm size for the vegetable and flower farms were 0.66 and 1.37 hectares respectively.

Before deciding what crops to plant, farmers have from past experience developed subjective judgements concerning the probable expected price at harvest; the onset, amount and distribution and duration of rainfall; pest and disease incidence; and sufficiencies of labour at critical periods of the cropping cycle. As the season progresses, these expectations are revised and farmers (may or may not) sequentially adjust their cropping patterns and cultivation practices to correspond to the occurrence of exogenous shocks. Reducing predetermined commitments eg. fertiliser levels, and maintaining a high degree of flexibility in farm practices during this period in which conditions can vary is crucial in determining farm success. After harvesting, the farmer has to decide if and how much to sell at the local market and which of the marketing channel(s) to dispose of the bulk of his produce (Chiew, 1976).

Generally, farm decisions can be examined in terms of pre-planting, post-planting and post harvest phases. Results of analysis relating to risk management strategies were based on the sample of farmers interviewed.

a. Pre-Planting Stage

Reasons for crop selection: the vegetable farmers' main considerations in crop selection are expected high price at harvest, rainfall patterns, low pest and disease, low labour requirement and expected high demand. For cut-flowers, the main reasons given were stable price, contract/guaranteed price, expected high demand and familiarity with crop. For orchid growers, they were high current price, expected high demand, stable price, expected high price at harvest and lastly according to rainfall patterns. The reasons given mirror the concerns of the growers. Since vegetable cultivation is usually more conducive to the vagaries of weather, reduction of technical and production risks were given priority. On the other hand, the flower growers' main considerations were market risks, ie., stable prices, contract prices and high expected demand.

Market information: market information is necessary for farmers to make appropriate decisions on crop selection. While more than 70% of vegetable farmers are aware of the current price before planting, all flower growers have such information. Most of the information is obtained directly from lorry operators or indirectly from friends and neighbours.

Crop diversification: of crops, varieties, and plot locations (land-type diversifications) is one of the most common means by which farmers attempt to stabilise farm income. Crop diversification is practiced by means of planting various enterprises in different plots as well as through planting of crops in mixtures or inter-cropping on the same plots. The analysis indicate that all vegetable farmers, 50% of cut-flower growers and 70% of orchid growers follow a crop diversification pattern. Those flower growers who do not have a crop diversification pattern could be attributed to the planting of enterprises such a roses, cymbidiums and oncidiums which are perennials. More than 60% of the farmers plant 2-3 types of vegetables. Of those who plant temperate cut-flowers, all plant either 2 or 3 types of flowers. The most popular types of vegetables planted in descending order were English and Chinese cabbages, tomato, lettuce, sweet pea and leek. Of the temperate cut-flowers and orchids , roses, carnations, chrysanthemums, asters, oncidium and cymbidium orchids were the most popular. The reasons given by most vegetable growers for crop diversification were to reduce production and income risk, increase efficient use of production factors and to exploit morphological complementarities.

Farmers also select different varieties of the major vegetables and flowers as part of their risk management strategies. 80% of the vegetable and all cut-flower growers practice varietal diversification. The major reasons given by vegetable farmers are better price obtained and to reduce pest and disease risk whereas as expected for the cut-flower growers, market demand and marketing agents' advice were the major reasons given.

On some farms in particular vegetable farms, vegetables are planted on wide (platform) terraces on gentle slopes as well as narrow terraces on steep slopes as well as flattened hill tops. By diversifying plot locations across the various topography, farmers may match crops to soil suitability or micro-environment to maximise land productivity. More than a quarter of the vegetable farmers select the type of vegetables according to the location of the plot on the farm.

Most of the vegetable and cut-flower growers reported staggering of plantings to reduce income variability. Furthermore, more than half of the vegetable farmers practice intercropping. The common crop

combinations are either English cabbage, Chinese cabbage and tomato intercropped with leek; tomato with either celery, lettuce, sweet pea and butter beans; and English cabbage and tomato.

Purchase of seeds: to ensure quality of planting materials or seed viability, most of the vegetable growers depend on input supply stores for the seeds which are imported. Growers of temperate cut-flowers get their planting materials, such as chrysanthemum seedlings, from specialty nursery suppliers.

Labour availability: on the question of labour availability prior to planting, all vegetable growers interviewed replied that they rely on family labour. Of the 57% who said they do employ hired labour, the majority indicated that have no problems hiring foreign labour. It is the same for cut-flower and orchid growers except that most of the farms (because they are larger operations) in fact 90% and 70% respectively, rely on hired labour to supplement their family labour. They have no problems either hiring contract labour as and when required. While two-thirds of the hired labour on vegetable farms are daily rated (mostly for planting and harvesting operations), all the hired labour on the flower farms are paid monthly.

Water availability, source and irrigation method: more than three-fourths of the vegetable growers obtained their water by diverting from streams (gravity) above their farms whereas all the cut-flower growers obtained their water pumped from nearby streams. An equal number of orchid farms obtained their water by diverting from streams or pumped from streams. The main method of irrigation for all farms is by means of sprinklers although the conventional hose is still popular among cut-flower growers. Drip irrigation is used by a small percentage of the farmers. Field storage, blamed for recent landslips, is evident on 38% of vegetable farms, 100% on cut-flower farms and 60% on orchid farms. More than 80% of vegetable and all other growers reported adequate water supply and except for one farmer, none of the other farmers wait for the onset of rainfall to commence planting or transplanting.

b. Post-Planting Stage

As the season progresses after planting, price and yield expectations at time of planting are revised and farmers may or may not choose to adjust their input decisions and cultivation practices accordingly. Reducing predetermined commitments eg. fertiliser levels, and maintaining a high degree of flexibility in farm practices during this period in which conditions can vary is crucial in determining farm success.

Input decisions: 65% of the vegetable growers incorporate a basal dressing during planting/transplanting stage while all cut-flower growers reportedly do so. As orchids are commonly grown in pots or polybags, basal dressing is not used. Basal dressing is not delayed by almost all growers even if the price is low or water supply/rainfall inadequate at time of planting. During the course of the planting period, if the price of the crop were to drop or if the low prices were to persist despite favourable weather, almost all the vegetable and all orchid growers would not reduce the number of applications, quantity of fertiliser or herbicide applied nor reduce manual weeding. On the contrary, in a similar situation, 60% of the cut-flower growers would reduce the number of fertiliser applications, quantity of fertiliser or herbicide applied. On the other hand, if the price of the crop were to increase or high prices persist, all flower growers would not increase the number of applications nor quantity applied implying that adequate amounts are applied irregardless. About a third of the vegetable growers would increase the number of application and quantity of fertiliser applied. For the situation where water supply is inadequate and it is likely that yield is going to be affected, only the cut-flower growers will reduce the number of fertiliser applications, and quantity of fertiliser and herbicide applied.

More than 70% of the vegetable farmers, all the cut-flower growers and 40% of the orchid growers practice calendar spraying i.e., spraying regularly irrespective of pest and disease incidence. Due to the practice of mixing different insecticides and fungicides, i.e., cocktails, the frequency of sprays for the control of insects and diseases are somewhat similar. The English and Chinese cabbage require a high number of chemical sprays, higher in the wet than dry season due to the chemical runoff during the wet season despite a higher incidence of the diamond back moth (DBM) during the dry season. The mean number of sprays in the wet season is 21 and 14-15 in the dry season with ranges of 10-35 in the wet and 12-20 in the dry season. Lettuce and tomato are sprayed less. For cut flowers and orchids which are planted under protective plastic shelters, 70-80% of the growers spray weekly.

On the use of integrated pest management (IPM), only 15% of the vegetable farmers interviewed follow some form of IPM practices such as deciding whether, when and what to spray for DBM. None of the flower growers follow any form of IPM practices.

On the question of labour sufficiency, almost all farmers reported having adequate labour to complete all farm operations. Of those who require extra labour, the vegetable and cut-flower growers reported hiring temporary labour and the orchid growers reported they could delay harvesting operations.

Except for one vegetable farmer, none of the other growers sell in advance via forward sales or contract price. Price of vegetables is determined at time of sale or after consignment whereas the price of flowers are determined by the contract price set by the growers' association. More than 80% of the vegetable and cut-flower growers, and 10% of orchid growers reported that there have been occasions in the past that output price was so low that the crop was not harvested and left in the field because it was just not worth the trouble with estimated income not even sufficient to cover harvesting cost.

c. Post-harvest Stage

Marketing: After harvesting, the marketing decisions a farmer has to decide are how much to sell at the local market (if at all he does) and if he has the option, which of the marketing channel(s) to dispose of the bulk of his produce. Vegetable farmers may sell their produce to wholesalers, lorry operators and collectors. For floricultural products, the scenario is different in that generally the producers (except contract farmers) are directly involved in the distribution to local retail outlets or marketing agents and importers in overseas markets.

Slightly more than half of the vegetable farmers sell their produce to more than one buyer. Wholesalers are the major buyer of vegetables at 52%, collectors at 29% and lorry operators at 19%. Not surprisingly, farmers' business ties with the wholesalers, who have been the traditional market intermediary in Cameron Highlands, have been the longest with a mean of 13.5 years, followed by lorry operators (9.9 years) and collectors (5.6 years). 45% of the total produce were sold to wholesalers, followed by 32% to lorry operators and 23% to collectors. 57% of the vegetable farmers reported that they decide on where their produce is sent. Those who had no choice attributed it to indebtedness due to credit extended. For the flower growers, more than 80% of their produce is sold to marketing agents cum larger producers themselves and the farmers generally have no input on where the product is marketed. Less than 10% of the vegetable farmers sell in the local farmers' market (Cameron Highlands is a major tourist destination). For those who do not sell in the local market, the reasons given are insufficient demand, transport problem and no experience in selling. Likewise, only 30% of the cut-flowers and 10% of the orchid growers sell in the local market. There are limited opportunities for delaying harvest or processing even if prices are expected to increase further. Produce (vegetables as well as flowers) could only be stored in the cold room for a limited time.

Off-Farm Income and Insurance: Of the vegetable farmers interviewed, 2 farmers out of the 21 households interviewed and 2 of farmers' wives together with 3 adult daughters reported having off-farm employment. Of these, two-thirds are employed in local non-farm jobs and the rest in non-local off farm work. They work an average of 20 days per month with average total enumeration of \$1121.40. Their average contribution to the household was \$510.00 per month. On insurance, most of the farmers motor vehicle liability, life and medical insurances. However, crop damage insurance is unavailable.

IV. DEVELOPMENT AND AGRICULTURE AND FUTURE PROSPECTS

The townships of Tanah Rata and Brinchang in Cameron Highlands are undergoing massive development with a proliferation of urban development projects, including the construction of hotels, chalets, condominiums, apartments, shophouses and a district hospital. In addition to the above, land development for housing and hillside clearing in other areas for agriculture have caused grave concerns among various quarters as to its impact on the

hillstation. A study conducted by the state authorities showed that the temperature could increase between two and three degrees celsius by the year 2010. By then, total rainfall would be reduced from the present 2,580mm to 2,420mm. All this would occur if forests continue to be cleared, vegetation stripped compounded by the actions of some farmers who encroach on slopes well beyond their allocated land. All of these will hasten erosion and landslips which have occurred periodically especially with the onset of continuous heavy rainfall. Soil conservation measures such as (strip) reforestation, gully control, soil loss quantification, proper land management and other measures should be introduced.

With all these development, three fourths of the farmers interviewed expressed that it will definitely have a negative impact on farming. These negative impacts include higher incidences of pests and diseases, tastes, size and quality declines, more yellowing of tomato leaves, more difficult to plant, unsuitable for vegetable and flower cultivation. One farmer indicated that 'he will probably look for another job!' If change is imminent, about half the vegetable growers indicated that they would consider a shift to alternative enterprises ie., to flowers. 90% of the cut-flower growers expressed that they too would shift (to vegetables presumably) while most of the orchid growers said no or uncertain. For vegetable growers, two-thirds stated that flower production would require higher labour, inputs and overheads capital. They are also aware that fruit cultivation would require less of labour, inputs and capital requirements. As to the prospects of flower cultivation, less than half of the vegetable growers (as well as

orchid growers) stated that income from flower cultivation is higher and more stable whereas the other half of the vegetable growers indicated that there is not much difference, with similar risks faced, and if flower production were to increase, prices would subsequently fall.

The recent expansion of flower production at the expense of vegetable cultivation is an indicator of the dismal prospects of vegetable production. Increasing cost of production and low selling prices have induced some of the vegetable farmers to grow flowers instead, attracted due in part to the stable prices and less pest and disease problems. FAMA's monthly monitoring project have estimated that more than 30% of the vegetable areas, especially in the North and South, have converted to flower cultivation since the early 1980s when the area under vegetable production was about 2,000 hectares. This trend may not be uni-directional however, as there are cases of flower growers returning to vegetable production. The trend is however towards flower cultivation. Over the last few years, with new areas being opened for vegetables legally or otherwise, the net reduction in vegetable area in Cameron Highlands was reported much less than the figure stated above, at only 4-6%.

Even if given that the locality is suitable, not every vegetable farmer can convert to temperate cut-flower production. The overhead cost in establishing flower farms are extremely high - to the tune of an estimated R\$210,000 per acre. Land development cost and protected structures (plastic sheetings over wooden frames as rain shelters) are the main cost components. While high overhead cost limit the number of conversions, difficulties to access funds from financial institutions for what is considered a high risk business venture further compounds the situation.

Given that costs of production inputs are ever increasing whereas produce prices are either stagnant or discouraging and uncertain, a third of the farmers said nothing can be done or have no idea of how to overcome the problem. Another third of the farmers indicated that they will decrease input use whilst some of the remaining farmers said they would take loans from banks and wholesalers or delay repayment of loans!

IV. SUSTAINABILITY, PROFITABILITY, RISK AND FARM DECISION-MAKING

Certain sustainable agriculture practices such as the integrated pest management for the control of DBM has been introduced to farmers for adoption in Cameron Highlands (Zainal, 1994). Thus far, there is no

universally acceptable definition of sustainable agriculture but it incorporates issues relating to food productivity, food safety, resource protection, quality of life and environmental quality. A sustainable agriculture must be ecologically sound and economically viable. Alternative production systems are used to meet environmental concerns, but questions remain over whether these alternatives are profitable, risk-reducing and sustainable in the long term. The current knowledge on sustainable agriculture is somewhat limited. It is a fact that well-managed sustainable farming systems nearly always use less synthetic chemical pesticides and fertilizers than conventional farms. Reduced use of these inputs lowers production costs, lessens agriculture's potential for adverse environmental and health effects while not necessarily decreasing yields. These sustainable farm practices would however require more information, trained labour and management skills than conventional farming.

The study by Taylor et. al. (1993) on the sustainability of English cabbage production practices in Cameron Highlands examined the nature and rationale for insect, disease, weed control and fertiliser practices being followed by vegetable growers in the three zones of Cameron Highlands. Special focus was given to determining the degree to which current practices are sustainable and factors associated with the adoption of sustainable farm practices. The farmer sustainability index formulated with input from an expert panel showed that farmers in the central zone was more sustainable than the north or south despite relying less on organic fertilisers and crop rotations. Their greater adherence to IPM control of DBM more than made for it in the index despite adopting other less sustainable farm practices. What is interesting was that the farmers who adopted more sustainable practices did not suffer yield declines. What the study did not show however was the relationship between sustainability and farm profits and its variability over time.

A few empirical attempts have been made to determine the degree of sustainability of a specific farming system. Storkle et. al. (1994) proposed a framework for evaluating the relative sustainability of a farming system using nine attributes including profitability, productivity, soil quality, water and air quality. Each attribute is scored and then weighted by an evaluating team. Some of the constraints are quantified by direct measurement and for those that are not needed other evaluation techniques, including expert opinion and computer simulation models.

Some of the studies investigating issues on sustainable agriculture such as Ikerd (1993) have shown that a number of alternative systems actually improve short-run profits, as well as having favourable

environmental effects. However, farmers still need to know if those net returns are great enough to justify the investment costs and management skills used in the systems. In a related study, Pimentel (1993) showed that yields of crops such as vegetables and fruits under organic production may be substantially reduced because pests cannot always be effectively controlled by non-chemical means. If judicious use of agrochemicals is used, then it would be entirely possible to maintain similarly high yields. Combining reduced chemical inputs combined with environmentally sound technologies would require farmers to have a greater knowledge of the sustainable management strategies practices used than farmers who employ the more conventional chemical-dependent input systems. Several other studies also concluded that low-input systems performed well with respect to risk criteria.

V. SUMMARY AND CONCLUSION

Vegetable and flower production in the tropical upland in Cameron Highlands can be a high risk venture. Important production and marketing risks are periodic drought, pest and disease infestations, market glut and a growing dependence on foreign labour. The farmers in Cameron Highlands have over the years, developed a variety of methods to reduce both production and marketing risks imposed upon them by the general farm environment. Most of these methods focus on reducing the probability of production and price fluctuations. These risk reducing methods would reduce the variability of farm income and be vital to their survival in the business.

Analysis of the results reveal that the management strategies of the vegetable and flower growers reflect their concerns of the sources of risks and uncertainties they are more exposed to and therefore which they deemed to be important. This is partly due to the fact that, other than the different capital requirements and marketing arrangements (vegetable growers face the full brunt of market price fluctuations whilst the flower growers do enjoy the comfort of a contract price), most of the vegetable production is carried out in the open fields (except for higher-valued, low-volume crops such as broccoli, cauliflower and capsicum) whereas the flower production is carried out almost exclusively under protective plastic rain shelters with advanced drip and sprinkler facilities. The analysis shows that while market demand and prices are obviously important to both, vegetable farmers show much concern with technical and production risks.

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