ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC

STUDIES IN TRADE AND INVESTMENT

"TOWARDS A MORE VIBRANT PEPPER ECONOMY"

UNITED NATIONS

ECONOMIC AND SOCIAL COMMISSION
FOR ASIA AND THE PACIFIC

Studies in Trade and Investment 4

"TOWARDS A MORE VIBRANT PEPPER ECONOMY"

STUDIES PRESENTED AT THE INTERNATIONAL PEPPER SEMINAR 1994

17-19 August 1994
Bangkok, Thailand

UNITED NATIONS
New York, 1995

ST/ESCAP/1494

PREFACE

Pepper is a perennial crop, the methods of cultivation of which vary from very intensive cultivation as a monoculture utilizing large doses of fertilizer on good, well-drained soil using high-yield cultivars, to extensive cultivation of old vines as an intercrop in homestead gardens, in combination with coffee, cocoa, arecanut, jack-fruit or mango tree, without any special care. In most of the producing countries, pepper is a small-holder crop and more than one million farmers are dependent on it for their livelihood.

The major producers/exporters of pepper are from the Asia-Pacific region, namely, India, Indonesia, Malaysia, Sri Lanka, Thailand and Viet Nam. Together, they produce and export more than 80 per cent of the world output of pepper. Outside of the Asia-Pacific region, Brazil and Madagascar are the two other significant pepper producing countries.

Since the beginning of the present decade, due to an oversupply situation, the pepper economy has been plagued by sharp decline in prices leading to a drastic fall in export earnings and farmers' incomes. However, in the years 1993 and 1994, lower levels of production allowed prices to gradually recover, providing in turn renewed incentives for revitalizing the pepper economy. Other challenges facing the pepper industry are the increasingly stringent quality requirements imposed by consuming countries on import of pepper and the slow pace in product development. However, the global trend towards liberalization of trade and, in particular, increasing outward orientation of the Asia-Pacific region's economies has increased their potential to influence the commodity market. Accordingly, the contribution of Asia-Pacific region not only in the supply but also in the demand of pepper is expected to increase.

Given such issues and challenges, the Economic and Social Commission for Asia and the Pacific (ESCAP), within the framework of a project financially supported by the Government of the Netherlands, organized in close cooperation with the International Pepper Community (IPC), an International Pepper Seminar in August 1994 under the theme "Towards a More Vibrant Pepper Economy". The main objective was to provide all major pepper producing/exporting and importing countries of the region with an opportunity to discuss and consider measures to increase export earnings through quality improvement, product development and enhancement of marketing capabilities.

To facilitate consideration of the above issues, a series of technical papers, focusing on current problems, prices, processing and marketing issues related to the pepper economy, were presented at the Seminar. Country papers were also presented to provided national perspective on the issues and problems that the pepper industry was facing in each country. It is hoped that these papers incorporated in this publication, together with the proceedings of the International Pepper Seminar 1994, will provide useful information not only to those directly concerned, but also to those interested in the development of the pepper economy and its trade. The financial support of the Government of the Netherlands, which made this publication possible, is gratefully acknowledged.

CONTENTS

CONTENTS *(Continued)*

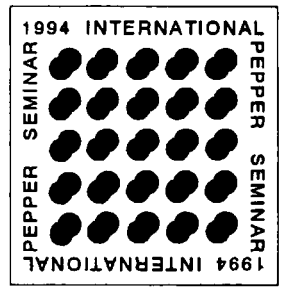
CONTENTS *(Continued)*

Page

Part Three

PROCESSING AND PRODUCT DEVELOPMENT

CONTENTS *(Continued)*



PART ONE

REPORT OF THE SEMINAR

Immature pepper berries

Photo by courtesy of IPC.

REPORT OF THE INTERNATIONAL PEPPER SEMINAR 1994 "TOWARDS A MORE VIBRANT PEPPER ECONOMY"

A. Organization of the Seminar

The United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) in collaboration with the International Pepper Community (IPC) and with the financial support of the Government of the Netherlands, organized the International Pepper Seminar 1994 under the theme: "Towards a More Vibrant Pepper Economy" from 17 to 19 August 1994 in Bangkok, Thailand. The objective of the Seminar was to provide people concerned from both producing/exporting and importing countries with a forum on the development of the pepper industry in the region to exchange information, views and ideas in regard to the future of the pepper industry with a view to developing a more vigorous and vibrant pepper economy.

1. Attendance

Participants representing both the government and private sectors from major pepper producing/exporting and importing countries of the Asian and Pacific region participated in the Seminar. The countries represented were China, India, Indonesia, Malaysia, Federated States of Micronesia, Pakistan, Singapore, Sri Lanka, Thailand and Viet Nam. Both the United Nations Food and Agriculture Organization (FAO) and the International Trade Centre UNCTAD/GATT (ITC) deputed their representatives. The Seminar also benefitted from the input provided by eleven resource persons and the participation of an observer from Germany. A list of participants is in annex I.

2. Opening Statements

In his welcoming address to the Seminar, the Executive Secretary of ESCAP stressed the importance to the countries of Asia and the Pacific region of such a Seminar, whose main objective was to look into the future potential of the pepper industry. Indeed, together those countries produced and exported more than 80 per cent of the world output of pepper. The Executive Secretary, in his analysis, stated that between 1989 and 1992, the pepper economy, faced with oversupply, was badly hit by a sharp decline in prices leading to a drastic fall in export earnings and farmers' incomes. As a consequence, the declining interest of farmers in investing in the cultivation of pepper contributed to a gradual reduction in world pepper production since the beginning of 1993. It was thus estimated that the current season's production of pepper destined for the export market would fall short against the expected demand.

While prices had since then gradually recovered providing indeed renewed incentives for revitalizing the pepper economy, in the years to come the pepper industry

would also have to face such challenges as the increasingly stringent quality requirements imposed by consuming countries on importers of pepper, the slow pace in product development as well as the low level of export of value-added pepper products. He added that the other important challenge was the emergence of new markets, especially the dynamic one from the Asia and Pacific region fuelled by its successful economic growth drive.

The Executive Secretary, therefore, expressed the hope that the Seminar would be a timely occasion for major actors involved in the trade and development of pepper to exchange views to enhance their ability to cope with the momentous changes taking place in the pepper industry in both the region and the world. In concluding, he conveyed his deep appreciation to the Government of the Netherlands for providing the financial support which made the organization of the Seminar possible and to the International Pepper Community (IPC) for its collaboration in the event.

In his opening statement to the Seminar, the Executive Director of IPC, particularly elaborated on the causes of the drastic declining in prices of both black and white pepper and their adverse impact on the regional pepper economy during the last six years. He went on to say that as a result the farmers' income in 1992 was only about 20 per cent of that they used to get in 1987.

The Executive Director also mentioned that most of the pepper exported was in a raw form as black whole pepper. On the other hand, production of value-added pepper products was still very small. For example, in 1989 the collective production of value-added products from IPC member countries amounted to only 1,400 tons valued at around $US 9 million compared to the export of unground black and white pepper of some 130,000 tons valued at $US 350 million. He stressed that efforts, therefore, needed to be pursued by exporting countries to devise measures to increase export earnings through export of processed pepper products.

Finally, he recalled that it was at Nineteenth Session of IPC, held in Kuala Lumpur in October 1991, where representatives of the member countries voiced their concern about the depressed situation that the pepper economy was facing, that a decision to hold the present International Seminar was taken. He was, therefore, looking forward to the outcome of the Seminar with great interest and hoped that the Seminar would provide input which would help the pepper industry in the region to look at new avenues for further development. He concluded by informing that the findings and recommendations of the Seminar would subsequently be studied by the Twenty-Second Session of IPC, to be held in Chiang Mai, Thailand, from 22 to 24 August 1994, for further action by the Community.

In his statement, Mr. Paul Vehmeyer, First Secretary and Deputy Permanent Representative of the Netherlands to ESCAP, stressed the long and continuing interest and commitment of his Government to promote development and trade of commodities in Asia and the Pacific region. Indeed, for many years the Netherlands has been

supporting several ESCAP initiatives on development programmes in the field of commodities. He was, therefore, especially pleased to be associated with this Seminar, as pepper was a commodity of particular interest to the Netherlands Development Cooperation.

Mr. Vehmeyer stated that the basic challenge for pepper was how to help a rather small commodity to keep up its potential in bringing sustainable earning to the numerous pepper small-holders. He added that, with the help of improved prices, the pepper industry would now have to concentrate on upgrading the sector by developing value-added pepper products while at the same time enhancing market capabilities. Finally, he concluded that providing systematic information to producers and consumers would greatly facilitate the functioning of the markets which should be left to free market forces.

In his inaugural address to the Seminar, Mr. Banchong Sikkhamondhol, Deputy-Director General, Department of Agriculture, Ministry of Agriculture and Cooperatives of the Royal Thai Government welcomed the participants to the Seminar. He, then, expressed the hope that this International Seminar would help people concerned in the development of the pepper industry to take stock of the situation and to chart new direction for the benefit of the entire pepper economy.

3. Programme

To facilitate the discussion and consideration of relevant issues and measures to increase export earnings through quality improvement, product development and enhancement of market capabilities, the Seminar was divided into three technical sessions, i.e. global pepper economy (session I), processing and product development (session II) and marketing (session III), and a panel discussion session.

Each technical sessions included the presentation of a number of papers by experts from the academia, government and private sectors who provided the necessary background information and guidance for the consideration and discussion of the issues. The subjects ranged from the general outlook of the pepper economy, past and future price trends, pepper quality requirements of today and tomorrow, pepper product development and processing to market potential and constraints in marketing pepper in the Asia and Pacific region. To supplement this background information, individual country papers were also presented to provide national perspective on the issues and problems that the pepper industry was facing in each respective country.

Each technical session had a different chairman, who also served as a panelist at the final session of the Seminar. They were as follows:

Session I: Global Pepper Economy

Mr. Ashok Kumar, Joint Secretary, Ministry of Commerce, Government of India.

Session II: Processing and Product Development

Mr. R. Venugopal, Under Secretary, Ministry of Primary Industries of Malaysia.

Session III: Marketing

Mr. Rachim Kartabrata, Secretary General, Association of Indonesian Pepper Exporters (AIPE).

B. Summary of the discussions

1. Global pepper economy

The first paper, presented by Dr. Hidde P. Smit from the Free University of Amsterdam, gave a general outlook of the pepper economy including an assessment of possible effects of and prerequisite for implementing supply management scheme and diversification programmes. It attempted to elaborate the future of the pepper economy and the scenario for the pepper prices to the year 2020. It then reviewed supply management measures such as minimum export prices, export quotas with or without organized national stock, international buffer stock and internationally coordinated stock and the extent to which these measures have served the purpose of price stability. In conclusion, the paper proposed the conduct of a study for the implementation of supply management measures.

The following paper, presented by Mr. Rachim Kartabrata, Secretary General, Association of Indonesian Pepper Exporters (AIPE), looked at pepper price trends and predicted good times for the pepper producing countries for the years to come. Moreover, the paper forecasted that after 1993 the markets would be bullish. However, the major issue of concern in this regard was the large swings that characterized the pepper price cycle. There was, therefore, an urgent need to bring some order to the pepper economy and minimize these swings.

Dr. Muzafar Shah Habibulah, Associate Professor, Department of Economics, Universitii Pertanian Malaysia, made an empirical study establishing that white pepper and black pepper were different market segments and price swings in one market needed not necessarily have any impact on prices in the other.

In their joint paper, Dr. M.G. Kanbur, Professor of Economics, Graduate School and Ms. Yen Siew Hwa, School of Economics, both from Universitii Utara Malaysia, attempted a quantitative analysis and forecasting of Malaysian pepper prices and showed that both sinusoidal and Box-Jenkins models have proved to be useful in the context of forecasting as well as providing an useful framework within which analysis of the effects of various price stabilization could be possible.

Consequently, the Seminar agreed that the large swings characterizing pepper prices were not satisfactory to both producing/exporting and importing countries alike

and thus remedial measures were urgently needed. In this context, the development of better data base and the adoption of appropriate supply management schemes were mentioned.

2. Processing and product development

In his presentation, Mr. Ashok Kumar, Joint Secretary, Ministry of Commerce, Government of India, dwelled on major issues related to processing and product development of pepper, with particular emphasis on the Indian experience. His presentation was followed by country reports from the major producing countries. All of them underlined that efforts were currently made in conducting appropriate research and development programmes. However, they pointed out that the production of value-added pepper products was still unsatisfactory. There was, therefore, a need to increase financial support of research and development programmes and to develop infrastructure to facilitate the production and marketing of such products.

In his paper, Dr. Wanchai De-Eknamkul, Associate Professor and Head of R and D Unit for Herbs and Spices, Faculty of Pharmaceutical Sciences, Chulalongkorn University of Bangkok, attempted to demonstrate how agroclimatic conditions have an important influence on the quality of pepper.

Both papers presented by Mr. Karl Jahn, Purchasing Manager of Ubena Gewurze GmbH, Germany and Mr. Eapen George, Executive Director, A.V. Thomas Industrial Products Ltd., India, demonstrated that quality was an important requirement for the future of the pepper economy. Indeed, pepper was gradually evolving from a primary commodity to an industrial product with all the gamut of quality requirements string attached to it. To respond to this challenge, there was, thus, a need for a better and greater collaboration between producers and consumers.

3. Marketing

The three main papers presented, namely by Mr. Anandan Adnan Abdullah, General Manager, Pepper Marketing Board, Ministry of Agriculture of Malaysia, Mr. Kamlesh J. Tanna, Director, Jamnadas Madhavji International Ltd., India, and Mr. Fazli A. Husain, Senior Commodity Marketing Officer, International Trade Centre UNCTAD/ GATT, had the same objective: to maintain and increase the level of world pepper consumption. In this connection, Mr. Anandan demonstrated that based on income per capita, the Asia and Pacific region, a non-traditional market, held good prospects for increased consumption and market expansion, particularly Australia, Japan, Pakistan, the Philippines, Republic of Korea and Taiwan Province of China. However, the expansion of these markets were still subjected to a number of constraints which Mr. Tanna described as of three types, i.e. physical, fiscal and policy nature. Moreover, it was observed that the structure of the pepper economy was changing as the number of layers of intermediaries were diminishing. In this context, as Mr. Fazli Husain explained, trade promotion for pepper needed to be more focus as the consumption of pepper was now moving from the household to the fast-food industry.

The Seminar was also informed of a current project undertaken by the United Nations Conference on Trade and Development (UNCTAD) whereby a feasibility study was being conducted to devise means on how to reduce volatility of pepper as well to minimize price risks. An interim report on the possibility of developing pepper future contracts was presented. Mr. T. Vidyasagar, President of the India Pepper and Spice Trade Association, gave a presentation on the major features of the Pepper Exchange in operation in India.

4. Country situation

China

China began to grow pepper in the Hainan island in 1947 when overseas Chinese brought back seeds from Singapore. But only in 1965, when 1,000,000 yuans or $US 406,504 was invested by the National Supply and Marketing Cooperative (NSMC) to promote pepper production, that area for pepper growing substantially increased. Thus, by 1970 the output of the country was 2,000 tons. Unfortunately, from 1970 to 1977, during the period of Cultural Revolution, production was sharply reduced. In 1977, NSMC again provided support to the pepper industry. Hence in 1980, production of pepper was restored to the level of output in 1970. From then on, production gradually increased. In 1992, the pepper-growing area in China reached 220,000 mus or 14,667 hectares while volume of production amounted to 13,000 tons.

The pepper-growing area is widely distributed over the sub-tropical zone of the country. However, plantings are predominant in Hainan province where 170,000 mus (11,333 has.) or 77.27 per cent of the total area are located. Guangdong province has 48,000 mus (3,200 has.) or 21.8 per cent share while Yunnan, Jiangxi and Fujian provinces represent the remaining 1.0 per cent.

With the continuously improving technology and the wide use of chemical fertilizer, yield rose to 80 kilograms per mu in 1992 as compared to 50 kilograms per mu in the 1960s and 1970s.

Before 1983, the state monopolized the purchase and marketing of pepper. The state purchased all pepper production through marketing cooperatives in the local area who collected the produce from peasants. Under this marketing scheme, the purchasing price was very steady. Beginning in 1983, pepper was traded under a free market. With the price being influenced by normal market forces, prices fluctuated from a high of 30 yuans or $US 8.10 per kilo to as low as 10 yuans or $US 2.70 per kilo. Since 1993 up to the present, the price has been stable at 20 yuans or $US 2.29 per kilo.

Prior to 1984, pepper was used mainly in the domestic market. Thereafter, exports of pepper gradually increased. In 1993, China exported 2,441 tons generating foreign exchange earnings of $US 3,345,000. Exports of Chinese pepper went to 20 countries all over the world.

The effect of international market interaction on export prices is considered as a major factor affecting the country's export. Also, quality of pepper remains an area of concern although some progress has been made lately on this aspect.

There is no import restriction for pepper in China. Pepper imports grew steadily but the volume is not quite significant though importation in 1984 and 1993 exceeded 300 tons. South-East Asian countries were the main suppliers.

The pepper industry in China has grown steadily throughout the years. With improved processing technology, maximum utilization of land and labour force and finding good markets, the pepper industry in China faces a bright and profitable future.

India

Pepper is one of the few commodities exported from India. It was once considered black gold because of the high income earned by the producers. In 1992-1993, annual production was estimated at 54,930 tons representing a slight reduction from 55,190 tons in 1989-1990. Production, however, is foreseen to increase in the coming years. Cultivation is concentrated in the foothills of Western Ghats. Kerala state contributes about 95 per cent of the country's production. Over 70 traditional varieties and 8 released varieties are under cultivation.

While export is mainly in the raw form, there is a sizeable export of processed pepper products. India is now exporting about 8-10 per cent of its production as processed products of higher local value added. The important pepper products being exported are pepper oil, pepper oleoresin, dehydrated green pepper, freeze dried pepper, pepper in brine, frozen pepper, white pepper and pepper powder.

Extraction of pepper oil and oleoresin started in the 1970s when a small factory in Calicut in Kerala started to operate. Since there was no local demand for these products, the entire production was exported. At present, there are 22 units manufacturing oil and oleoresin. Only a few units, however, are working to full capacity. It is estimated that not even 50 per cent of the aggregate installed capacity is currently being utilized.

Pepper oil is obtained by steam distillation of black pepper. Being a product valued for its aroma, it is widely used in the preparation of men's toiletries, perfumes as well as in the flavor industry to provide better aroma to the food. In 1972-1973, India exported a mere 0.12 tons of pepper oil valued at Rs. 0.205 million. Production and export, however, have increased substantially in recent years. The country exported an average of 26 tons per annum of pepper oil corresponding to an average annual earnings of Rs. 15.7 million during the last five years, 1989-1990 to 1993-1994. Export of pepper oil rose to 33.1 tons valued at Rs. 20.62 million in 1991-1992, but gradually decreased during the last two years. Australia, Canada, France, Germany Japan, the Netherlands and the Republic of Korea are the major destinations of Indian pepper oil.

Oleoresin of pepper is extracted from black pepper with the help of a solvent. Pepper oleoresin which is the second most widely used oleoresin after paprika oleoresin is used mainly for meat processing. From 46.7 tons valued at Rs. 2.83 million in 1972-1973, exports of oleoresin increased steadily and reached 104.4 tons with value of Rs. 15.2 million in 1977-1978. In 1993-1994, India exported 464.4 tons valued at Rs. 168.40 million. From among the 40 countries buying oleoresin from India, the main buyers are Australia, Canada, France, Germany, the Netherlands, the Republic of Korea, Sweden, the United Kingdom of Great Britain and Northern Ireland and the United States of America.

Dehydrated green pepper is prepared by dehydrating immature green pepper but retaining its green color. The technology was developed in early 1970s. Dehydrated green paper is used in the meat and sausage industry, preparation of beef and pork steaks and also in soup. From a measly 0.5 ton valued at Rs. 2.7 million in 1975-1976, exports of dehydrated green pepper grew to 81.64 tons valued at Rs. 5.563 million in 1977-1978. While level of exports of this product increased substantially in recent years, the trend, however, was quite erratic. From 1989-1990 to 1993-1994, the average volume of exports was 129 tons with value of Rs. 23.20 million. For this product, Germany is the largest buyer while Australia, Canada, France, Spain and the United States are considered important buyers.

Pepper in brine is prepared by keeping freshly harvested immature green pepper in brine. India has been exporting this product in cans and in bulk for more than three decades. Present export, however, is largely packed in bottles. From 1973-1974 to 1977-1978, export of pepper in brine grew from 10.82 tons with value of Rs. 0.096 million to 139.21 tons amounting to Rs. 1.616 million. Further growth in exports of this product was observed in recent years. In 1992-1993, the highest quantity exported of 1,003.2 tons with value of Rs. 17.67 million was recorded. During the last five years, India exported an average of 823.6 tons per annum corresponding to an average value of Rs. 16.88 million per annum. Just like the other pepper products of India, Germany is the leading importer of pepper in brine. Australia, Belgium, France, Japan, the Netherlands, the United Kingdom and the United States are the other notable buyers.

Freeze dried green pepper is a new product obtained by freeze drying immature green pepper. Because of the high cost of processing, this product is highly priced and market has yet to pick-up. India exported a total of 30.5 tons with value of Rs. 17.14 million for the period 1989-1990 to 1993-1994.

Another new product is frozen pepper. To obtain this product, immature fresh green pepper is frozen but not dried or dehydrated. Owing to its cheaper price compared to freeze dried green pepper, fairly large quantities are exported. However, export trend is widely fluctuating. The highest volume of export of 163.7 tons was recorded in 1992-1993 while minimal volumes were exported in two prior years.

Exports of white pepper from India is quite insignificant considering that white pepper corresponds to about 25 per cent of the world pepper trade. The highest export was effected in 1993-1994 at 32.2 tons valued at Rs 2.222 million while in three prior years, exports was negligible. The reason for the low volume of white pepper exports is the general tendency of farmers to convert their harvest into black pepper. With the prevailing attractive prices of white pepper, however, farmers are encouraged to produce this type of pepper product. Hence, production and export of this product is projected to increase in the future.

Pepper powder or ground black pepper is one of the value added products being exported from India for more than three decades. However, there is not much growth in the export of this product due to consuming countries' preference for freshly ground pepper.

There is a number of other new products which are being introduced in the export market. These products are pink pepper, micro-encapsulated pepper, green pepper concentrate, pepper perfume, pepper plus, pepper sweet and pepper sauce/salad dressing.

Several food research establishments under the Council of Scientific and Industrial Research and various State Agricultural University as well as those belonging to the private sector are involved in the development and processing of new products. Moreover, the Spices Board has put the thrust in the export of value added products out of spices including pepper. Some of the steps taken up by the Board include participation in international exhibitions, publication of literature for consumers, buyer-seller meets, sending trade delegations and awarding Spices Board logo for consumer packs.

Indonesia

Indonesia is considered as one of the largest producers and exporters of pepper. The production of pepper in 1992 was 62,706 tons and increased further to approximately 65,567 tons the following year. Almost 90 per cent of Indonesia's production is being exported while the remaining 10 per cent is consumed locally.

Black and white pepper are the two main pepper products produced and exported from Indonesia. Production of pepper oil, oleoresin and other pepper products with higher local value added is still very little. Processing of green pepper products has been achieved on experimental scale, but not yet produced for commercial purpose.

Black pepper is produced from whole, unripe but fully developed berries characterized by dark green color with hard and well-formed endocarp.

White pepper production utilized fully matured berries which are characterized by yellowish to reddish skin and hard pepper corn and usually 8 to 9 months old.

Bottled green pepper is prepared and preserved in acid solution or in brine to keep the green color and natural taste of pepper. For this particular product, harvesting is done when berries are light green, pulverizable and the endocarp is not yet complete.

For dehydrated green pepper, freshly harvested, slightly immature, dark green small berries are being used. The steps in the processing of dehydrated green pepper includes harvesting, threshing, washing, blanching, sulphating, drying, sorting and packaging. The quality of the dehydrated product is affected by 1) quality of pepper berries, 2) method of treatment preparation, 3) the density of loading, 4) temperature and method of dehydration.

The production of pepper oil in Indonesia is still in a small scale as the market is limited and the economic value is relatively lower compared to black and white pepper. In this sense, utilization of light pepper, pepper waste or pepper of low quality for the production of pepper oil is more practical.

Pepper oleoresin is obtained by solvent extraction of ground pepper. To obtain a standard quality of oleoresin, the type of solvent, particle size of pepper and the ratio of pepper to solvent are very important. In Indonesia, Lampung black pepper is regarded as the best raw material to produce oleoresin due to its high content of volatile oils.

Farm level processing of black and white pepper is being performed with less attention on the quality and hygienic aspects. While pepper processing machines has been designed by the Research Institute for Spice and Medicinal Crops for improved processing and quality of white pepper, several research activities are further required to address the issue of quality and hygiene.

On diversification of pepper products, several research programmes are being conducted in Indonesia, particularly, on pepper perfume, beverage and confectionery product with pepper as flavoring agent, pepper as insect repellant, pepper oil as anti-fungi and heliotropin production out of piperine.

Almost 99 per cent of pepper plantations in Indonesia is owned by smallholder. Each plantation normally consists of small and separate units and located in remote areas far from public transportation. Aside from their financial difficulties, smallholder farmers have a relatively lower education. Such conditions hindered the transfer of improved technology produced by research institutes. In consideration of these issues, the expert from Indonesia recommended that efforts should be concentrated on the following concerns, 1) development of most appropriate technology at the farmers' level; 2) development of infrastructure such as road and electricity sufficient enough to reach the outlying places of pepper farms and industries; 3) development of farmers group within center of production area; 4) improvement of access to financial support/ credit; 5) development of smallholder nucleus estates to increase the status of pepper farmers in getting added values from the applica-tion of more advanced technology of pepper processing.

Malaysia

Pepper in Malaysia is a smallholder crop predominantly grown in the State of Sarawak. Cultivation involves an estimated 50,000 farm families with farm holdings ranging from 0.1 to 0.4 hectares each family. The commodity is considered as a vital cash crop among rural farmers. The industry being an export oriented one has significantly contributed towards the socio-economic development of the country especially to Sarawak.

The upsurge in world pepper prices in the 1970s propelled the steady increase of the area under pepper cultivation from 5,992 hectares in 1970 to 12,851 hectares in 1980. However, area planted to pepper followed a generally decreasing trend, thereafter. Long periods of depressed prices from 1981 to 1985 as well as in recent years resulted in the decline of area planted. In fact, the current level of 9,720 hectares is even lower compared to 1970s level of 9,930 hectares.

Expectedly, the volume of production of pepper has been on a downward trend also. Reduction in hectarage, depressed market conditions, and the outbreak of serious foot rot disease contributed to the decline. In 1993, production is estimated at 17,573 tons. This is 32.6 per cent lower than that of 1992 and 53.6 per cent lower than it was 18 years ago. Production is expected to decline further to 16,073 tons in 1994.

The average yield per hectare, likewise, has not improved substantially through the years. During the period 1980-1990, the average yield per hectare ranged between 3 to 3.8 tons except for the period 1986 to 1987 when the yield declined to 2.5 tons per hectare. From 1990-1993, the average annual yield ranged from 3.18 to 3.81 tons per hectare.

Several problems, namely, low prices, pest and diseases, high labor and production cost and low yield have affected pepper production and productivity. The prolonged period of low pepper prices is a serious contributory factor to the declining pepper production. Areas planted to pepper were either replaced in favor of other cash crops or poorly maintained thus production and productivity are adversely affected. Pests and diseases, likewise rendered considerable damage. Annual crop loss due to phytophthora foot rot disease alone is estimated to be between 5-10 per cent. Cultivation of pepper is labour and capital intensive compared to other commodities. Thus, against a background of low pepper prices but high production costs, pepper farms were inadequately maintained if not abandoned.

Cognizant of these problems, several development strategies have been introduced. Under the production strategy, Malaysia has implemented two measures, namely, 1) maintenance of the present hectarage and adoption of mixed cropping, and 2) intensification of extension programs for better dissemination of new information on input utilization and proper agronomic practices. Proper maintenance scheme strategy which began in 1993 granted smallholders with essential inputs for free during the period

of low pepper prices. To meet the consumers' stringent quality requirements, the quality enhancement strategy which is being observed in all levels of production was adopted. Downstream processing strategy is being pursued through research and development of new pepper products. Under the rehabilitation scheme strategy, assistance in the form of planting materials and other agricultural requisites are provided to smallholders to enable them to plant new vines or replace unproductive vines. Malaysia also launched a continuing campaign to promote and increase domestic consumption. Finally, production cost reduction strategy is being undertaken through development of high yielding varieties, utilization of live support, restriction of plant height and mechanized threshing of berries.

Pepper production as well as exports is still predominantly in the traditional form of black and white berries. The production of processed with higher local value added pepper products has been minimal. Annually, the value of these processed pepper products amounted to a little over $US 1 million.

It is estimated that about 97 per cent of the average annual production is being exported. Malaysian export of pepper rose steadily from 14,104 tons in 1987 to 28,495 tons in 1990. But because of low export prices, export earnings declined from RM 161.16 million to RM 117.64 for the same period. With the declining production and prices, volume and value of pepper exports further fell to 16,573 tons and RM 61.07 million in 1993. As a result of recent improvement of prices, exports for 1994 and 1995 is forecasted to recover and reach 17,050 tons and 18,750 tons, respectively.

Majority (72.8 per cent) of Malaysian pepper is exported in black unground form while white pepper and ground pepper account for 23.9 per cent and 3.3 per cent, respectively. In 1991 and 1992, Malaysian pepper was exported to more than 32 countries with Germany, Japan, the Netherlands, the Republic of Korea, Singapore, Taiwan Province of China, the United Kingdom and the United States as the important markets.

Risk of default or non-payment, irregular shipping schedules and high freight rates to potential markets, complicated documentation in some countries of destination, lack of big volume traders in Malaysia, stiff competition and trade preference and lack of market information are the current problems facing Malaysia with respect to marketing of pepper.

The Pepper Marketing Board (PMB), one of the main government agencies entrusted with the development of the pepper industry, has implemented several programs to improve the quality of Malaysian pepper. New pepper marketing centers in major producing areas were set-up. Farm level processing were provided to selected farmers group. More importantly, the grading and processing facilities of PMB which has 3 processing plants at the 3 major exporting ports were upgraded and expanded. Under the current sixth Malaysian plan, several research programs for the development of new pepper product are being implemented. These new products include Sarawak clean black pepper, Sarawak extra bold black pepper, Sarawak creamy white pepper and several green pepper products.

Still, the pepper industry faces several issues and constraints for the development of pepper processing. Inadequate government infrastructure in growing areas as well as lack of basic processing facilities at farm level prevents the production of pepper products other than the traditional form. Financing, technology in research and development, shortage of labour and increasing labour costs are other issues which need to be addressed.

For the years to come, there is a strong feeling that the Malaysian pepper industry should transform from a mere supplier of black and white pepper to a producer and exporter of pepper products with higher local value added. In order to attain that status, the Malaysian pepper industry should take the following initiatives, 1) increase the budget for research and product development; 2) intensify product development capability and efforts through, inter alia, increased investment in modern technology and proper training of its human resources; 3) expand the existing production base for value-added pepper and pepper products tailored to the customer's requirements; 4) develop the necessary infrastructure to facilitate the production and marketing of such products; 5) enhance the grading capability to include grading of all value added pepper and pepper products for export; and 6) promote direct marketing of pepper products to end-users instead of through commodity traders as currently being practised.

Pakistan

Pakistan is not a producer of pepper. It depends on a number of countries for the supply of this spice. Pepper was of little use before but has gained acceptance in recent years. Consumers in Pakistan are gradually shifting from chillies to pepper.

Pepper importation was on an increasing trend from 1989-1990 to 1991-1992. Volume of imports reached 4,372 tons in 1991-1992 but fell to 3,758 tons in 1992-1993. The country's value of pepper imports in 1989-1990 amounted to Rs. 112.3 million but declined to Rs. 95.8 million in 1990-1991. Then the value increased again to Rs. 114.7 million in 1991-1992 only to fall again to Rs. 97.8 million the following year.

Majority of Pakistan's pepper import is black pepper. Of the country's average import volume of 3,476 tons from 1989-1993, majority (98.6 per cent) is black pepper while the remaining percentage is attributed to white pepper, ground pepper and other pepper products. For the same period, the country imported black pepper from a total of 17 countries. Indonesia, Malaysia, Singapore were the major sources of Pakistan's black pepper importation while significant volume were supplied by China, Thailand and Viet Nam.

Pakistan's importation of white pepper had an average volume of only 20 tons per annum and worth about Rs 0.8 million annually for the period 1989-1993. White pepper were imported from China, Indonesia, Malaysia and Singapore.

Singapore

Singapore is not a "natural producer" but a major re-exporter of pepper. The country's involvement in the international trade of spices dates back to more than 100 years. Being in the center of major spice producing Asian countries. Singapore has been functioning as a link of these countries to market their spices. Similarly, many countries have been using Singapore as a base to source their requirement of spices.

Pepper is the single most important item to Singapore's spice trade. In terms of volume and value, pepper accounted for 28 per cent and 32 per cent, respectively, of Singapore's total spice trade of 196,000 tons valued at S$378 million in 1993. The country imported approximately 28,000 tons of pepper majority of which is black pepper valued at S$36 million in 1993. Malaysia, Thailand and Viet Nam were the major sources of these imports.

With a population of about three million, Singapore's domestic consumption of spices, in general, and pepper, in particular, is very negligible. Hence, majority of the pepper imported into Singapore is subsequently re-exported with or without value adding process. Value adding process in Singapore would normally include cleaning, grading, sterilization, grinding and packaging of pepper before the final product is re-exported. In 1993, France, Germany, Japan, the Netherlands, the Republic of Korea, the United Kingdom and the United States were the major destinations of pepper re-exports from Singapore. Moreover, a significant volume of pepper of Indonesian, Malaysian and other origins are being transhipped via Singapore.

Singapore handles between 20 to 25 per cent of world's movement of pepper trade, largely due to the excellent shipping, banking and telecommunication facilities in which the country had heavily invested and being upgraded constantly to meet the changing needs of the international trade. Among other things, Singapore provides reliable support services to its neighbours in the Asia-Pacific region as well as other countries in Africa to effectively market their pepper overseas. Singapore ensures timely delivery of pepper to buyers on behalf of the producing countries. This is an important element in the pepper trade as delay in shipment would lead to longer storage and subsequent quality deterioration of pepper. Nevertheless, for cases of delayed shipment, Singapore has also developed storage and warehousing facilities to maintain the quality of pepper until the shipment reached the final destination.

Importers and exporters as well as consumers of pepper in Singapore are at their liberty to adhere to the SINGAPORE STANDARD 315:196 (SS315) — Specifications for Black Pepper and White Pepper (Whole and Ground), in transacting pepper shipments. Currently, this set of standards is under review by the Singapore Institute of Standards and Industrial Research (SISIR). The Singapore Trade Development Board (STDB) which sits in the technical committee reviewing the SS315, is exploring the possibility of incorporating the minimum quality standards for the sterilization of pepper. This is in view of the stringent quality requirements imposed by major importers and

end-users of pepper. The SS315 is intended to give maximum degree of assurance to buyers for their continued sourcing of pepper from Singapore.

Moreover, to augment increased spice trading activity, particularly in pepper, new technologies in spice processing are now developed and undertaken by the spice industry in Singapore. Some of the latest value adding technologies include the natural sterilization of pepper by steam heat process to reduce bacterial contamination without the use of fumigant gases or irradiation.

The current rapid geo-political developments in the region coupled with the improving trend in pepper prices is expected to boost further Singapore's volume of pepper trade in the future. There is however a continuing need for the country to closely monitor the developments affecting the production, processing, marketing, end-usage, supply and demand, pricing, changes in regulation and other relevant aspects of the pepper trade.

Indeed, consumers in developed countries are, and will become more quality conscious and aware of health hazards from shipments of raw and contaminated pepper and importers will expect the quality of pepper to remain consistent until it reaches the final consumers.

Sri Lanka

Sri Lanka has been famous for its range of spices for centuries. In the course of time, however, other products such as tea have overtaken spices, in terms of value and volume but its traditional position as a supplier of quality spices stands unassailed.

From a large number of spice crops under cultivation, the major ones are cinnamon, pepper cardamom, cloves, nutmeg and mace. According to current estimates the area under spice crops is approximately 40,000 hectares. Of this extent, nearly 40 per cent or 16,000 hectares are under pepper cultivation, mostly as a mixed home garden crop scattered throughout the country of which approximately 60 per cent is concentrated in Kandy, Matale, and Kegalle districts in central part of Sri Lanka. The local varieties of pepper come into bearing relatively late and generally yield about 1/2 kilogram or less of dry pepper per vine per year. Research efforts are directed to identify superior lines from among the local varieties. Both local and imported varieties are planted to maintain a broad genetic base and to minimize the risk of loss due to pest and disease problems. Increasing the productivity of smallholder pepper farmer remains difficult as these crops are cultivated on small lots together with other crops. Various programmes have been implemented to assist the smallholders to increase both the productivity and quality of produce. Also, assistance in the form of subsidized credit is being provided to encourage commercial cultivation of selected spice crops including pepper.

Traditionally, Sri Lanka produces black pepper which is prepared by sundrying the mature but unripe green berries. Attempts however are being made to introduce suitable low cost hot air dryers to improve the quality of the produce.

Sri Lanka has been exporting pepper since the 1940s. About 80 per cent of Sri Lanka's pepper production is being exported while the rest is being consumed locally. Exports have been mainly in black pepper form. While volume of exports is negligible compared to that of India, Malaysia, and Viet Nam, Sri Lankan pepper, nevertheless, fetches a premium price due to its high extraction value. From 1984-1993, the annual volume of pepper exports averaged 2,438 tons. Export performance for 1993 was exceptional as Sri Lanka exported a record quantity of 7,847 tons of pepper. The large quantity of pepper exports in 1993 was attributed to an unusually good harvest brought about by the well distributed rainfall and good fertilizer programmes.

The bulk of Sri Lanka's spice exports has been mainly in black pepper form. A very small percentage is exported in value added form such as spice mixes, ground pepper, pepper in small consumer packs or as essential oils or oleoresins. The extraction of essential oil was a flourishing industry some years ago. But with the dwindling prices of pepper, the progress of the industry in recent years is less encouraging. Nevertheless, the technology for the extraction of essential oil and oleoresin is well established in the country and there had been many initiatives to modernise the technology. However, insufficient volume of raw material to be processed is a mitigating factor against the growth of this promising sector of the industry.

The Sri Lanka Standards Institute (SLSI) sets and implements the export standards for spices. Simple post-harvest technology programs are carried out to educate the farmers to facilitate standardization and quality control.

Pepper together with cinnamon and cardamom has been identified by the Government of Sri Lanka for promotion and development over the next few years. Commercial cultivation and development of high local value added products are priority areas of development with the ultimate objective of stabilization of pepper prices.

Thiland

In the past when pepper production in Thailand was just enough for local consumption, farmers grew pepper using traditional methods and farm productivity was very poor. In recent years, particularly from 1986-1992, area planted to pepper as well as the volume of production gradually increased at 11 per cent and 12 per cent, respectively. Also, in the advent of commercialization and with the adoption of appropriate technology, productivity substantially improved.

In 1993, area planted was approximately 3,084 hectares. About 80-90 per cent of the total planted area is in the Eastern part of Thailand while the rest is located in the South. However, area planted and production are not expected to increase in the years to come as the government advocated the gradual reduction of pepper plantings starting 1994 as part of the pepper farming restructuring programmes. The programme requires government subsidy to provide incentives to farmers for the replacement of pepper plantings with various fruit trees. The program aims to 1) improve

the pepper productivity and quality to meet domestic and world market demand, 2) prevent pepper price fluctuation, and 3) enhance farmers' income. Area planted to pepper for 1994 will be about 2,462 hectares and further decreasing to 2,400 hectares in 1995. Volume of production is expected to decrease from 9,000 tons in 1993 to 8,100 tons by 1995.

It was observed that the decreasing price of pepper, pest and disease infestation, lack of unskilled labour force and drought are the current problems affecting production and productivity.

Black and white pepper are the major pepper products of Thailand. In the production of black pepper, fully matured with greenish and corn berries are harvested and dried on concrete floors for 1-2 days. Thereafter, berries are separated from the spikes using beating machine and allowed to dry for another 3-4 days until the moisture content is between 12-14 per cent. For white pepper production, fully matured berries with red-yellowish and hard corn are harvested and fermented for 1-2 days. After being separated from the spikes, the corns are soaked in clean and clear water for 5-7 days. The adhering pericarp and spoiled berries are then removed under running water while the intermediate product is then dried in the sun for 2-3 days.

On pepper products with more local value added, the Chemical-Agricultural Division and Horticultural Institute under the Department of Agriculture have cooperated to conduct research programmes on the following areas, namely, 1) effect of harvesting time and temperature of drying pepper on essential oil and oleoresin quality, 2) dehydrated green pepper corns, and 3) canned green pepper corns.

Inadequacy of drying and storage facilities, lack of financial support for research, non-availability of new processing technology and lack of specialists on pepper product and processing are the main issues and constraints of the pepper processing and product development.

Thailand's volume of exports increased substantially from 1,816 tons in 1986 to 6,156 tons in 1992. Because of the decreasing price, however, value of pepper exports declined from $US 8.5 million to $US 5.52 million for the similar period. In 1993, volume and value of pepper exports fell to 4,422 tons and $US 5.13 million, respectively. The Netherlands, Singapore, and the United States are the important importing countries.

Export price of pepper decreased from $US 4.75/kg in 1986 to $US 0.93/kg in 1992. Naturally, farm gate prices followed the same pattern. Thus, during the period 1986-1992, farm gate prices of pepper were even lower than production costs. Beginning in 1993, the decreased pepper production resulted to better prices for pepper.

Oversupply and low prices, low quality of farm produce, stagnation of pepper product development are the problems being encountered in the marketing of pepper. Regardless of these constraints, the pepper industry of Thailand will continue to put

emphasis on production of high quality pepper as well as maintain an export volume of 4,000 tons a year.

5. Recommendations

The Seminar made a number of recommendations, most of them to be implemented individually by concerned countries, especially in the area of product development where governments were urged to support research and development programmes and provide adequate assistance in developing production and marketing capabilities for new products.

To support these proposed initiatives for implementation at national level, the Seminar, during its deliberation at the panel discussion session, proposed the following recommendations for implementations by pepper producing/exporting countries collectively:

(a) To conduct a study to assess the problems and prospects of the pepper industry in pepper producing countries of the Asia and Pacific region with a view to strengthening and improving market transparency through availability of relevant information and facilitating appropriate programmes to enhance the pepper economy.

(b) To conduct research on attributes of pepper, especially on medicinal uses, to facilitate new product development.

(c) To develop a mechanism to collect relevant information and discuss as well as take appropriate action, where necessary, on matters related to quality requirements by consuming countries.

(d) To conduct a market survey on trade potential of pepper in selected Asian non-traditional markets.

(e) To formulate, on the basis of the findings of the market study, a promotional programme for pepper and pepper products in those countries.

LIST OF PARTICIPANTS

CHINA

Official representative

Mr. Ou Meng, Assistant Economist, China Chamber of Commerce of Importers and Exporters of Foodstuffs Native Produce and Animal By-Products, Local Produce Department, 95 Beiheyan Street, 3rd Floor, Dongchengqu, Beijing 100006
(Tel: (86-1) 5136677/5133307; Telex: 210482 CCFNA CN; Fax: (86-1) 5139064)

INDIA

Official representative

Dr. C.K. George, Executive Director, Spices Board, Ministry of Commerce, St. Vincent Cross Road, P.B. No. 1909, Ernakulam North, Cochin 682018
(Tel: (off.) (91-484) 353837 and (Res.) (91-484) 348417; Fax: (91-484) 370429)

Participants

Mr. Eapen George, Chief Executive Officer, A.V. Thomas Group of Companies, 28/961 B Panampilly Nagar, P.O. Box 1685, Cochin 682015
(Tel: (91-484) 315312; Fax: (91-484) 312541)

Mr. K.P. Philip, Managing Director, Cochin Spices Ltd., Spice House, Manikkath Road, Cochin 682016
(Tel: (91-484) 353742; Fax: (91-484) 370357)

Mr. Kishor S. Kuruwa, Exporter, Kishor Spices Company, P.O. Box 262, Jew Town, Cochin 682002
(Tel: (91-484) 225111; Telex: (885) 7024 SPOT IN; Fax: (91-484) 223884)

Mr. N.G. Panickar, Managing Director, Produce and Spices Marketing Co., Ltd., "VETHENKA", 16 Satyanarayana Avenue, Off Boat Club Road, Madras 600028
(Tel: (91-44) 457581; Telex: (41) 23131 PSM IN; Fax: (91-44) 456727)

Mr. T. Vidyasagar, President, India Pepper and Spice Trade Association, Post Box 344, Jew Town, Cochin 682022
(Tel: (91-484) 224628/224832; Telex: (885) 7038 SIPC IN; Fax: (91-484) 225939)

INDONESIA

Official representative

Dr. Ir. Djiman Sitepu, Senior Researcher, Research Institute for Spice and Medicinal Crops, Department of Agriculture, Jl. Tentrara Pelajar No. 3, Bogor 16111
(Tel: (62-251) 321879; Fax: (62-251) 327010)

Participants

Mr. Zulkifli Siregar, Director of Export for Agriculture and Forestry Products, Department of Trade, Jl. Moh. Ridwan Rais No. 5, Jakarta 10110
(Tel: (62-21) 3858202; Fax: (62-21) 3858195)

Mr. Agoes Soebijanto, Head of Commodity Division, Directorate for Foreign Trade Relation, Directorate General for Foreign Trade, Department of Trade, Block II, 6th Floor, Jl. M.I. Ridwan Rais No. 5, Jakarta 10110
(Tel: (62-21) 3858195; Fax: (62-21) 3858195)

Mr. Enda Iskandar Yusuf, Official, Directorate Economic Multilateral Cooperation, Department of Foreign Affairs, Jl. Pejamban 6 Jakarta

Mr. Sadullah Muhdi, Head, Division of Export Market Analysis, Agribusiness Agency, Ministry of Agriculture, Jalan Harsono RM No. 3, Ragunan, Jakarta 12550
(Tel: (62-21) 7804006/7004196; Fax: (62-21) 7804337)

Mr. Syuhaeri, Executive Secretary, Association of Indonesian Pepper Exporters (AIPE), Kerta Niaga Building, 2nd Floor, Jl. Roa Malaka Selatan No. 35, Jakarta 11230
(Tel: (62-21) 6926401/6929765; Telex: 42718 KERTA IA; Fax: (62-21) 6926401)

Mr. David Quane, Agroprocessing Advisor, Agribusiness Development Project, Mampang Plaza, Suite 306, Jl. Mampang Prapatan Raya No. 100, Jakarta 12760
(Tel: (62-21) 7984972; Fax: (62-21) 7984971)

Mr. Lau Nai Kwong, Executive Director, P.T. Delapan Delapan, Wisma Barito Pacific, 6th Floor Tower A, Jalan S. Parman Kav. 62-63, Jakarta
(Tel: (62-21) 5486950 ext. 1600; Fax: (62-21) 5486950)

Mr. Tiau Tuong Ming, General Manager, P.T. Delapan Delapan, 6th Floor, Tower A. Wisma Barito Pacific, Jalan S. Parman Kav. 62-63, Jakarta 11410
(Tel: (62-21) 5486950 ext. 1600; Fax: (62-21) 5482503)

Mr. Tan Bambang Soeryono, Director, Fa. M. Jusuf Latip, Jl. Roa Malaka Selatan No. 28/16, Jakarta 11230
(Tel: (62-21) 6907631/6906462; Telex: 42950 MJL IA; Fax: (62-21) 6925937)

MALAYSIA

Official representatives

Mr. Saadul Baharim Abdul Mutalib, Principal Assistant Secretary, Ministry of Primary Industries, 6-8th Floor, Menara Dayabumi, Jalan Sultan Hishamuddin, 50654 Kuala Lumpur
(Tel: (60-3) 2747511; Telex: MA 30808 KPU; Fax: (60-3) 2745014)

Mr. Ng Siaw Chiung, Head of Quality Assurance Division, Pepper Marketing Board, Lot 1115, Jalan Utama, Bintawa Industrial Area, P.O. Box 1653, 93450 Kuching, Sarawak
(Tel: (082) 331811; Telex: PMB KG MA 70987; Fax: (082) 336877)

Participants

Mr. R. Venugopal, Undersecretary, Ministry of Primary Industries, 6-8th Floor, Menara Dayabumi, Jalan Sultan Hishamuddin, 50654 Kuala Lumpur
(Tel: (60-3) 2747511; Telex: MA 30808; Fax: (60-3) 2745014/2732933)

Mr. Churchill Lawi, Agricultural Economist, Ministry of Agriculture and Community Development, 9th Floor, Wisma Bapa Malaysia, Petra Jaya, 93502 Kuching, Sarawak
(Tel: (082) 442843; Fax: (082) 440410)

Mr. Abdul Rahman Azmil B. Idris, Research Officer, Malaysia Agriculture Research and Development Institute (MARDI), MARDI Research Centre, P.O. Box 12301, 50774 Kuala Lumpur
(Tel: (60-3) 9486601; Fax: (60-3) 9426434)

Mr. Maria Hasman, Economist, Agriculture Department HQ., Planning Division, State Complex, Jalan Simpang Tiga, 93632 Kuching, Sarawak
(Tel: (082) 254111; Fax: (082) 426879)

Mr. Wong Ting Hung, Research Officer, Department of Agriculture, c/o Agriculture Research Centre, Semongok, P.O. Box 977, Kuching, Sarawak
(Tel: (082) 254111/611171; Fax: (082) 419769/611178)

Mr. Madhu Govind Kanbur, Professor of Economics, School of Economics and Public Administration, Universitii Utara Malaysia, Sintok, 06010 Jitra, Kedah
(Tel: (04) 741801 ext. 1529; Telex: MA 42052; Fax: (04) 741585)

Ms. Yen Siew Hwa, Lecturer, School of Economics, Universitii Utara Malaysia, Sintok, 06010 Jitra, Kedah
(Tel: (04) 700362-3; Telex: MA 42052; Fax: (04) 741585)

FEDERATED STATES OF MICRONESIA

Official representative

Mr. Sailas J. Henry, Administrator, Division of Agriculture, Department of Resources and Development, FSM National Government, P.O. Box 12, Palikir, Pohnpei FM 96941
(Tel: (69-1) 320-2646/5133; Fax: (69-1) 320-5854)

Participant

Mr. John K. Gnanaratnam, Spice Consultant, Department of Conservation and Resources Development, Pohnpei State Government, Kolonia, Pohnpei FM 96941
(Tel: (69-1) 320-2735/2736; Fax: (69-1) 320-5997)

PAKISTAN

Official representative

Mr. Ghulam Mohyuddin, Deputy Chief/I.T.O. Wing, Ministry of Commerce, Room No. 507, Block 'A', Pakistan Secretariat, Islamabad
(Tel: (92-51) 826411; Telex: 5859 COMDN PK; Fax: (92-51) 826241)

SINGAPORE

Official representative

Mr. G. Selvaraju, Trade Officer, Singapore Trade Development Board, 1 Maritime Square #10-40 (Lobby D), World Trade Centre, Telok Blangah Road, Singapore 0409
(Tel: (65) 2719388/2790409; Telex: RS 28617 TRADEV; Fax: (65) 2740770/2782518)

Participants

Mr. Philip Tan, Sales Manager, McCormick Ingredients Southeast Asia Pte. Ltd., 4, Enterprise Road, Jurong, Singapore 2262
(Tel: (65) 2653433; Fax: (65) 2653378)

Ms. Teo Siew Ping, QA Manager, McCormick Ingredients Southeast Asia Pte. Ltd., 4, Enterprise Road, Jurong, Singapore 2262
(Tel: (65) 2653433; Fax: (65) 2653378)

Mr. Chong Kim Seng, General Manager, Singapore Commodity Exchange Limited, 111 North Bridge Road #23-04/05, Peninsula Plaza, Singapore 0617
(Tel: (65) 3385600; Telex: RS 20554 SICOM; Fax: (65) 3389116/3389640)

Mr. Tan Kok Sin (George), Managing Director, Kinway Company (PTE) Ltd., 150 Cecil Street, #04-04, Wing On life Building, Singapore 0106
(Tel: (65) 2245555; Telex: RS 22636 SMILES; Fax: (65) 2250278)

Mr. Koh Kok Chin, Director, Kinway Company (PTE) Ltd., 150 Cecil Street, #04-04, Wing On Life Building, Singapore 0106
(Tel: (65) 2245555; Telex: RS 22636 SMILES; Fax: (65) 2250278)

SRI LANKA

Official representative

Dr. Daya Wijayawardena, Director/Export Agriculture, Sri Lanka Export Development Board, Ramada Renaissance Bldg., 115 Sir Chittampalam A, Gardiner Mawatha, Colombo 2
(Tel: (94-1) 438517/438512-5; Telex: 21457 EXDEV CE; (94-1) Fax: 438404)

Participants

Mr. Gulamhusein S. Chatoor, Chairman and Managing Director, Saboor Chatoor and Co., Ltd., and Chairman of Advisory Committee on Spices of the Export Development Board, 20, Sri Wickrema Mawatha, Colombo 15
(Tel: (94-1) 522024/25/30; Telex: 21619 SACHA CE; Fax: (94-1) 502768)

Mr. M.C.M. Zarook, Ceylon Export Syndicate, 7D, Tower Building, 25, Station Road, Colombo 4
(Tel: (94-1) 501263/587851; Telex: 22217 TWO CE; Fax: (94-1) 501263)

THAILAND

Official representative

Mr. Sanit Suksawat, Agricultural Scientist, Chantaburi Horticulture Research Center, Horticultural Research Institute, Department of Agriculture, Chantaburi Province
(Tel: (039) 397236; Fax: (039) 397236)

Mr. Boontam Prommani, Agricultural Economic Specialist, Office of Agricultural Economics, Ministry of Agriculture and Cooperatives, Rajdamnern Avenue, Bangkok
(Tel: (66-2) 2812766; Fax: (66-2) 2801548)

Mrs. Pranart Pipitkul, Agricultural Economic Research Division, Office of Agricultural Economics, Ministry of Agriculture and Cooperatives, Rajdamnern Avenue, Bangkok 10200
(Tel: (66-2) 2829562/2810371; Fax: (66-2) 2801542)

Mrs. Phawana Assawaprapa, Subject-Matter Specialist, Horticultural Crop Promotion Division, Department of Agricultral Extension, Ministry of Agriculture and Cooperatives, Jatuchak, Bangkhen, Bangkok 10900
(Tel/Fax: (66-2) 5614879)

Mr. Vichai Vongsakul, Foreign Agricultural Relations Division, Ministry of Agriculture and Cooperatives, Rajdamnern Avenue, Bangkok 10200
(Tel: (66-2) 2819313/2822564)

Participants

Miss Leena Phongpruksa, Economist, Department of Business Economics, Ministry of Commerce, Rajdamnern Klang Avenue, Bangkok 10200
(Tel: (66-2) 2826171-9; Fax: (66-2) 2800775/4393720)

Mrs. Chamaiporn Chuecharoen, Economist, Commodity and Marketing Research Division 2, Department of Business Economics, Ministry of Commerce, Rajdamnern Klang Avenue, Bangkok 10200
(Tel: (66-2) 2828884; Telex: 84361 DEPBUSE TH; Fax: (66-2) 2800826)

Dr. Prateungsri Sinchaisri, Senior Research Scientist, Division of Agricultural Chemistry, Department of Agriculture, Kasetsart University Campus, Bangkok 10900
(Tel: (66-2) 5791992; Fax: (66-2) 5615034)

Mr. Chao Tiantong, Minister Counsellor (Agriculture), Office of Agricultural Affairs, Royal Thai Embassy, Jl. Jend. Gatot Subroto Kav. 12-13, 8th floor, CASE Building, Jakarta 12930, Indonesia
(Tel: (62-21) 5250093; Fax: (62-21) 5250068)

Mr. Pornchai Chanwanichwong, Director, Thai Commodities Co., Ltd., 5th Floor, Bangkok Bank Building, Siam Square Branch, 394 Rama I Road, Pathumwan, Bangkok 10330
(Tel: (66-2) 2553120-9; Telex: 87217 WEALTH TH; Fax: (66-2) 2553330)

Mr. Viroj Skulboonrasi, Manager, Bangkok Chili Ltd., Part., 156-158 Isaranuparb Lane, Jaowaraj Road, Bangkok 10100
(Tel: (66-2) 2263241-2/2263244-5; Telex: 20506 BKCHILITH; Fax: (66-2) 2255508)

Mr. Visit Limprana, Managing Director, Artchit International Pepper and Spice Co., Ltd., 83/4 Moo 5 Soi Suksawad 2, Suksawad Road, Jomtong, Bangkok 10150
(Tel: (66-2) 4770905/4770926; Telex: 20506 BK CHILI TH; Fax: (66-2) 4600901)

Mr. Vraluck Chatarupavanich, Assistant Executive Agent and Director, Policy and Planning Division, Mekong Secretariat, Kasatsuk Bridge, Rama I Road, Bangkok 10330
(Tel: (66-2) 2250029; Telex: 21322 MEKONG TH; Fax: (66-2) 2252796)

Mr. Charoon Keartkul, Thai Commodities Co. Ltd., 5th Floor, Bangkok Bank Building, Siam Square Branch, 394 Rama I Road, Pratoomwan, Bangkok 10330
(Tel: (66-2) 2553120-9; Fax: (66-2) 2553330)

Miss Nantiya Sritep, Asa Merchandising Limited, RIMCO Building, 139 Soi Charoensuk, Ekamai Road, Bangkok 10110
(Tel: (66-2) 3810743-7; Telex: ASABKK 21918 TH; Fax: (66-2) 3918588/3918590)

VIET NAM

Official representative

Mr. Nguyen Viet Vinh, President, Viet Nam National Agricultural Produce Import — Export Corporation (AGREXPORT), No. 6, Trang Tien Street, Hanoi
(Tel: (84-4) 253543/265550; Telex: 411510 AGRE VT; Fax: (84-4) 259170)

SPEAKERS AND PANELISTS

Session I: Global Pepper Economy

Dr. Hidde P. Smit, Division Chief Economic Research, Economic and Social Institute, Free University of Amsterdam, P.O. Box 7161, 1007 MC Amsterdam, the Netherlands
(Tel: (31-20) 5484915/548 6621; Fax: (31-20) 6462645)

Dr. Muzafar Shah Habibullah, Associate Professor, Department of Economics, Faculty of Economics and Management, Universitii Pertanian Malaysia, 43400 Serdang, Selangor, Malaysia
(Tel: (60-3) 9486101/110 ext. 1633; Fax: (60-3) 9486188)

Mr. Rachim Kartabrata, Secretary-General, Association of Indonesian Pepper Exporters (AIPE), Kerta Niaga Building, 2nd Floor, Jl. Rao Malaka Selatan No. 35, Jakarta 11230, Indonesia
(Tel: (62-21) 676401/679765; Telex: 42718 KERTA IA; Fax: (62-21) 676401)

Session II: Processing and Product Development

Mr. Ashok Kumar, Joint Secretary, Ministry of Commerce, Udyog Bhawan, New Delhi 110011, India
(Tel: (91-11) 3013460/3011462; Fax: (91-11) 3014418/3013583)

Mr. Karl G. Jahn, Purchasing Manager, Ubena Gewürze GmbH, Hans-Bredow-Strasse 36, 28307 Bremen, Germany
(Tel: (49-421) 4869535; Fax: (49-421) 4869511)

Dr. Wanchai De-Eknamkul, Associate Professor, Department of Pharmacognosy, Faculty of Pharmaceutical Sciences, Chulalongkorn University, Bangkok 10330, Thailand
(Tel: (66-2) 2511871 ext. 248; Fax: (66-2) 2558227)

Session III: Marketing

Mr. Anandan Adnan Abdullah, General Manager, Pepper Marketing Board, Ministry of Agriculture, Lot 1115 Jln. Utama, P.O. Box 1653, 93450 Kuching, Sarawak, Malaysia
(Fax: (082) 336877)

Mr. Fazli A. Husain, Senior Commodity Marketing Officer, Market Development Section (Commodities and Agro-based Products), Division of Product and Market Development, International Trade Centre UNCTAD/GATT, Palais des Nations, 1211, Geneva 10, Switzerland
(Tel: (41-22) 7300111; Telex: 414119 ITC-CH; Fax: (41-22) 7346810)

Mr. Kamlesh Jagjivandas Tanna, Director, Jamnadas Madhavji International Ltd., Tanna House, Ground Floor, 11-A, Nathalal Parekh Marg, Bombay 400039
(Tel: (91-22) 225111/225487; Fax: (91-22) 2021746)

SPECIALIZED AGENCY

Dr. Narong Chomchalow, Regional Plant Product Officer, FAO Regional Office for Asia and the Pacific, Maliwan Mansion, Phra Atit Road, Bangkok 10200, Thailand
(Tel: (66-2) 2817844; Telex: 82815 FOODAG TH; Fax: (662) 2800445)

Mr. H.M. Carandang, Regional Agricultural Planning Economist, FAO Regional Office for Asia and the Pacific, Maliwan Mansion, Phra Atit Road, Bangkok 10200, Thailand
(Tel: (66-2) 2817844; Telex: 82815 FOODAG TH; Fax: (66-2) 2800445)

OBSERVER

Mr. Michael Rendlen, Managing Director, Gewürzmuller GmbH, Klagenfurter Strasse 1-3 P.O. Box 300480 D-70444 Stuttgart, Germany
(Tel: (49-711) 8999218; Fax: (49-711) 8999200)

Mr. H.V. Henle, Consultant and Former FAO Officer, Apt. 2A River Mansion, 23 Pra Athit Road, Banglampoo Bangkok, Thailand

PART TWO

GLOBAL PEPPER ECONOMY

Photo by courtesy of IPC.

Mature and fully ripened pepper berries

I. ANALYSIS, PROJECTIONS AND SUPPLY MANAGEMENT POLICIES FOR THE WORLD PEPPER ECONOMY[1]

Introduction

This paper focuses on analyzing and forecasting supply and demand of pepper. First, in Sections A to C, a description is given of the pepper economy and the model applied to analyze the pepper economy. The model used for the current paper is a somewhat revised, extended and updated version of the model described in Bade and Smit (1992). At that time it was the first detailed model for the pepper economy. Data and time constraints did not allow a further and more in-depth analysis. Such an analysis is clearly called for when more sound policy conclusions are to be drawn up.

Sections A and B concentrate on supply and demand respectively, while Section C focuses on prices and equilibrium in the market. The model is presented in full in Appendix A. In Section D projections for the pepper economy are presented. Section E concentrates on supply management measures and in Section F some conclusions are drawn regarding the effectiveness of such measures using the current version of the model. Further work required for a sound analysis of supply management measure is outlined in Section F, while some further remarks on data are given in Section G. A proposal for a project to investigate concretely and in detail how such supply management measures could be very well assessed and how they could be implemented is given in Section H. The model in mathematical terms is described in the Appendix A. Appendix B gives the outlook for the world economy which is a basis for the outlook for the world pepper economy. Appendix C shows the relevant articles on producer cooperation as they are now on the way for cocoa.

A. Analysis of the pepper economy — the supply side

1. Introduction

In this Section the model of the pepper economy is presented and discussed as far as the supply side is concerned. It was already mentioned that data limitations account for the major hurdle in model building. Therefore many comments in this Section and in Section G point to restricted data availability or the dubious quality of data. Nevertheless this Section will also provide insight in the ways that can be exploited to estimate relationships. The large number of assumptions provide an equal

[1] Based on the paper prepared by Messrs, Jan Bade and Hidde P. Smit, Economic and Social Institute, Free University, Amsterdam, The Netherlands.

amount of challenges to check their validity. All quantities of pepper mentioned in this report are in tons unless stated otherwise.

We will deal with supply of pepper on a country basis, looking at area, production and exports. The best approach would be to base the analysis on the number of productive vines, to be multiplied by the average yield of a vine to receive what may be called *normal production*. Although measurement by vines must be considered much better, the same line of reasoning can be applied with area and average yield per hectare. The major draw back of this method in comparison to using vines is that the it adds a source of variation. Not only does the yield per vine fluctuate, but of course also the number of vines per hectare. In some countries, like India for example, this variation is very strong, while in others (e.g. Thailand) the number of vines per hectare is almost the same all over the country. If there is no significant change in cultivation patterns and the intensity of cultivation is relatively constant it is possible to estimate a nation-wide normal average yield per hectare. If however the average number of vines per hectare cannot be expected to be constant an assumption is needed about the change. If intensification takes place or superior varieties are introduced, it can be assumed for example, that there will be an upward trend in the *normal yield per hectare* some two years after the start of the intensification, when the planted vines become productive. We will come back to this when discussing Indian yields.

If *normal yield* can be used as a basis for forecasting, the actual yield will deviate from it because of weather influences, amount of fertilizer applied and time spent on maintenance. Regretfully, these effects are not confined to one year. In the occurrence of a very wet year, there will be a smaller crop, but perhaps even more important is that there will be more foot-rot and other diseases. These diseases also influence next year's crop. Also the effects of neglect or exceptionally good maintenance will spread over more than one year.

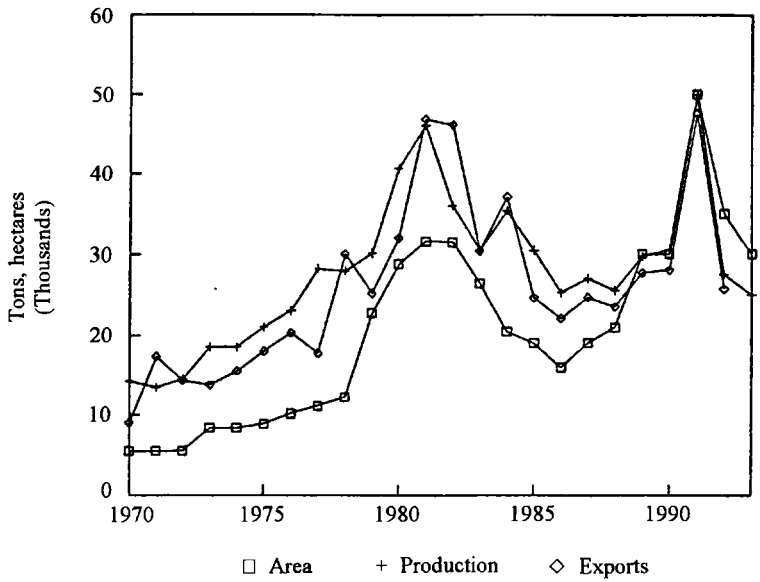
This illustrates that, even when data on productive vines and average yields were available and absolutely reliable, there would be enough scope for simulation and expert interpretation. Unfortunately we live in a world where information is costly. Gathering data on agricultural activities is even very costly, because it is time consuming. As a matter of fact it is not one of the priorities of developing countries. Planning however depends largely on information and a model cannot compensate for lack of quality of data. As far as quality of information is concerned it can only interpret and detect inconsistencies. The conclusion of this paragraph is therefore that the modelling of production and supply presented in this Section must be seen as a step on the road towards a more sophisticated modelling analysis based on superior data. We will come back to this topic in Section G.

2. Brazil

Although there are different systems of cultivation in Brazil, there are no time series on area by cultivation system. In fact we do not know how the Brazilian Pepper

Exporters Association gets the data that are presented at IPC meetings. The relevant data are shown in Figure 1. The assumption on which the area equation is based is that the data are on productive area. That means that the price of pepper as of last year has been an incentive or disincentive to plant or replant. That price will be a good explanatory variable for the change in the current productive area under pepper. The years 1979 and 1991 were found to be outliers and dummies were applied.

Figure 1. Area, production and exports in Brazil



When looking at area and production one would expect that yields have gone up over time. Unfortunately the opposite is true. If production is divided by area the result is a decreasing function over time. There is even a strong fall in yield from '78 to '79 when area increased rapidly, suggesting that in those years data on area did also include area with immature newplanting. After 1979 the correlation between area and production is strong although 1984 was extraordinary, with a much higher yield than could be explained. Obviously there should be a positive price correlation. The influence of price has been included with a one year lag.

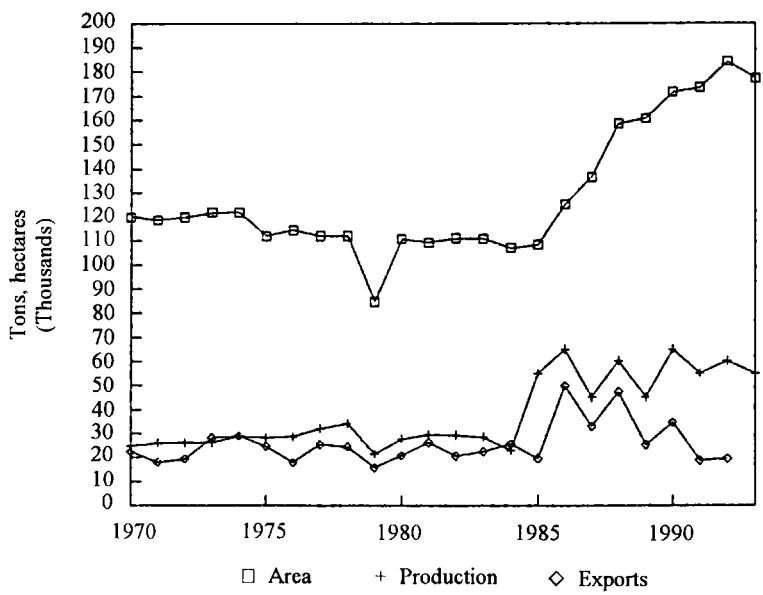
Finally exports are analyzed. As pepper consumption in Brazil is negligible compared to production and presumably kept out of production statistics as there are some other small pepper producing region outside Para state, it can be expected that total production will be virtually exported, as represented by a coefficient of 0.98. However, there is rather constant amount apparently not exported of just over 1.5 thousand tons.

The resulting equations are given in Appendix A.

3. India

Indian data are shown in Figure 2. Area under pepper in India was enough to supply the whole world with pepper if yields were only in the order of one third of what they are in Sarawak. Plenty of reason to take a close look and ask some questions about the way these data are collected. Up to 1986 a survey among extension workers was held in randomly chosen parts of Kerala State, in such a way that within five years every part was visited once. The total area under pepper from the population was then multiplied by the inverse of the (sample area/state area) ratio. The question asked was to estimate area on the basis of 560 vines per hectare. The method was applied, asking the same people, to get production estimates. Since 1987 the Department for Economics and Statistics is trying to introduce a more sophisticated system, especially to estimate production. The reason that this method of data gathering is described here is that it gives a plain indication of the quality of data we have to deal with. Especially when it is considered that India is a country with a long history where it comes to organized collection of statistical information. Probably the data on area and production of other countries are not collected in a better way. Consistency of data of other countries could on the other hand even be interpreted as an indication that they were calculated backwards with export figures as a starting point.

Figure 2. Area, production and exports in India



Returning to Indian area, the equation that was estimated does not differ from the one for Brazil. Again, the change in area (in logartithms) is explained from the price of one year ago. While the data for the first part of the sample period are rather poor in quality still the full sample period of 1971-1993 has been used, while applying a dummy for the period 1971-1981 in particular. Comparing the coefficients with Brazil

it is noteworthy that the price-elasticity is much lower (0.09 compared to 0.21). The reason for this may be that vines in India get much older. A large part of the Indian vines stand over 20 years.

When modelling production in terms of the ratio between production and area, one finds an increasing trend, contrary to the case of Brazil. This implies that recent extension to the area are more productive. The fact that the price of last year significantly influences production per hectare illustrates probably two things. Firstly, that the use of manure and better maintenance and perhaps more picking rounds are effective. The higher last year's price the greater the incentive. Secondly farmers keep pepper in stock. If stocks at farm level are not part of production figures it is obvious that when the price goes up and farmers release there stocks it will seem as if production has gone up. The opposite will happen if the price goes down and farmers are reluctant to sell. If this latter explanation would be the most important one it would have been better to take the current year's price as explanatory variable. The years 1985 and 1986 are exceptionally high, while 1984 was very low.

Indian exports depend largely on this year's crop. The other factor is the influence of price changes on stocks of traders. Note that if there is a sudden increase in price the total amount of exports may even exceed production. Again 1985 is exceptional. The same applies for 1991 and 1992 because of the restructuring of the Indian economy.

The resulting equations are shown in Appendix A.

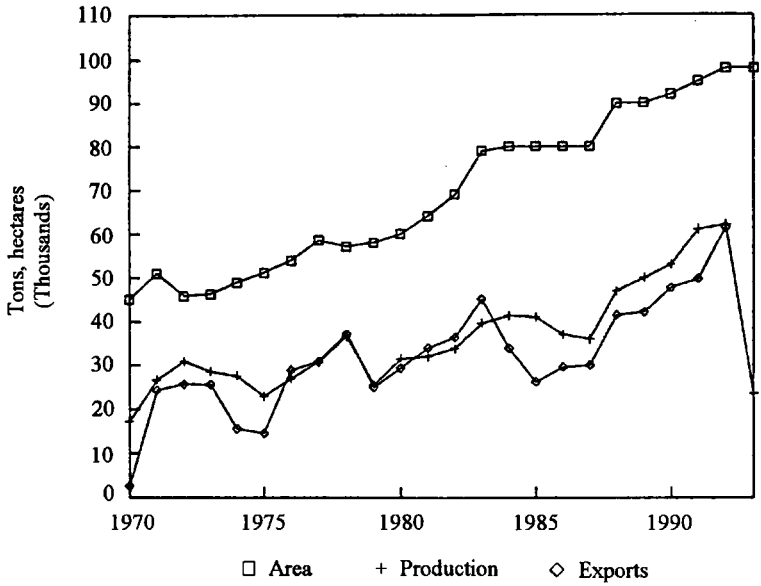
4. Indonesia

Data on aggregate area under pepper in Indonesia are very poor. They are shown in Figure 3. Official records claim that total area did not change from 1983 until 1987. Records for Lampung and Bangka show considerable changes over these years. Unfortunately the time series on area of Lampung and Bangka are still too short. Furthermore there is hardly any information on area in Kalimantan. Regional disaggregation of supply of Indonesia is one of the important items for future modelling research. Especially because of the special position of Bangka where only white pepper is produced. The area equation is again familiar, with prices of three years playing a small role. Other price influences could not be demonstrated. This may partly be a reflection of the reality, partly an indication of the poor quality of the data. Clearing of new land has been important and will continue to be important. Nowadays this clearing of new land predominantly takes place in Kalimantan and Sulawesi.

When looking at production per hectare, the price of 4 years ago performed better than other prices, indicating that for Indonesia the influence of the price on stocks is far less important than on maintenance. This is the same as the conclusion drawn in the case of India.

A very straightforward relation was superimposed on exports. Regression of exports with only production as explanatory variable gave an elasticity of 0.88. Any regression with price or price difference as explanatory variable resulted in a strong

Figure 3. Area, production and exports in Indonesia



negative relation and was therefore rejected. Dummies were applied for 1974, 1975 and 1985 because of unexpectedly low levels of exports.

The resulting equations are presented in Appendix A.

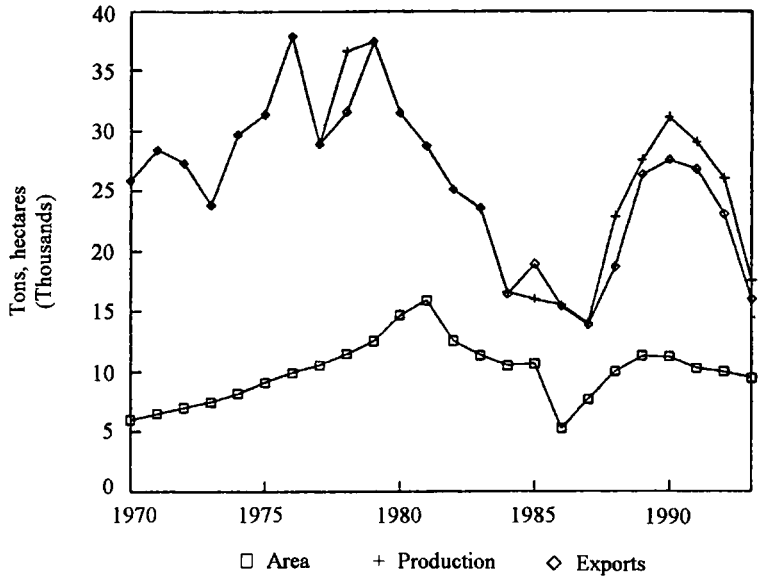
5. Malaysia

When looking at data on area and production in Malaysia (mainly on Sarawak) one immediately becomes aware of the fact that either the data are wrong or yields are extremely volatile (see Figure 4). Sources claim that both is the case. Yields are strongly influenced by foot-rot and data are unreliable as production used to be estimated on the basis of exports, whereas it is well known that the farmers in Sarawak are relatively rich and speculate with pepper as is also done by exporters. So there may be large differences between production and exports from time to time. The area equation performed very well except for 1982 and 1986. A one year lagged price has a very significant influence.

The price of pepper two years ago as independent variable was very significant in explaining production per hectare, although it is clear that this influence should largely materialize through new planting of vines. Of course one would also still expect the one year lagged price to have effect on maintenance and the current price or price change to affect stocks. Speculation was taken into account partly by taking current and last year's production as independent variables in the export equation next to price changes. Again, 1985 was found to be an outlier.

For the equations see Appendix A.

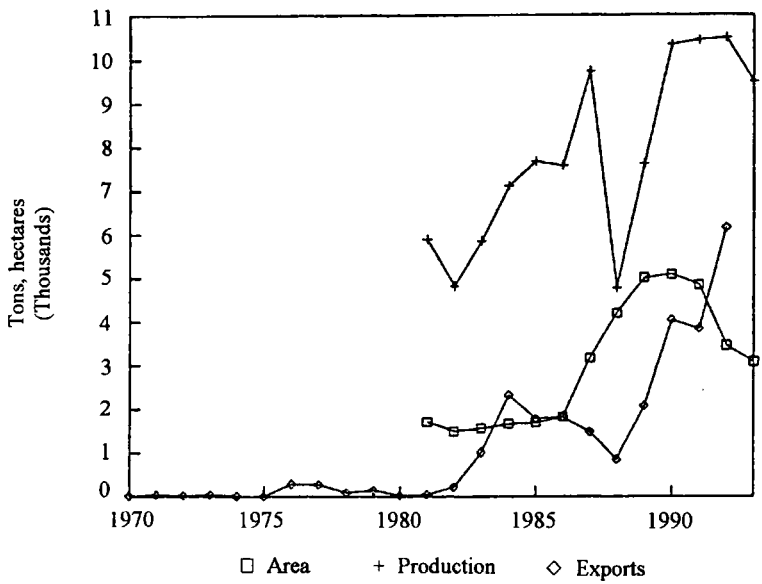
Figure 4. Area, production and exports in Malaysia



6. Thailand

Thailand is a relative newcomer in pepper (see Figure 5). Area was quite steady until 1986, increased strongly afterwards, but dropped again during 1991 to 1993 when prices were low. Changes in area were found to be influenced by prices of last year.

Figure 5. Area, production and exports in Thailand



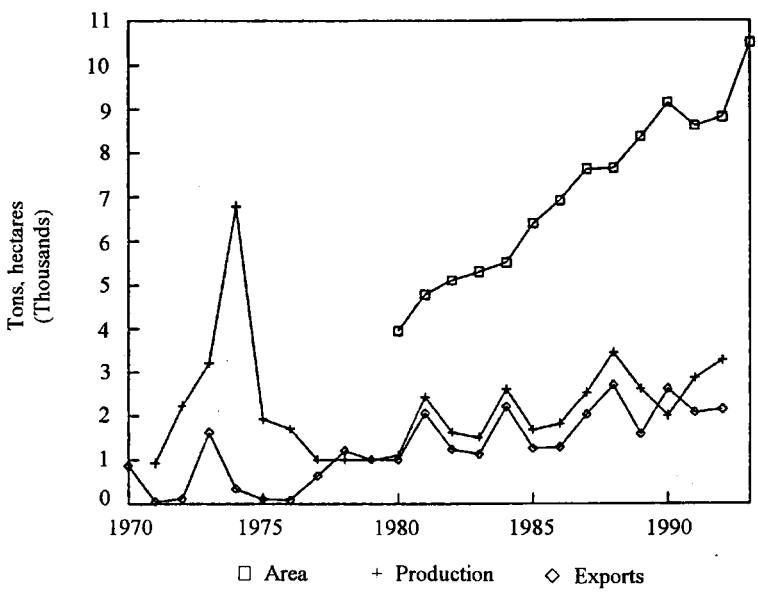
Productivity per hectare is very high, while production is also strongly influenced by prices of four years back. The production figures for 1987 could not be satisfactorily explained by the model. Domestic consumption in Thailand is substantial: around 5,000 tons per year. Exports take a rather fixed share of production, while being affected by a relative surplus or shortage in the previous year.

The equations are shown in Appendix A.

7. Sri Lanka

Sri Lanka is a traditional producer of pepper. Area data show a slight increase over time. We have adjusted the figures for 1986 and 1987, which were around 1 million hectare to high. Productivity is very low and production does not show a significant increase, which is surprising because area is on the increase, requiring new area with a higher productivity. Area has been explained in a straightforward way from a trend term and one-year lagged and two-year lagged prices, while production per hectare can to some extent be seen as a function of three-year lagged prices. Export could be well explained from production, the change in production and the domestic price level. Export in the year 1990 was unexpectedly high.

Figure 6. Area, production and exports in Sri Lanka



8. Other countries

For the other producing countries, i.e. Madagascar, Viet Nam and China graphs on exports are shown in Figures 7 to 9. Only an export equation was estimated or some crude assumption was made. To improve on this, longer time series and information

Figure 7. Exports of Madagascar

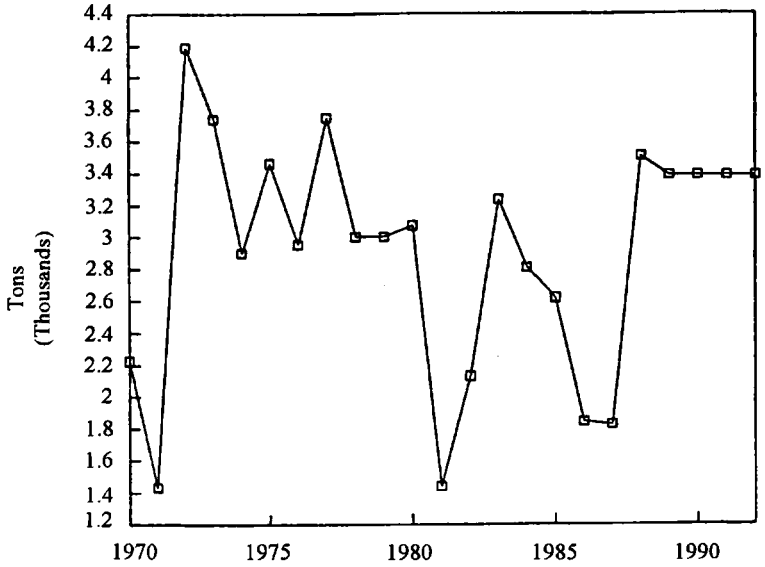
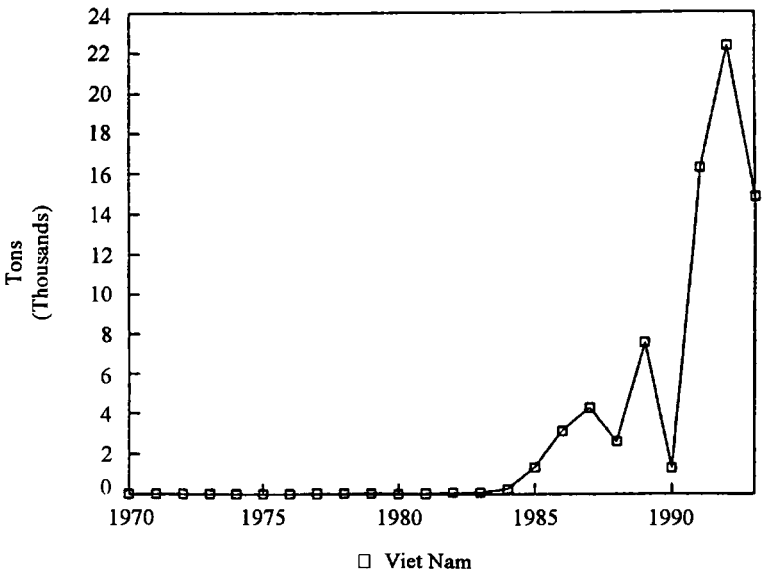
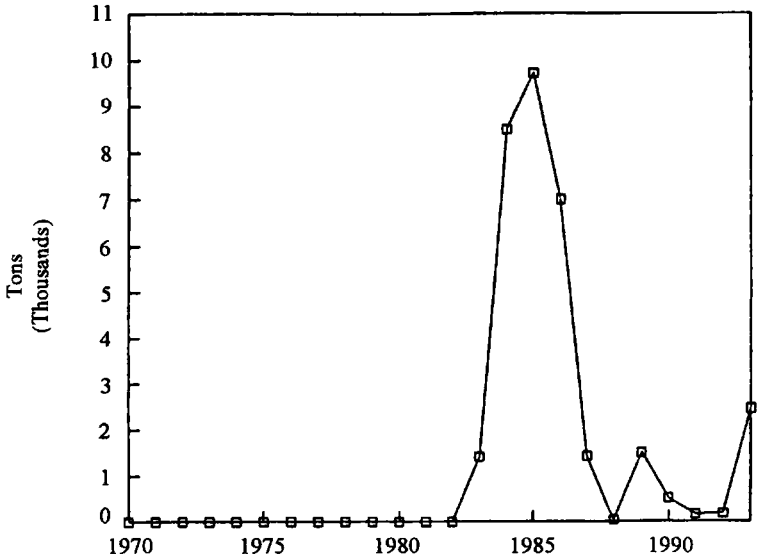


Figure 8. Exports of Viet Nam



on area and production as well as on internal markets and export possibilities are needed. It should be noted that scope for improvement is considerable with respect to this part of the model.

Figure 9. Exports of China



B. Analysis of the pepper economy — the demand side

1. Introduction

Modelling demand for pepper is proposed to be based on imports consisting of consumption and changes in stocks. Lack of data on end-use of pepper forced us to use general variables as income and/or population as explanatory variables for consumption. A more sophisticated modelling approach of demand, including a differentiation of pepper use in food industries, institutional catering and household consumption must be considered almost impossible at the moment as there are only rough estimates of shares available, but nothing on changes in these percentages. More important and useful would it be if the market for black and white pepper could be modelled separately. For this it is only needed that import statistics distinguish them.

As far as aggregation of consuming countries or regions is concerned, the European Community could be taken as one region or as several separate countries or regions; the first option was chosen, although there are marked differences in the development of demand over time, especially between Northern and Southern European countries. The same applies for the other European groupings: The countries united in the European Free Trade Association (EFTA) and Eastern Europe in combination with the CIS. It may be argued that after the falling apart of the communist block in 1989 there is not much reason left to take the CIS and the Eastern European Countries together. However as trade channels have not changed much since and for reasons of consistency in the analysis, they will still be taken together. Only the reunion of the two Germanies

has been incorporated. It should be stressed that pepper consumption will increase in Eastern Europe and the CIS only after political and economic reforms have been successful and income starts to rise. The Middle East, where growth in consumption is high, but imported quantities are still small in absolute terms was treated separately as was China, where, although statistical information is lacking, consumption as well as production is said to increase rapidly. Some other groupings are obvious such as the United States and Canada, Japan, Latin America (except Brazil), Australia and New Zealand and the rest of the world (divided in African and Asian countries).

To estimate data for consumption we used imports as the dependent variable and Gross Domestic Product as independent variable, mostly accompanied by population size. In mathematical terms:

$$mppcxx = f(ypcxx)$$

with $mppcxx$ = import of pepper per capita in region xx
$ypcxx$ = income per capita in region xx

Then follows the resulting estimated, 'normal' level of import as a proxy for consumption:

$$cpxx = nxx * \hat{mppcxx}$$

with $cpxx$ = consumption of pepper in region xx
nxx = population in region xx

The effect of changes in income needs some explanation. In some countries a rise in income leads to more meat consumption as people can afford to buy more and as a result particularly household use of pepper increases. In very rich countries, such as the United States or the countries of the EC a rise in income leads to more outdoor fast and/or ready-made food consumption as well as to a greater variety in food choice, including exotic, spicy dishes. The increase in the use of pepper is concentrated in the institutional catering and food processing. A somewhat different story applies to Japan, where growth of GDP is related to openness of the country and this openness is correlated with changing patterns in food consumption and taste. Here household consumption of pepper and other uses are equally affected.

The estimation of data for changes in stocks was done by deducting consumption as estimated above from import:

$$\Delta zpxx = mpxx - cpxx$$

with $\Delta zpxx$ = changes in stock

To arrive at an equation explaining behaviour of stockholders was not an easy task. We will give comments when discussing the country results whenever necessary basically:

$$\Delta zpxx = f(\Delta rpsny, \Delta zpxx_{-1}, zpxx_{-1}, (xprw - cpw), \text{etc.})$$

with

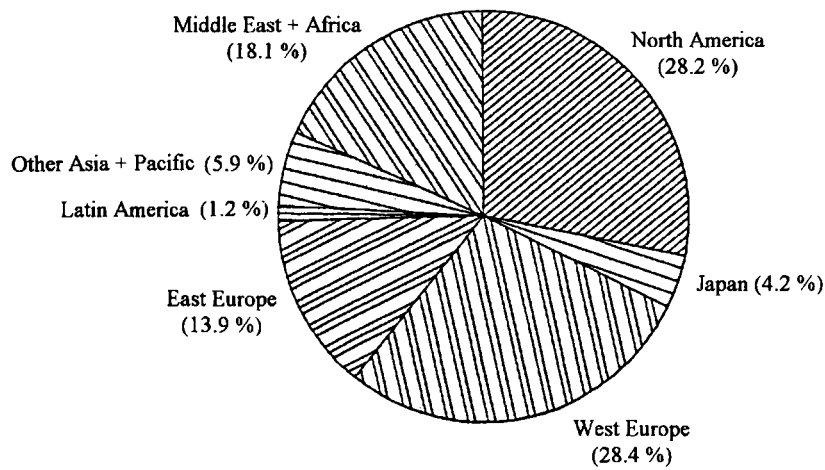
$\Delta rpsny$	=	change in the real price of pepper
$\Delta zpxx_{-1}$	=	changes in stock lagged 1 year
$zpxx_{-1}$	=	level of stock lagged 1 year
xprw-cpw	=	difference between export and consumption in the world

For forecasting consumption the equation used to derive consumption data is used as well. The equation representing the behaviour of stockholders is used to project changes in stocks. Projections of import then result from adding projected changes in stocks to projections of consumption:

$$mpxx = cpxx + \Delta\hat{zp}xx$$

In the following Sections estimation results are discussed by country or region. The international distribution of estimated consumption by region outside the producing countries in 1990 is shown in Figure 10.

Figure 10. 1990 consumption in non-producing countries



2. North America (USA and Canada)

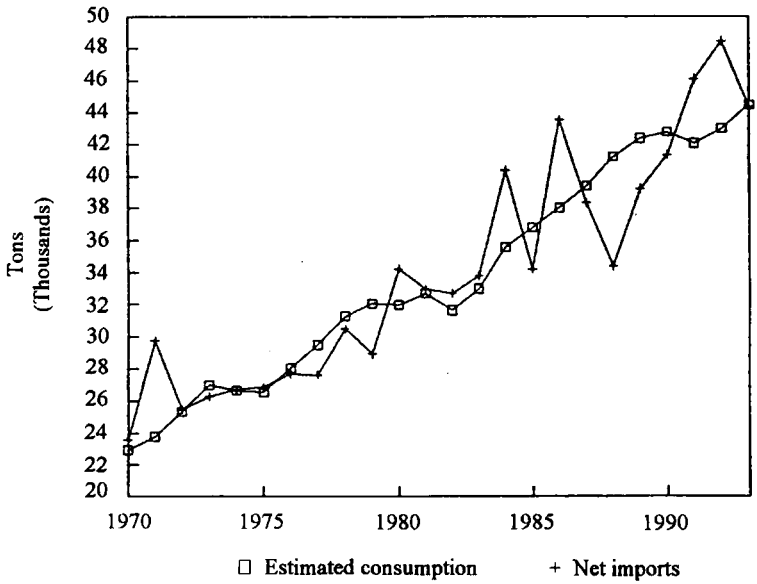
Explaining imports in terms of income is used to estimate data for consumption. Obviously, in view of the purpose of the equation, the regression estimation results are not very good in terms of R^2. The income elasticity is slightly above 1. Figure 11 shows consumption and imports of pepper in North America.

Modelling stocks in North America runs along the standard lines with the starting stocks and the price level as explanatory variables, both with a negative

relationship: if prices are low, traders will keep more stock, expecting prices to increase again some time in the near future, and if stocks were high, traders will tend to sell.

The resulting model for North America is shown in Appendix A.

Figure 11. Net imports and estimated consumption in North America



3. Japan

We mentioned already that demand in Japan depends on GDP in more than one way. A change to more outdoor and ready-made food, in particular Western food goes along with a rising GDP. The income elasticity is somewhat below 1. For a graphic presentation see Figure 12.

For Japan the change in stocks was best modelled similarly to the North America: depending on the level of the price as well as the level of the stock at the end of last year. Again the coefficients are found to be negative as it should be.

The model results are given in Appendix A.

4. Australia and New Zealand

The analysis on consumption is straightforward as in the cases of the previously discussed countries. Again the per capita income elasticity is slightly below 1. Results are shown in Figure 13.

Figure 12. Net imports and estimated consumption in Japan

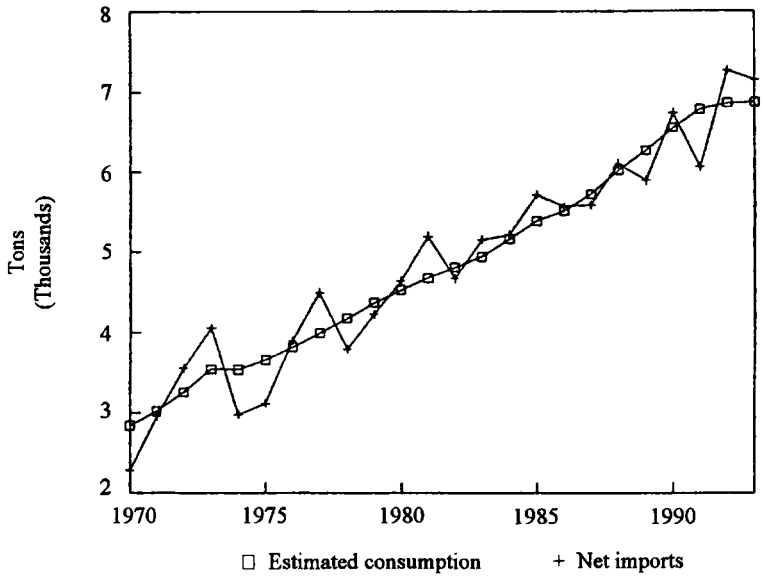
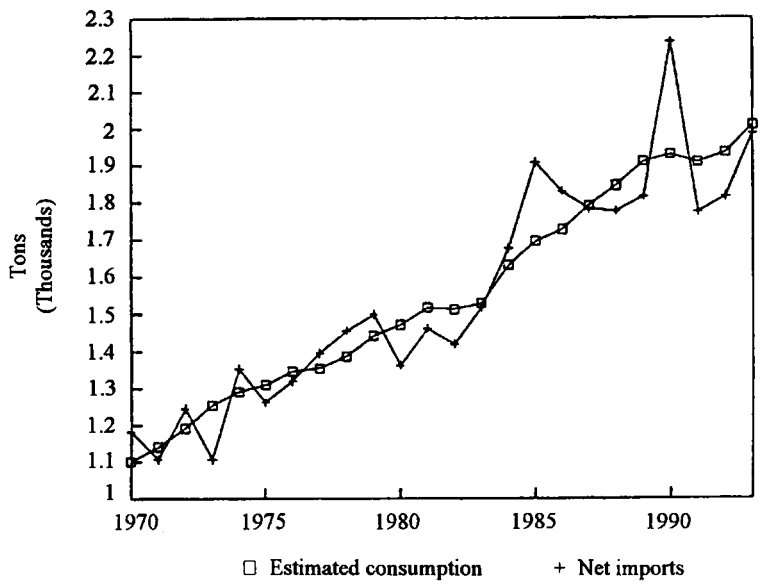


Figure 13. Net imports and estimated consumption in Australia and New Zealand



Regarding modelling stocks, no influence of the price could be found and the lagged stock level did not yield proper results as explanatory variable either. So, stock levels have now in priciple been related to consumption, but a reduced form was taken, using income as explanatory variable.

The equations are presented in Appendix A.

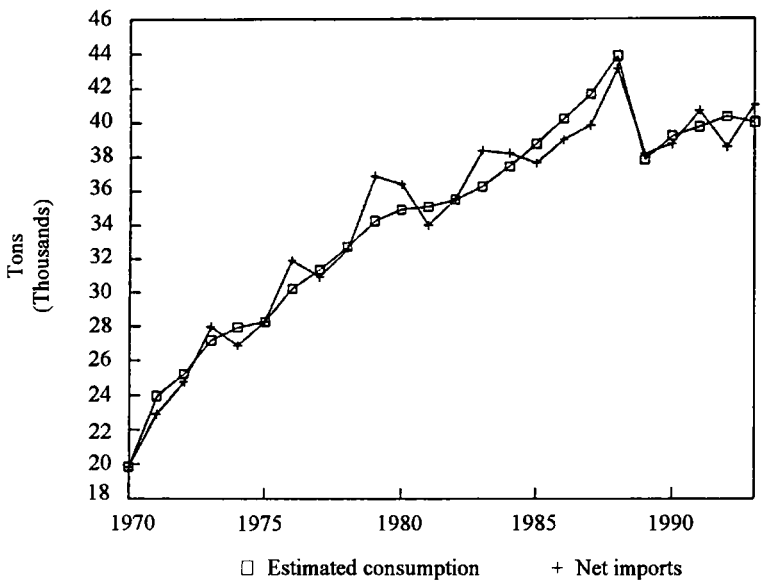
5. European Community (EC)

To get estimates of consumption we started as usual with a regression of per capita imports on per capita income. The income elasticity is very high: 1.38. This will be largely due to a shift in the eating pattern in Europe: more prepared food, more fast food. The results are shown in Figure 14. There appears to be an inconsistency in the data base for which a dummy from 1989 onwards has been included.

Western Europe, as most regions, is price conscious, as far as stock formation is concerned. Also, the level of stocks at the end of the previous year has a reasonably significant influence.

The equations are given in Appendix A.

Figure 14. Net imports and estimated consumption in the European Community



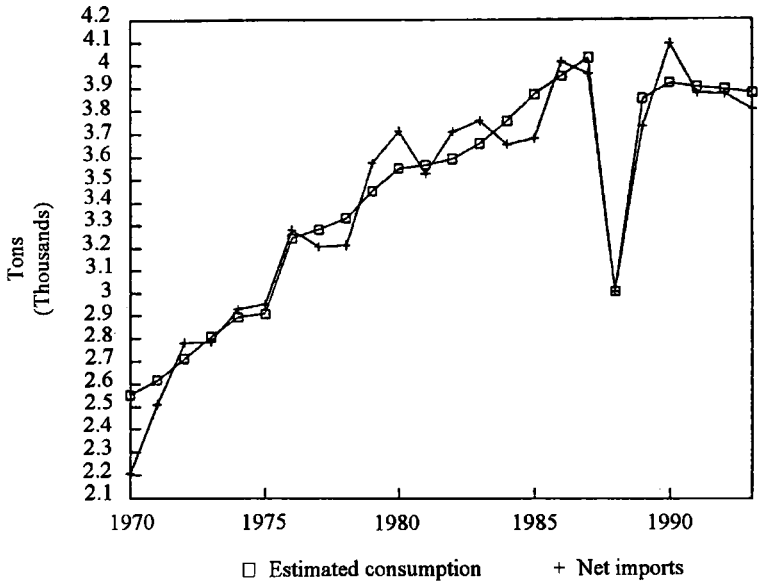
6. Rest of Western Europe, EFTA

From 1988 onwards Switzerland presents import data on pure pepper, whereas until then these figures also included pimento and capsicum. Therefore a dummy variable was introduced for the period 1976-1987. The figure for 1988 was exceptionally low. There may have been some data problems. The final income elasticity is somewhat less than 1. For results see also Figure 15.

Stock formation could be explained reasonably well from changes in the price. Some dummies had to be added.

All model results for are shown in Appendix A.

Figure 15. Net imports and estimated consumption in the Rest of Western Europe; EFTA



7. Eastern Europe and CIS

For Eastern Europe and the CIS estimating the relationship between income and food consumption gave a very income elasticity. Of course, and on top of this, the economic problems have had a devastating effect on imports since 1990, necessitating dummies for 1992 and 1993. For results see also Figure 16.

Stock formation could reasonably well be explained from changes in prices.

The model results for Eastern Europe and the CIS are shown in Appendix A.

8. Latin America

Import of pepper per capita did not show any significant increase. For that reason imports rather than imports per capita were taken as dependent variable and were explained from income. The periods 1976-1980 and 1985-1988 gave significantly lower figures than the rest of the sample period Results are shown in Figure 17.

Explaining stock formation from lagged stocks and prices was reasonably succesful if a dummy for the 1970s was applied.

The equations are presented in Appendix A.

Figure 16. Estimated consumption and estimated imports in Eastern Europe and CIS

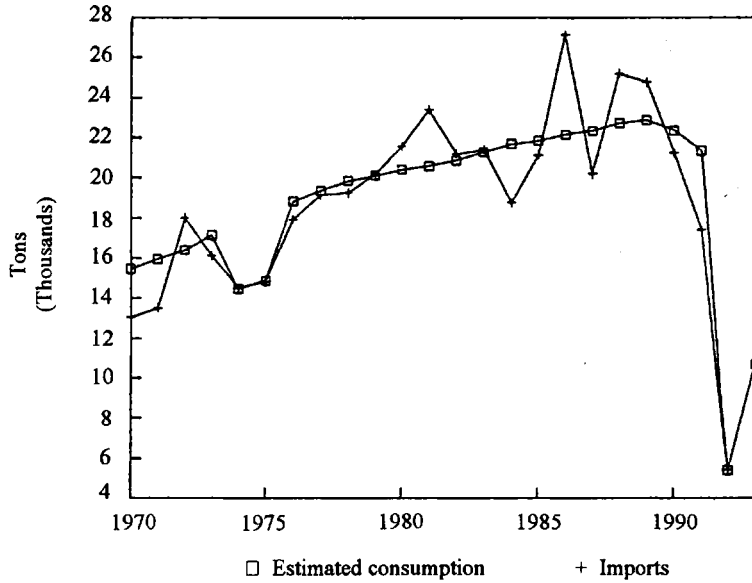
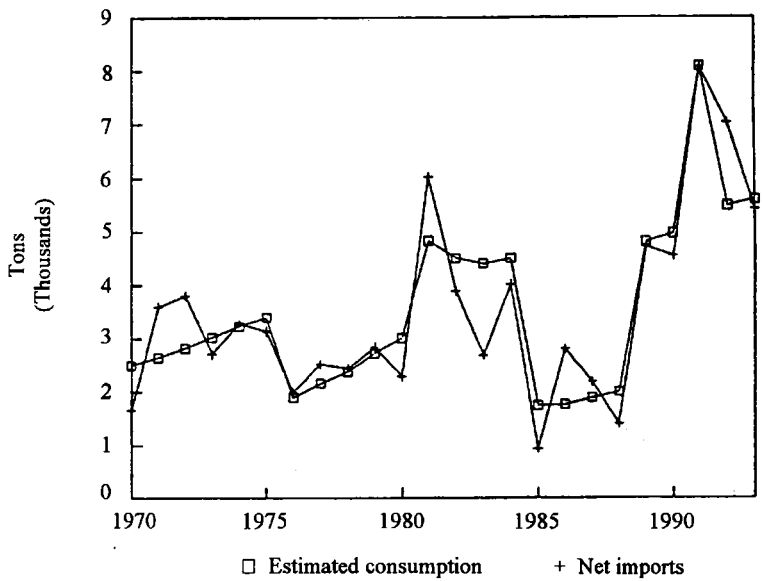


Figure 17. Net imports and estimated consumption in Latin America



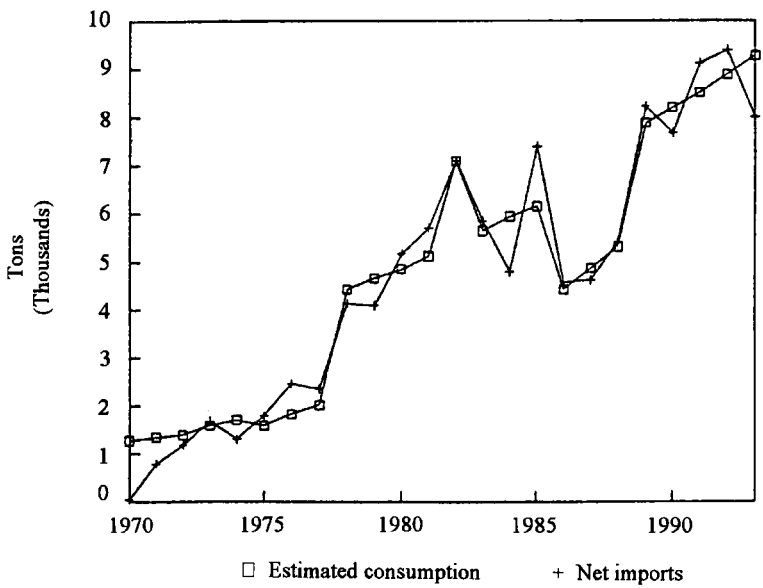
9. Asia and Pacific, excludes China, producing countries, Singapore, Australia and New Zealand

This region excludes China, the other producing countries, Singapore, Australia and New Zealand, because those are treated elsewhere. The import/consumption equation could best be estimated without transforming the variables to logarithms. Apparently there have been shifts in the data, which have been accommodated in the analysis by including dummies for the periods 1970-1977 and 1986-1988. Results are shown in Figure 18.

Regarding modelling stocks, some influence of the level of the price and of lagged stocks could be found. For three years a dummy had to be added.

The equations are presented in Appendix A.

Figure 18. Net imports and estimated consumption in Other Asia and Pacific



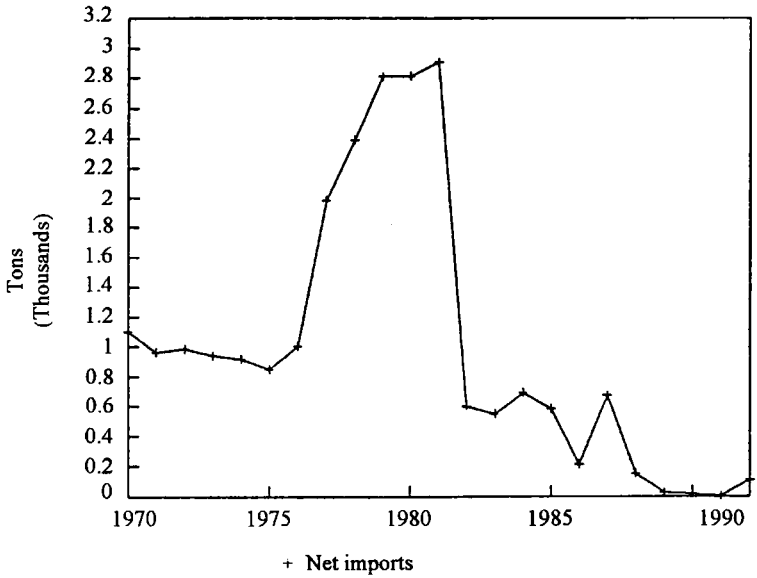
10. China

China was a small importer with rather high levels in the latter part of the 1970s. Imports have now dwindled and are not anticipated for the future. The picture is shown in Figure 19.

11. Middle East and North Africa

The import figures for this region are somewhat irregular as can be seen from Figure 20. No transformation to import and income per capita was made, because

Figure 19. Net imports in China



of the quality of the estimation results of imports per capita. For the model for this region a dummy was introduced for the years 1980-1983 and for the years 1991-1992. Results are shown in Figure 20.

Stock formation was influenced by price changes. However, this equation also needed a number of dummy variables.

The equations are presented in Appendix A.

12. Rest of Africa

Import of pepper per capita did not show any significant increase as was the case in Latin America. Therefore imports rather than imports per capita were taken as dependent variable and were explained from income. The period 1990-1992 gave significantly higher figures than the rest of the sample period. Results are shown in Figure 21.

Stock formation could again be explained from price changes after adding dummies.

The equations are presented in Appendix A.

Figure 20. Net imports and estimated consumption in the Middle East and North Africa

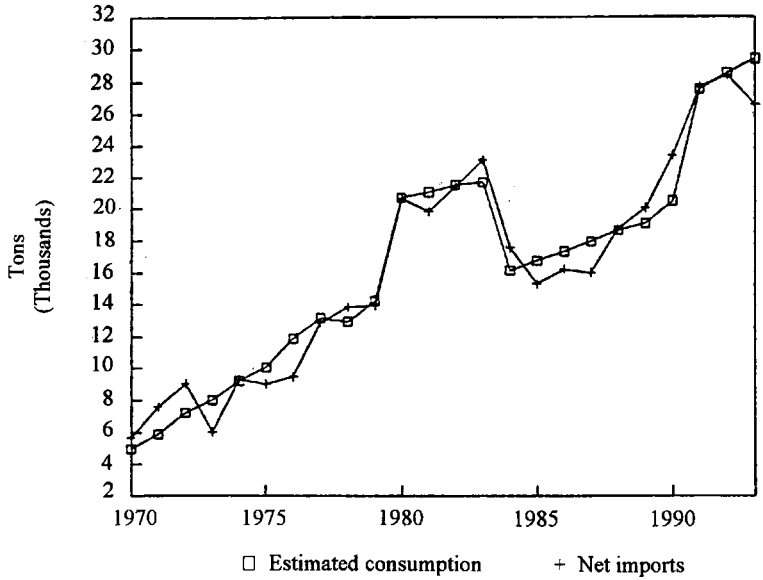
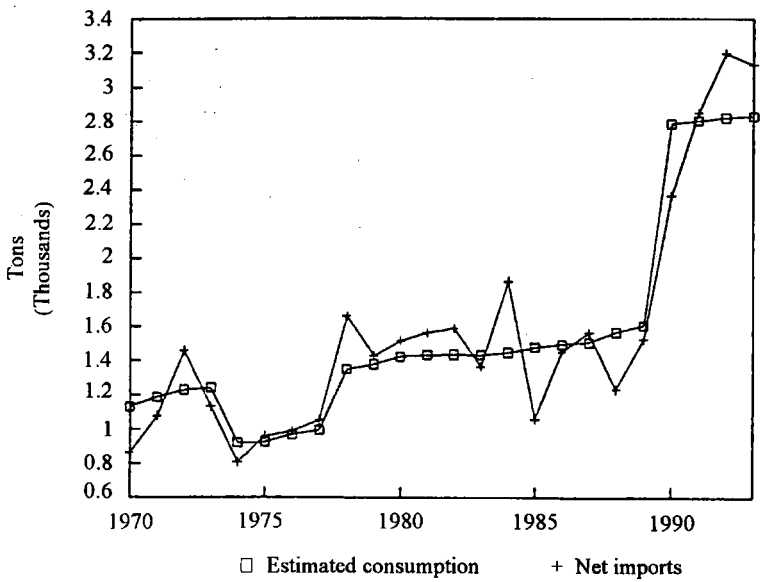


Figure 21. Net imports and estimated consumption in the Rest of Africa



C. The world market, prices and equilibrium

1. Introduction

The focus of this Section is on the determination of local prices and world market prices as they result from the required balance between demand and supply. First some remarks are made about the position of Singapore especially in relation to data. Then a review is given on the relationships between local prices in domestic currencies and world market prices. Finally the chosen world market price is discussed and the development in and explanation of such a price is elaborated upon.

2. Singapore

More needs to be said about the special position of Singapore as an entrepot for pepper and its consequences. We explain in Section G why and how we adjusted the data as import and export statistics revealed that exports exceeded imports by an average 10,000 tons a year. Although the importance of Singapore for Malaysia is decreasing, it is still important. We therefore used gross exports from Malaysia as independent variable. The estimation indicates that 69 per cent of Malaysian pepper exports is shipped via Singapore. This could be slightly over-estimated especially for the future, as it is the concrete policy of the Pepper Marketing Board to encourage direct trade. The function of Singapore as an entrepot is accounted for by the variable total exports of producing countries minus estimated world consumption, which is merely our estimate of the change of stocks outside producing countries. Singapore is expected to import part of these stocks and keep the major part of it as carry over stocks. This is reflected by the negative sign in the export equation. Some part of pepper imports are of course consumed, but no statistics of pepper consumption in Singapore are available. If we assume that the change in stocks outside the producing countries has an expected value of zero, i.e. positive and negative changes balance, then consumption would be approximately 1 per cent of imports. Finally, the significance of the price indicates that presumably pepper traders are more interested in trade if prices are high, which does not seem unrealistic as margins will probably be correlated with the height of the price. The above has resulted in the model as presented in Appendix A.

3. Local prices

About the determination of local prices we can be relatively brief. To model the differences in f.o.b. prices and prices in final markets correctly one would have to look at costs of freight and insurance. The precision of an exercise like that would however be in sharp contrast with the crudeness of the rest of the model and add little to the accuracy of price forecasts and simulation results. In our modelling exercise we have chosen to take a constant relationship between the price in New York and the price in a producing country converted into $US (see Figures 22 and 23). For reasons of comparison we took only black pepper prices. For the producing countries this resulted in the regression equations presented in Appendix A.

Figure 22. Pepper prices, f.o.b. New York, Malaysia, Indonesia, Thailand

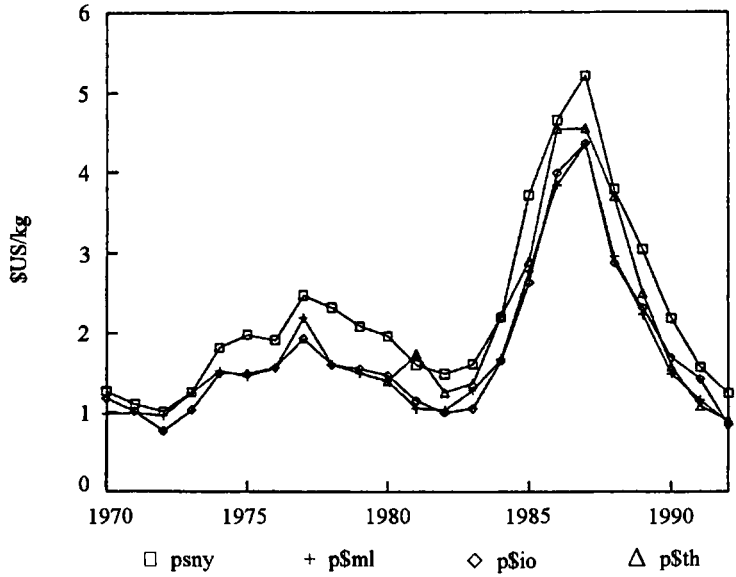
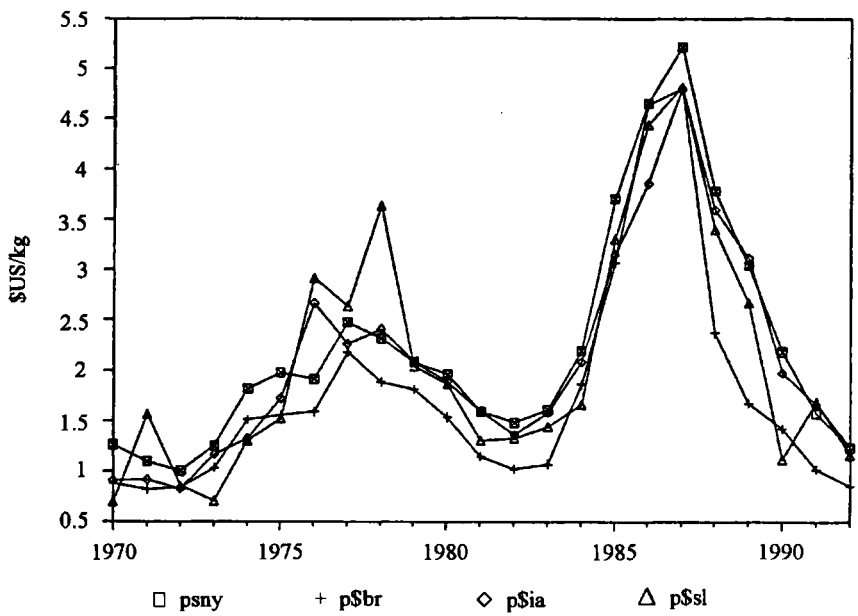


Figure 23. Pepper prices, f.o.b. New York, Brazil, India, Sri Lanka



Along with these some definitions of other prices are given, that are straightforward and take account of inflation and depreciation effects. These prices are used as explanatory variables in area and supply equations in the producing countries.

4. Equilibrium on the market

The model assumes that prices are determined as resulting from equilibrium between demand and supply. So the model is solved by deriving a level of the price that clears the market. The clearing price is the real price of pepper in New York. The model is therefore closed with the following *identities*:

$$mpw = xpw$$

where

mpw = total world net imports
xpw = total world net exports

D. Projections of the pepper economy

1. Introduction

It is the purpose of this Section to draw a picture of the future of the pepper economy using the model that was presented in Sections A to C. Thereby a reference scenario is developed, which will be discussed in the next Sub-Section. Afterwards, in Sub-Section 3, projections of supply are followed by projections of demand in Sub-Section 4.

2. Standard scenario: the outlook for pepper prices to the year 2020

Before embarking on the presentation of figures for likely future developments, it needs to be stressed again, that the results in this Section in some cases would benefit from a more solid database. In interaction with country experts and using additional data, improvements are expected to be possible. One of the aspects not yet sufficiently captured is for example the size of the Indian supply responses to price fluctuations. For all countries the investment side is not yet represented adequately for long-term analyses. Stock formation at various levels need further work as well. In this way a list of necessary activities can be formulated, depending of the concrete policy question at hand: an investment policy question requires elaboration in a different direction than a question about the feasibility of a buffer stock. Nevertheless, the projected figures are likely to have been accurate predictions or at least accurate indicators of moments and directions of changes.

Two earlier sets of projections were derived. The first one in late 1990 was presented in a paper called *Modelling the pepper market* to the International Workshop on "Cooperation among the IPC member countries in the development and use of a computer simulation model for forecasting supply, demand and prices of pepper", Jakarta, 12-21 March 1991. At that time our projections indicated a slight recovery in prices in 1991, compared to 1990. Unfortunately, the recession took longer than expected, especially in Eastern Europe and the CIS.

In a paper *The pepper economy — present and future* — prepared for the International Workshop on the Progress and Development in the Control of Pepper Diseases in the Producing Countries, Lampung, Indonesia, 3-5 December 1991, the forecasts were based on the same model but including all available new information and data. The model indeed projects lower prices in 1991 but higher prices especially in 1993. This has materialized. All this refers to real prices, obtained as nominal prices deflated with a price index.

We are now in a position to make projections of the pepper economy incorporating to the extent possible the 1992 and 1993 information into the model described above. No information on 1994 is available. The figures for 1994 therefore are model estimates and not data. When using a model for the purpose of making projections it is necessary do make assumption regarding variables which are not explained by the model. This is especially the case for two categories of variables:

(a) Developments in population and income (GDP) per country or region, and

(b) Developments in exports by those countries which are not covered in detail by the current model, notably Viet Nam, China and Madagascar.

The following assumptions have been made.

Regarding population the database of the ESI on population forecasts has been used; this database is slightly adjusted from projections by the United Nations and the World Bank. For projections of GDP a model is available at the ESI. This model as well as the projections for population and GDP are given in Appendix B.

Projections for exports from Viet Nam and China this could not as yet be derived nicely from the data since these countries have only recently become more outward looking. Viet Nam and China are assumed to increase exports along the lines of the model structure for Thailand. The assumed model is given in Appendix A.

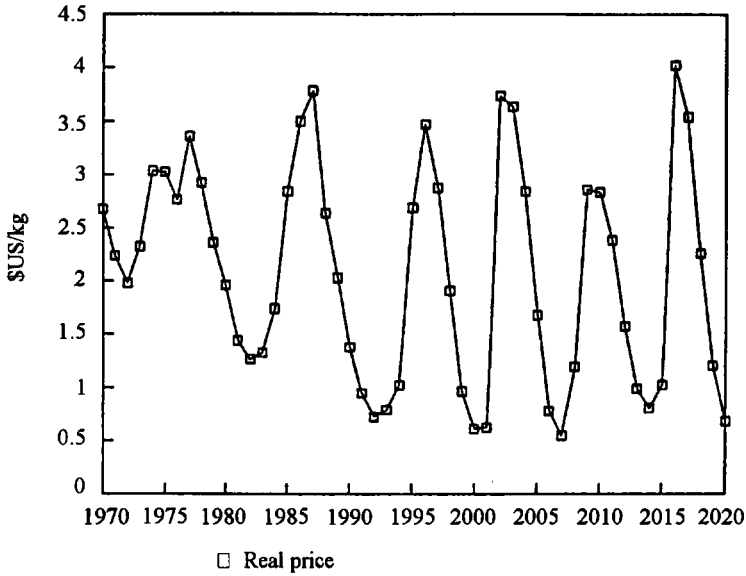
This completes the major assumptions apart from some standard forecasts about exchange rates and deflation.

In this Section only price forecasts are given. The following two Sub-Sections concentrate on supply and demand respectively. Figure 24 shows the price projection. It can be concluded that the model projects the price cycles of around 7 years to continue in future and that there will not be a slight increase in average real prices. Obviously, with inflation of about 4 per cent per year, nominal prices do increase on average.

3. Projections of supply

Projections for the six major producing countries for which a model was developed for area, production and exports results are shown in Figures 25 to 30. For the three countries China, Viet Nam and Madagascar, for which simple equations were postulated, the projections are shown in Figures 31 to 32. Brazil shows a modest increase on

Figure 24. Price simulation of spot price Lampung black in New York



average, while India and Indonesia show a strong growth. The same conclusion, although somewhat unexpectedly, results for Malaysia. Thailand will increase strongly and then level off somewhat, while Sri Lanka is expected to decrease, largely because of a decrease in area. Exports from China are rather modest, while Viet Nam is assumed to export around 35 thousand tons in the years to come. Exports from Madagascar are expected to be steady.

Figure 25. Area, production and exports in Brazil

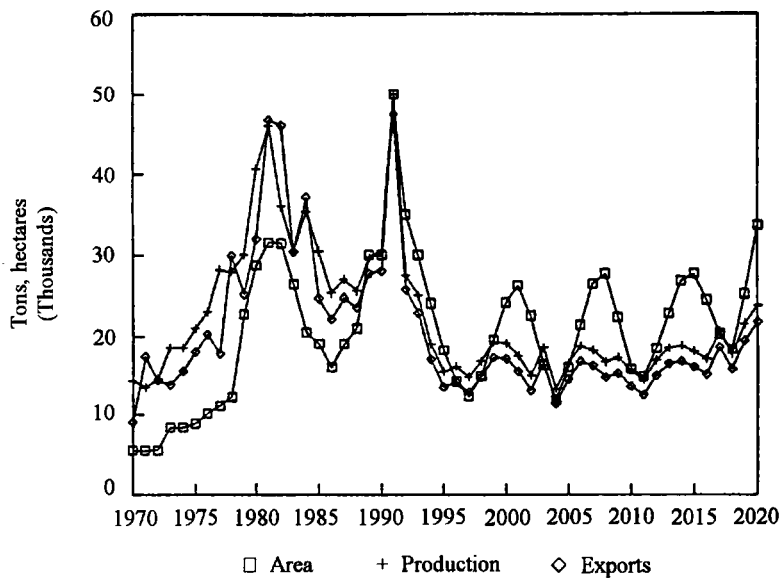


Figure 26. Area, production and exports in India

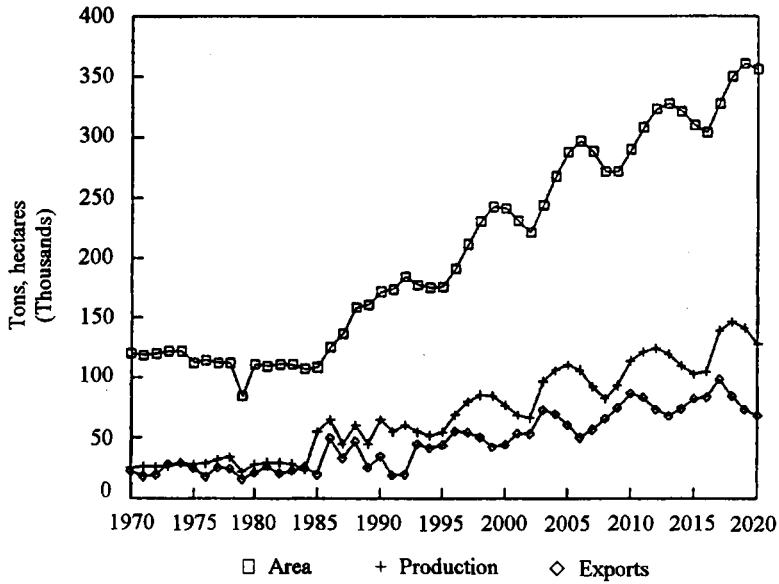


Figure 27. Area, production and exports in Indonesia

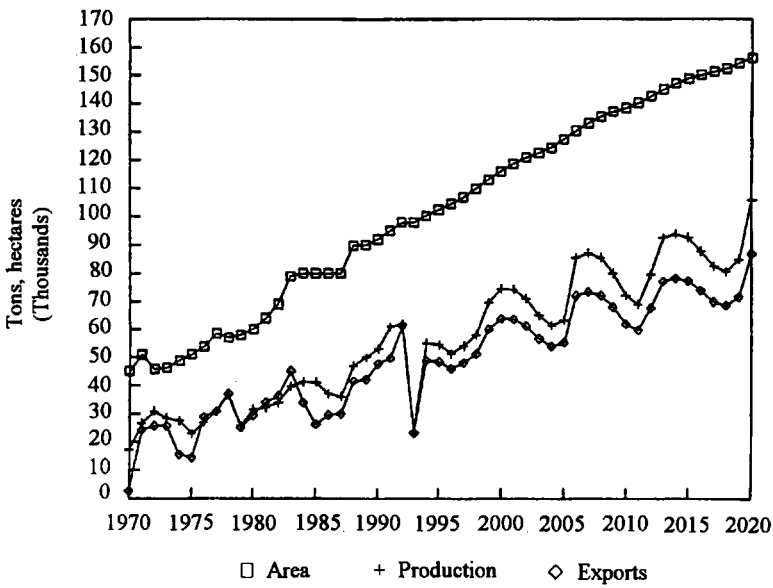


Figure 28. Area, production and exports in Malaysia

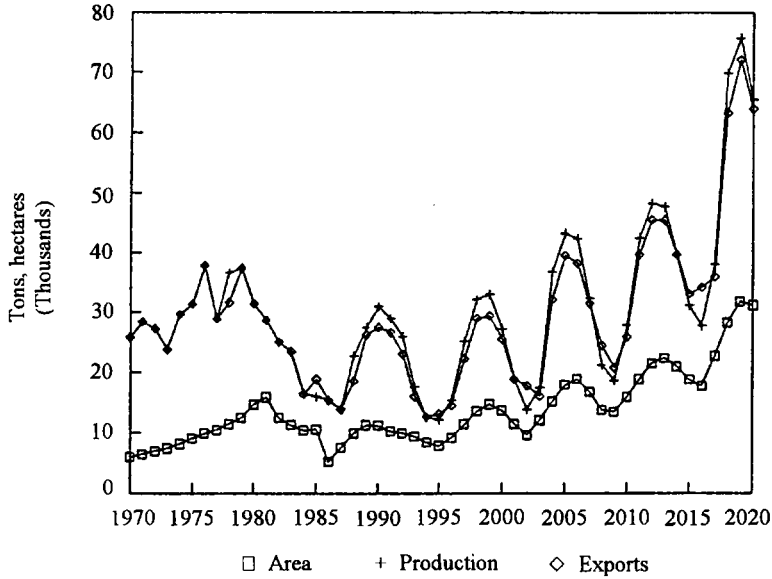


Figure 29. Area, production and exports in Thailand

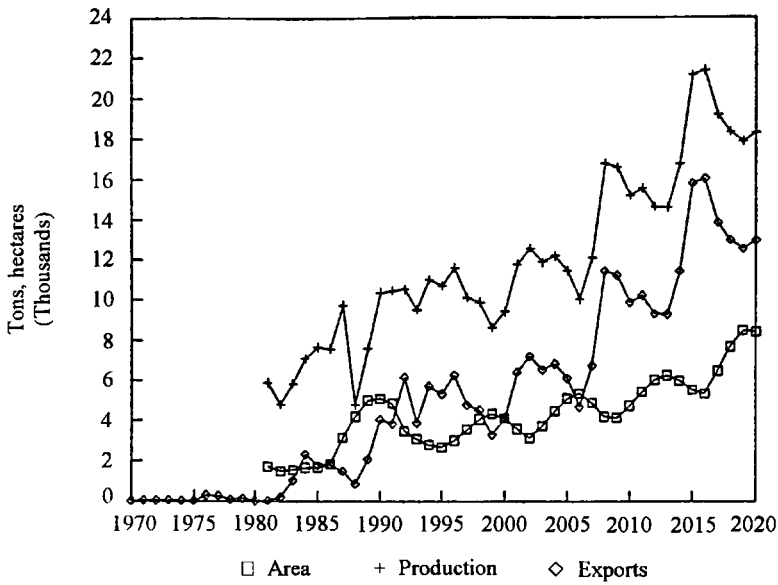


Figure 30. Area, production and exports in Sri Lanka

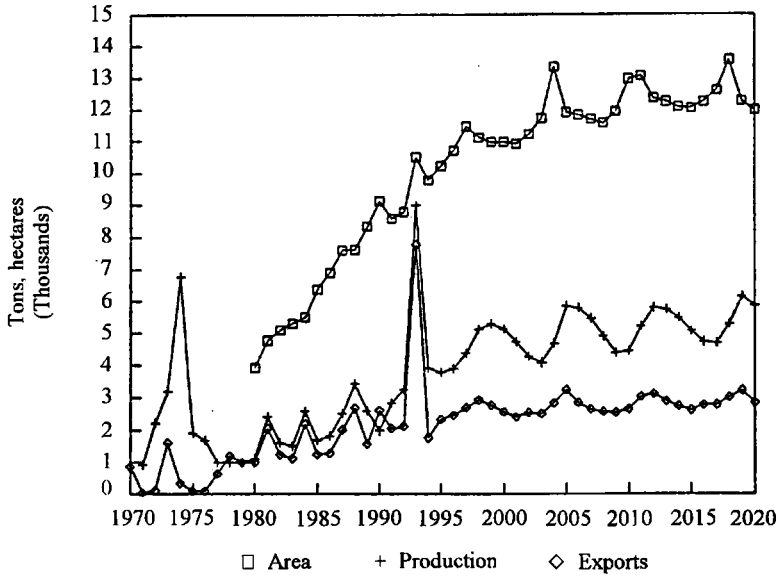


Figure 31. Exports of China

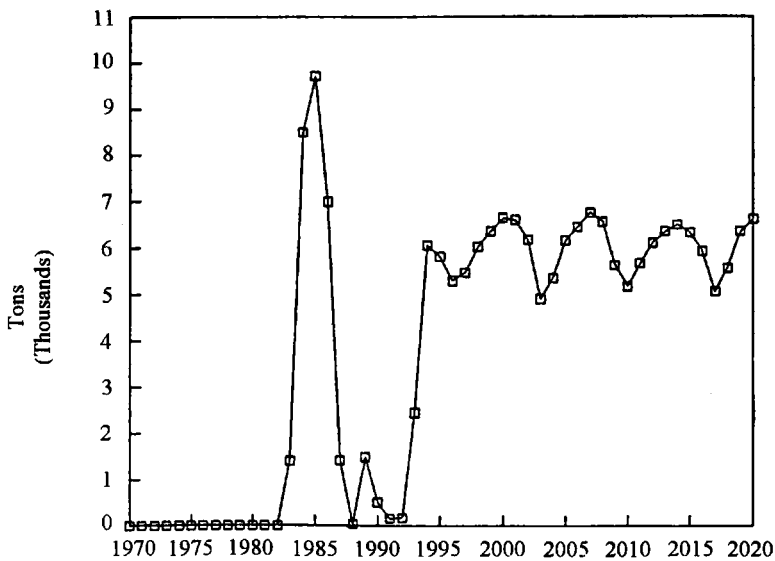


Figure 32. Exports of Viet Nam

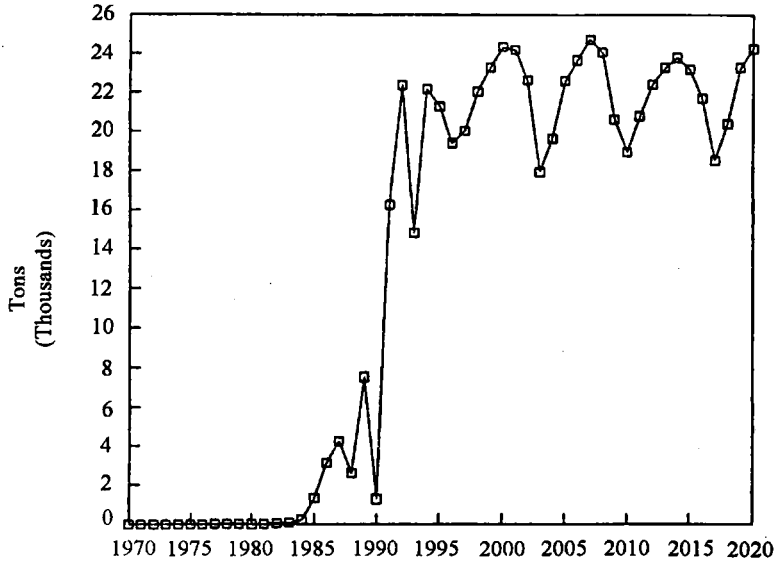
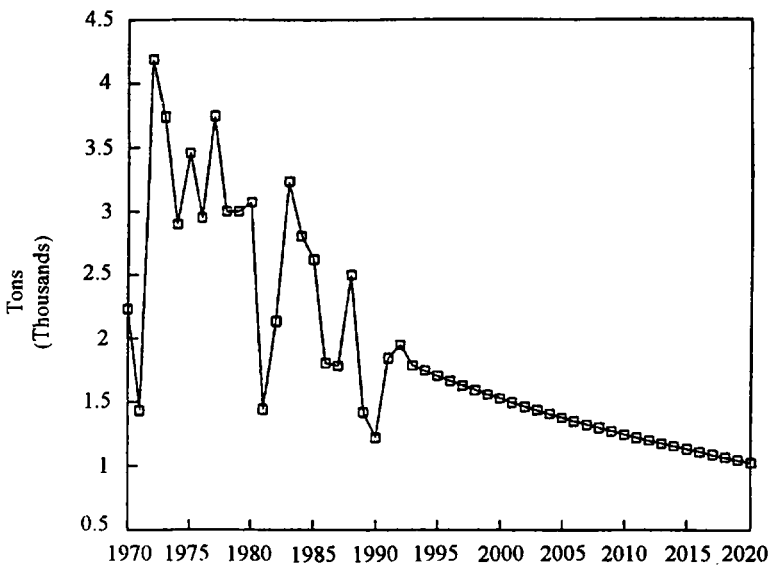


Figure 33. Exports of Madagascar



4. Projections of demand

On the consumption side results for five regions are depicted: the EC, North America and Japan show a steady growth (Figures 34 to 36). Important are developments in Eastern Europe (Figure 37) and upcoming Other Asia and the Pacific, (Figure 38) which will be a major consumer in a few decades. Figure 39 shows the result for a major consuming area, the Middle East and North Africa.

Figure 34. Consumption and imports in North America

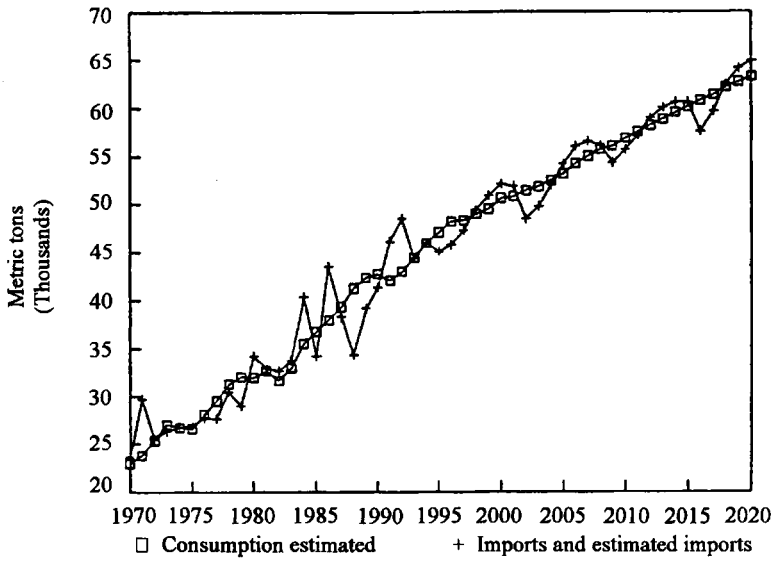


Figure 35. Consumption and imports in Japan

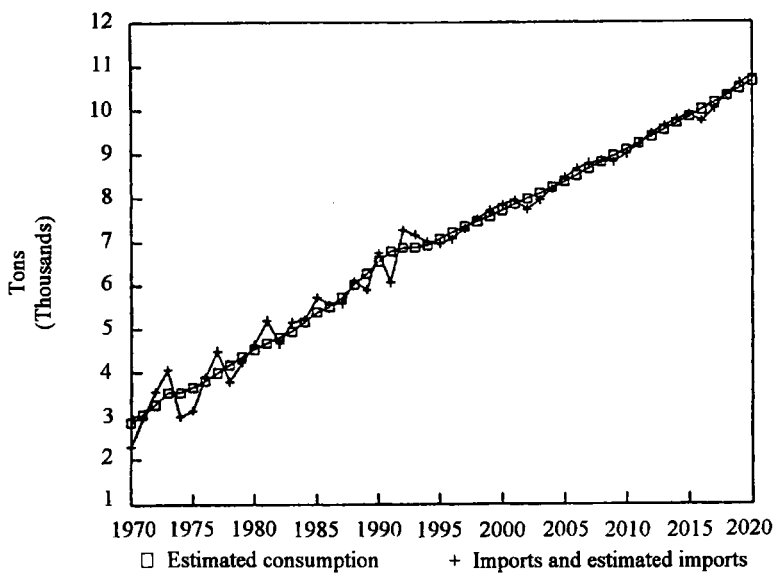


Figure 36. Consumption and imports in the European Community

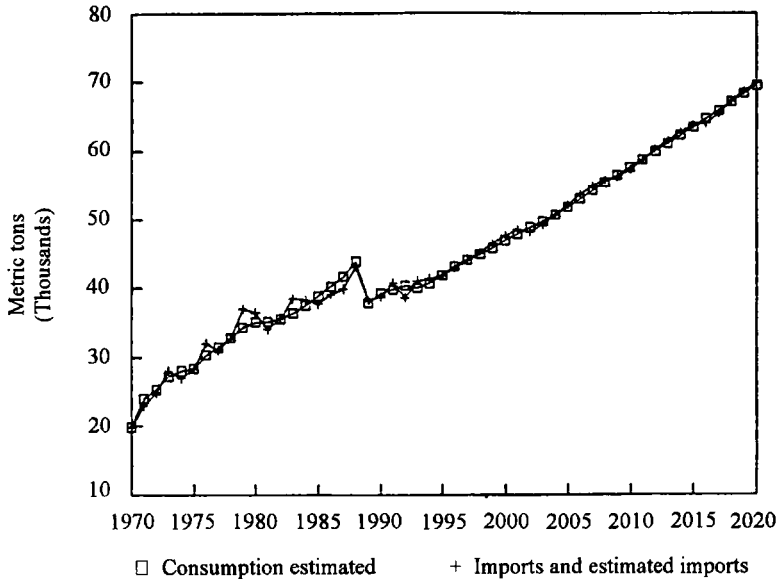


Figure 37. Consumption and imports in Eastern Europe and CIS

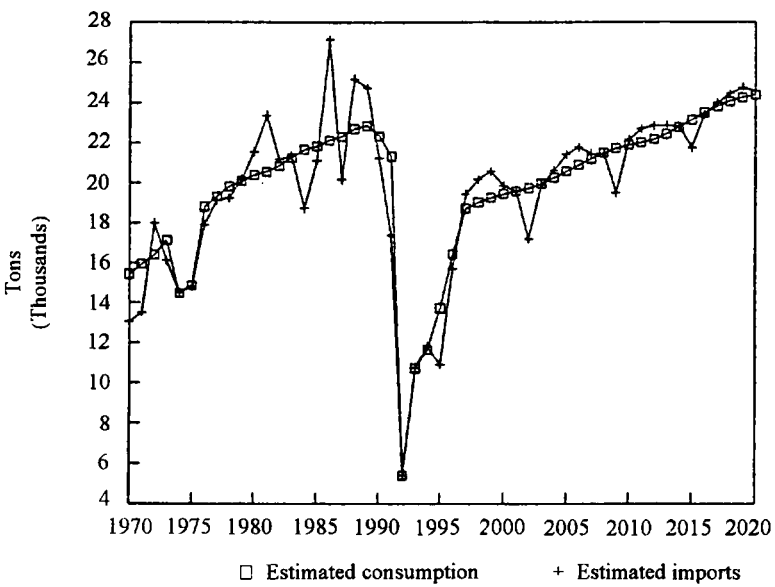


Figure 38. Consumption and imports in Other Asia and Pacific

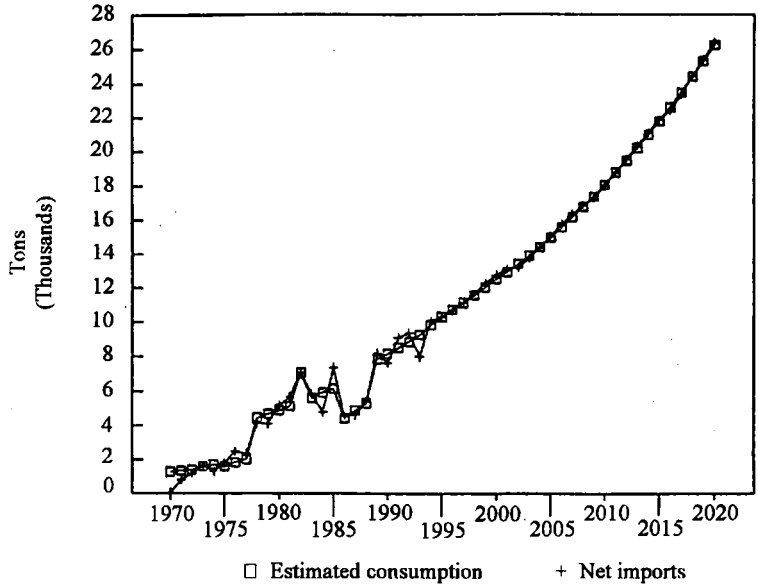
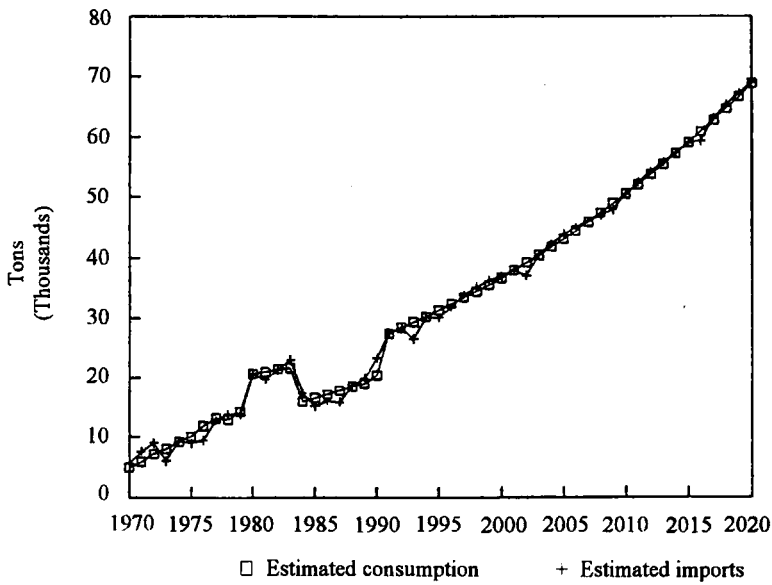


Figure 39. Consumption and imports in the Middle East and North Africa



E. Selected supply management measures

1. Introduction

Pepper typically is a crop with periods of surpluses and periods of shortages. By and large, prices have secured a balance between demand and supply. In this connection one has to take into account that a particular feature of pepper is that consumption is not price sensitive and that demand is only price sensitive to the extent that inventory demand is price sensitive (see Section B). This implies that on the demand side price only plays a role in the very short term. The more structural medium- to long-term balance between demand and supply through prices has to come from the supply side. Prices in the past have been quite volatile (see Section C) and are likely to be so in future (see Section D).

The objective of this Section and the following one is to indicate ways and means to smoothen the troughs and thereby most likely the peaks. In this Section we review supply management measures in a verbal way indicating what kind of measures might serve certain objectives. In the following Section we will indicate how the selected supply management measure(s) would work out in the pepper economy, using the model of Sections A to C. This is followed by some remarks on to what extent the existing model is capable of assessing the impact of the various supply management measures and in which ways the modelling analysis has to be extended and additional information has to be collected.

It is interesting to note that after the collapse of the International Cocoa Agreement, a new agreement is being worked out. This basically implies that producers have to implement a production management plan and that consumers have to encourage the expansion of cocoa consumption in their own countries. Each group has to work together in respectively a Production Committee and a Consumption Committee. The text of the articles relevant to producers are attached in Appendix C. Only in vague terms is reference made to a production management plan, to be drawn up by the producing countries, designed to achieve a lasting equilibrium between world production and consumption. What is mentioned in detail is that:

— The Committee shall fix indicative figures for annual levels of global production necessary to achieve and maintain equilibrium between supply and demand in accordance with the aims of the Agreement;

— The Committee shall adopt annual forecasts of world production and consumption for a period corresponding at least to the lifetime of the Agreement, to be reviewed and revised every year;

— The exporting Members shall as a group implement the production-management plan in order to achieve global equilibrium between supply and demand in the medium and long term;

— Each exporting Member shall draw up a programme for the adjustment of its production enabling the objectives set in this article to be achieved; and

— To facilitate the evaluation of world cocoa stocks and to ensure greater transparency of the market, Members shall provide the Executive Director, by not later than the end of May of each year, with information to which they have access on stocks of cocoa as at the end of the previous cocoa year held in their respective countries.

We will come back to this in Section H for the case of pepper.

2. Planting policies

Supply management through planting policies include all kind of measures aiming at influencing planting, diversification, replanting and rehabilitation. The objective is to directly or indirectly affect the investment decisions of farmers in such a way that supply reaches the target levels. Such target levels in turn can be derived from what producers see as the levels at which attractive prices are to be obtained.

For a crop like pepper planting policies should best be counter-cyclical: when prices are low, replanting, and perhaps some newplanting, should be stimulated so that current supply is reduced and prices are somewhat alleviated. This will then lead to more pepper available in times of high prices. Such high prices would then be somewhat lower, reducing the eagerness of new or existing farmers to heavily invest in pepper and then only have the vines bearing fruit when prices have become low again. The suggestions in this paragraph only refer to the case where in the medium- to long-term shortages and surpluses will even out.

In case of structural medium- to long-term surpluses other measures have to be taken. Very often low prices are enough to make farmers move to other crops. However, a discouragement of pepper planting can only be successful if there are alternative crops. Diversification measures through subsidizing and stimulating other crops seem to be the best way to reduce pepper planting. In countries where the life cycle of pepper vines is short, e.g. Malaysia and Brazil, the effects will be larger than in India and Lampung, where an investment decision involves the next ten to twenty years. However in India and Lampung there seem to be more alternative crops. If no alternative crops seem viable, one may resort to replanting with better yielding crops.

In many cases national policies are undertaken in the field of planting, diversification, replanting and rehabilitation. These are domestic policies taking the world as given. In order to optimize the aggregate of all national policies, since they do influence the world substantially, international coordination of stimulation or reduction programmes is needed. This is first to avoid overshooting (stimulation in all producing countries could easily lead to oversupply) and secondly to make sure prices will not reach such a high level because of low supply that other countries will take up production and enter the market. There seems to be little reason to fear for substitution on the

demand side at high price levels, although some irreversible loss could be the result of the development of new spice mixtures (only partly consisting of pepper) as an alternative for pepper.

The model presented in Sections A to C could be employed in a first attempt to evaluate the above supply management measures. However, it is not yet elaborate enough to adequately simulate the effects of planting policies. Developing the model in such a way that it can be used for this purpose is one of the most important recommendations for further work. This will also be discussed in Section G.

3. Production policies

Production policies in this Section refer to such supply management schemes, where production is influenced, with influencing investment. In case of pepper, this would mean to accept that the vines are there in a certain year and production in that year should be enhanced or reduced.

The production of first grade qualities of pepper depends not only on the number of vines and the weather. The amount of inputs, like the time spent on weeding, pruning, etc. and taking care of ill vines to prevent a spread of disease as well as the amount of fertilizer and pesticide is very important and so is the number of pickings in the harvest time. Especially to farmers with different crops or with alternatives to earn a living, the allocation of time and money will be an optimization process. This will add to stability, as inputs will be higher when pepper prices are higher and vice versa. The only possible way of supply management seems to be to influence credit facilities and/or the price of fertilizer as instruments. This will, however, not only affect pepper production, but agricultural production in general and hence cannot be regarded as an easy policy option. We will therefore not pay any further attention to this method of supply management.

4. Minimum export price

The concept of a minimum export price (m.e.p.) is a simple one. If all exporters stick to a minimum price and do not sell below that price, they can effectively avoid a drop in prices. However, because the internationally arranged minimum export price is likely to become effective only in times of oversupply, stocks in producing countries will grow. This then leads to the same choices that had to be made in the case of export quotas; either no regulated stocks in combination with lower farm prices and an incentive for smuggling and avoidance of the m.e.p. or regulated stock keeping with the problems mentioned in the above paragraph to be solved. Commodities for which the price elasticity of demand is low are most suitable for m.e.p. schemes as for these a small difference between supply and demand can result in a large fall in prices.

Pepper is a commodity where the price elasticity of consumption is 0 and where the price elasticity of demand only refers to (speculative) inventory demand (see Section B). Pepper therefore seems excellent to benefit from m.e.p. schemes and for a couple of years there was a minimum price, set by the IPC at the regular Pepper Exporters' Meetings. However, these arrangements failed to be effective, because it was to easy for exporters to avoid the m.e.p.. Again the message is that m.e.p. schemes need to be combined with supportive planting and production management and planning.

5. Export quotas

A system of export quota implies that on a world basis for each period (year, quarter etc.) the level of export is determined (negotiated) in a meeting attended by all participating exporting countries. This may be split into various types or grades. Each country is then obliged not to export more than the quantity allowed. There may be a possibility that the quotas are also formulated in terms of to which countries to export.

There is a great number of problems, of which we shall mention a few. The first problem is that a model is required with reasonable accuracy, built on reasonably accurate database, forecasting the situation on the market in the period ahead, and capable of assessing what the effect on demand and price will be if export quota are set at a certain level.

Then, for each individual country, export quotas are allocated for that period, again possibly by type or grade, based on the information that country gave to the international community regarding the level of last years export. The new quotas are then normally derived from the share that country had in last period's total. There is therefore an incentive to inflate such data in order to obtain a higher level of quota.

Some other problems are the coverage of world exports and imports, leading to a possible free-ride problem. There is likely to be a two-tier market: the market governed by the quota and the 'free market'. The price on the free market will mostly be lower, which is an incentive for importing countries not to be a member. The world market price in terms of the weighted average of the quota market and the 'free market' should be higher than in case of a free market only. This stimulates exporting countries not to be a member and still to benefit from the activities of their competitors.

Then there is the problem of the reinforcement of the quota system and the possibilities for smuggling. Domestic over-supply will be created because more is produced and available for export than can be exported. Domestic stocks have to be kept in order to also keep domestic prices at reasonable prices and not only enhance the world market price. Private stock holders may exploit the situation.

This export quota system was used for many years in the International Coffee Agreement (ICA). The ICA was a price supporting scheme and not a price stabilization

scheme. There was no price range to defend, in particular no upper price level. The ICA was a producer-consumer agreement where consuming countries helped reinforcing the quota system by only buying from the participating producers to the extent that the quota allowed. One of the major problems in case of coffee and one of the reasons why the ICA failed was the distribution of the quota over the various exporting countries, especially where it referred to types and grades of coffee. Newcomers wanted a higher quota because they had invested, while old established countries did not want to give up their traditional shares of the market. Shifts between types and grades on the world market, as demanded by the consumers, could therefore not materialize. Thus the system was not flexible, often gave too high shares to the old established countries and could not follow market trends. Such consumer-producer agreements have not worked properly to the benefit of those producers who needed the benefits most. A detailed evaluation of the ICA was done by Herrmann, Burger and Smit (1993).

Assistance from consuming countries to reinforce the export quota is not likely in the case of pepper, because it would be unrealistic to assume any kind of consumer cooperation in this respect: pepper is too small, the coffee agreement failed and the world is now tuned toward a free market. The absence of consumers in a possible agreement for pepper implies that the reinforcement of the quota has to be done by the exporting countries themselves. This is complicated to monitor, let alone police. Export quota will create oversupply on the local markets in producing countries, leading to a drop in prices. Smuggling can be very profitable in such a situation and will be hard to avoid. There also is no direct incentive for countries to prevent smuggling (the free rider problem). For the governments of pepper producing countries export earning from pepper are very small when related to total export earnings. Governments of these countries will not really make an effort to reinforce export quotas. Therefore the system of export quota without national stockpiling is not a feasible avenue.

6. Export quotas with organized national stocks

In this Sub-Section we concentrate on a possible system where export quotas are accompanied by a system of national stockpiling. The aspect of export quota is exactly the same as in the system described above but now with supporting national stock formation. It again implies that on a world scale for each year the level of export, possibly split into various types or grades, is determined by all participating producing countries and that subsequently for each individual country, export quota are allocated to countries. Again, the same problem of the distribution of the quota over the various exporting countries remains, thus reducing flexibility in the market. Also, the monitoring and policing has to be done, which is very difficult. However, a proper system of national stocks may help reducing or perhaps eliminating oversupply on the local markets in producing countries, thus avoiding a drop in domestic price and production. Smuggling should not be very profitable in this situation. In conclusion, this approach seems to be better than the previous one, but more costly and still not at all good enough. It seems that the strong part of system proposed in this Sub-Section is the organized national stocks and not the system of export quota. However, again there should be some international coordination. We will come back to this in Sub-Section 8.

7. International buffer stock

The system of an international buffer stock for price stabilization implies that a buffer stock manager buys and sells the commodity in such amounts as necessary to keep the market price within a certain price band. The stock is kept in various places. Normally there will be an agreed maximum to the buffer stock, which may make it impossible to defend the lower price of the range at all times. Obviously, it may also be impossible to defend the upper price of the price range if the stock is depleted. There will be (more or less automatic) revisions to the price range.

International buffer stocks have been in operation for a number of commodities. A detailed review is given in Herrmann, Burger and Smit (1993). The only commodity for which an international buffer stock is still in operation is natural rubber. All others have collapsed because of disagreement between the various parties on the interpretation or renewal of the agreement or because of inappropriate management. Herrmann, Burger and Smit are quite negative on the achievements of the international commodity agreements they investigated in more detail. Only the international natural rubber agreement (INRA) has brought about some stabilization of prices. Because one has to buy first when prices are low and sell later when prices are high, new and growing producers benefit less than static or declining countries. They conclude that in the cases of cocoa, coffee and rubber there is no reason to continue striving towards international commodity agreements of this type. One of the main reasons is the problem of getting a workable agreement between producers and consumers. Another is the extremely high costs of running such a buffer stocking scheme, especially the administrative costs including the secretariat and attending of meetings. Further, there is the large number of countries involved, many of whom had special schemes protecting their farmers from world market developments and thus from the buffer stock scheme. Vice versa such farmers did not contribute to the working of the scheme: they just kept producing as if nothing had happened, thus annihilating the effect of the scheme. The latter was especially the case for cocoa. The natural rubber market is much more sensitive to interventions.

Comparing the specific aspects of pepper to other commodities it appears that the pepper market would be even more sensitive to interventions than the rubber market: farmers are not shielded from the world market, so interventions have a direct impact. Pepper is not very expensive to store. In the absence of consumers in a possible agreement there is less reason for difficulties in reaching an agreement and for very expensive arrangements. There is no real risk that pepper will loose its market to competing products. The main risk is the emergence of new producers, being either other countries or new farmers in the countries.

Some kind of buffer stocking could therefore very well work in the case of pepper. However, it is likely to be better to go one step further: instead of an international buffer stock located somewhere on 'neutral' ground with all the shipping costs involved, one might wish to resort to a system of internationally coordinated national stocks. This will be discussed in the following Sub-Section.

8. Internationally coordinated national stocks

In his report, ESCAP (1979), on stabilization of export earnings Pande recommended so called price-supply management schemes for the main producing countries. The calculations of Pande to estimate the costs and benefits of such a stabilization programme are very straightforward. He had to make strong assumptions. Furthermore he could not take into account the effects of price stabilization on supply and he did not make any assumptions on the effects these schemes could have on the level of the stocks that are held by farmers and exporters. However, it is an interesting illustration of how national stockpiling can be organized.

In this Sub-Section we will follow up from this approach and first design a system of internationally coordinated national stocks (ICNS) as emerging as a conclusion both from Sub-Section 6 and Sub-Section 7. This is followed later on by some aspects to which attention has to be paid. A first attempt to assess the system will be done in the next Section.

ICNS are located in the various countries. The following questions need to be answered:

(a) how large should the total stock be;
(b) how large should the stock be in each country;
(c) is there a need for a distribution over types and grades;
(d) who is handling the stock in terms of buying and selling;
(e) who is checking the presence and composition of the stock;
(f) who is paying for it.

There may be more questions, but the above seem the most important ones.

In order to assess the possible merits of such a system of ICNS, one has to answer to broad groups of questions:

(a) what is the effect of taking pepper out of the market or putting it back in on the price and on the future developments of all factors, and

(b) what is the effect on the behaviour of the various parties in the market and how will that affect the market and the working of the ICNS.

Regarding item (a) above one can derive the amount of pepper to be taken out or to be put back in and run the model. It is also important to know how long the pepper has to be kept in stock as it is impossible to support a situation of structural oversupply for a longer period. In the case of pepper, internationally coordinated national stocks must be used complementary to internationally coordinated planting policies. In the following Section the model will be used to estimate the amount of pepper required for the ICNS depending upon the suggested price range. The dynamic effects will also be demonstrated.

Complicated is the question how the various parties in the market will react notably the farmers and the stockholders and their behaviour will change over time once the degree of success of the ICNS has become clear. Farmers will presumably first want to wait and see. If the price stabilizes at an attrac-tive level they will stay more with pepper or move to pepper. It needs to be emphasized in this connection that it is likely that prices will be stabilized somewhere near the average over the past period.

Presumably the most complicated part is to what extent current stockholders will reduce their stocks. Currently there are basically four groups of stockholders:

— Farmers, who keep their stock largely as a kind of saving and only partly for speculative reasons;

— Traders in the producing countries who keep stocks as part of their dealing or for speculative reasons;

— Traders in the consuming countries who also keep stocks as part of their dealing or for speculative reasons;

— Consumers, meaning processors, who keep their stock only as part of the processing operations.

It is not likely that the existence of ICNS will affect stocking behaviour of the farmers and the processors but this has to be checked through a sample survey. More important is the behaviour of the traders. To what extent will their stocks be reduced? The extent to which they can speculate will definitely be reduced. In many cases this may lead to a reduced role of traders. Will this lead to a reduction of activity on the market? And will this then ultimately lead a market, which is less representative? Would this then also affect the long-run level of average prices? All this has to be checked as well using a sample survey among traders. It will be difficult to obtain reasonably unbiased answers, but an attempt has to be made.

In the following Section we will estimate the stocks required and illustrate the possible effects of the supply management policies: internationally coordinated national stocks (ICNS). Changing behaviour of market participants to the presence of the ICNS, rather than to different prices alone can as yet only be 'guestimated'.

F. Assessment of a system of internationally coordinated national stocks

1. Introduction

It is the purpose of this Section to draw a picture of the future of the pepper economy using the model that was presented in Sections A to C thereby broadly assessing supply management measures particularly referring to the problem of price instability. The measure selected in the previous Section is the system of internationally

coordinated national stocks (ICNS). The reference scenario to which all results will be compared has been in presented in Section D.

As indicated before we will assess the stocks required to achieve more stable prices and indicate the possible effects of the ICNS. Changing behaviour of market participants to the presence of the ICNS, rather than to different prices will briefly be touched upon.

When mentioning price stabilization one needs to determine which price should be stabilized. We have chosen the price central in our analysis: the spot price Lampung black in New York in $US/kg. In order to avoid the problems of inflation, we have chosen to fix the price range in terms of the real price; the nominal price can then be calculated directly. The base year is 1980. The lowest real price was in 1992, $US 0.73/kg and the highest one was in 1987 ($US 3.78/kg.). The corresponding nominal prices were $US 1.24/kg. in 1992 and $US 5.21/kg. in 1987. We will estimate the requirements and effect for the following price bands expressed in the real spot price of Lampung black in New York in $US/kg (rpsny):

(a) 1.00-1.50: buy if rpsny will be below 1.00 and sell if rpsny will be above 1.50;

(b) 1.00-1.60: buy if rpsny will be below 1.00 and sell if rpsny will be above 1.60;

(c) 0.90-1.50: buy if rpsny will be below 0.90 and sell if rpsny will be above 1.50.

These three possibilities will be assessed in the following three Sub-Sections. Some concluding remarks will be made in the last Sub-Section of this Section.

2. Defending the price band $US 1.00-1.50 per kg in real terms

A lower intervention level of $US 1.00 is reasonably modest; only during 1991-1993 were the average annual prices in real terms below $US 1.50. Our model predicts that such will happen again in 1999. That means that there is plenty of time to prepare for such action.

The question then is how much should be purchased. We have calculated that by taking 1,500 tons out of the market the average price in 1999 will be kept above $US 1.00. Then, because of the continuing low price, an amount of 23,000 tons will have to be taken out of the market in the year 2000 and another 12,000 tons in 2001 (see Table 1). The total costs in nominal terms of purchasing these amounts will be 3.2 + 49.7 + 26.7 million $US. To this has to be added the cost of storage, interest, insurance, administration etc.

The price range allows the stock to be sold again when the price is above $US 1.50. As can be seen from Table 1, this can be done starting two years later in

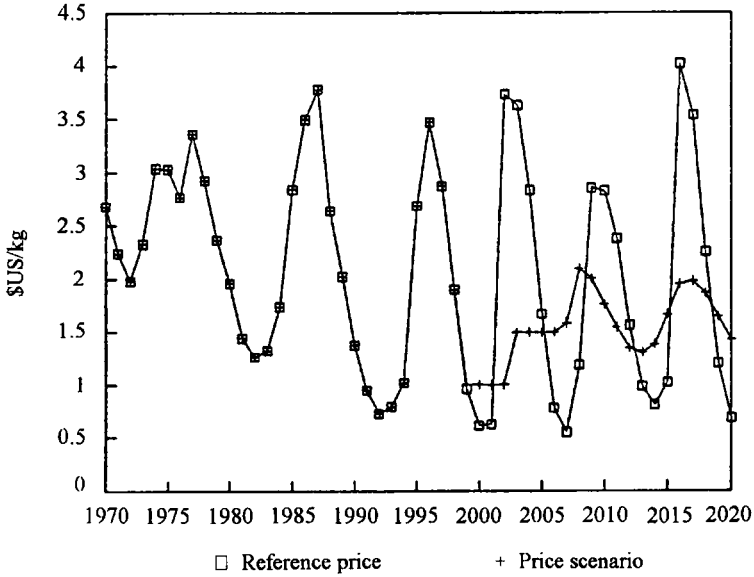
Table 1.

Year	ICNS interventions	Nominal price psny $US/kg	Real price rpsny $US/kg
1990	–	2.18	1.38
1991	–	1.57	0.95
1992	–	1.24	0.73
1993	–	1.39	0.79
1994	–	1.84	1.02
1995	–	4.99	2.68
1996	–	6.64	3.47
1997	–	5.67	2.87
1998	–	3.86	1.90
1999	1 500	2.10	1.00
2000	23 000	2.16	1.00
2001	12 000	2.22	1.00
2002	–	2.29	1.00
2003	4 000	3.52	1.50
2004	–10 000	3.64	1.50
2005	–9 500	3.74	1.50
2006	–9 500	3.86	1.50
2007	–3 500	4.20	1.58
2008	–	5.73	2.10
2009	–	5.64	2.01
2010	–	5.11	1.76
2011	–	4.61	1.55
2012	–	4.14	1.35
2013	–	4.14	1.31
2014	–	4.50	1.38
2015	–	5.59	1.66
2016	–	6.75	1.95
2017	–	7.04	1.97
2018	–	6.84	1.86
2019	–	6.21	1.64
2020	–	5.56	1.43

2003, up to 2007. In each of the first four years only a part can be sold to keep the prices at $US 1.50. In 2007 the full stock is depleted and the price shoots up further. The revenues from selling the stock are of course higher because the price difference is at least $US 1.50 per kg in nominal terms. The total amount can be calculated from Table 1: $US 137.4 million. The profit purely from the stock is therefore around $US 58 million or $US 2.36 per kg held in the stock. From this all the costs have to be deducted.

The resulting price projections are shown in Figure 40. At least two features are interesting. Because of the intervention in the market in 1999 to 2001, resulting in higher prices in those years and in lower prices a few years later, a large part of the fluctuation in price for the more distant future has also disappeared because farmers have lost their stimulus for heavy planting and maintenance or uprooting and neglect. The second conclusion is that there is no reason to intervene again.

Figure 40. Price simulation of real spot price Lampung black, New York



Here a word of caution is in order: the simulations shown above do not incorporate odd events which may disturb the market in the future, such as wars, diseases etc. Such events could lead to the need to intervene more often.

3. Defending the price band $US 1.00-1.60 per kg in real terms

The upper intervention level in this case has been raised to $US 1.60, which is a little higher. Obviously there will be the same need to intervene in 1999 to 2001.

Selling these quantities of pepper at a price of at least $US 1.60 can start in 2003, but will take many years in view of the higher price. Only in 2018 can the last bit be disposed off. The amount received is $US 160.0 million and the gross profit will be $US 80.0 million or 2.20 per kg kept in the stock.

4. Defending the price band $US 0.90-1.50 per kg in real terms

The purchasing side is obviously different compared to the previous Sub-Section. Buying starts in 2000 and is required for only two years. Because only 26.5 thousand tons need to be sold, this is completed in three years. The gross profit will be $US 50.2 million or $US 1.89/kg. The net profit can be obtained by deducting all costs. Results are shown in Table 3 and Figure 42.

5. Some concluding remarks

Above we have seen how large the ICNS has to be to take the required amount out of the market and to achieve a more stable price. This depends on the lower

Table 2.

Year	ICNS interventions	Nominal price psny $US/kg	Real price rpsny $US/kg
1990	–	2.18	1.38
1991	–	1.57	0.95
1992	–	1.24	0.73
1993	–	1.39	0.79
1994	–	1.84	1.02
1995	–	4.99	2.68
1996	–	6.64	3.47
1997	–	5.67	2.87
1998	–	3.86	1.90
1999	1 500	2.10	1.00
2000	23 000	2.16	1.00
2001	12 000	2.22	1.00
2002	–	2.29	1.00
2003	–3 500	3.74	1.59
2004	–8 000	3.88	1.60
2005	–7 000	3.99	1.60
2006	–5 500	4.11	1.60
2007	–1 000	4.23	1.60
2008	–2 000	4.38	1.61
2009	–	4.47	1.59
2010	–	4.53	1.56
2011	–	4.74	1.59
2012	–	4.93	1.60
2013	–2 500	5.05	1.60
2014	–1 000	5.21	1.60
2015	–	5.39	1.60
2016	–1 500	5.53	1.60
2017	–1 500	5.70	1.60
2018	–3 000	5.87	1.60
2019	–	6.31	1.67
2020	–	6.65	1.71

intervention price. One may estimate this total stock to range from 20 to 30 per cent of a year's export, while the annual purchase may be around 10 per cent of a year's export. The profits to be reaped at the end of the period are nice, but the costs have to be carefully considered. We have not considered how to distribute the quantities over the countries, but this could be done proportional to exports. Such does not seem to significantly affect the working of the scheme.

Again a word of caution referring back to the remarks at the end of the previous Section about the behaviour of the traders. We have not included an estimate as to what extent their stocks will be reduced. The extent to which they can speculate as well as the need to keep stock for a precaution will definitely be reduced. This has to be checked as well using a sample survey among traders. In general one might perhaps say that the amounts quoted in the previous Sub-Sections may have to be increased by some 10 per cent or 20 per cent.

Figure 41. Price simulation of real spot price Lampung black, New York

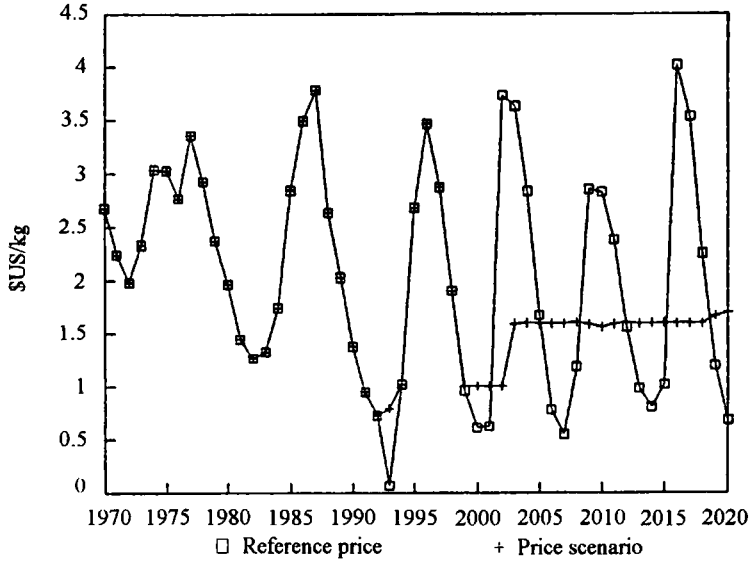
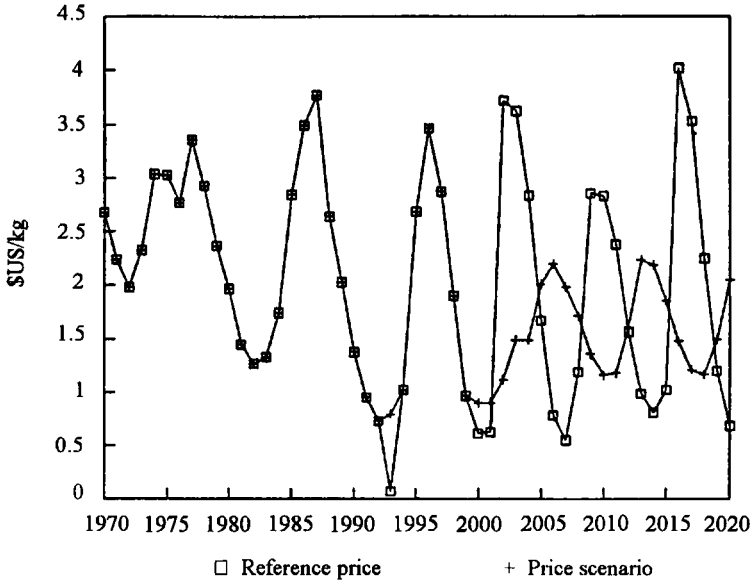


Table 3.

Year	ICNS interventions	Nominal price psny $US/kg	Real price rpsny $US/kg
1990	–	2.18	1.38
1991	–	1.57	0.95
1992	–	1.24	0.73
1993	–	1.39	0.79
1994	–	1.84	1.02
1995	–	4.99	2.68
1996	–	6.64	3.47
1997	–	5.67	2.87
1998	–	3.86	1.90
1999	–	2.03	0.97
2000	18 000	1.93	0.90
2001	8 500	2.00	0.90
2002	–	2.55	1.11
2003	–7 500	3.51	1.49
2004	–14 000	3.61	1.49
2005	–5 000	5.02	2.01
2006	–	5.66	2.20
2007	–	5.26	1.98
2008	–	4.69	1.72
2009	–	3.83	1.36
2010	–	3.36	1.16
2011	–	3.52	1.18
2012	–	4.93	1.60
2013	–	7.07	2.23
2014	–	7.13	2.19
2015	–	6.24	1.86
2016	–	5.12	1.48
2017	–	4.31	1.21
2018	–	4.28	1.17
2019	–	5.66	1.50
2020	–	7.98	2.05

Figure 42. Price simulation of real spot price Lampung black, New York



A final remark: there are still data problems. If these could be solved the model could become more sound and that is what would be needed if the model would be used for short-term and refined policy formulation. The data problems are touched upon in the following Section. A proposal on how to carry on from here is given in Section H.

G. Data availability and requirements

1. Introduction

The International Pepper Community (IPC) has played a significant role in the collection and dissemination of information by starting a series of Pepper Statistics and Pepper Statistical Yearbooks in 1980. However, as everyone in the IPC and its Secretariat would acknowledge, there is still scope for further improvement. In Chapter 5 of Bade and Smit (1991) an overview of the existing pepper statistics is given and shortcomings in data availability are discussed. They are summarized here.

2. Data on area and supply

With respect to the supply of pepper, the yearbooks of the IPC give series on area and production. These are obtained from various sources in the producing countries. As is often the case with statistics, these figures are not very accurate and also not always comparable. There is for example some confusion on the definition of "area". While in most countries area applies to planted area, the data of Brazil at least for some years refer to harvested area. Mostly it is not very clear in what way the area

data are estimated and whether production figures are derived from export data or are also based on other information (e.g. data on area under pepper cultivation and average yields). To improve the accuracy of the analysis it would also be helpful to have more information on the quantity of immature vines, the density of vines, the average age structure of the vines, the effect of age on yield (the so-called yield profile), the number of farms and their sizes and the extent of pruning, weeding, remounding and fertilizer application. To get an impression of medium and long-term price-elasticity of pepper supply and the relative profitability of pepper in comparison with other crops, data on the costs of production are needed. Since short-term variation of production seems to be mainly the result of fluctuations in weather conditions and the effects of diseases (which is related to maintenance), data on rainfall (as given in the last two country reports of Malaysia) and data on the number of vines damaged by diseases might be helpful.

3. Data on prices

All the important price quotations in New York, London and Singapore are reported by IPC in the statistical yearbooks. Furthermore they present a price series of monthly average FOB prices in Sarawak. Publication of series of market prices in the major producing and consuming countries would be very relevant. Collecting national FOB price series and average farm gate prices in the major pepper growing districts would be very good activities as all prices paid, especially farmer prices are very important. Unfortunately the world producer price is often somewhat confusing as this could refer to the price paid by exporters to middlemen or to the actual farm gate price.

4. Data on stocks

On this subject one can be very brief as no data series on stocks could be traced. As pepper has low storage costs and can be stored for a long period without much deterioration, there might be considerable stocks from time to time, held by farmers and exporters as well as by importers, grinders and food industries. As has been argued this is particularly relevant for the purpose of supply management for price stabilization through a system of internationally coordinated national stocks (ICNS).

5. Data on trade

Data on exports, imports and re-exports of pepper are supplied by the IPC in the statistical yearbooks and by the FAO. Export data concerning black and white unground pepper for Brazil were supplied by CACEX, which is the name of the Foreign Trade Department of the Bank of Brazil. The Spices Board of India gave more disaggregated figures regarding black, white, green dehydrated, green canned unground pepper as well as pepper oil and oleoresin. The Indonesian Central Bureau of Statistics supplied export quantities and values of black and white unground whereas the Pepper Marketing Board of Malaysia in addition reported on oil, ground and green unground pepper exports. Black and green unground pepper exports are registered by Le Directeur Général de la Banque Données de l'État of Madagascar while no

break-down in different products appear in the statistics of the Department of Census and Statistics of Sri Lanka and the Department of Customs of Thailand.

For most importing countries there are only import figures on pepper as an aggregate or on pepper and ground pepper. For some countries black, white and sometimes green pepper and oleoresin imports are distinguished or difference is made between imports for industrial manufacturing of essential oils or resinoids and other imports. Almost all data were obtained from the various national bureaus on (trade) statistics. With respect to re-exports one gets the same picture: pepper is taken as an aggregate. Even for countries with large re-exports as Germany, the Netherlands and the United Kingdom there seem to be no data which are more disaggregated. Only for Singapore and the United States the difference between black pepper and white pepper is made.

One particularly important aspect is consistency on a world level between imports and exports. This is now lacking for many years.

6. Data on demand

The only statistics available are on aggregate imports as reported above. This leaves out demand in the producing countries which is very important when one considers supply management for price stabilization through a system of internationally coordinated national stocks (ICNS).

Regarding market information a study of the International Trade Centre UNCTAD/ GATT gives a lot of information on market characteristics in the major consuming countries. Estimates of the industrial shares of consumption and the ratio of black and white pepper used are presented in this survey that was published in 1982 and needs updating. Addresses of spice traders organizations and other important organizations in the consuming countries are provided.

H. Proposal for a study into the implementation of supply management measures

1. Introduction

In Section E two sets of supply management measures were suggested: internationally coordinated national planting (ICNP) and internationally coordinated national stocks (ICNS). In Section F the possible effects of the latter supply management policy, ICNS, were illustrated using the model and in Section G some further desires were made clear, especially in terms of data. Some detailed remarks on the need for more information in terms of market behaviour were made in Sub-Section 8 of Section E. In this Section a proposal for a study is outlined to be a good basis for the implementation of the above mentioned two supply management measures, with an emphasis on the ICNS as the ICNP could be worked out within the framework of the current system of exchanges in IPC.

The study would be called **Analysis and proposal for implementation of supply management measures for pepper**. The study should have four components:

(a) improving the **analysis of the supply side** including a survey among farmers in order to improve the database on production, area and stocks and to collect information on how they would react in terms of planting and stock holding should ICNP and ICNS be implemented and be effective;

(b) improving the **analysis of the demand side** including a survey among traders and consumers in order to improve the database on stocks and to collect information on how they would react in terms of stock holding should ICNP and ICNS be implemented and be effective;

(c) an improved database and model combined with **human resource development** in terms of staff training, to assess exactly how to formulate and implement ICNP and ICNS;

(d) **suggestions for the actual implementation of the ICNS**.

2. Activities for the project 'Analysis and proposal for implementation of supply management measures for pepper'

Below the tasks to be done are listed in more detail. All tasks should be coordinated by the secretariat of IPC. In each participating producing country a team of counterparts should be available for survey work, data work, modelling work and organization of the ICNP and ICNS. While trying to remain modest, it would be cost efficient to recruit the services of the ESI, in view of their experience with modelling work for the pepper economy and their expertise in survey work.

(a) The analysis of the supply side

— Data base improvement by representatives of the producing countries, preferably the participants of the 1991 IPC workshop in Jakarta or their successors.

— Data collection through sample surveys:

- collection of data on planting and production, by small scale sample surveys, in the main producing countries,
- collection of agronomic information on productivity and cost of production.

— Improvement of the model specifications for the pepper producing members and non-members of IPC, including a consultative visit to Thailand and Viet Nam.

— Data processing and updating of the country-specific sub-modules of the model with the use of the new data by the representatives of the producing countries.

— Model improvements on the basis of the above results as well as additional information on member and non-member countries.

(b) The analysis of the demand side

— Improvement of the data base on the demand side using published and unpublished statistics.

— Visits and a sample survey among manufacturers and traders with the objective

- to explain the purpose of the supply management scheme, being not against consumers;
- to collect data or other information on consumption and stocks;
- to understand better the behaviour of the trading and consuming side as well as how that would change in the presence of ICNS.

— Data processing and updating of the country-specific sub-modules of the model with the use of the new data.

— Model improvements on the basis of the above results as well as additional information on member and non-member countries.

(c) Human resource development

— Training of the Programmer/Research Assistant of the IPC Secretariat, who will be responsible for the future maintenance and use of the model and the collection and distribution of the data that are the necessary input to the model.

— Transfer of the model and the resulting analysis for ICNS and the ICNP to key-persons from the producing countries.

— National workshops for wider dissemination of the approach, the methodology and the results to policy makers and others.

(d) Suggestions for the actual implementation of the ICNS

— Consultations with (former) buffer stock holders for other commodities.

— Formulation of a draft proposal on the running of the ICNS.

— Meetings with expert representatives in each of the producing countries.

— Finalization of the proposal and decision making at IPC.

Required inputs from various organizations

In the past a very good working relation has been built up between the consultants of ESI, the Secretariat of IPC and various government and private agencies in the pepper producing countries. The most important ones are listed:

- The Association of Brazilian Pepper Exporters
- The Indian Spices Board
- The Bureau of Economics and Statistics in Kerala
- Bombay Oil
- The Association of Pepper Exporters in Indonesia
- The Ministry of Agriculture in Indonesia
- The Pepper Marketing Board in Malaysia
- The Department of Agriculture in Sarawak (Malaysia)
- The Ministry of Agriculture in Malaysia
- The Ministry of Primary Industries in Malaysia

These organizations all cooperated in the earlier joint work and sent participants to the International workshop in Jakarta. In view of the additional emphasis in this study on stock holding the list of cooperating institutions should be enlarged.

APPENDICES

APPENDIX A

THE STRUCTURAL PEPPER MODEL IN MATHEMATICAL NOTATION

All quantities of pepper are in tons unless stated otherwise. An explanation of the used abbreviated variables can be found at the end of each paragraph. An "1" before a variable name means that its natural logarithm was taken. Absolute t-values are presented in parenthese.

Supply side

Brazil

$$\underset{}{dlapbr} = \underset{[3.4]}{-0.16} + \underset{[4.6]}{0.30}\ lpcbr_{-3} + \underset{[4.2]}{0.53}\ d79 + \underset{[4.1]}{0.52}\ d91 \qquad (A.1)$$

1974-1993; $\bar{R}^2 = 0.74$; D.W. = 2.11

$$lqpbr - lapbr = \underset{[8.6]}{1.20} + \underset{[4.0]}{0.27}\ lpcbr_{-1} - \underset{[7.8]}{0.40}\ lt + \underset{[2.8]}{0.44}\ d84 \qquad (A.2)$$

1972-1993; $\bar{R}^2 = 0.84$; D.W. = 1.28

$$xpbr = \underset{[0.8]}{-1565.77} + \underset{[14.4]}{0.98}\ qpbr - \underset{[2.7]}{8250.7}\ d77 + \underset{[4.1]}{12538.8}\ d82 \qquad (A.3)$$

1970-1992; $\bar{R}^2 = 0.92$; D.W. = 2.26

India

$$dlapia = \underset{[3.1]}{-0.22} + \underset{[3.7]}{0.09}\ lpcia_{-1} - \underset{[6.9]}{0.29}\ d79 + \underset{[6.6]}{0.28}\ d80$$

$$- \underset{[2.9]}{0.05}\ d7081 \qquad (A.4)$$

1971-1993; $\bar{R}^2 = 0.84$; D.W. = 2.50

$$lqpia - lapia = \underset{[14.6]}{-2.17} + \underset{[3.4]}{0.17}\ lpcia_{-1} + \underset{[7.1]}{0.18}\ lt - \underset{[3.1]}{0.25}\ d84$$

$$+ \underset{[8.8]}{0.51}\ d8586 \qquad (A.5)$$

1972-1993; $\bar{R}^2 = 0.90$; D.W. = 2.46

$$lxpia - lqpia = \min [-0.26 + 0.63\ l(rpsny/rpsny_{-1}) - 1.10\ d85 - 0.66\ d9192,\ 0.8] \quad (A.6)$$
[8.1] [4.0] [6.6] [5.7]

1971-1992; $\bar{R}^2 = 0.83$; D.W. = 2.10

Indonesia

$$dlapio = -0.02 + 0.01\ lpcio_{-3} + 0.11\ d83 + 0.09\ d88 \quad (A.7)$$
[0.2] [0.5] [3.6] [2.8]

1973-1993; $\bar{R}^2 = 0.46$; D.W. = 1.51

$$lqpio - lapio = -1.86 + 0.15\ lpcio_{-4} + 0.06\ lt + 0.21\ d78 - 0.14\ d79 \quad (A.8)$$
[11.5] [6.6] [1.8] [4.1] [3.0]

1976-1992; $\bar{R}^2 = 0.85$; D.W. = 1.65

$$lxpio = 1.18 + 0.88\ lqpio - 0.53\ d74 - 0.44\ d75 - 0.36\ d85 \quad (A.9)$$
[1.2] [9.5] [4.7] [3.7] [3.3]

1971-1992; $\bar{R}^2 = 0.90$; D.W. = 1.33

Malaysia

$$dlapml = -0.24 + 0.22\ lpcml_{-1} - 0.21\ d82 - 0.85\ d86 \quad (A.10)$$
[4.6] [6.1] [2.9] [12.0]

1973-1993; $\bar{R}^2 = 0.90$; D.W. = 1.16

$$lqpml - lapml = 0.28 + 0.28\ lpcml_{-2} + 0.43\ d86 + 0.34\ d91 + 0.38\ d92 \quad (A.11)$$
[1.9] [3.0] [3.0] [2.3] [2.5]

1980-1992; $\bar{R}^2 = 0.61$; D.W. = 1.83

$$lxpml = -0.79 + 0.94\ lqpml + 0.13\ lqpml_{-1} + 0.15\ l(pcml/pcml_{-1}) + 0.16\ d85 \quad (A.12)$$
[1.9] [14.6] [2.3] [3.1] [3.1]

1971-1992; $\bar{R}^2 = 0.97$; D.W. = 1.67

Thailand

$$dlapth = -0.54 + 0.16\ lpcth_{-1} + 0.35\ d87 - 0.26\ d92 \quad (A.13)$$
[3.7] [4.2] [4.4] [3.4]

1983-1993; $\bar{R}^2 = 0.91$; D.W. = 1.39

$$lqpth - lapth = 1.17 + 0.66\ l(pcth/pcth_{-1}) - 0.87\ d88 - 0.47\ d89 \quad (A.14)$$
[32.0] [6.0] [6.7] [3.5]

1981-1993; $\bar{R}^2 = 0.92$; D.W. = 1.88

$$qpth - xpth = 6832.66 - 0.28\ (qpth_{-1} - xpth_{-1}) + 3028.34\ d87 \quad (A.15)$$
[5.1] [1.2] [3.3]

1982-1992; $\bar{R}^2 = 0.51$; D.W. = 1.43

Sri Lanka

$$lapsl = 6.13 + 0.98\ lt70 + 0.06\ l(pcsl_{-1}/pcsl_{-2}) - 0.09\ d84 + 0.09\ d90 \quad (A.16)$$
[54.2] [23.4] [3.1] [2.8] [2.7]

1981-1993; $\bar{R}^2 = 0.99$; D.W. = 1.60

$$lqpsl - lapsl = -1.78 + 0.18\ lpcsl_{-3} \quad (A.17)$$
[3.5] [1.3]

1980-1993; $\bar{R}^2 = 0.04$; D.W. = 2.19

$$lxpsl = 2.15 + 0.65\ lqpsl + 0.29\ l(qpsl/lqpsl_{-1}) + 0.07.\ lpcsl + 0.67\ d90 \quad (A.18)$$
[3.4] [9.0] [3.4] [1.3] [5.9]

1978-1992; $\bar{R}^2 = 0.92$; D.W. = 2.10

Madagascar

$$xpmd = 4970.98 - 1002.68\ lt - 1126.65\ d81 \quad (A.19)$$
[14.1] [6.9] [2.4]

1972-1993; $\bar{R}^2 = 0.71$; D.W. = 1.78

Viet Nam

$$lxpvm = \ln(22000) - 0.11\ lrpsny - 0.05\ lrpsny_{-1} - 0.06\ lrpsny_{-2} \quad (A.20)$$

China (Hainan)

$$lxpch = \ln(6000) - 0.11\ lrpsny - 0.05\ lrpsny_{-1} - 0.06\ lrpsny_{-2} \quad (A.21)$$

Mexico

$$xpmx = 1500 + 500\ xpmx_{-1} \quad (A.22)$$

Singapore

$$\underset{[1.1]}{mpsp} = \underset{[1.1]}{4268.46} + \underset{[6.1]}{0.70}\ xpml + \underset{[2.2]}{2553.40}\ rpsny + \underset{[1.6]}{0.18}\ (xprw\text{-}cpw) \quad (A.23)$$

1975-1989; $\bar{R}^2 = 0.82$; D.W. = 1.85

$$\underset{[35.5]}{xpsp} = \underset{[35.5]}{0.99}\ mpsp - \underset{[1.7]}{0.15}\ (xprw\text{-}cpw) \quad (A.24)$$

1975-1989; D.W. = 1.85

$$\Delta zpsp = \hat{mp}sp - \hat{xp}sp \quad (A.25)$$

Explanation of variable abreviations:

apbr = total area under pepper in hectares in Brazil
apia = total area under pepper in hectares in India
apio = total area under pepper in hectares in Indonesia
apml = total area under pepper in hectares in Malaysia
apsl = total area under pepper in hectares in Sri Lanka
apth = total area under pepper in hectares in Thailand
pcbr = f.o.b. price of black pepper in Brazil in constant 1980 dollars
pcia = f.o.b. price of black pepper in India in constant 1980 rupees
pcio = f.o.b. price of black pepper in Indonesia in constant 1980 rupiahs
pcml = f.o.b. price of pepper in Malaysia (Sarawak) in constant 1980 M$
pcsl = f.o.b. price of black pepper in Sri Lanka in constant 1980 Rupees
pcth = f.o.b. price of black pepper in Thailand in constant 1980 Baht
psny = New York spot price of Lampung black pepper in US cents/kg
qpbr = total production of pepper in Brazil
qpia = total production of pepper in India
qpio = total production of pepper in Indonesia
qpml = total production of pepper in Malaysia (Sarawak)
qpsl = total production of pepper in Sri Lanka
qpth = total production of pepper in Thailand
rpratio = $rpsny/rpsny_{-1}$
rpsny = New York spot price of Lampung black pepper in US cents/kg in constant 1980 dollars

t70 = linear trend starting in 1970: $t = t_{-1}+1$, in this case used to estimate technical progress or shift in cultivation
t75 = linear trend starting in 1975: $t = t_{-1}+1$
t80 = linear trend starting in 1980: $t = t_{-1}+1$
xpbr = total exports of pepper from Brazil
xpia = total exports of pepper from India
xpio = total exports of pepper from Indonesia
xpma = total exports of pepper from Malaysia
xpmd = total exports of pepper from Madagascar
xpmx = total exports of pepper from Mexico
xpsp = total net exports from Singapore and Hong Kong
xpsl = total exports of pepper from Sri Lanka
xpth = total exports of pepper from Thailand
xprw = total world exports of producing countries
zpsp = stocks in Singapore

Prices

Brazil

$$p\$br = \underset{[-5.0]}{-0.40} + \underset{[30.1]}{1.01}\ psny - \underset{[5.8]}{1.04}\ d88 - \underset{[5.7]}{0.99}\ d89 \qquad (A.26)$$

1970-1992; $\bar{R}^2 = 0.98$; D.W. = 1.96

pcbr = p$br/pius * 100

India

$$p\$ia = \underset{[2.4]}{0.26} + (\underset{[4.5]}{0.55} + \underset{[2.8]}{0.10}\ lt70)\ psny + \underset{[5.6]}{0.97}\ d76 \qquad (A.27)$$

1970-1992; $\bar{R}^2 = 0.97$; D.W. = 1.55

pcia = (p$ia * eria) /piia * 100

Indonesia

$$p\$io = \underset{[1.2]}{-0.092} + \underset{[27.0]}{0.82}\ psny \qquad (A.28)$$

1970-1992; $\bar{R}^2 = 0.97$; D.W. = 1.61

pcio = (p$io * erio) /piio * 100

Malaysia

$$p\$ml = \underset{[1.0]}{-0.072} + \underset{[26.9]}{0.81}\ psny \qquad (A.29)$$

1970-1992; $\bar{R}^2 = 0.97$; D.W. = 1.15

pcml = (p$ml * erml) /piml * 100

Thailand

$$p\$th = \underset{[1.1]}{-0.21} + \underset{[14.7]}{0.95}\ psny \qquad (A.30)$$

1980-1992; $\bar{R}^2 = 0.95$; D.W. = 2.79

Sri Lanka

$$p\$sl = \underset{[1.3]}{-0.15} + \underset{[22.3]}{0.96}\ psny + \underset{[5.6]}{1.24}\ d76 + \underset{[7.1]}{1.57}\ d78 - \underset{[3.7]}{0.82}\ d90 \qquad (A.31)$$

1972-1992; $\bar{R}^2 = 0.97$; D.W. 1.41

Explanation of variable abbreviations:

eria = exchange rate of India (Rupees per US dollar)
erio = exchange rate of Indonesia (Rupiahs per US dollar)
erml = exchange rate of Malaysia (Malaysian dollars per US dollar)
ersl = exchange rate of Sri Lanka (Rupees per US dollar)
erth = exchange rate of Thailand (Baht per US dollar)
p$br = f.o.b. price of black pepper in Brazil in current dollars
p$ia = f.o.b. price of black pepper in India in current US dollars
p$io = f.o.b. price of black pepper in Indonesia in current US dollars
p$ml = f.o.b. price of pepper in Malaysia (Sarawak) in current US dollars
p$sl = f.o.b. price of black pepper in Sri Lanka in current US dollars
p$th = f.o.b. price of black pepper in Thailand in current US dollars
pcbr = f.o.b. price of black pepper in Brazil in constant 1980 dollars
pcia = f.o.b. price of black pepper in India in constant 1980 rupees
pcio = f.o.b. price of black pepper in Indonesia in constant 1980 rupiahs
pcml = f.o.b. price of pepper in Malaysia (Sarawak) in constant 1980 M$
pcsl = f.o.b. price of black pepper in Sri Lanka in constant 1980 Rupees
pcth = f.o.b. price of black pepper in Thailand in constant 1980 Baht
piia = consumer price index of India
piio = consumer price index of Indonesia
piml = consumer price index of Malaysia
pisl = consumer price index of Sri Lanka
pith = consumer price index of Thailand
pius = consumer price index of the United States
psny = New York spot price of Lampung black pepper in US cents/kg

Demand side

North America (United States and Canada)

data:

$$\underset{\quad [6.2]\quad [6.6]}{lmppcna = 2.37 + 1.19\ lypcna} \qquad (A.100)$$

1972-1993; $\bar{R}^2 = 0.68$; D.W. = 1.75

$$cpna = nna * \hat{mppc}na \qquad (A.101)$$

$$\Delta zpna = mpna - cpna \qquad (A.102)$$

model:

$$lcppcna = 2.37 + 1.19\ lypcna \qquad (A.103)$$

$$\underset{\quad [2.5]\quad [1.3]\quad [1.5]\quad [2.7]}{\Delta zpna = 3819.48 - 0.27\ zpna(-1) - 1189.09\ rpsny + 7827.57\ d86} \qquad (A.104)$$

1975-1993; $\bar{R}^2 = 0.35$; D.W. = 1.86

$$mpna = cpna + \hat{\Delta zp}na \qquad (A.105)$$

Japan

data:

$$\underset{\quad [15.9]\quad [10.8]}{lmppcjp = 2.21 + 0.85\ lypcjp} \qquad (A.110)$$

1971-1993; $\bar{R}^2 = 0.85$; D.W. = 2.10

$$cpjp = njp * \hat{mppc}jp \qquad (A.111)$$

$$\Delta zpjp = mpjp - cpjp \qquad (A.112)$$

model:

$$lcppcjp = 2.21 + 0.85\ lypcjp \qquad (A.113)$$

$$\underset{\quad [2.6]\quad [1.2]\quad [1.7]\quad [2.4]}{\Delta zpjp = 528.82 - 96.02\ rpsny - 0.30\ zpjp(-1) - 796.22\ d91} \qquad (A.114)$$

1971-1993; $\bar{R}^2 = 0.31$; D.W. = 1.89

$$mpjp = cpjp + \hat{\Delta zp}jp \qquad (A.115)$$

Astralia and New Zealand

data:

$$\underset{[11.0]\ [6.8]}{lmppcaz = 2.73 + 0.90\ lypcaz} \qquad (A.120)$$

1970-1993; $\bar{R}^2 = 0.68$; D.W. = 2.16

$$cpaz = naz * \hat{mppc}az \qquad (A.121)$$

$$\Delta zpaz = mpaz - cpaz \qquad (A.122)$$

model:

$$lcppcaz = 2.73 + 0.90\ lypcaz \qquad (A.123)$$

$$\underset{[0.2]\ [1.6]\ [2.4]}{zpaz = 22.50 + 1.46\ yaz + 252.81\ d90} \qquad (A.124)$$

1970-1993; $\bar{R}^2 = 0.29$; D.W. = 0.82

$$mpaz = cpaz + \Delta\hat{zp}az \qquad (A.125)$$

European Community (EC)

data:

$$\underset{[16.5]\ [17.4]\ [7.3]\ [3.4]}{lmppcec = 2.27 + 1.38\ lypcec - 0.14\ d70 - 0.20\ d8993} \qquad (A.130)$$

1970-1993; $\bar{R}^2 = 0.96$; D.W. = 1.91

$$cpec = nec * \hat{mppc}ec \qquad (A.131)$$

$$\Delta zpcec = mpcec - cpcec \qquad (A.132)$$

model:

$$lcppcec = 2.27 + 1.38\ lypcec - 0.14\ d70 - 0.20\ d8993 \qquad (A.133)$$

$$\underset{[2.4]\ [1.7]\ [2.3]\ [2.8]}{\Delta zpec = 1333.77 - 0.15\ zpec_{-1} - 607.65\ rpsdr + 2420.37\ d79}$$

$$\underset{[2.3]\ [2.6]}{+ 2034.66\ d83 - 2465.31\ d92} \qquad (A.134)$$

1971-1993; $\bar{R}^2 = 0.53$; D.W. = 2.13

$$mpec = cpec + \Delta\hat{zp}ec \qquad (A.135)$$

Rest of Western Europe, EFTA

data:

$$\begin{matrix} lmppcre = & 2.90 & + & 0.83\ lypcre & - & 0.22\ d88 & + & 0.09\ d7687 \\ & [27.4] & & [16.4] & & [6.7] & & [6.9] \end{matrix} \quad (A.140)$$

1971-1993; $\bar{R}^2 = 0.94$; D.W. = 2.15

$$cpre = nre * \hat{mppcre} \quad (A.141)$$

$$\Delta zpre = mpre - cpre \quad (A.142)$$

model:

$$lcppcre = 2.90 + 0.83\ lypcre - 0.22\ d88 + 0.10\ d7687 \quad (A.143)$$

$$\begin{matrix} \Delta zpre = & 3.79 & - & 181.61\ \Delta rpsdr & - & 221.05\ d78 & - & 178.15\ d88 \\ & [0.2] & & [4.4] & & [3.1] & & [2.3] \end{matrix}$$

$$\begin{matrix} & - & 193.83\ d89 & + & 106.38\ d8283 \\ & & [2.7] & & [2.1] \end{matrix} \quad (A.144)$$

1975-1993; $\bar{R}^2 = 0.61$; D.W. = 2.45

$$mpre = cpre + \Delta\hat{zpre} \quad (A.145)$$

Eastern Europe and USSR

data:

$$\begin{matrix} lmpee = & 6.30 & + & 0.53\ lyee & - & 1.31\ d92 & - & 0.56\ d93 & - & 0.20\ d7475 \\ & [6.6] & & [3.8] & & [12.6] & & [5.3] & & [2.5] \end{matrix} \quad (A.150)$$

1972-1993; $\bar{R}^2 = 0.91$; D.W. = 2.12

$$cpee = nee * \hat{mppcee} \quad (A.151)$$

$$\Delta zpee = mpee - cpee \quad (A.152)$$

model:

$$lcpee = 6.30 + 0.53\ lyee - 1.31\ d92 - 0.56\ d93 - 0.20\ d7475 \quad (A.153)$$

$$\begin{matrix} \Delta zpee = & -121.22 & - & 1347.94\ \Delta rpsdr & + & 5372.17\ d86 & - & 4267.12\ d91 \\ & [0.4] & & [2.1] & & [4.0] & & [3.2] \end{matrix} \quad (A.154)$$

1973-1993; $\bar{R}^2 = 0.56$; D.W. = 2.30

$$mpee = cpee + \Delta\hat{zpee} \quad (A.155)$$

Latin America

data:

$$\begin{matrix} mpla = -489.95 & +16.61\ yla & +2871.02\ d91 & -2778.31\ d8588 \\ [0.5] & [4.7] & [3.2] & [5.7] \end{matrix} \quad (A.160)$$

$$\begin{matrix} -1641.10\ d7680 \\ [3.8] \end{matrix}$$

1970-1993; $\bar{R}^2 = 0.77$; D.W. = 2.01

$$cpla = \hat{mpla} \quad (A.161)$$

$$\Delta zpla = mpla - cpla \quad (A.162)$$

model:

$$cpla = -489.95 + 16.61\ yla + 2871.02\ d91 - 2778.31\ d8590 \quad (A.163)$$

$$-1641.10\ d7680$$

$$\begin{matrix} \Delta zpla = 878.71 & -0.50\ zpla_{-1} & -203.27\ rpsdr & +1804.75\ d81 \\ [2.2] & [3.9] & [1.1] & [3.0] \end{matrix}$$

$$\begin{matrix} +1085.90\ d7079 \\ [3.4] \end{matrix} \quad (A.164)$$

1971-1993; $\bar{R}^2 = 0.45$; D.W. = 1.69

$$mpre = cpre + \hat{\Delta zpre} \quad (A.165)$$

Asia and Pacific, excl. China, prod. countries, Singapore, Australia and New Zealand

data:

$$\begin{matrix} mppcap = 2.15 & +30.40\ ypcap & -3.71\ d82 & -5.12\ d7077 \\ [1.0] & [4.9] & [2.7] & [5.5] \end{matrix}$$

$$\begin{matrix} -4.10\ d8688 \\ [4.8] \end{matrix} \quad (A.170)$$

1970-1993; $\bar{R}^2 = 0.91$; D.W. = 2.19

$$cpap = nap * \hat{mppcap} \quad (A.171)$$

$$\Delta zpap = mpap - cpap \quad (A.172)$$

model:

$$cppcap = 2.15 + 30.40\ ypcap - 3.71\ d82 - 5.12\ d7077 - 4.10\ d8688 \quad \text{(A.173)}$$

$$\Delta zpap = \underset{[1.6]}{641.14} - \underset{[1.4]}{185.70}\ rpsdr - \underset{[1.0]}{0.16}\ zpap(-1) - \underset{[2.9]}{1168.37}\ d84 + \underset{[2.9]}{1234.93}\ d85 - \underset{[2.9]}{1343.99}\ d93 \quad \text{(A.174)}$$

1971-1993; $\bar{R}^2 = 0.55$; D.W. = 1.75

$$mpap = cpap + \Delta zpap \quad \text{(A.175)}$$

China

data:

mpch = 0 from 1993 onwards (A.180)

Middle East and North Africa

data:

$$mpmn = \underset{[4.0]}{-5755.42} + \underset{[13.4]}{65.41}\ ymn + \underset{[7.5]}{6184.87}\ d8083 + \underset{[4.9]}{6248.02}\ d9192 \quad \text{(A.190)}$$

1970-1993; $\bar{R}^2 = 0.95$; D.W. = 1.50

$$cpmn = nmn * \hat{mppcmn} \quad \text{(A.191)}$$

$$\Delta zpmn = mpmn - cpmn \quad \text{(A.192)}$$

model:

$$cpmn = -5755.42 + 65.41\ ymn + 6184.87\ d8083 + 6248.02\ d9192 \quad \text{(A.193)}$$

$$\Delta zpmn = \underset{[1.5]}{(-349.58+350)} - \underset{[2.3]}{1105.90}\ Drpsdr + \underset{[2.6]}{2639.40}\ d90 - \underset{[2.2]}{2173.58}\ d76 - \underset{[2.8]}{2077.40}\ d8384 \quad \text{(A.194)}$$

1971-1993; $\bar{R}^2 = 0.50$; D.W. = 1.97

$$mpmn = cpmn + \hat{\Delta zpmn} \quad \text{(A.195)}$$

Rest of Africa

data:

$$\underset{[1.4]}{\text{mprf} = 558.23} + \underset{[2.2]}{5.35\ \text{yrf}} + \underset{[6.1]}{1164.78\ \text{d9092}} - \underset{[2.6]}{368.69\ \text{d7477}} \qquad \text{(A.200)}$$

1970-1993; $\bar{R}^2 = 0.84$; D.W. = 1.98

$$\text{cprf} = \hat{\text{mprf}} \qquad \text{(A.201)}$$

$$\Delta\text{zprf} = \text{mprf} - \text{cprf} \qquad \text{(A.202)}$$

model:

$$\text{cprf} = 558.23 + 5.35\ \text{yrf} + 1164.78\ \text{d9092} - 368.69\ \text{d7477} \qquad \text{(A.203)}$$

$$\underset{[2.1]}{\Delta\text{zprf} = (-91.70 + 100)} - \underset{[1.4]}{105.63\ \Delta\text{rpsdr}} + \underset{[2.6]}{179.68\ \text{d7582}}$$

$$+ \underset{[3.6]}{559.41\ \text{d84}} + \underset{[3.0]}{446.78\ \text{d92}} - \underset{[2.5]}{387.71\ \text{d90}} \qquad \text{(A.204)}$$

1971-1993; $\bar{R}^2 = 0.58$; D.W. = 2.41

$$\Delta\text{zprf} = \hat{\text{mprf}} - \hat{\text{cprf}} \qquad \text{(A.205)}$$

Explanation of variable abreviations:

Consumption, imports exports and stocks of pepper are measured in tons, GDP in millions of constant 1975 US dollars and population in millions of people.

cpap	=	consumption of pepper by Asia and the Pacific excl. China, prod. countries, Australia and New Zealand
cpaz	=	consumption of pepper by Australia and New Zealand
cpec	=	consumption of pepper by the European Community
cpee	=	consumption of pepper by Eastern Europe and the USSR
cpjp	=	consumption of pepper by Japan
cpla	=	consumption of pepper by Latin America (Brazil excl.)
cpmn	=	consumption of pepper by the Middle East and North Africa
cpna	=	consumption of pepper by North America
cpre	=	consumption of pepper by the EFTA-countries
cprf	=	consumption of pepper by the rest of Africa
cpw	=	world consumption of pepper of non-producing countries
dxx	=	dummy variable, having the value one in the year 19xx and zero in other years
dxxyy	=	dummy variable, having the value one for the years between 19xx and 19yy and zero otherwise

mpap	=	net imports of pepper by Asia and the Pacific excl. China, prod. countries, Australia and New Zealand
mpaz	=	net imports of pepper by Australia and New Zealand
mpch	=	net imports of pepper by China
mpec	=	net imports of pepper by the European Community
mpee	=	net imports of pepper by Eastern Europe and the USSR
mpjp	=	net imports of pepper by Japan
mpla	=	net imports of pepper by Latin America (Brazil excl.)
mpmn	=	net imports of pepper by the Middle East and North Africa
mpna	=	net imports of pepper by North America
mpre	=	net imports of pepper by the EFTA-countries
mprf	=	net imports of pepper by the rest of Africa
naz	=	population size of Australia and New Zealand
nec	=	population size of the European Community
nee	=	population size of Eastern Europe and the USSR
nna	=	population size of North America
nre	=	population size of the EFTA-countries
p$br	=	f.o.b. price of black pepper in Brazil in current dollars
psny	=	yearly average New York spot price of Lampong black pepper in US cents/ kg.
rpsdr	=	yearly average spot price of black Lampung in New York in constant 1980 special drawing rights per kg.
rpsny	=	yearly average spot price of black Lampung in New York in constant 1980 US cents per kg.
yap	=	Gross Domestic Product of Asia and the Pacific excl. China, prod. countries, Australia and New Zealand
yee	=	Gross Domestic Product of Eastern Europe and the USSR
yjp	=	Gross Domestic Product of Japan
ymn	=	Gross Domestic Product of the Middle East and North Africa
yre	=	Gross Domestic Product of the EFTA-countries
yrf	=	Gross Domestic Product of the rest of Africa
xpbr	=	total exports of pepper from Brazil
xprw	=	total net exports of pepper producing countries
xpw	=	world net exports = xprw + Δzpsp
Δzpaz	=	assumed change of carry-over stocks in Australia and New Zealand
Δzpec	=	assumed change of carry-over stocks in the E.C.
Δzpee	=	assumed change of carry-over stocks in Eastern Europe and the USSR
Δzpjp	=	assumed change of carry-over stocks in Japan
Δzpla	=	assumed change of carry-over stocks in Latin America (Brazil excl.)
Δzpna	=	assumed change of carry-over stocks in North America
Δzpre	=	assumed change of carry-over stocks in the EFTA
Δzprf	=	assumed change of carry-over stocks in the rest of Africa

Identities

cpw = cpec + cpna + cpjp + cpmn + cpee + cpap + cpaz + cprp + cpla + cprf (A.81)

mpw = mpec + mpan + mpjp + mpmn + mpee + mpap + mpaz + mpre + mpla + mprf (A.82)

xprw = xpbr + xpia + xpio + xpml + xpmd + xpsl + xpth + xpvm + xpch (A.83)

xpw = xprw + Δzpsp (A.84)

mpw = xpw (A.85)

mpw = total world net imports

xpw = total world net exports

rpsny = clearing price (A.91)

APPENDIX B

THE WORLD ECONOMY — A SIMPLE ANALYSIS AND SCENARIOS FOR THE FUTURE

1. Introduction

The world pepper economy depends on the world economy. This is also clear in the demand analysis, as described in Section B, where one finds GDP as the foremost factor influencing pepper demand. It is therefore essential when working towards projections of world pepper demand, to start from developments in the world economy. In this Appendix projections will be provided for world economic growth as well as for growth per country or region. Finally, projections of growth in population by country or region will be given.

2. World economic growth — a simple analysis and projections

It would obviously have been wonderful to have a full fledged model per country for the purpose of making projections of economic growth. This is not possible within the context of this study. Besides, to our knowledge there are no reliable and generally accessible long-term forecasts available for GDP per country or region from other sources. Finally, having a model running permits the design of scenarios. For the purpose of obtaining projections of economic growth per country, a very simple set of equations has therefore been set up. They can be considered as reduced form equation of a full economic model. Equations for individual countries are available in detail upon request. In this Sub-Section we concentrate on world economic growth, leaving economic growth per country or region to be discussed in the next Sub-Section.

The basic approach has been to explain current growth in GDP from past figures. The basic model we have used here is briefly described first. The following system of variable names is used:

GGDP = GDP growth rate for the world total;
Dum*xx* = Dummy variable; equal to 1 in year *xx* and 0 otherwise
Dum*xxyy* = Dummy variable; equal to 1 from year *xx* up to year *yy* and 0 otherwise

The following equation for the world total has been estimated:

$$ggdp_t = \alpha_1 + \alpha_2*Dum74 + \alpha_3*Dum91 + \alpha_4*Dum7492 + \alpha_4*ggdp_{t-1} + \alpha_5*ggdp_{t-2} + \alpha_6*ggdp_{t-8} + \alpha_7*ggdp_{t-9} + \alpha_8*ggdp_{t-10}$$

The regression results for the world are in the scheme below. The dependent variable is ggdp, the growth rate in world GDP. The sample range is 1971-1992.

Variable	Coefficients	Standard error	T. statistic		
Constant	3.88	1.575	2.47	R-squared	0.779
Dum74	–2.85	1.306	–2.18	Mean of dependent var.	3.278
Dum91	–2.71	1.195	–2.27	S.D. of dependent var.	1.692
Dum7492	–1.94	0.778	–2.49	S.E. of regression	1.010
ggdp (–1)	0.59	0.180	3.30	Sum of squared resid.	13.260
ggdp (–2)	–0.44	0.174	–2.51	Log likelihood	–25.648
ggdp (–8)	0.27	0.158	1.74	Durbin-Watson stat.	2.076
ggdp (–9)	–0.42	0.193	–2.18	Prob (F-statistic)	0.003
ggdp (–10)	0.35	0.168	2.11	F-statistic	5.741

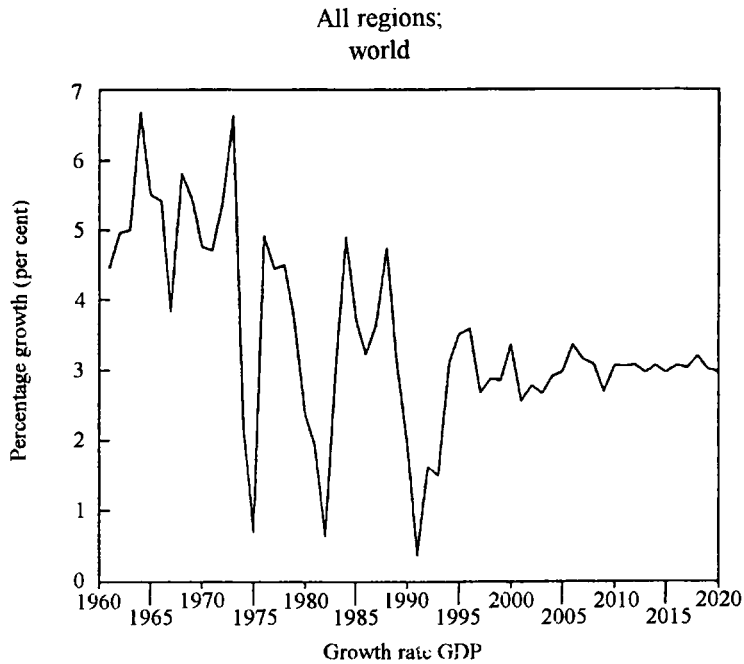
As can be seen there are two groups of lagged effects: recent, 1 or 2 years back, and a long-term effects with lags running from 8 to 10 years. This very simple model gives the projections of GDP growth rates for the world total as in Figure B.1. According to this analysis world economic growth rates will hover around 3 per cent. We will call this scenario **GO**, the **standard scenario for economic growth**.

3. Economic growth by country or region — historic developments and projections

In this Sub-Section the modelling and projection results are presented for the 65 countries or regions in which the world has been divided. There are estimated models for 54 countries or regions. In these models country growth rates in GDP have been explained from world growth rates as well as from lagged country growth rates. Details of the estimations are presented in Appendix A. In view of the most irregular developments during the past few years, e.g. in Eastern Europe and the former USSR, no models could be estimated for those (groups of) countries. This concern 11 (groups of) countries for which the coefficients for future economic growth have been fixed in a simple and intuitive way. For 7 regions future growth rates have been somewhat adjusted downwards for the more distant future, by adjusting the constant term. This refers to regions especially in East and South-East Asia, which enjoy a very high growth rate now. Such high growth rates cannot be kept for decades, as has been clearly shown by other countries with a high growth in the past.

Data and projection results for all countries are presented summarily in Table B.1. These simple analyses show that the United States is clearly recovering, but in the long-term running at just over 2 per cent growth. Canada is doing slightly better. Japan will recover, but does not appear to reach the growth levels of the United States, after the period of high growth up to 1990. In Western Europe growth rates will vary around 1 to 3 per cent, with Germany and Spain doing relatively well. The countries of Eastern Europe, the former USSR and the former Yugoslavia are expected to come back, but on average at rather moderate levels of economic growth. Growth rates in Latin America will be somewhat higher than in Europe. In South Asia India is doing

Figure B1. Data and projections of the world GDP growth rate (1960-2020)



a steady growth of around 5 per cent, with Pakistan somewhat higher and the other countries slightly lower. In South East Asia, the outlook for the Philippines is still rather moderate, while the other countries will show high, but somewhat declining rates. The same applies to China, while Viet Nam will reach over 4 per cent growth. Africa is showing very moderate growth rates with a possible exception of Nigeria.

4. World population growth — historic developments and projections

The scenario for population projections has been based on the Medium Variant of the United Nations and the projections by the World Bank. The results are presented for selected years in Table B.2. No further comment is required.

Table B.1 Growth rates in GDP in constant prices, compound annual growth rates over 5 or 10 year periods (Period)

	1975/1980	1980/1985	1985/1990	1990/1995	1995/2000	2000/2010	2010/2020
United States	3.3	2.5	2.6	2.1	2.3	2.1	2.2
Canada	3.7	2.8	3.0	2.0	3.2	3.0	3.0
Japan	5.0	4.0	4.7	1.7	2.0	1.9	1.8
Australia	2.9	3.1	3.1	2.4	2.2	2.2	2.2
New Zealand	0.1	3.0	0.5	1.6	1.3	1.1	1.2
Germany	3.4	1.6	2.9	1.6	3.4	3.2	3.1
France	3.3	1.5	3.2	1.0	1.7	1.7	1.6
United Kingdom	1.8	1.9	3.1	1.0	2.2	2.1	2.1
Netherlands	2.6	1.0	2.7	1.5	1.7	1.5	1.5
Belgium and Luxemburg	3.1	0.7	3.3	1.0	1.6	1.6	1.5
Denmark	2.5	2.6	1.6	2.2	1.8	1.9	1.9
Iceland	4.1	1.4	3.0	0.3	2.4	2.2	2.3
Sweden	1.3	1.8	2.2	–0.1	1.2	1.0	1.0
Switzerland	1.8	1.4	2.8	0.7	1.6	1.4	1.4
Ireland	4.6	2.6	4.6	3.0	3.1	3.0	3.0
Norway	4.8	3.9	1.6	3.2	2.7	2.8	2.8
Finland	3.0	3.0	3.4	–1.2	1.6	1.8	1.8
Austria	3.4	1.2	3.0	1.7	2.4	2.3	2.2
Italy	4.8	1.6	3.0	1.0	2.0	1.8	1.7
Spain	2.0	1.4	4.5	1.1	2.0	1.8	1.7
Portugal	5.4	0.9	4.7	1.5	3.3	3.1	3.0
Greece	4.4	1.3	1.8	1.3	1.7	1.6	1.6
Turkey	2.6	4.6	6.0	3.7	4.2	4.0	3.9
Yugoslavia	5.6	0.7	–1.4	–7.5	2.8	2.6	2.5
Other Western Europe	11.5	1.7	6.5	2.9	2.1	1.8	1.7
Poland	1.2	–0.8	–0.2	–0.3	2.7	2.6	2.5
Czech and Slovak Republics	3.7	1.8	1.1	–3.0	2.0	1.8	1.8
Hungary	3.7	1.5	–0.1	–2.1	2.6	2.5	2.5
Romania	7.2	3.0	–2.7	–4.2	3.0	3.0	2.9
Other Eastern Europe	6.2	4.8	2.3	–2.4	2.2	2.1	2.1
C.I.S.	4.3	3.2	1.5	–9.8	2.6	2.5	2.5
Brazil	6.7	1.0	1.9	1.1	2.8	2.6	2.6
Argentina	2.2	–2.1	–0.2	3.5	2.8	2.6	2.6

Table B.1 *(Continued)*

	1975/1980	1980/1985	1985/1990	1990/1995	1995/2000	2000/2010	2010/2020
Mexico	6.7	1.6	1.2	4.4	4.2	4.0	3.8
Chile	7.5	–0.4	6.1	5.0	5.2	5.1	4.9
Venezuela	3.3	–1.1	2.8	5.2	3.7	3.6	3.5
Other Latin America	7.5	–1.8	2.1	3.2	3.6	3.3	3.1
India	3.5	5.6	5.9	3.7	5.0	4.9	4.7
Sri Lanka	5.5	5.2	3.4	4.6	3.1	2.9	2.6
Bangladesh	5.1	3.8	4.0	3.7	3.8	3.7	3.6
Pakistan	6.0	6.6	6.0	5.3	5.0	5.0	4.8
Other South Asia	3.5	3.6	2.7	3.3	2.0	2.0	1.9
Indonesia	7.9	4.7	6.2	5.7	5.7	5.1	5.0
Malaysia	8.5	5.1	6.6	7.9	6.0	5.1	4.8
Philippines	6.2	–1.3	4.5	2.1	1.6	1.8	1.6
Thailand	7.9	5.6	9.9	6.4	7.3	5.9	5.7
Singapore	8.6	6.2	8.0	5.6	6.1	5.6	5.1
Hong Kong	11.9	6.3	6.9	5.6	5.3	4.3	4.2
Republic of Korea	7.7	8.4	9.3	5.5	4.2	3.5	3.6
Taiwan Province of China	9.4	6.2	8.2	7.7	6.4	5.8	5.7
China	6.0	10.0	7.5	9.3	5.7	4.8	4.8
Viet Nam	1.7	1.0	1.7	3.3	4.1	4.0	3.9
Other East Asia	0.2	0.5	1.5	2.1	2.6	2.6	2.5
Other South-East Asia and Other Oceania	7.7	7.5	5.4	5.5	2.9	3.0	2.9
Iran (Islamic Republic of)	–4.7	7.9	–0.4	6.6	4.2	4.7	4.1
Saudi Arabia	9.3	–1.3	4.5	4.0	2.7	2.4	2.3
Iraq	7.8	–4.9	–1.8	–5.3	2.3	2.0	1.8
Israel	3.5	2.8	3.8	4.7	5.1	4.9	4.7
Algeria	10.1	2.5	0.9	1.6	2.7	2.4	2.5
Other oil producing countries	9.5	–1.6	3.3	2.9	2.3	2.3	2.2
Egypt	8.4	7.6	4.9	0.8	1.6	2.4	2.2
Other Middle East	5.5	3.4	4.0	2.2	2.6	2.3	2.1
Nigeria	3.7	–2.1	5.6	2.9	4.0	3.7	3.6
South Africa	3.5	1.1	1.7	1.0	1.7	1.6	1.7
Other Africa	3.0	2.4	2.9	1.9	2.2	2.1	2.1
World	4.0	2.8	3.3	2.0	3.1	2.9	3.0

Table B.2 Population by country or region (millions)
(Region)

		1960	1980	1990	2000	2020
United States	1	182.7	227.7	246.7	261.2	284.9
Canada	2	17.9	24.0	26.8	29.0	32.1
Japan	3	94.1	116.8	122.7	128.3	132.2
Australia	4	10.5	14.7	16.5	18.0	20.1
New Zealand	5	2.4	3.1	3.3	3.6	3.9
Germany	6	72.7	78.3	77.8	77.9	75.8
France	7	45.8	53.9	56.0	58.5	62.0
United Kingdom	8	52.4	56.4	56.4	56.9	57.8
Netherlands	9	11.5	14.1	14.8	15.4	16.0
Belgium and Luxemburg	10	9.5	10.2	10.3	10.4	10.5
Denmark	11	4.6	5.1	5.1	5.2	5.2
Iceland	12	0.2	0.2	0.3	0.3	0.3
Sweden	13	7.5	8.3	8.4	8.5	8.5
Switzerland	14	5.4	6.3	6.5	6.4	6.2
Ireland	15	2.9	3.4	3.8	4.2	4.9
Norway	16	3.6	4.1	4.2	4.3	4.5
Finland	17	4.4	4.8	4.9	5.1	5.4
Austria	18	7.0	7.6	7.6	7.6	7.7
Italy	19	50.2	56.4	57.3	58.1	58.6
Spain	20	30.3	37.5	39.8	42.3	46.0
Portugal	21	8.6	9.8	10.4	11.0	12.0
Greece	22	8.3	9.6	10.1	10.4	11.0
Turkey	23	27.6	44.4	54.8	65.4	83.5
Yugoslavia	24	18.4	22.3	23.9	25.4	27.2
Other Western Europe	25	0.3	0.4	0.4	0.4	0.4
Poland	26	29.6	35.6	38.8	41.1	45.1
Czech and Slovak Republics	27	13.7	15.3	15.9	16.5	17.7
Hungary	28	10.0	10.7	10.7	10.7	10.7
Romania	29	18.4	22.2	23.7	25.2	27.3
Other Eastern Europe	30	9.5	11.5	12.4	13.1	14.3
C.I.S.	31	215.2	265.5	288.0	305.5	332.8
Brazil	32	70.5	121.3	150.3	178.8	228.1

Table B.2 *(Continued)*

		1960	1980	1990	2000	2020
Argentina	33	21.2	28.2	32.6	36.5	43.5
Mexico	34	36.9	69.4	88.7	109.4	145.6
Chile	35	7.6	11.1	13.2	15.0	18.0
Venezuela	36	7.5	15.0	20.6	25.7	34.2
Other Latin America	37	70.2	114.8	142.2	176.0	276.5
India	38	433.7	675.0	844.0	994.4	1 250.4
Sri Lanka	39	9.8	14.8	17.9	21.1	26.2
Bangladesh	40	53.0	88.7	113.7	141.1	197.9
Pakistan	41	46.7	82.6	105.9	133.1	193.9
Other South Asia	42	40.6	65.3	81.1	98.8	143.0
Indonesia	43	96.3	146.4	178.9	212.0	269.3
Malaysia	44	7.8	13.7	17.3	20.5	26.1
Philippines	45	27.5	48.3	60.5	73.3	95.3
Thailand	46	27.2	46.7	55.9	65.1	81.0
Singapore	47	1.6	2.4	2.7	2.9	3.3
Hong Kong	48	3.1	5.1	5.9	6.5	7.3
Republic of Korea	49	25.0	38.1	44.5	50.5	60.0
Taiwan Province of China	50	11.8	17.5	20.3	23.6	31.8
China	51	682.0	996.1	1 105.7	1 242.3	1 440.7
Other East Asia	52	54.2	83.5	107.4	133.2	180.2
Other South-East Asia and Other Oceania	53	11.7	19.4	24.2	29.1	37.5
Iran (Islamic Republic of)	54	22.3	39.3	53.1	71.2	104.4
Saudi Arabia	55	4.2	9.4	13.5	18.9	30.6
Iraq	56	6.9	13.2	18.7	26.3	41.8
Israel	57	2.1	3.9	4.7	5.4	6.6
Algeria	58	10.8	18.7	26.5	37.7	60.7
Other oil producing countries	59	2.4	6.9	10.7	14.6	21.1
Egypt	60	26.0	42.1	52.4	62.8	81.6
Other Middle East	61	26.5	44.9	57.5	77.5	114.1
Nigeria	62	44.3	80.6	118.1	162.7	268.0
South Africa	63	16.9	28.6	38.8	49.4	69.6
Other Africa	64	195.6	332.7	447.1	600.9	1 085.3
World	65	3 079.1	4 504.1	5 333.0	6 242.0	8 098.1

APPENDIX C

PRODUCER COOPERATION IN COCOA

In this Appendix part of the Articles from the Economic Provisions designed as a follow up to the old International Cocoa Agreement are reproduced.

Article 28

Cooperation among Members

1. Members recognize the importance of ensuring the greatest possible growth of the cocoa economy and therefore of coordinating their efforts to encourage the balanced development of production and consumption so as to secure the best equilibrium between supply and demand. They shall cooperate fully with the Council in the attainment of this objective.

2. The Council shall identify the obstacles to the harmonious development and the dynamic expansion of the cocoa economy and shall seek mutually acceptable practical measures designed to overcome these obstacles. Members shall endeavour to apply the measures elaborated and recommended by the Council.

3. The Organization shall collect and keep up to date the available information needed to establish, in the most reliable way, the world's current and potential consumption and production capacity. In this respect, Members shall cooperate fully with the Organization.

Article 29

Production

1. In order to deal with the problem of market imbalances in the medium- and long-term, and in particular the problem of structural overproduction, the exporting Members undertake to abide by a production-management plan designed to achieve a lasting equilibrium between world production and consumption. The plan shall be drawn up by the producing countries in a Production Committee set up for this purpose by the Council.

2. The Committee shall be composed of all exporting and importing Member countries. However, all decisions of the Production Committee related to the production-management plan and programmes shall be taken by the exporting Members participating in the Committee subject to the provisions of article 43.

3. The Committee's terms of reference shall be, in particular:

   (a) To coordinate the policies and programmes decided on by each producing country, taking into account the production-management plan drawn up by the Committee;

(b) To identify and recommend the application of any measures and activities, including where appropriate diversification, likely to help re-establish a lasting equilibrium between world cocoa supply and demand as soon as possible.

4. The Council shall adopt at its first session following the entry into force of this Agreement annual forecasts of world production and consumption for a period corresponding at least to the lifetime of this Agreement. The Executive Director shall provide the data necessary for the preparation of these forecasts. The forecasts thus adopted by the Council shall be reviewed and revised if necessary every year. The Committee shall fix indicative figures for annual levels of global production necessary to achieve and maintain equilibrium between supply and demand in accordance with the aims of this Agreement. The factors to be taken into consideration shall include the expected variations in production and consumption in accordance with movements in real prices and the estimated variations in stock levels.

5. In the light of the indicative figures fixed by the Committee under paragraph 4 of this article, the exporting Members shall as a group implement the production-management plan in order to achieve global equilibrium between supply and demand in the medium and long term. Each exporting Member shall draw up a programme for the adjustment of its production enabling the objectives set in this article to be achieved. Each exporting Member shall be responsible for the policies, methods and controls it applies to implement its production programme and shall inform the Committee regularly of any policies and programmes recently introduced or abandoned and of their results.

6. The production Committee shall follow and monitor the implementation of the production-management plan and programmes.

7. The Committee shall submit detailed reports to each regular session of the Council, on the basis of which the Council shall review the general situation, in particular assessing the movement of global supply and demand in the light of the provisions of this article. The Council may make recommendations to Members on the basis of this assessment.

8. The financing of the production-management plan and programmes shall be borne by the exporting Members, with the exception of the costs related to the normal administrative services required by the functions of the Production Committee.

9. Each exporting Member shall be responsible for the financing of the implementation of its production-management programme.

10. Any exporting Member or institution may contribute to the joint financing of activities formulated by the Production Committee.

11. The Committee shall draw up its own rules and regulations.

12. The Executive Director shall assist the Committee as required.

Article 30

Stocks

1. To facilitate the evaluation of world cocoa stocks and to ensure greater transparency of the market, Members shall provide the Executive Director, by not later than the end of May of each year, with information to which they have access on stocks of cocoa as at the end of the previous cocoa year held in their respective countries.

2. On the basis of this information, the Executive Director shall submit to the Council for consideration at least once a year a detailed report on world cocoa stocks. The Council may thereafter make appropriate recommendations to Members.

3. The Council shall establish a working group to assist it in respect of the implementation of the provisions of this article.

Article 31

Assurance of supplies and access to markets

Members shall conduct their trade policies having regard to the objectives of this Agreement, so that those objectives may be attained. In particular, they recognize that regular supplies of cocoa and regular access to their markets are essential for both importing and exporting Members.

Bibliography

Bade, J. and Hidde P. Smit (1988): *Cooperation among the IPC member countries in the development and use of a computer simulation model for forecasting supply and demand of pepper and pepper products*, Report for UNCTAD and the International Pepper Community, Economic and Social Institute, Free University, Amsterdam.

Bade, J. and Hidde P. Smit (1991): Modelling and policy formulation for commodity markets, Paper prepared for the International Workshop on Cooperation among the IPC member countries in the development and use of a computer simulation model for forecasting supply, demand and prices of pepper, Jakarta, 12-21 March 1991, Economic and Social Institute, Free University, Amsterdam.

Bade, J. and Hidde P. Smit (1991): The Pepper Economy, report to The International Workshop about Pepper Diseases, Lampung, ESI-VU, Amsterdam, 57 pp.

Bade, J. and H.P. Smit, An annual model of the world pepper economy, Seminar on Commodity Analysis, Jakarta, Indonesia, ESI-VU, Amsterdam, 1992, 63 pp.

Burger, K. and Smit, H.P. (1989), Long-term and short-term analysis of the natural rubber market, *Weltwirtschaftliches Archiv*, Vol. 125(4), pp. 718-747.

ESCAP (1978): *An Examination of the Pepper Economy in Brazil and Madagascar*, Consultants' report of the Royal Tropical Institute Amsterdam by dr.ir. P.W.F. de Waard and ir. C.B. Houtman, ESCAP, Bangkok, Thailand.

ESCAP (1979): *Study on the Stabilization of Export Earnings from Pepper*, by Pande, V.C., ESCAP, Bangkok, Thailand.

ESCAP (1981a): *Report on a Socio-economic Study on Production and Productivity of Pepper Holdings in India*, by George, C.K. and Lakshmanachar, M.S., ESCAP, Bangkok, Thailand.

ESCAP (1981b): *Report on a Socio-economic Study on Production and Productivity of Pepper Holdings in Indonesia*, by Sjamsu Okeng and Nasution, A.G., ESCAP, Bangkok, Thailand.

ESCAP (1981c): *Report on a Socio-economic Study on Production and Productivity of Pepper Holdings in Malaysia*, by Wong Ting Hung and Chua Teck Kheng, ESCAP, Bangkok, Thailand.

ESCAP (1981d): *Report on a Socio-economic Study on Production and Productivity of Pepper Holdings in India, Indonesia and Malaysia*, ESCAP, Bangkok, Thailand.

ESCAP (1983): *A Consolidated Study Report on Determination of Remunerative Price Levels of Pepper in India, Indonesia and Malaysia*, by M. Balaraman Nair, H. Soedarno, S. Haji Abdullah and J. Lau Lik Chu, ESCAP, Bangkok, Thailand.

ESCAP (1984): *Market Study to determine the Demand Prospects of Pepper in Selected Countries of the ESCAP Region*, ESCAP, Bangkok, Thailand.

Food and Agriculture Organization (1986): *The World Pepper Economy: Projections of Supply, Demand and Trade to 1990 and 1995*, F.A.O., Rome, Italy.

Food and Agriculture Organization — Regional Office for Asia and the Pacific (1988): *A Study of Possible New Low-cost Approaches to Small-holder Tree Crop Development*, 2 volumes, draft report AG TCP/INS/6654 by R. Cambell, Pasril Wahid, D.P. Tarigans, Mudrig Yahmadi. Arifin Sultoni and A.F. Fulliott, F.A.O., Bangkok, Thailand.

Herrmann, R., Burger, K. and Smit, H.P. (1990), Commodity policy: price stabilisation versus financing, in: L.A. Winters and D. Sapsford (eds.), *Primary Commodity Prices: Economic Models and Economic Policy*, Cambridge University Press, Cambridge.

Herrmann, R., Burger, K. and Smit, H.P. (1993), Intternational commodity policy — A quantitative analysis, Routledge, London.

International Pepper Community (1980, 1982): *Pepper Statistics*, I.P.C., Jakarta, Indonesia.

International Pepper Community (1984, 1985, 1986, 1987): *Pepper Statistical Yearbooks*, I.P.C., Jakarta, Indonesia.

International Pepper Community (1986): *Report of the eleventh meeting of the permanent panel on techno-economic studies*, I.P.C., Jakarta, Indonesia.

International Pepper Community (1990): *Report of the fifteenth meeting of the permanent panel on techno-economic studies in London*, I.P.C., Jakarta, Indonesia.

International Pepper Community (1988): *Report of the thirteenth meeting of the permanent panel on techno-economic studies*, I.P.C., Jakarta, Indonesia.

International Trade Centre UNCTAD/GATT (1982): *Spices, a survey of the world market*, 2 volumes, ITC UNCTAD/GATT, Geneva, Switzerland.

International Trade Centre UNCTAD/GATT (1988): *A Note on the Development of Restructured Pepper or "Plus Pepper"*, prepared for the 13th meeting of the International Pepper Community, ITC UNCTAD/GATT, Geneva, Switzerland.

Nasution, A.G., *Intensification Project of Pepper in Indonesia during PELITA II and Programme for PELITA III*, Directorate General of Plantations, Jakarta, Indonesia.

Purseglove, P.W., Brown, E.G. Green, C.L. and Robbins, S.R.J. (1981): *Spices*, Longman, London, United Kingdom.

Raja Sekhar, S. (1982), *A Study of Pepper Growers*, interim report No. 12 of the Indo-Dutch Kerala Research Project on Labour and Poverty in India and the Philippines, University of Amsterdam, Amsterdam, The Netherlands.

Tropical Products Institute (1980): *A Technical and Economic Study to Assess and Evaluate the Prospects for Pepper Processing in the Countries of the Pepper Community*, final report to UNIDO by Walters, P.R. and Smith, A.E., TPI, London, United Kingdom.

Tropical Products Institute (1980): *Report of a Study of Primary Processing, Handling and Grading of Pepper (Piper nigrum) in Member Countries of the International Pepper Community*, part I: Black Pepper in India, by F.V. Robinson, TPI, London, United Kingdom.

Tropical Products Institute (1981): *Report of a Study of Primary Processing, Handling and Grading of Pepper (Piper nigrum) in Member Countries of the International Pepper Community*, part II: Black and White Pepper in Malaysia, by F.V. Robinson, TPI, London, United Kingdom.

Tropical Products Institute (1981): *Report of a Study of Primary Processing, Handling and Grading of Pepper (Piper nigrum) in Member Countries of the International Pepper Community*, part III: Black and White Pepper in Indonesia, by F.V. Robinson, TPI, London, United Kingdom.

Tropical Products Institute (1981): *Report of a Study of Primary Processing, Handling and Grading of Pepper (Piper nigrum) in India, Malaysia and Indonesia, Member Countries of the International Pepper Community*, part IV, final report by F.V. Robinson and C.L. Green, TPI, London, United Kingdom.

Wahid, P. (1986): *Rainfed Resource Development Project in Bicol Region, The Republic of Philippines*, consultant's report, Research Institute for Spices and Medicinal Crops, Bogor, Indonesia.

World Bank (1984): *Madagascar, Export Crops Sub-sector Review*, report No. 5097-MAG, World Bank, Washington, USA.

II. PEPPER PRICE TREND DURING THE LAST DECADE SINCE 1984 AND EXPECTATION OF PEPPER PRICE IMPROVEMENT AFTER 1993[1]

Introduction

Market analysis is helpful to people involved in the trading of primary commodities including pepper in preventing unnecessary big losses. However, not all are acquainted or have appropriate knowledge on utilizing such information to eliminate price risk. It is well known that prices of most primary commodities in the international market is volatile. Thus, dealing with the trading of primary commodities including pepper means consciously or unconsciously dealing with speculative activities. In the producing countries, the attitude and the sales policy of the exporters/shippers will always give influence to the other local market participants, that is, the intermediary traders and also the farmers in selling their products or in price discovery. Ironically, some exporters especially those who belong to small firms or are new in the business do not have the means to get updated market information from international sources either through the telephone or facsimile telecommunication and have limited ability in making interpretations and conclusions of the available market analyses to avoid erroneous decisions in their sales policy. In other words, these exporters are highly exposed to price risk. There is a danger that their attitude and sales policy might be followed by other local market participants. Consequently, these exporters and other local market participants might face the same problem of adverse price changes in the international market.

Price movement as the subject of the analysis is separated into 2 categories, namely, the Long Term Price Trend and the Short Term (Daily) Price Fluctuation.

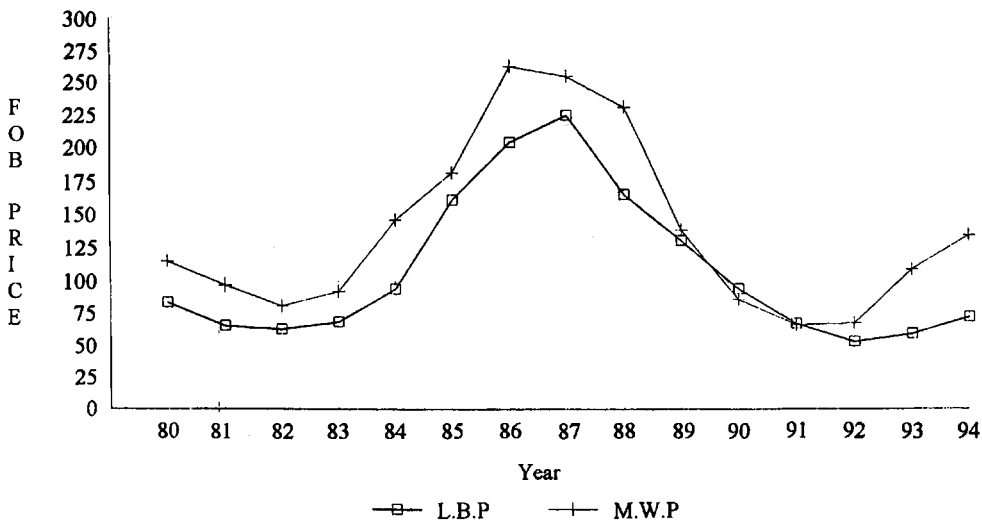
Normally, exporters are confronted with information on short term (daily) price changes from the international market sources. These price changes/fluctuations are mostly dominated by the impact of market sentiments. It is not surprising if information on short term (daily) prices changes is difficult to understand. It would be helpful to start first with the long-term price trend analyses to have a broader and comprehensive idea about what is going on in the world pepper market. Knowing the world pepper situation first would make it easier to understand short-term price changes/fluctuations.

[1] Based on the paper prepared by Mr. Rachim Kartabrata, Secretary-General, Association of Indonesian Pepper Exporters (AIPE), Jakarta, Indonesia

A. Long-term price trend

The price trend of most primary commodities including pepper during a long period normally tends to follow a typical pattern called a *price cycle* which starts with a bottom price, reaches a peak and followed again by another bottom price. Such price cycle could be followed by another price cycle during the next long-term period. The pepper price trend during the last decade (1984-1993) is clearly showing the same typical price cycle i.e. starting with a bottom price in 1984 (after the price war between the Indonesian and Brazilian Black Pepper in 1981/82), a peak in 1987 and followed by a second bottom price in 1993. This price cycle covers 2 extreme parts, i.e. the price increase during 1984 until 1987 and the price decrease after 1987 until 1993. For a better idea of this long-term price cycle, please refer to Graph 1.

Graph 1. Long-term price trend 1980-1994 based on annual average price in US cents/lb Indonesian pepper



Source: United States Department of Agriculture.

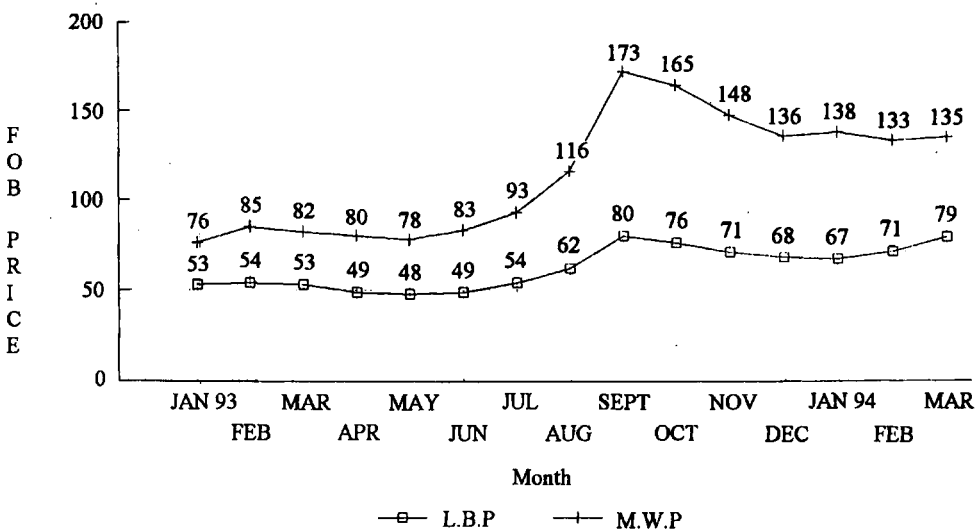
Note: LBP = Lampung Black Pepper.
MWP = Muntok White Pepper.

The question now is whether the next price cycle after 1993 will take the same pattern as the price cycle during the previous period of 1984 until 1993, noting the especially strong price increase from 1984 to 1987?

Initially, the general conclusion on the serious set back of total world pepper production/supply due to the prolonged depressed price since 1988 until 1993 has led to a general bullish view that the same pattern of strong price improvement during 1984 will also take place after 1993. However, the price improvement after 1993 was not taking place as dramatically as it was initially predicted. For example, the price

of Muntok White Pepper (MWP) during the period of 1984 until 1987 was moving from the bottom price of $US 1,900. C and F per ton in 1983 to a peak price of $US 6,500, per ton in 1987. In contrast, the price of MWP has indeed been improving after May 1993, i.e. from $US 1,500 C and F per ton to an average of $US 3,500, per ton in September 1993. However, it has weakened to an average of $US 2,850 per ton during the first quarter of 1994. Unfortunately, the price improvement of white pepper has not proportionally followed the price improvement of black pepper. Hence, a big price difference of almost $US 1,000 per ton lies between them. Why has the price improvement of black pepper being left behind as compared with the price improvement of white pepper since May 1993? For a better picture of this unproportional price improvement between white and black Pepper, please refer to Graph 2.

Graph 2. Monthly average price (US cents/lb) Indonesian pepper for the year 1993/94



Source: United States Department of Agriculture.

Note: LBP = Lampung Black Pepper.
MWP = Muntok White Pepper.

To better understand such an abnormal price phenomena, a discussion of the 3 main aspects of market analyses, i.e. the world pepper supply conditions, the speculative practices and the market sentiments, must be undertaken.

B. Perception of the world pepper supply and demand

1. The world pepper supply

There are different interpretations of the world pepper supply. We, nevertheless, have to differentiate between total production and total exportation/shipments which can be perceived as the effective total pepper supply to the world market. The balance

between the total production and the total exportation/shipments after deducting the domestic consumption becomes the carry-over stock in relevant producing countries. Figures of the world pepper production and the world pepper exportation during the last 13 years starting 1980 is shown on Table 1 below.

Table 1. World pepper production and exportation (Tons)

Years	Production	Exportation	Balance*
1980	140.097	122.775	17.322
1981	144.882	133.029	11.853
1982	130.583	131.643	(1.060)
1983	122.280	132.224	(9.944)
1984	122.251	119.197	3.054
1985	151.672	96.317	55.355
1986	155.431	124.886	30.545
1987	137.995	111.198	26.797
1988	183.476	139.681	43.795
1989	166.717	132.256	34.461
1990	191.014	146.258	44.756
1991	221.000	164.192	56.808
1992	209.500	159.535	49.965

Source: International Pepper Community.

* Including for Domestic Consumption.

2. The world pepper demand

From the point of view of producing countries, the world pepper demand could be simply equivalent to the total exports/shipments. However, in market analyses, we should differentiate between total exports/shipments on the one hand and the total commitments of pepper delivered by dealers (traders) in importing countries to the food industries/grinders on the other. The balance between the total commitments of pepper bought by the dealers from the exporters/shippers in the producing countries and the total commitments of pepper delivered or being delivered to the food industries/grinders will be equivalent to the total pepper available along the *pipe line* between the origins and the food industries/grinders. From the point of view of trading policy, those pepper along the pipe line is simply considered as *long position* taken by dealers, although in practice this long position should not necessarily consist of 100 per cent physical pepper, as part of it could only be in the form of a *paper contract.* In peculiar conditions like crop failure in the producing countries, these buying contracts might not be executed. Thus dealers are always exposed to risk of non-delivery. Therefore dealers in importing countries are supported partly by *physical long position* which consists of ready stock and afloat and partly by *paper contracts* which is exposed to risk of non delivery.

Meanwhile, what is the *demand elasticity of pepper?* There are two kinds of demand, *elastic* and *inelastic.* It is believed that:

— Demand of the Food Industries/Grinders is presumed to be basically inelastic; whereas

— Demand of the Dealers/Traders is presumed to be basically elastic.

However, in analyzing the background of the long-term price trend, emphasis is given more on the supply aspect rather than on the demand aspect.

C. Problem of supply pressure

The cause of the period of prolonged depressed price after 1987 until 1993 was the world pepper glut. From the figures available in Table 1, it is apparent that there has been a strong increase in production since 1985. Although world pepper exports have also been increasing after 1987, a significant carry-over stock in the relevant producing countries is still leftover. Based on the world pepper exports and carry-over stock recorded since 1980, the long-term price cycle over 1980-1992 can be divided into 3 stages; as follows:

The total world pepper exports	**Index**
Average 1980-1984: 129,918 ton	100
Average 1985-1987: 112,900 ton	87
Average 1988-1992: 148,384 ton	114
The total world carry-over stocks*	
Average 1980-1984: 4,543 ton	100
Average 1985-1987: 28,938 ton	637
Average 1988-1992: 45,955 ton	1012

* Including for domestic consumption.

The supply pressure during the long period of depressed price between 1988 until 1993 was due to 2 reasons, namely:

1. The issue of big carry-over stock in the producing countries; and
2. The issue of big long position (physical + contracts) taken by dealers in the importing countries.

The above average figures pertaining to both issues especially during the period 1988-1993 supports the presumption that *supply pressure* did exist during that period. World pepper supply consists of black and white pepper. We shall now try to trace which kind of pepper was mainly exerting supply pressure. Table 2. shows figures of world pepper exports, black and white for the period 1989 until 1992.

Table 2. World pepper exports (1989-1992)
(Tons)

	1989	1990	1991	1992
Black pepper				
1. Brazil	26 558	27 110	45 581	25 103
2. India	25 120	34 429	18 735	19 399
3. Indonesia	17 303	13 015	19 024	31 327
4. Malaysia	22 467	25 602	23 649	20 244
5. Thailand*	1 827	3 617	3 460	5 489
6. Sri Lanka	1 575	2 607	2 058	2 127
7. Madagascar	628	579	625	420
8. Viet Nam	7 551	1 228	16 252	22 358
Sub-total	103 029	108 187	129 384	126 467
(Per cent)	(78)	(74)	(79)	(79)
White pepper				
1. Brazil	1 134	904	1 972	599
2. Indonesia	24 833	34 661	30 643	30 111
3. Malaysia	3 057	2 104	1 809	1 688
4. Thailand*	203	402	384	670
Sub-total	29 227	38 071	34 808	33 068
(Per cent)	(22)	(26)	(21)	(21)
Total	132 256	146 258	164 192	159 535

Source: International Pepper Community.

* The quantities of black and white pepper exported in 1989-1991 were estimated on the basis of the 1992 figures made available at the IPC meeting in Bali.

1. The role of black pepper

As can be noted from the above figures, black pepper dominates world pepper exports with an average share of 78 per cent of total exports during the period 1989 to 1992. In 1993, the share of white pepper exports drastically decreased as Indonesia, the biggest supplier of white pepper, exported only half (around 17,000 metric tons) of its previous volume of exports. Black pepper consists of *high grade* quality (equivalent to ASTA quality) and *low grade* quality (equivalent to FAQ quality). The price of low grade black pepper will normally follow the price of the high grade black pepper proportionally. Most of the high grade black pepper goes to United States, Japan, EEC and the former USSR. Price movements/changes in the New York market strongly influence the price movements/changes in other main markets. The traditional suppliers of black pepper in the world market are Brazil, India, Indonesia and Malaysia. However, since 1991 black pepper from Viet Nam was beginning to gain recognition in the international market. The market share of the 5 main suppliers of black pepper is shown in Table 3.

Table 3. Black pepper production by major producing countries (Tons)

	1989	1990	1991	1992
1. Brazil	26 558	27 110	45 581	25 103
2. India	25 120	34 429	18 735	19 399
3. Indonesia	17 303	13 015	19 024	31 327
4. Malaysia	22 467	25 602	23 649	20 244
5. Viet Nam	7 551	1 228	16 252	22 358
Sub-total	98 999	101 384	123 241	118 431
(Per cent)	(96.09)	(93.71)	(95.25)	(93.65)
6. Others	4 030	6 803	6 143	8 036
(Per cent)	(3.91)	(6.29)	(4.75)	(6.35)
Total	103 029	108 187	129 384	126 467

Initially, the world pepper supply shows a basic pattern of market territories, i.e. the traditional markets of United States and EEC were mostly supplied by Brazil, Indonesia and Malaysia, while India with its Malabar Black Pepper was supplying the East European countries especially the former USSR. However, this supply pattern has changed as India has been having problems with the East European market as reflected by the decrease in its exports since 1991.

Another factor which has caused the change in the supply pattern is the problem of prolonged crop failure of Lampung Black Pepper (LBP) due to unfavorable weather conditions during the flowering and fruiting seasons in January-February.

An extraordinary exception was for the crop season of 1991/92 when the production of LBP was extremely high as reflected by the level of exports reported in 1992. Also Brazil had an extraordinary high crop in 1990/91. Meanwhile, Viet Nam has become a main supplier of black pepper since 1991.

From the above figures of black pepper exports for the period 1989 to 1992, it can be noted that:

— 1991 was the year of Brazil, Malaysia and Viet Nam; while,
— 1992 was the year of Indonesia, Malaysia and Viet Nam.

Based on the figures available from IPC, 1993 is undoubtedly the year of India with exports of almost 50,000 tons of Malabar Black Pepper.

During the prolonged decrease in price from 1988 to 1993, three factors affected the world black pepper supply, namely:

1. The continuous big carry-over stock of Malabar Black Pepper in India with an average of 10,000 tons a year due to its problem with its East European markets, especially the former USSR.

2. The unavailability of information about exports of black pepper from Viet Nam which was mostly shipped via Singapore. It is only recently that the International Pepper Community (IPC) could furnish information on black pepper exports from Viet Nam for the period 1989 to 1992.

3. The prolonged crop failure of Lampung Black Pepper (LBP) due to repeated heavy rainfall during the flowering and fruiting period, except for the crop year 1991/92.

The problem of high accumulated carry-over stock of Malabar Black Pepper in India seems to have been solved by exporting a significant volume in 1993 as reflected in Table 4.

Table 4. Exports of Malabar Black Pepper 1992/93 (Tons)

Months	1992	1993	Increase
January	1 100	1 800	700
February	2 399	2 836	437
March	3 537	6 698	3 161
April	1 459	6 113	4 654
May	1 981	2 634	653
June	1 207	3 590	2 383
July	1 288	2 471	1 183
August	2 529	4 300	1 771
September	1 182	5 277	4 095
October	551	4 725	4 174
November	866	4 144	3 278
December	1 299	4 220	2 921
Total	19 399	48 808	29 409

The release of Malabar Black Pepper took place at the right moment, i.e. when the other pepper producing countries especially Brazil and Indonesia were not in a position to supply black pepper at their habitual levels.

2. The role of white pepper

As shown in Table 2, the share of white pepper is relatively small, averaging only at about 22.5 per cent of total pepper exports for the period 1989 to 1992. These exports were mostly of Indonesian White Pepper (Muntok White Pepper/MWP) which had an average share of 88.75 per cent of total world of white pepper.

The production of white and black pepper in Indonesia takes place in separate areas unlike in other producing countries such as Brazil and Malaysia. In Indonesia, white pepper is produced mainly in Bangka Island, while black pepper is planted in Lampung. The decision whether to plant black or white pepper in other producing

countries like Brazil and Malaysia depends on the price differential between black and white pepper in the international market. Producing white pepper entails more cost than producing black pepper. It is therefore understandable why during the period, 1988 to 1993, of prolonged depressed pepper prices, production of white pepper in producing countries (except Indonesia) was not encouraged. This can be seen in the export figures as presented Table 5.

Table 5. World exports of white pepper 1989-1992 (Tons)

	1989	1990	1991	1992
1. Brazil	1 134	904	1 972	599
	(3.9)	(2.4)	(5.7)	(1.8)
2. Indonesia	24 833	34 661	30 643	30 111
	(85.0)	(91.0)	(88.0)	(91.1)
3. Malaysia	3 057	2 104	1 809	1 688
	(10.4)	(5.5)	(5.2)	(5.1)
4. Thailand	203	402	384	670
	(0.7)	(1.1)	(1.1)	(2.0)
Total	29 227	38 071	34 808	33 068
(Per cent)	(100.0)	(100.0)	(100.0)	(100.0)

Since white pepper is priced higher than black, an acceptable price difference for the farmers to produce white pepper is around 20 per cent and higher. However, during the oversupply period after 1988, the difference became so small that sometimes the price of black pepper became even higher than the white pepper price level. The loss of income for the farmers in Bangka Island led to a situation wherein the farmers had a difficult time maintaining their pepper gardens at normal levels. The decrease in pepper harvest since 1992/93 in Bangka Island, as reflected by the low level of export figures of MWP in 1993, showed the negative impact of the prolonged loss of income by farmers in that island. This occurs despite the increase in prices of white pepper in the international market since September 1993. However, this increase has not reached the level of prices recorded during the period 1984-1987.

D. Speculative practices

As it was mentioned in the Introduction, market participants along the marketing channels of pepper exportation especially traders, being constantly exposed to price risk, are inevitably forced to make speculative decisions. Dealers or traders make good speculations as they are considered to know better what is happening on the side of the consumers. Therefore, being aware of the demand condition, their attention is focused on deciding what sales policies to adopt regarding the supply aspect. But before deciding the sales policies, how does one predict the pepper supply conditions? Motivated by making profits, dealers/traders normally make decisions on their sales policies (against consumers) before the world pepper supply capacity is known. In other

words, there will always be a *time lag* between the time they have to make decisions and the time when the real supply conditions are known.

There are two sales policies that can be adopted by these market participants. First is *Short Covering*. This means selling the pepper first to importers on paper before actually buying the pepper from the producers. The second is *Long Covering*. This is the opposite of the first one. This means buying the pepper first from the producers before actually selling it to the consumers/importers. Theoretically there is a third one called *Square Covering*. This is sell and buy at the same time. It is also called *Back to Back Trading*. But this is a rare situation and is hardly practiced.

1. Short covering sales policy

Short covering sales policy (sell first and buy later) is usually adopted by dealers and exporters during a continuous decrease in price due to the excess world supply of pepper. Such conditions usually create a loss of confidence and *bearish views* among market participants that they prefer to give priority to selling instead of buying. Cheap pepper and the guarantee of continuous and regular delivery of pepper for a long-term period is what food industries/grinders want. However, these industries usually avoid speculating and the burden of making speculations lie on the traders/dealers. They are more concerned with safeguarding the continuity of production/processing of their end products. To meet such requirements from the industries (especially in utilizing the availability of cheap pepper in the long-term), dealers will commit themselves to long-term Forward Sales Contracts based on short covering policy. On the other side, in dealing with the exporters/suppliers in the origins, dealers will offset their short covering by committing long-term Forward Purchase Contracts with them. To meet such long-term purchase contracts from the dealers, the exporters will also commit to a long-term Forward Sales Contract based on short covering to avoid high interest costs. As both dealers and exporters are committed in the same sales condition, i.e. based on short covering sales policy, their interest would be keep local prices in the origins at low levels. In such a situation, the farmers are left helpless. They do not have much bargaining position as they are left holding most of physical stock of pepper. Because of this, it is possible that prices will continuously decline in the long-term period. This is a situation favorable to the exporters/dealers.

2. Long covering sales policy

Long covering sales policy (buy first and sell later) is usually adopted by the exporters and dealers during continuous price increase due to a short world supply of pepper. Such conditions usually create full confidence and a *bullish view* among the market participants. Thus, they prefer to safeguard first their *physical stocks* based on long covering sales policy and would be reluctant to commit to a long-term Forward Sales Contract. As the market becomes *seller's markets*, farmers are now in a favorable bargaining position. In a bullish situation, pepper prices will continue to improve and no exporter or dealer would dare adopt a short covering sales policy.

E. Market sentiments

Market sentiment relates to the behaviour of the market participants against the available market information. Some of the participants respond rationally and carefully based on the available data while others on their feeling or intuition. Market sentiments could either positively or negatively affect the market transactions. There are many factors which may create market sentiments, but to simplify the case, the discussion is limited to two aspects, namely, world pepper supply condition and speculative practices.

1. The world pepper supply condition

Owing to several factors like weather condition, plant disease, attitude of farmers in maintaining their pepper gardens, etc., production estimates of primary commodities have always been difficult to predict. Some big firms may be able to carry out field survey among the relevant producing countries, but most of the other market participants are not in a position to undergo the same and rely only on second hand information gathered through formal or informal channels. It is not surprising, therefore, that there are many versions about the conclusion of the world pepper supply condition. Market participants, especially those in the pepper importing countries will have varying response against these various versions of conclusions, as follows;

(a) Loss of confidence

If the consumer tends to believe a bearish conclusion where there will be an excessive supply of pepper in the world market and therefore the market will become a buyers market, then the consumers will not be very keen on buying immediately or simply adopt the from hand to mouth attitude. However, this attitude may change if the dealers can convince the consumers or users that the present price is extremely low and such low prices would not take place for unlimited period and thus they are willing to buy even for long term forward purchases.

(b) Full confidence

On the contrary, if the industry tends to believe a bullish conclusion where there will be a serious shortage of pepper supply in the world market and therefore the market will become a sellers market; then the attitude will be to buy pepper eagerly either for prompt deliveries and also for long term deliveries in order to ensure the continuity of production of the users end products.

However, in reality the attitude of buyers and sellers in responding to the information of the world pepper supply condition varies from one participant to the other as they have varying and different interpretations of the available information.

2. Speculative practices

This is related to the attitude and decisions made by the sellers side either based on short or long covering sales policy. Once the decision has been made, their attitude

and steps of action will be consistent to the relevant sales policy they have made. In this context, it frequently happens that the speculators are creating misleading statements which may have bearish or bullish influence to the market sentiments among the market participants, so that market response will be in favour of their sales policy. In other words, the speculators mislead the other market participants on purpose to stimulate their selling and purchasing decisions and favour the sales policy that has been made by the speculators.

In practice, it is difficult to trace and distinguish whether a particular market sentiment is in relation to the aspect of world pepper supply condition or to the aspect of speculative practices. Nevertheless, the impact of the market sentiments will be reflected in the short term or daily price changes/fluctuation, rather than in the long term price trend.

F. Price prospect after 1993

The main question is whether the pepper price trend after 1993 could be concluded as bullish or bearish. Short-term (daily) price fluctuation and long-term price trend will behave in relation to the following aspects, namely, the world pepper supply conditions, the speculative practices and the market sentiments. And yet the emphasis of the long-term price trend analysis will be in reference to the first aspect, that is to have a general idea of how the last world pepper supply conditions have been taking place.

It has been concluded that based on the export figures of 1989 until 1992, world pepper supply consisted of about 78 per cent black pepper and 22 per cent white pepper.

The world supply of white pepper during 1989-1992 was dominated by the Indonesia white pepper. It had 89 per cent share of the world supply, most of which were the Muntok white pepper (MWP) from Bangka Island. The share of the MWP in the Indonesia white pepper in 1991 and 1992 in metric tons were as follows:

	1991	1992
Muntok white pepper	26,561	27,351
Other white pepper*	8,247	5,717
Total	34,808	33,068

* Other white pepper from Indonesia originated from Pontianak (West Kalimantan) and Samarinda (East Kalimantan). In many cases, some MWP was transported to Jakarta and later on shipped abroad from Tanjung Periok harbor.

In 1992/93, the white pepper crops of Indonesia suffered a serious setback as reflected by the low exports of MWP from Bangka Island of only 17,067 tons. However, the supply pressure from the world white pepper has ended since 1993 as reflected by the significant price improvement of white pepper beginning September 1993.

However, the price improvement of white pepper was not followed by a corresponding price increase in black pepper. There was an abnormal price difference of almost $US 1,000 per ton. Why has this occurred even after 1993? Is there still supply pressure from the black pepper? We recall that there are five main suppliers of black pepper in the world:

- Malabar Black Pepper from India
- Brazilian Black Pepper
- Lampung Black Pepper (LBP) from Indonesia
- Sarawak Black Pepper from Malaysia
- Viet Nam Black Pepper

Unfortunately, the 1993 export figures of black pepper from all countries is not yet available. So far, only the export figures of Malabar Black Pepper from India and LBP from Indonesia are available. Contrary to the exports of LBP from Indonesia of only 7,920 tons in 1993, exports of Malabar Black Pepper from India stood at an abnormally high of 48,808 tons. This figure is almost triple the average exports in 1990 and 1991. With the assumption that the supply of black pepper from Brazil, Malaysia and Viet Nam in 1993 were unchanged, then it could be concluded that the supply pressure during 1993 was coming from Malabar Black Pepper. The question now is whether this supply pressure from Malabar Black Pepper will occur again in 1994?

How was India in a position to supply a huge volume of black pepper in 1993? Assuming that the domestic consumption of India is stable at the level of about 30,000 tons per year and with a normal crop of about 55,000 tons, then the normal available Malabar Black Pepper for export would be 25,000 tons. Where did India get the balance to export almost 50,000 tons in 1993?

Recalling the three main factors strongly influencing market sentiments during the depressed prices of 1988 to 1993 when there was a loss of confidence among the buyers:

- The continuous big carry-over stocks of Malabar Black Pepper in India averaging 10,000 tons per year due to a problem in its traditional markets of East European Countries, especially the former USSR.
- The unavailability of appropriate information about the exportation of black pepper from Viet Nam which was mostly shipped via Singapore.
- The prolonged crop failure of Lampung Black Pepper (LBP) due to repeated heavy rainfall during the flowering and fruiting period, except for the crop year 1991/92.

In relation to the supply pressure from Malabar Black Pepper, it seems that such extraordinary high exports of Malabar Black Pepper in 1993 arose from a large accumulated carry-over stocks as a result of low level of exports in 1990 and 1991, as shown below:

Year	Volume of exports
1989	25,120 tons
1990	34,429 tons
1991	18,735 tons
1992	19,399 tons
1993	48,808 tons

As to whether the Malabar Black Pepper will be in a position to repeat the supply pressure after 1993, it will depend on the level of available carry-over stock by the end of 1993 and the harvests during crop year 1993/94.

If the carry-over stock is limited and if the low estimate of last crop 1993/94 of approximately 45,000 tons is indeed true, then theoretically there would be no further supply pressure from the Malabar Black Pepper after 1993.

Concerning the supply condition of Brazilian Black Pepper, according to the last letter received from ABEP (Associacao Brasileira Dos Exportadores E Produtores De Pimenta Do Reino) dated May 26, 1994, the harvest in 1994 will be on the low side, approximately 19,600 tons consisted of 18,000 tons of black pepper and 1,600 tons of white pepper. Using the estimates of domestic consumption in Brazil presented during the last IPC meeting in Bali in 1993, then the balance available for export of Brazil will be as follows:

	Production	Domestic Consumption	Balance
Black Pepper	18,000	4,500	13,500
White Pepper	1,600	500	1,100
Total	19,600	5,000	14,600

If the carry-over stock from 1993 is also limited, then it could be concluded that there would be no supply pressure from the Brazilian Black Pepper. The exportation of black pepper during the period 1989 until 1992 was as follows:

1989	26,558 tons
1990	27,110 tons
1991	45,581 tons
1992	25,103 tons

In regard to the supply condition of Indonesian Black Pepper, the recent estimate is provided herein:

Estimated production	21,500 tons
Domestic consumption	2,500
Balance	19,000
Shortage on processing	2,280
Balance	16,720
Carry-over stock 1993	5,338
Total	22,058
Expected exportation	15,000
Carry-over stock 1994	7,058 tons

It is estimated that the available supply of black pepper from Indonesia will be twice as big compared to exports in 1993, assuming estimated production for 1994 will be realized.

It is unfortunate that official figures about the supply condition of black pepper from Malaysia and Viet Nam are not yet available. However, according to unofficial sources, Sarawak Black Pepper from Malaysia in 1994 will be at the lower level compared to the previous year.

Assuming that the supply condition of Viet Nam Black Pepper would be on the same level as last year, it can be safely concluded that there would be no supply pressure in black pepper for 1994. Similarly, there would be no supply pressure for white pepper after 1993. It can be said that the world pepper market after 1993 would fundamentally be a bullish market and pepper price trend will improve.

G. Conclusion

The discussion of the above issues leads us to the following remarks and conclusions:

1. Traders and/or exporters dealing with primary commodities (including pepper) are exposed to price risks, due to unstable prices in the international market. They are confronted with the short-term (daily) price changes/fluctuation, as well as complex and sometimes confusing market information.

2. Short-term (daily) price fluctuation is caused by many factors. But, basically there are two main aspects that give rise to such short-term (daily) price fluctuation, namely, a) unclear or controversial conclusions about the world pepper supply conditions which might lead to a bearish view, and b) the misleading statements which at times made on purpose by the speculators to create market sentiments so that the response of the market participants will favour the speculators.

3. Before getting involved directly in the short-term (daily) price analyses (which is hard to conclude), it would be helpful for traders (exporters) to have a general idea about the world pepper condition by analyzing the long-term price trend, especially relating to the world pepper supply condition.

4. It was concluded that the world pepper supply comprises about 78 per cent black pepper and about 22 per cent white pepper, which means that the black pepper supply condition has a very important role in the world pepper market.

5. The world supply of white pepper during the period of 1989 to 1992 was dominated by the Indonesian white pepper with about 90 per cent of the total average world exportation during the period representing about 34,000 tons. The exportation of white pepper from Indonesia itself during that period was dominated by MWP from Bangka Island. However, MWP exports for 1992/93 was substantially reduce to only 17,067 tons mainly due to low production. Exports of white pepper from Indonesia in 1993 were about 20,242 tons. The present situation in Bangka Island gives the impression that MWP is still hard to get in the local market. The market confidence is high and the local market is in the sellers side (Sellers Market). It appears that there will be no supply pressure for white pepper after 1993.

6. The world supply of black pepper during the period of 1989-1992 was dominated by 5 producing countries, namely, Brazil, India, Indonesia, Malaysia and Viet Nam, whose aggregate production represents almost 95 per cent of the whole world supply.

7. The exportation of Malabar Black Pepper from India was reduced sharply from 30,000 tons in 1989/90 to 19,000 tons in 1991/92. In 1993, according to the export figures available in IPC, India appears to have released more of their carry-over stock as reflected by the extremely high exportation of 50,000 tons during that year. If the low estimates of 45,000 tons for last crop 1993/94 is true and the assumption of domestic consumption around 30,000 tons is still valid, then the resulting carry-over stock of Malabar Black Pepper will be relatively small. Hence it can be concluded that there will be no more supply pressure from Malabar Black Pepper after 1993.

8. It was also concluded that there will be no supply pressure from other black pepper producing countries, especially from Brazil and Indonesia. This led to a further comprehensive conclusion that after 1993 there would be no supply pressure from either black pepper or white pepper. Assuming that the demand conditions would be stable, then it can be concluded that bullish conditions will prevail in the world pepper markets after 1993.

III. CAN PEPPER FARMERS PREDICT WHITE PEPPER PRICES USING CHANGES IN BLACK PEPPER PRICES? AN EMPIRICAL STUDY[1]

Introduction

The objective of the study is to determine the existence of cointegration between black and white pepper markets in Malaysia. For cointegrated pepper markets, pepper farmers can use the changes in the black pepper prices to forecast white pepper prices, and gain excess profit consistently by using the changes in black pepper prices as a trading rule. Using a sample of 583 weekly data for the period January 1981 to June 1992, our cointegration analysis suggest that black and white pepper markets in Malaysia are not linked together.

In 1991, Malaysia was ranked fourth in the world after Indonesia, India and Brazil in pepper production (see Table 1). During the same period, Malaysia contributed about 12.8 per cent of the world's pepper production. Malaysia is the world's third biggest exporter of pepper, capturing 15.6 per cent of the world's market share, trailing Indonesia with 29.4 per cent and Brazil with 28.2 per cent. On the other hand, India had about 11.2 per cent of the world's market share of pepper exports. These four countries which formed the International Pepper Community (IPC) contributed more than 80 per cent of the world's total pepper exports.

The state of Sarawak accounts for 98 per cent of the total land acreage under pepper in Malaysia. As shown in Table 1, the other producing states, Peninsular Malaysia and Sabah, contributed about 2 per cent of the total land area cultivated under pepper. Currently, nearly 90 per cent of the total pepper production are in the form of black pepper. More than 90 per cent of the pepper produced are for the export markets, as the domestic consumption of pepper in Malaysia is very low, about 3 per cent of the total pepper production. Practically all of Malaysia's pepper exports are in the form of black and white berries. In 1991, major importers of Malaysia's pepper are United States (25.8 per cent), Singapore (24.8 per cent), Japan (16.8 per cent) and Germany (8.3 per cent).

In recent years, more black pepper are produced in Malaysia (see Table 1). In 1980, white pepper comprised almost 30 per cent of the total pepper produced. However

[1] Based on the paper prepared by Dr. Muzafar Shah Habibullah and Ahmad Zubaidi Baharumshah, Associate Professor and Lecturer respectively, Department of Economics, Faculty of Economics and Management, Universiti Pertanian Malaysia.

in 1991, it only formed less than 10 per cent of the total pepper produced. This implies that black pepper production is gaining significance over white pepper production. There are at least two important factors that contributed to the decline in the production of white pepper. First, as pepper farmers are mostly poor and small-scale in nature, they would prefer to incur less cost in producing pepper. Producing black pepper is less time consuming, has low cost of production and give early returns. Despite all that, in some instances, the cost of producing pepper is even higher than the price received by the farmers. Second, the farmers are reluctant to produce pepper because of the substantial decline in the price of white pepper as compared to black pepper. Further, the narrowing price differential between white and black pepper has made black pepper a more lucrative commodity to market.

The objective of our study is to determine the degree of substitution between white and black pepper, by examining linkages between black and white pepper markets. This can be illustrated by giving an example. Suppose that black pepper is a good substitute for white pepper, i.e. a rise in the price of black pepper will increase the production of black pepper, and subsequently, there will be a drop in the production of white pepper. As such, we can see that if black pepper and white pepper are substitutable, the price of both types of pepper will move together over time. This long-run relationship can be captured by an approach coined by Granger (1981) known as the *cointegration approach.*

According to Granger (1981, 1986), if two variables of the same order of integration, each being stationary in its changes, are said to be cointegrated if some linear combination of the two variables is stationary. The concept of cointegration introduced by Granger (1986) and Engle and Granger (1987) have several important implications for the present study. If the prices of white pepper and black pepper are cointegrated, this will imply that, at the production level, producers tend to substitute white pepper for black pepper. Unless white pepper prices are attractive enough, we could probably find that the production of white pepper will drop significantly in the future.

The cointegration between black and white pepper prices will mean that one market can represent the other, that is, there is a market linkage between the two markets. As such, for policy purposes, one can either use the white pepper market to represent the black pepper market. If on the other hand, black and white pepper prices are not cointegrated, then researchers should study the Malaysian pepper market independently: one study for each type of pepper. This will suggest that earlier studies by Ng and Kanbur (1993) and Yusoff (1993) are misspecified.

Further, a very important consequence of a cointegrated market is that, one market can be used to predict the other market. As Granger (1986) notes that,

> *"If x_t, y_t are I(1) and cointegrated, there must be Granger causality in at least one direction as one variable can help forecast the other."*

The method of cointegration is a very useful tool in economics, particularly in searching for long-run relationships between economic variables. It can be applied to various economic issues, as properly stated by Granger (1986),

> *"Examples of such variables are interest rates on assets of different maturities, prices of a commodity in different parts of the country, income and expenditure by local government and the value of sales and production costs of an industry. Other possible examples would be prices and wages, imports and exports, market prices of substitute commodities, money supply and spot and future prices of a commodity."*

Therefore, in our case, if such market linkages is established, farmers can predict white pepper prices using the changes in black pepper as a trading rule to consistently derive excess profit.

A. Materials and methods

1. The concept of cointegration

The concept of cointegration is related to the notion of a long-run or equilibrium relationship among two or more variables. Granger (1981) pointed that the series may be unequal in the short-run but they are tied together in the long run, that is, they move parallel to each other over time.

However, before we test for cointegration among variables, we need to know the stationarity status of the series. In empirical works, we only deal with stationary series. It is important that the series under study have the same order of integration. Series B_t and W_t are integrated of the same order, denoted by $B_t \sim I(d)$ and $W_t \sim I(d)$, if the two time series require to be difference d times to achieve stationary. A series of $B_t \sim I(1)$, that is integrated of order one, need to be different only once to render stationary, that is, to become I(0). According to Granger (1986), "an I(0) series has a mean and there is a tendency for the series to value frequently and with rare extensive excursions".

For any I(1) series, it is always true that the linear combination of the two series will also result in an I(1). However, if there exist a constant A, such that,

$$z_t = B_t - AW_t \qquad (1)$$

is I(0), then B_t and W_t will be said to be cointegrated, with A called the cointegrating parameter.

2. The tests of cointegration

Before examining the cointegrating regressions, we employed unit root tests to determine the order of integration of the individual series. In this study, the unit root tests are conducted using the Dickey-Fuller (DF) and augmented Dickey-Fuller

(ADF) tests. This test is the t-statistics on parameter ρ, of (for black pepper price B, say) the following equation

$$\Delta B_t = \alpha_0 + \rho B_{t-1} + \sum_{i=1}^{H} \alpha_i \Delta B_{t-1} + \eta_t \quad (2)$$

where η is the disturbance term. If xi equals zero, we have the DF test, but otherwise it is the ADF test. To ensure that η is white noise, the optimal lag length (H) is chosen using the Akaike's information criterion (AIC). The optimum number of lags is calculated by minimizing the AIC statistic defined as

$$AIC_H = \log D_H + (2n^2 H/N) \quad (3)$$

where N is the total number of observations, n is the dimension of vector B_t, H is the number of lags and D_H is the determinant of the covariance of the residuals.

The null hypothesis Ho:B_t is I(1), which is rejected in favor of I(0) if P is found to be negative and statistically significant. The t-ratio on parameter ρ, calculated, is compared to the approximate critical value given in Fuller (1976). A time trend is also included in Equation (2) in order to determine whether the series is trend stationary (TS). A series characterized by a trend stationary process (TSP), need to include a time trend in order to achieve stationary. Following Dickey and Fuller (1981), we used the likelihood ratio test, and the value Φ_3 is compared with the actual value reported in Table VI of Dickey and Fuller (1981). The null hypothesis Ho:B_t is unit root with drift, which is rejected in favor of TS, if Φ_3 is found to be greater than the critical value.

The above tests were also carried out for first difference of the variables. That is, we estimate the following equation

$$\Delta^2 B_t = \beta_0 + \rho \Delta B_{t-1} + \sum_{i=1}^{H} \beta_i \Delta^2 B_{t-i} + \mu_t \quad (4)$$

where the null hypothesis is Ho:B_t is I(2), which is rejected in favor of I(1) if ρ is found to be negative and statistically significant.

After determining that the series are of the same order of integration, we test whether the linear combination of the series are non-stationary in levels are cointegrated. To conduct the cointegration test, we follow Engle and Granger (1987) two-step procedure for testing the null of non cointegration. In the first step, we run the following cointegrating regression, that is, white pepper price (W) on black pepper price (B) or = f(B_t), as follows:

$$W_t = \gamma_0 + \gamma_1 B_t + \varepsilon_t \quad (5)$$

and, in the second step, the following unit root test is conducted on the residual ε, as follows

$$\Delta\varepsilon_t = \varphi\varepsilon_{t-1} + \sum_{i=1}^{H} \theta_i \Delta\varepsilon_{t-i} + \nu_t \quad (6)$$

The null hypothesis is Ho:φ=0, that is W and B are not cointegrated. The ADF test is conducted by including lagged dependent variables on the right hand side of Equation (6).

Apart from using ADF as a test for cointegration, Engle and Granger (1987) have recommended the use of the following cointegrating regression Durbin-Watson (CRDW) statistic

$$\text{CRDW} = \left[\sum_{t=2}^{N} (\varepsilon_t - \varepsilon_{t-1})^2\right] / \left[\sum_{t=1}^{N} \varepsilon_t^2\right] \quad (7)$$

The null hypothesis of no cointegration is rejected for value of CRDW which are significantly different from zero. The critical values for CRDW are tabulated in Engle and Yoo (1987).

3. Sources of data

In this study, 583 weekly observations of both black and white pepper prices covering the period January 1981 to June 1992 were used. The price data were collected from various issues of the Pepper Market Bulletin published quarterly by the Pepper Marketing Board of Sarawak, Malaysia. Price series of seven major towns in Malaysia were selected, of which six of the towns were located in Sarawak and one in Johor, Peninsular Malaysia. However, pepper prices for Sabah was not available for this study. The six major towns of Sarawak include Kuching, Sri Aman, Sarikei, Sibu, Bintangor and Batu Niah. However, for Bintangor and Batu Niah, the pepper price series started only from July 1985 until June 1992.

B. Results

The results of the unit root tests for black (B) and white (W) pepper prices for Kuching, Sri Aman, Sarikei, Sibu, Bintangor, Batu Niah, and Johore Baru are reported in Table 2.

Results for the first-difference of the variables show that all fourteen price series appear to be strongly I(1), and clearly suggest that the price series are non-stationary in levels. In all cases, the null hypothesis of $B_t \sim I(2)$ and $W_t \sim I(2)$ are rejected at the one percent level of significance, implying that the price series do not require second differencing to achieve stationarity. We conclude that the black and white pepper prices are stationary after differencing once, that is, they follow an I(1) process.

On the other hand, the likelihood ratio statistics Φ_3 suggests that we cannot reject that all pepper price series are difference-stationary process (DSP) against the alternative that they are trend-stationary process (TSP). As shown in Table 2, the

calculated Φ_3 do not exceed the critical value of 8.34 as tabulated in Dickey and Fuller (1981).

Having shown that all the price series are of the same order of integration, we then proceed to test for the existence of cointegration between the price. Results of the cointegration tests are summarized in Table 3. The empirical results of the ADF test for all cointegrating regressions B = f(W) and W = F(B), could not reject the null hypothesis of non-cointegration. Furthermore, the CRDW statistics show that the null hypothesis of no cointegration are rejected in all of the cointegrating regression equations. We conclude that black and white pepper prices in each of the seven major towns in Malaysia are not cointegrated. These results support a conclusion that black and white pepper prices is not a part of the long-run cointegration relationship in Malaysia. In other words, black and white pepper markets are not linked.

C. Conclusion

The primary purpose of this paper is to determine whether we can use changes in the black pepper prices as market information to predict the white pepper prices, and vice versa. In order to do this, the market between black and white pepper must be linked together. Using the approach of cointegration, our results suggest that the market for black and white pepper in Malaysia are not linked together for the period under study.

The results of the present study imply that the prices of black and white pepper are independent. They are not cointegrated. As such, one cannot use the price in one market to predict the price in the other market. An important policy implication from the study is that, one has to take into account the exogeneity between black and white pepper markets. Thus, one has to study a separate market for black and white pepper in Malaysia.

ANNEXES

Table 1. Statistics on pepper

	1980		1991	
	Volume	Per cent	Volume	Per cent
A. Production of pepper: World ('000 tons)				
India	30.0	23.5	55.0	24.3
Indonesia	30.0	23.5	61.0	27.0
Brazil	30.0	23.5	47.5	21.0
Malaysia	31.5	24.7	29.0	12.8
Other countries	18.7	4.7	33.8	14.9
B. Export of pepper: World ('000 tons)				
India	25.0	21.3	18.9	11.2
Indonesia	26.0	22.2	49.7	29.4
Brazil	30.0	25.6	47.7	28.2
Malaysia	31.7	27.0	26.3	15.6
Other countries	4.6	3.9	26.4	15.6
C. Area under pepper cultivation: Malaysia (Hectare)				
Peninsular Malaysia	1 200	8.4	100	0.9
Sabah	395	2.8	130	1.1
Sarawak	12 698	88.8	10 998	98.0
D. Production of pepper: Malaysia (ton)				
Black pepper	22 815	–	26 554	–
Per cent of total	72.27	–	91.35	–
White pepper	8 755	–	2 515	–
Per cent of total	27.73	–	8.65	–
E. Export of pepper to major countries: Malaysia (ton)				
United states	1 132	3.6	6 769	25.8
Singapore	24 168	76.2	6 524	24.8
Japan	3 331	10.5	4 413	16.8
Germany (Federal Republic of)	958	3.0	2 169	8.3
United Kingdom	552	1.7	954	3.6
Natherlands	35	0.1	857	3.3
France	185	0.6	33	0.1
Other countries	1 357	4.3	4 548	17.3

Source: Ministry of Primary Industries, Malaysia (1993).

Table 2. Results of the unit root tests

Towns	Black pepper			White pepper		
	ADF	Lag	ϕ_3	ADF	Lag	ϕ_3
I. Level form						
Kuching	–0.73	2	1.67	–0.80	10	1.81
Sri Aman	–0.47	19	3.25	–0.63	6	1.81
Sarikei	–0.49	18	3.34	–0.60	18	1.96
Sibu	–0.47	18	3.06	–0.51	19	2.41
Bintangor	0.44	1	5.50	–0.05	10	7.48
Batu Niah	0.14	2	5.95	–0.03	10	7.40
Johor	–0.53	19	3.20	–0.46	18	3.35
II. First-Difference						
Kuching	–5.71*	21	–	–5.16*	22	–
Sri Aman	–6.31*	11	–	–5.11*	22	–
Sarikei	–5.21*	22	–	–5.14*	22	–
Sibu	–5.54*	21	–	–5.17*	22	–
Bintangor	–5.47*	8	–	–5.60*	9	–
Batu Niah	–5.08*	11	–	–4.91*	12	–
Johor	–5.20*	22	–	–5.10*	24	–

Notes: The critical value for ADF at $\alpha = 0.01$ is –3.44 for N = 500 [see Fuller (1976, p. 373)]. The critical value for ϕ_3 at $\alpha = 0.01$ is 8.34 for N = 500 [see Dickey and Fuller (1981, p. 1063)].

Table 3. Results of cointegration tests

Towns	Black pepper			White pepper		
	CRDW	ADF	Lag	CRDW	ADF	Lag
Kuching	0.04	–3.09	1	0.04	–3.05	1
Sri Aman	0.05	–3.24	1	0.05	–3.21	1
Sarikei	0.04	–3.01	15	0.04	–3.03	15
Sibu	0.03	–2.94	21	0.03	–2.98	21
Bintangor	0.10	–2.52	1	0.10	–2.41	1
Batu Niah	0.11	–2.37	3	0.12	–2.26	3
Johor	0.05	–2.31	14	0.05	–2.32	14

Notes: The critical value for ADF at $\alpha = 0.01$ is –3.92 or N = 500 [see MacKinnon (1991, p. 275)]. CRDW is the cointegrating regression Durbin-Watson statistics. The critical value at $\alpha = 0.01$ is 0.13 for N = 200 [see Engle and Yoo (1987)].

Bibliography

Dickey, D.A. and Fuller, W.A. 1981. Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. *Econometrica* 49: 1057-1072.

Engle, R.F. and Granger, C.W.J. 1987. Cointegration and Error Correction: Representation, Estimation and Testing. *Econometrica* 55: 251-276.

Engle, R.F. and Yoo, B.S. 1987. Forecasting and Testing in Cointegrated Systems. *Journal of Econometrics* 35: 143-159.

Fuller, W.W. 1976. *Introduction to Statistical Time Series.* New York: Wiley.

Government of Malaysia. 1986. *Fifth Malaysia Plan 1986-1990.* Kuala Lumpur: Government Printers.

Granger, C.W.J. 1981. Some Properties of Time Series Data and their use in Econometric Model Specification. *Journal of Econometrics* 16: 121-130.

Lau, J.L.L. 1993. Promotion of Domestic Pepper Consumption in Malaysia. *Pepper Market Bulletin* July/September: 14-18.

Lau, J.L.L. and Tiong, I.C. 1993. Marketing and Quality Control of Pepper in Malaysia: Issues and Strategies. In M.Y. Ibrahim, C.F.J. Bong and I.B. Ipor (eds). *The Pepper Industry: Problems and Prospects.* Bintulu: Universiti Pertanian Malaysia Bintulu Campus. pp. 229-245.

MacKinnon, J. 1991. Critical Values for Cointegration Tests. In R.F. Engle and C.W.J. Granger (eds). *Long-Run Economic Relationships: Readings in Cointegration.* New York: Oxford University Press. pp. 267-276.

Ministry of Primary Industries, Malaysia. 1993. *Statistics on Commodities.* Kuala Lumpur: Percetakan Nasional Malaysia Berhad.

Ng, J. and Kanbur, M.G. 1993. The Pepper Industry of Malaysia: An Econometric Analysis of Demand and Supply. In M.Y. Ibrahim, C.F.J. Bong and I.B. Ipor (eds). *The Pepper Industry: Problems and Prospects.* Bintulu: Universiti Pertanian Malaysia Bintulu Campus. pp. 253-266.

Pepper Marketing Board, Malaysia. 1991. *Pepper Market Bulletin* 20: 11-15.

Pepper Marketing Board, Malaysia. *Pepper Market Bulletin,* various issues.

Siraj, N.M., A. Radam and Mansor, S.A. 1993. Utilization of Resources in Pepper Farming: The Case of Sarawak. In M.Y. Ibrahim, C.F.J. Bong and I.B. Ipor (eds). *The Pepper Industry: Problems and Prospects.* Bintulu: Universiti Pertanian Malaysia Bintulu Campus. pp. 299-312.

Yusoff, M.B. 1993. The Performance of Malaysian Pepper Export. In M.Y. Ibrahim, C.F.J. Bong and I.B. Ipor (eds). The Pepper Industry: Problems and Prospects. Bintulu: Universiti Pertanian Malaysia Bintulu Campus. pp. 267-282.

IV. A QUANTITATIVE ANALYSIS AND FORECASTING OF MALAYSIA PEPPER PRICE[1]

Introduction

It is documented that primary products account for a high proportion of the exports of developing countries. It is also indicated that the exports of developing countries tend to be concentrated in one or two specific primary commodities with more than fifty percent of export receipts coming from primary commodities. For example International Monetary Fund (IMF) study based on export-import data of 125 economies has indicated that in 1981, seventy per cent depended on primary commodities for at least fifty per cent of their export earnings. In view of the importance of primary products in the trade sector of developing economies, the determinants and movements of primary commodity prices become a topic of considerable importance. Of increasing concern is the price instability and its impact on the terms of trade.

The importance of foreign trade to the Malaysian economy has been very well accepted by policy makers. For example in 1980 and 1985, the share of exports in GNP was 54.5 per cent and 49.5 per cent respectively.

Malaysia ranks among the world's leading producers and exporters of pepper accounting for about twenty per cent of the world pepper supply. Its contribution to the Malaysian economy is less significant than the contributions of the other Malaysian major primary products. Ninety eight per cent of the Malaysian pepper comes from Sarawak. Pepper is the main contributor to the agriculture export earning of the state of Sarawak.

The two major kinds of pepper which are internationally traded are the black pepper and the white pepper. In Malaysia, exports of pepper peaked in 1976 and 1979 with an average of 37,000 tons exported. However from 1979 onwards exports of pepper grew less rapidly owing to various factors such as disease attacks, decline in soil fertility and low prices in domestic as well as in international markets. Thus the value of the trade in pepper is heavily influenced by price movements.

No studies have been carried out on the analysis of time series of pepper prices. However, there are some studies available on movements of prices of other primary products such as natural rubber and palm oil. Spectral and cross spectral methods

[1] Based on a paper prepared by Mr. M.G. Kanbur, Professor of Economics, Graduate School and Ms. Yen Siew Hwa, School of Economics, Universiti Utara Malaysia, Sintok, 06010 UUM, Kedah, Malaysia.

were used by Kanbur and Morris (1975) in their study on quantitative analysis of natural rubber prices. Their intention in using these methods was devoted to attempting to measure the cycles existing in rubber prices. Mohd. Napi Bin Daud and Mohd. Yusof Shahabuddin (1988) illustrated a statistical application for forecasting the prices of various grades of natural rubber. They used Box-Jenkins Univariate model comprising of a backward shift operator and two parameters for autoregressing and moving average respectively. The long-run behaviour of prices of most primary products is subjected to change from time to time depending on supply and demand of these products and a host of other macroeconomic variables. Kanbur, Yen Siew Hwa and Mohammed Nasser Katib (1991) have taken into consideration the variations in supply and demand of palm oil to study the movements of palm oil prices. Their forecasted price of palm oil was based on a least squares Sinusoidal model where the cosine type of cycle of about 125 months was expected to be generated within the system.

Besides the empirical studies cited above, there are other contributions which concern themselves on time series decomposition using the Sinusoidal model. Simmons (1990) argues that his paper empirically supports the hypothesis that a Sinusoidal model can be used to decompose time series into its components.

The material surveyed thus far has been concerned exclusively with the nature and movement of prices of some of the Malaysian primary commodities. The prices of pepper (black and white) are subjected to change from time to time depending on supply and demand of Malaysian pepper in the international markets as well as changes in other economic factors such as its usage, export and stock of pepper held nationally and internationally. Accordingly, the objective of this paper is to analyze, identify and quantify the movements in pepper price series so as to explore the price structure and the factors influencing price changes. Secondly, the objective is also to estimate a forecasting equation capable of providing useful price forecasts. Section A provides a theoretical framework of the study. For forecasting, we will use an extended Sinusoidal model as well as Box-Jenkins Univariate mode. Section B addresses estimation of the model and the empirical analysis of the results. Section C offers some concluding results.

A. Theoretical framework

Numerous models concerning time series analysis of prices have appeared in the literature. The two approaches which have been widely used and which we propose to use in our study are the Sinusoidal model and the Box-Jenkins model. We shall discuss the theoretical framework of these two models in relation to the time series analysis of pepper (black and white) prices.

Sinusoidal model

A general model that describes the pepper industry is assumed to consist of a simple demand equation where the price of pepper is regarded as a function of quantity (Q_t) and a supply response equation where the rate of change of quantity is proportional

to the deviation of price from its trend. Thus, our model consisting of equations will then be:

$$P_t = a - bQ_t \text{ where } b > 0 \quad (1)$$

and

$$d(Q_{t+\theta})/dt = k\ (P_t - \bar{P}) \quad (2)$$

Where θ is the production lag i.e. the time period elapsed between the time the decision to produce pepper has been made and the time production starts. k is some positive constant.

Combining equations (1) and (2), we get the autoregressive differential equations in price or quantity.

$$d/dt\ (P_{t+\theta}) = - bkp_t \quad (3)$$

similarly we can solve for quantity to get

$$d/dt\ (q_{t+\theta}) = - bkq_t \quad (4)$$

where the lower case p and q denote deviation from the trend in price and quantity, respectively. Since b and k are both slope parameters, not elasticities, their values depend on the units in which the price and production variables are expressed.

Changing t to $(t - \theta)$ in equation (3), we get

$$d/dt(P_t) = - mp_{(t-\theta)}\ m > 0 \quad (5)$$

where $m = bk$. m is greater than zero since both b and k are greater than zero.

Equation (5) shows the relationship between the change in price $d/dt\ (P_t)$ and the price level in the past $p(t-\theta)$. The rate of change is determined by the price θ months before time t. The constant m expresses the intensity of the reaction i.e. the magnitude of the change in price in time t that corresponds to a price level of one unit at time $(t-\theta)$. The equation (5) is a mixed difference and differential equation. Let the solution to equation (5) be

$$Pt = C\ e^{vt} \quad (6)$$

where C and v are constants. For the solution to have economic meaning, we require that it will be real. There are no such restrictions on the constants C and v and we assume that they are complex quantities.

If v* is conjugate to v and since the original equation is linear, a sum of the two solutions is also a solution which now taken the form

$$P_t = C_1 e^{vt} + C_2\ e^{v^*t} \tag{7}$$

If (7) has to be real, C_1 and C_2 must be complex conjugates. Thus equation (7) represents a Cosine function with fixed period whose amplitude can increase, decrease or remain unchanged in time. It can be shown that solution for P_t in equation (7) becomes

$$P_t = e\text{-}xt^* \ (D_1\ \text{Cos}\ wt^* + D_2\ \text{Sin}\ wt^*) \tag{8}$$

where $t = t/o$, $D_1 = C_1 + C_2$ and $D_2 = i\ (C_1 - C_2)$

Another way to write the last expression is

$$P_t = De^{-xt^*}\ \text{Cos}(wt^* + E) \tag{9}$$

where $D1 = D\ \text{Cos}\ E$, $D_2 = -D\ \text{Sin}\ E$ and $D = D_1 + D_2$, and E is a real constant.

Substituting t/θ for t*, the solution for Pt becomes

$$Pt = De^{-xt/\theta}\ \text{Cos}(wt/\theta + E) \tag{10}$$

It can be shown that the solution for P_t given in (10) is real. The phase E and the initial amplitude D are constants to be determined by initial conditions. The period and the damping factor are given through w and x respectively.

The sinusoidal time series model given by cosine function of time in equation (10) is very useful in time series. With the use of trigonometric expansion, equation (10) is further rewritten as the sum of a number of sinusoidal functions of the form.

$$P_t = B_0 + B_1 + B_2\ \text{Cos}(2\pi t/W) + B_3\ \text{Sin}(2\pi t/W) + B_4 t\ \text{Cos}(2\pi t/W) + B_5 t\ \text{Sin}(2\pi t/W) + Ut \tag{11}$$

where t is the index of time and Ut is the error term satisfying standard assumptions. The nonlinear regression model given in equation (11) allows for the direct estimation of a linear trend $(B_0 + B_1 t)$

The theoretical framework given in equation (11) is further amended to include other appropriate variables relevant to the pepper economy of Malaysia.

The revised model incorporating relevant variables with appropriate lag period can be presented in the following forms:

$$P_t = b_0 + b_1\ t + b_2\ \text{Cos}(2\pi t/W) + b_3\ \text{Sin}(2\pi t/W) + b_4 t\ \text{Cos}(2\pi t/W) + b_5 t\ \text{Sin}(2\pi t/W) + b_6\ S_t + b_7\ S_{t-1} + U_t \tag{12}$$

$$P_t = b_0 + b_1 t + b_2 \text{Cos}(2\pi t/W) + b_3 \text{Sin}(2\pi t/W) + b_4 t \text{Cos}(2\pi t/W) + b_5 t \text{Sin}(2\pi t/W) + b_6 S_t + b_7 S_{t-1} + EX_t + U_t \quad (13)$$

where

P_t = pepper prices at time t
W = number of business cycles
S_t = pepper stocks at time t
S_{t-1} = pepper stocks at time t
t = time trend
EX_t = export of pepper at time t
U_t = normally distributed random variable satisfying standard assumptions

If pepper producers react to current price levels in a rather systematic manner than one would expect to be able to observe a cycle in pepper prices (white and black). In this study the number of business cycles was obtained by deducting the price trend components from the cyclical components of the same variable. Based on the adjusted data for the period of this study separately for both white and black pepper prices, we have observed only two cycles (W = 2) in the series. Since W is equal to 2, it can be seen that no Sine waves will exist in the postulated Sinusoidal model.

The model thus can be presented as:

$$P_t = b_0 + b_1 + b_2 \text{Cos}(2\pi t/W) + b_3 t \text{Cos}(2\pi t/W) + b_4 S_t + b_5 S_{t-1} + U_t \quad (14)$$

$$P_t = b_0 + b_1 + b_2 \text{Cos}(2\pi t/W) + b_3 t \text{Cos}(2\pi t/W) + b_4 S_t + b_5 S_{t-1} + b_6 EX_t + U_t \quad (15)$$

Box-Jenkins model

From the graph plotted in Figures 1 and 2, it is obvious that for the past 139 months, the original price values of the time series do not seem to fluctuate around a constant mean. This implies that the values are nonstationary. The graphs also show nonseasonality in the price trend. Nonstationary time series can be reduced to stationary series by proper transformation. Based on the price trend, we decided to incorporate a nonseasonal Box-Jenkins model in this study.

In order to employ the Box-Jenkins methodology, we must examine and attempt to classify the "behaviour" of the sample autocorrelation, inverse autocorrelation and the partial autocorrelation. Based on these, different possible autoregressive, moving average and 'mixed' models were identified. Other related diagnostic checking were carried out before the final model was derived.

Figure 1. White pepper price from January 1982 to July 1993

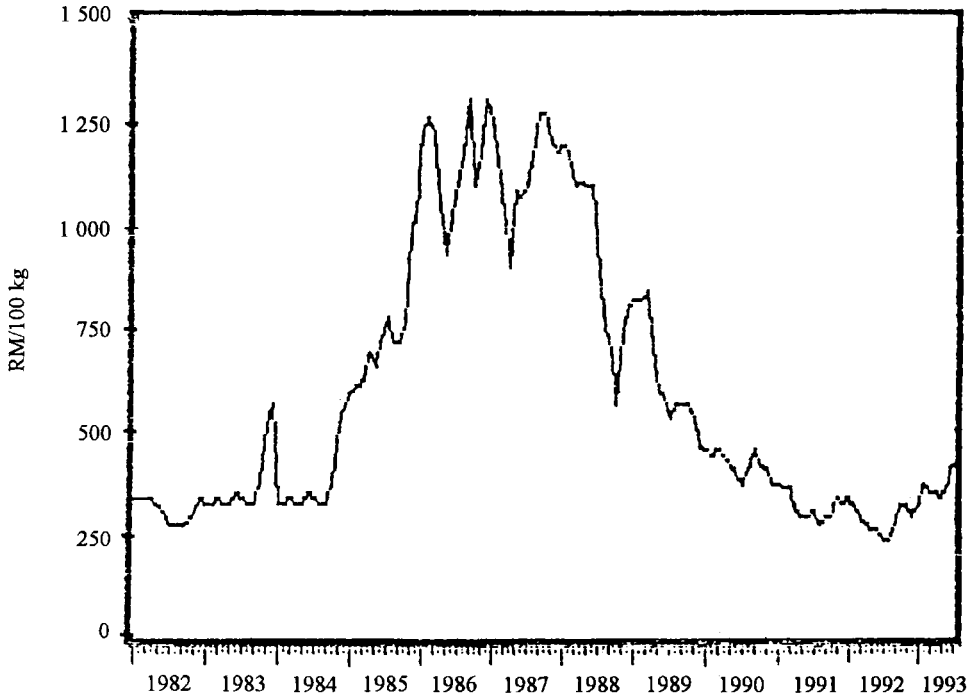
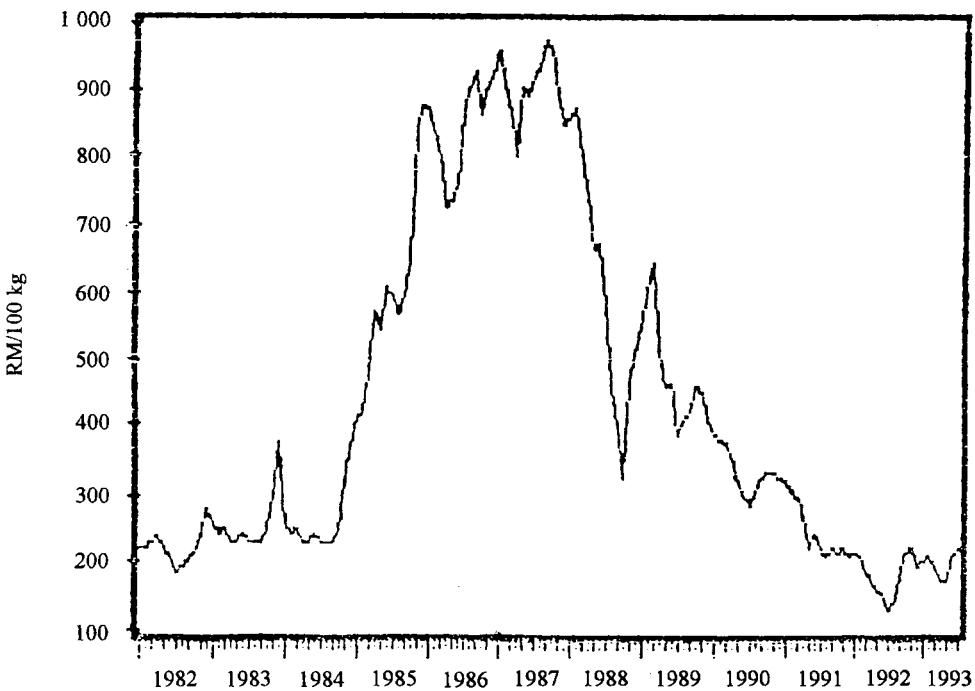


Figure 2. Black pepper price from January 1982 to July 1993



We have hypothesized that the model for both white and black pepper prices can be represented in the form:

$$a_2(B) = (1 - a_1B - a_2B^2)$$

where, B is the backward shift operator and a_1 and a_2 are parameters for autoregressive models.

B. Data and analysis

The study is based on monthly series of the black and white pepper prices and other relevant macrovariables relating to pepper economy of Malaysia. The basic data in the model was obtained from the Pepper Marketing Board of Malaysia and are generally assumed to be subject to only minor error. The data set represented prices (from January 1982 until July 1993), stock and export of pepper for the period January 1982 until March 1993.

Sinusoidal model

The final model is in semi-log form where data for prices, stock, lag of stock and export are transform into log. The estimated results of the hypothesized forecasting model are presented in Tables 1 and 2. Not all the estimated coefficients of equations (14) and (15) are significantly different from zero. However in all the equations the F test has indicated significance of the joint effect of all the explanatory variables. Besides, in all the equations the magnitude of R^2 is estimated to be above eighty per cent.

It is interesting to consider the contribution of each variable to the forecasted variable. The coefficient of the trend term is positive but its magnitude is small. Thus,

Table 1. Estimated coefficient of the price forecasting equation: white pepper

Model	Intercept	Trend	X_1	X_2	Log S_t	Log S_{t-1}	Log EX_t	R^2	F value
Model 1	12.068	0.0005	0.0069	–0.0001	–0.433	–0.380	–	0.83	127.0
	(52.19)	(1.071)	(0.180)	(–0.245)	(–5.927)	(–5.204)			(5 128)
Model 2	12.025	0.0006	0.007	–0.0001	–0.432	–0.382	0.008	0.83	105.07
	(41.72)	(1.054)	(0.199)	(–0.269)	(–5.877)	(–5.180)	(0.250)		(3 127)

Note: 1. $X_1 = \cos(2\pi t/w)$ S_t = Stock at time t
$X_2 = t\cos(2\pi t/w)$ S_{t-1} = Stock at time t-1
EX_t = Export at time t

2. Values in parentheses are the t-statistics except for F Values.

3. For F Values, the numbers in parentheses indicate the degree of freedom (df) for the numerator and denominator, respectively and tested at 5 per cent level of significance.

Table 2. Estimated coefficient of the price forecasting equation: black pepper

Model	Intercept	Trend	X_1	X_2	Log S_t	Log S_{t-1}	Log EX_t	R^2	F value
Model 1	11.71	0.003	0.0006	–0.00003	–0.376	–0.358	–	0.80	108.08
	(46.95)	(4.44)	(0.014)	(–0.061)	(–3.38)	(–3.227)			(5 128)
Model 2	11.21	0.002	0.001	–0.00003	–0.394	–0.389	0.128	0.82	98.3
	(39.27)	(3.97)	(0.029)	(–0.069)	(–3.674)	(–3.612)	(3.205)		(6 127)

Note: 1. $X_1 = \cos(2\pi t/w)$ S_t = Stock at time t
$X_2 = t\cos(2\pi t/w)$ S_{t-1} = Stock at time t-1
EX_t = Export at time t

2. Values in parentheses are the t-statistics except for F Values.

3. For F Values, the numbers in parentheses indicate the degree of freedom (df) for the numerator and denominator, respectively and tested at 5 per cent level of significance.

there happens to be a very marginal increase in the price. The term Cos ($2\pi t/W$) gives a cyclic effect with a period of W cycles to the forecasted prices. The inclusion of the term tCos ($2\pi t/W$) allows the amplitudes (heights of the cyclic function to change overtime.

Box-Jenkins model

Data for prices are transformed into log form. The model indicates the data need second degree nonseasonal differencing. A second order autoregressive model was found to be most suitable for the white and black pepper prices. The final model is estimated in the form:

$$P_t = \underset{(9.65)}{0.698P_{t-1}} - \underset{(-5.44)}{0.482P_{t-2}} \qquad \text{(White pepper price)}$$

$$P_t = \underset{(10.57)}{0.733P_{t-1}} - \underset{(-3.99)}{0.383P_{t-2}} \qquad \text{(Black pepper price)}$$

Values in parentheses are the t-statistics. Ut is the error term satisfying standard assumptions.

The models based on the Sinusoidal and Box-Jenkins methodology were then used to make an ex-post forecast for the prices. The forecasted and the actual prices from January 1992 onwards are shown in Tables 3 and 4 for the white and black pepper prices respectively. The accuracy of the forecasted prices is measured by the percentage absolute errors as shwon in Table 5.

Table 3. Ex-post forecasts for white pepper price (Rm/100 kg)

Time	Actual price	Forecasted price		Forecast error		95 per cent confidence limit			
		Model 1	Model 2	Model 1	Model 2	Model 1		Model 2	
						Lower limit	Upper limit	Lower limit	Upper limit
1992									
January	319	286	282	32	36	258	315	254	311
February	307	300	295	6	11	272	329	267	323
March	281	286	278	–5	2	258	314	250	306
April	285	259	254	25	30	231	288	226	283
May	283	285	280	–2	2	257	314	252	308
June	270	303	300	–33	–30	275	331	271	328
July	255	317	313	–62	–58	289	345	285	341
August	258	303	298	–45	–40	274	331	270	326
September	288	288	285	–0	2	260	316	256	313
October	333	272	267	60	65	244	301	239	296
November	295	266	263	28	31	238	295	235	291
December	268	269	265	–1	2	241	297	237	294
1993									
January	298	251	243	46	54	222	279	214	271
February	354	243	239	110	114	214	271	211	268
March	345	274	271	70	73	245	302	242	299
Standard error of forecasting		14.4	14.4						

Table 4. Ex-post forecasts for black pepper price (Rm/100 kg)

Time	Actual price	Forecasted price		Forecast error		95 per cent confidence limit			
		Model 1	Model 2	Model 1	Model 2	Model 1		Model 2	
						Lower limit	Upper limit	Lower limit	Upper limit
1992									
January	200	228	222	–28	–22	203	252	198	245
February	196	219	203	–23	–7	195	243	180	227
March	179	223	212	44	–33	199	247	188	236
April	177	229	205	–52	–28	205	253	181	229
May	173	222	196	–49	–23	198	247	172	220
June	161	210	203	–49	–42	186	234	179	227
July	148	193	197	–45	–49	169	218	173	221
August	153	185	184	–32	–31	161	209	160	207
September	186	179	180	6	5	155	203	156	204
October	218	183	65	34	52	159	207	141	188
November	207	187	181	19	25	163	211	158	205
December	180	190	180	–10	–0	166	214	156	204
1993									
January	187	188	158	–1	28	164	212	134	181
February	199	196	175	2	23	172	220	152	199
March	181	204	192	–23	–11	180	228	168	215
Standard error of forecasting		12.3	12.2						

Table 5. Percentage absolute errors for black and white pepper prices from January 1992 – July 1993

Month	Model 1		Model 2		Box-Jenkins	
	PB	PW	PB	PW	PB	PW
1992						
January	14.0	10.0	11.0	06.2	3.4	4.3
February	11.7	03.6	03.5	07.5	0.3	4.1
March	24.6	01.8	18.4	00.7	13.0	18.5
April	29.3	08.8	15.8	10.5	9.2	7.4
May	28.3	00.7	13.3	00.9	7.7	5.3
June	30.0	00.4	26.0	11.1	4.7	3.6
July	30.4	24.3	33.1	22.7	11.8	7.4
August	20.9	17.4	20.2	15.8	1.1	1.8
September	03.2	–	02.6	00.9	25.7	16.4
October	15.5	18.0	23.8	19.5	21.6	16.5
November	09.1	09.4	12.1	10.8	4.0	3.1
December	05.5	00.3	–	00.8	17.5	10.1
1993						
January	05.5	15.4	14.9	18.4	8.7	0.5
February	01.0	31.9	11.6	32.2	3.8	13.2
March	12.7	20.2	06.0	21.4	9.4	7.2
April	–	–	–	–	15.2	9.4
May	–	–	–	–	17.9	1.6
June	–	–	–	–	0.8	10.2
July	–	–	–	–	5.3	19.2
Mean	13.9	10.8	14.2	11.9	9.6	8.6

PB = Black Pepper price.
PW = White Pepper price.

C. Conclusion

Our study has shown that both Sinusoidal and Box-Jenkins models have proved to be useful in the context of forecasting as well as providing a useful framework within which the effects of various price stabilization schemes can be analyzed. However, from the accuracy test we conclude that the Box-Jenkins model has given a slightly better forecast. One of the reasons could be due to the nonseasonality in the price trend where no Sine waves were detected which has led to the weakness in the use of Sinusoidal model.

Figures 3 and 4 show the actual values and the ex-ante forecasts for the white and black pepper prices based on the Box-Jenkins model. The graphs also indicate the upper and the lower limit of the ex-ante forecast. Ex-ante forecast based on Sinusoidal model was not made because it has to depend on ex-ante forecasts for the stocks and exports of pepper.

Figure 3. Actual and ex-ante forecasts for white pepper price

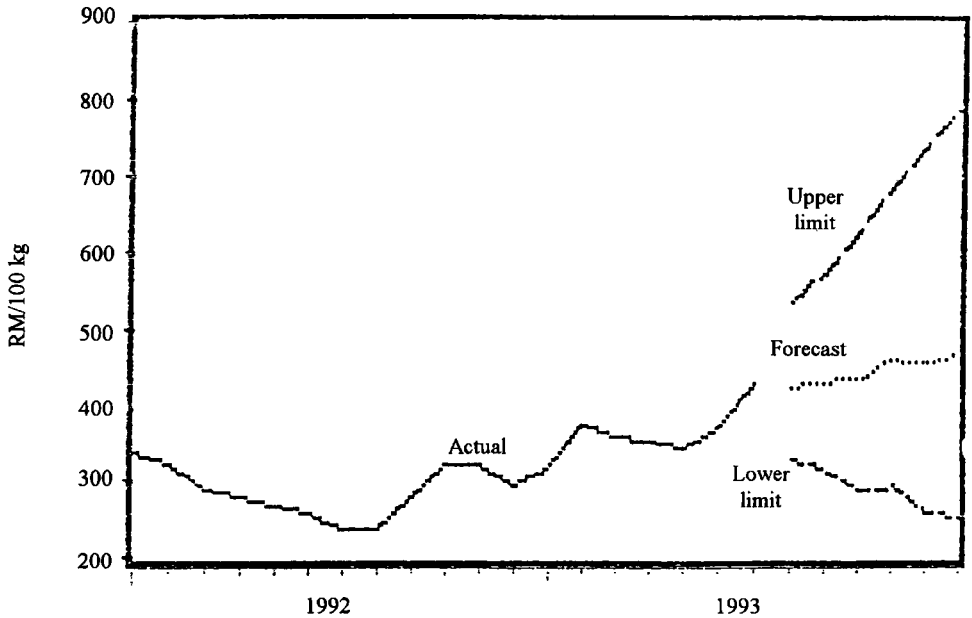
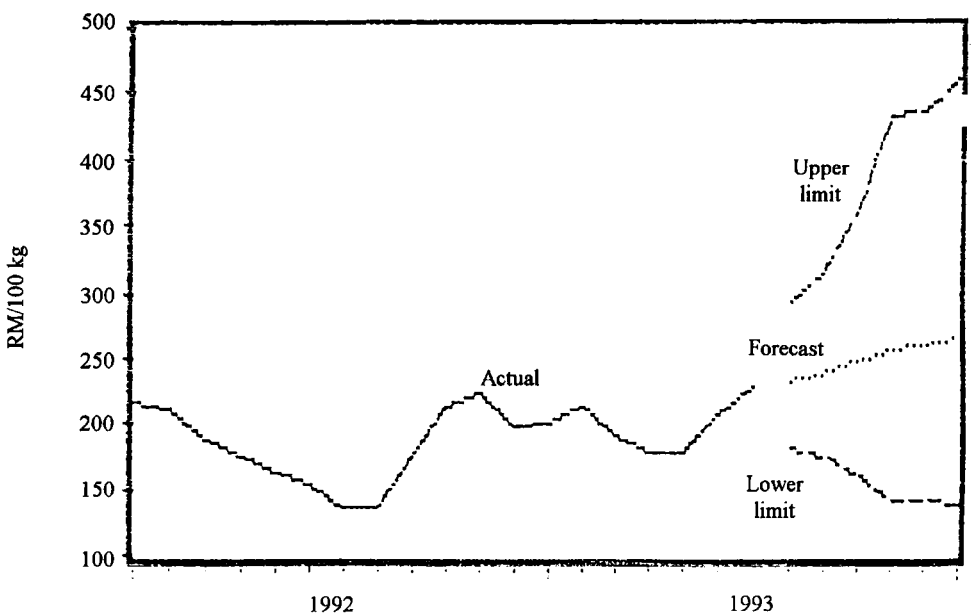


Figure 4. Actual and ex-ante forecasts for black pepper price



For the last few years the pepper market was a sick market with falling prices especially for the black pepper. The white pepper prices has shown some improvement lately. However we still feel that the market needs a shock treatment such as export cutting scheme and retention scheme. It is suggested that a production management committee is set up to monitor national production policies and thus achieve equilibrium in the world pepper market.

PART THREE

PROCESSING AND PRODUCT DEVELOPMENT

Photo by courtesy of IPC.

Processing pepper to various qualities sought by world market

I. PEPPER PRODUCTS DEVELOPMENT AND PROCESSING: AN INDIAN EXPERIENCE[1]

Introduction

Pepper (*Piper nigrum*) is a native of the Western Ghats in India. A large amount of pepper in its wild form still thrives well in these forests. The cultivated varieties of pepper are considered to have originated from these wild ones as a result of continuous selection followed by vegetative propagation. The words pepper in English, peperi in Greek and Piper in Latin, were derived from the Sanskrit word pippali, which was the name for pepper (*Piper longum*). This plant was taken by the Hindu Colonists to Java between 100 BC and AD 600. Its cultivation spread to Malayan Peninsula following the European colonization during the 18th century.

Pepper cultivation in India is taken up mainly in Kerala. Important districts growing pepper in Kerala are Trivandrum, Quilon, Idukki, Cannanore and Calicut. About 95 per cent of the area under cultivation of the crop in India is presently in Kerala.

Development of pepper cultivation in Tamil Nadu and Karnataka States has been in areas adjoining Kerala. It is now grown in large areas in the Nilgiri and Kanyakumari districts of Tamil Nadu and Kodagu, Dakshina Kannada and Uttara Kannada districts of Karnataka. The cultivation has spread from Karnataka to Konkan region in Maharashtra and Goa. It has further been extended to certain areas in Andhra Pradesh, Orissa, West Bengal and North Eastern States like Assam, Tripura, Meghalaya, Arunachal Pradesh and Andaman and Nicobar Islands recently.

A. Area and production

Though India was at one time the only producer of pepper in the world, her predominance gradually came down owing to the country's production remaining stagnant and other countries taking up pepper cultivation on commercial scale. Besides India, pepper is now grown in Indonesia, Malaysia, Madagascar, Sri Lanka, Viet Nam, Thailand, China and Federated States of Micronesia. The area, production and average yield of pepper in the major producing countries during 1992 are given in Table 1.

The State-wise area and production of pepper in India according to the official forecast for 1992/93 are shown in Table 2.

[1] Based on the paper prepared by Mr. Ashok Kumar, Joint Secretary, Ministry of Commerce, Government of India

Table 1. Area, production and productivity of pepper in 1992

Country	Area (ha)	Per cent share	Production (tons)	Per cent share (kg/ha)	Yield
Brazil	35 000	9.60	27 500	13.43	786
India	184 200	50.53	52 010	25.40	282
Indonesia	98 000	26.88	62 000	30.27	633
Malaysia	10 000	2.74	26 000	12.70	2 600
Madagascar	6 500	1.78	3 380	1.65	520
Sri Lanka	8 800	2.41	3 255	1.59	370
Thailand	3 463	0.95	10 500	5.13	3 032
Viet Nam	9 000	2.47	7 830	3.82	870
China	9 600	2.63	12 321	6.02	1 283
Total	364 563	100.00	204 796	100.00	–

Source: Author's estimates.

Table 2. Area and production of pepper in India 1992/93

States	Area (000' ha)	Production (000' tons)	Productivity (kg/ha)
Kerala	171.23	53.83	314
Karnataka	2.92	0.74	253
Tamil Nadu	2.81	0.28	100
Pondicherry	0.01	0.01	1 000
Andamans	0.39	0.07	179

Source: Author's estimates.

The area, production and productivity of pepper in India has not shown any remarkable improvement in the past several years except during 1985/86 in which there was a bumper production owing to the very favourable weather condition.

There is reason to believe that the present official estimates of area and production of pepper are not realistic considering the amount of export, internal consumption and the stocks held by the traders every year. The trade estimates of production have generally been higher by 10,000 to 15,000 tons than the corresponding official estimates.

The area and production of pepper according to official as well as trade estimates since 1970/71 are given in Table 3.

Production of pepper has staggered much year after year, though there is a general upward trend. Production was at its highest at 55,190 tons in 1989/90 as per official

Table 3. Area and production of pepper in India

Year	Area (ha)	Production (tons)	Trade estimate of production (tons)
1970/71	119 960	26 160	28 000
1971/72	118 630	26 160	34 000
1972/73	119 800	26 190	39 000
1973/74	121 720	28 700	39 000
1974/75	121 920	28 180	38 150
1975/76	111 930	25 570	41 000
1976/77	112 240	25 500	42 000
1977/78	104 700	21 100	36 000
1978/79	84 570	21 500	35 000
1979/80	110 720	27 700	38 000
1980/81	109 290	29 490	40 000
1981/82	111 020	29 230	38 000
1982/83	110 440	26 610	45 000
1983/84	107 350	22 710	38 000
1984/85	109 400	18 220	27 000
1985/86	125 120	34 000	65 000
1986/87	132 810	31 340	45 000
1987/88	149 930	48 090	65 000
1988/89	160 740	44 160	45 000
1989/90	171 490	55 190	65 000
1990/91	173 430	47 950	55 000
1991/92	174 870	42 690	60 000
1992/93	177 360	54 930	55 000

Source: Author's estimates.

estimates. The lowest production was in 1984/85 at 18,220 tons. Production has stagnated in the last six years.

B. Varieties

The cultivated varieties of black pepper originated from the wild types through continuous selection and the process of domestication must have taken place independently in many centres. As a result of this, there exists under cultivation a large number of cultivars in India. Thus most pepper growing areas have their own popular cultivars often named after the locality or based on plant characters. In Kerala alone more than 70 cultivars are reported under cultivation. With the screening and evolution of high yielding types with desirable characters some of the old and poor yielding cultivars are being rapidly replaced.

Improved varieties:

The National Research Centre for Spices (ICAR) at Calicut has recently taken up a programme for screening and selecting high yielding local varieties. The centre

has already identified a few high yielding types. These include two types of Karimunda and one type each of Aimpiriyan and Ottaplackal. Planting material of these selections are being passed on for large scale multiplication.

Panniyur-I is the first hybrid to evolve from two local cultivars, Uthirankotta and Cheriyakaniyakadan nearly three decades back. The plant is vigorously growing and has long spikes and bold berries. The performance of Panniyur-I has been found outstanding under many conditions. However, under shaded conditions and where the nitrogen status of the soil is high, this pepper shows a tendency for increased vegetative growth and corresponding decrease in yield.

The Pepper Research Station, Panniyur under the Kerala Agricultural University which developed the Panniyur-I hybrid has released three more promising varieties.

C. Package of practices

Pepper is a perennial glabrous woody climber growing to a height of 10 metres or more on support. Under cultivation when the height is restricted, the mature vine has a bushy columnar appearance with about 4 to 5 metres height and 1.5 metres diameter.

As a rule, it is propagated vegetatively through stem cuttings in India. They are generally taken from runner shoots (Stolons) originating from the base of the vine. In Indonesia and Malaysia terminal shoots are taken for planting. terminal shoots of growing young vines. The cuttings are planted in the nursery (bed or poly bags) or *in situ* with 1 or 2 nodes each below and above the soil surface 3 months before the planting season.

Pepper is planted at the base of existing live standards (trees) or specially planted standards, either live or dead. When live standards are used as in India, they are planted one or two seasons in advance adopting proper spacing. The live standards used are *Erythrina indica* (Murikku), *Garuga pinnata* (Karayam or Kilingil), *Grevilea robusta* (Silver oak), *Ailanthies excelsa* (Azgathal) etc. In the case of Erythrina and Garuga, stem cuttings are planted while in the case of others seedlings are used.

In the system of homestead planting and intercropping using existing trees like jack, mango, coconut, arecanut etc., as standards, the spacing for pepper varies considerably and depends on the spacing at which the standard trees are planted. Under the monocropping system using specially raised standards, pepper is planted at 3 to 4 metres apart. When non-living standards like wooden/concrete poles are used, the spacing can be much closer, 1.5 to 2 metres.

Pests and diseases:

More than 20 insect pests have been reported as infesting pepper crops in India. However, only 4 of them have seriously been affecting the pepper crops. They are the pollu-beetle, top-shoot borer, leaf gall thrips and scale insects.

Pepper is affected in India by a variety of fungi, bacteria, viruses and nematodes. The foot rot caused by *Phytophthora* sps. and slow wilt associated with parasitic nematodes are the major diseases causing heavy crop losses. Other important diseases are leaf spot and hollow berry (fungal pollu) and bacterial leaf spot.

The foot rot disease is the most serious disease of pepper in India as also elsewhere and is often a limiting factor in crop production. It is prevalent in all the pepper growing tracts.

The disease occurs during June to September in India coinciding with the south-west monsoon. The high moisture and relative humidity, the low temperature and shorter duration of sunshine hours during the monsoon period are conducive for the development of the foot rot disease.

The fungus, which is soil borne, infects leaves, stem and roots either individually or in combination. On the leaves the infection starts as dark brown spots which enlarge rapidly. Leaf spots with concentric zonation and grayish centre may occupy almost half of the leaf surface and infected leaves drop. Tender aerial branches also get infected resulting in rotting and the foliage beyond the point of infection dies showing die-back symptoms. The fungus also infects the spikes at the stalk region or at other points resulting in spike shedding.

The infection at the collar or foot region which is very fatal starts as discoloured patch and spreads downwards reaching the root system. This results in rotting of the tissues and emits a foul smell. At the initial stage of infection the vines exhibit mild foliar yellowing which intensifies with the advancement of disease. During advance stages aerial branches break off at nodal regions and gradual defoliation starts. Exclusive root infection is also noticed and symptoms similar to those of collar infection are produced in the foliar region. The intensity of foliar yellowing and defoliation depends upon the number of main/lateral roots infected and the extent of rotting.

An integrated disease management involving cultural practices and chemical and biological control measures is necessary to combat the disease. Phytosanitary measures involving removal and burning of all infected plant materials from affected gardens are very important to check the build up of inoculum. Removal of excessive shade of standards just before monsoon will help better light penetration rendering the microclimate less favourable for disease development. As the runner shoots spreading on the ground have been found to take up infection first, their removal will be helpful in reducing infection. Avoiding water stagnation and injury to root system during farm operations, growing of cover crops, etc., are also helpful in reducing disease incidence.

D. Productivity

Productivity of pepper in India is the lowest among various producing countries. There are a number of reasons for the low productivity:

1. *Poor genetic stock of the pepper vines under cultivation:* In Kerala which accounts for more than 95 per cent of the area under cultivation and production of pepper in the country, about 70 varieties or cultivars are reported to be under cultivation. However, only about half a dozen or so among them are good yielders. As farmers often use planting materials collected from their own gardens, the low yielding varieties continue to be grown. In order to increase productivity of the gardens, it is necessary to introduce high yielding types.

2. *High population of senile and unproductive vines:* Under the system of cultivation now being followed by farmers in India, pepper vines once planted are allowed to be retained until they die. There is a considerable decline in the yield of pepper after the vines have attained 18 to 20 years. It is estimated that at least 50 per cent of the existing vines are low yielding and therefore uneconomical to be maintained. It is therefore necessary to replant these vines in order to step up the productivity and production of pepper in the country.

3. *Losses due to pests and diseases:* Pepper vines are affected by a number of pests and diseases leading to sizeable loss on production every year. While the foot-rot caused by *Phytophthora* takes a heavy toll on the standing vines, the pollu-beetle and pollu disease cause severe damage to the crop. As farmers seldom adopt control measures against pests and diseases, losses continue to occur year to year.

4. *Inadequate supply of planting materials of improved varieties:* Adequate quantity of quality planting materials of improved varieties are not available to replace the undesirable varieties as well as senile and unproductive vines and also to take up fresh planting of pepper as an intercrop in the traditional areas and as inter/ mono crop in the non-traditional areas.

5. *Lack of proper manuring:* Due to the continuous growing of pepper, the soil in the majority of pepper growing areas is highly depleted. Pepper vines are very seldom manured and where manuring is practised it is either under-manuring or imbalanced manuring. Field studies conducted by different agencies have shown that yield of pepper vines can be increased to 100-200 per cent by proper manuring.

6. *Non-adoption of other agronomic practices:* Pepper continues to be grown in the most traditional way without paying proper attention to the package of practices. The prolonged period of dry spell extending over 5-6 months becomes detrimental to the crop when adequate measures for conserving soil moisture are not adopted. Regular and timely digging of the gardens to enable the soil to absorb rain water, arresting soil erosions by providing contour bunds, mulching plant bases with crop residues, growing cover crops etc. are also not taken up to obtain higher productivity.

7. *Extension and technology constraints:* State and Central Governments have not been paying adequate attention for pepper development. The extension personnel are not properly trained and directed to make available their services to the pepper

growers. The technology available has not reached the farmers in adequate measures. The extension personnel are also not assisting the farmers in procuring the necessary inputs to adopt the modern technology.

8. *Price fluctuation:* Pepper being a commodity meant for export, the price always depends on the international demand supply position. As production and supply of pepper in the world market are widely fluctuating depending upon the crop situation in different producing countries, world prices of pepper have always fluctuated widely. These fluctuations are reflected in the internal prices also. With uncertainty in the returns, growers are reluctant to invest much on the crop on a long-term basis.

There has been a short fall in the world supply position of pepper in the recent years owing to lesser production in major producing countries like Indonesia and Malaysia. Consequently the prices increased sharply in all markets in 1985/86 reaching record levels in 1986/87. However, from 1987/88, prices have declined owing to improved crop prospects and easing supply position. The average annual prices of pepper in Cochin market during the period since 1970/71 are shown in Table 4.

Table 4. Annual average domestic prices of black pepper at Cochin

Year	Price (Rs./100 kg)	Year	Price (Rs./100 kg)
1970/71	670	1982/83	1 252
1971/72	621	1983/84	1 619
1972/73	554	1984/85	2 578
1973/74	730	1985/86	4 103
1974/75	1 099	1986/87	5 429
1975/76	1 191	1987/88	5 282
1976/77	1 586	1988/89	3 840
1977/78	1 737	1989/90	4 203
1978/79	1 687	1990/91	3 337
1979/80	1 487	1991/92	3 372
1980/81	1 320	1992/93	2 858
1981/82	1 299	1993/94	3 769

Source: Author's estimates.

The highest price of Rs. 5,429 per quintal was in 1986/87. The price declined gradually and reached a low of Rs. 2,859 in 1992/93. It has improved to Rs. 3,769 per quintal in 1993/94.

E. Strategy for development

Considering the slow growth of pepper production in India in contrast to the fast growth in other producing countries and the need to increase Indian production, the

implementation of comprehensive programmes of both the short term and the long-term is proposed.

The most important step to enhance production on short term basis is to increase productivity of the existing gardens through adoption of cultural practices, proper manuring, plant protection, replanting and rejuvenation. Pepper is mostly a small farmers' crop and more than 70 per cent of the area under cultivation is considered to be in the hands of growers with less than 2 ha holding. Pepper gardens are also widely scattered in all the districts in Kerala, the principal growing state. In other states, cultivation is confined to a few districts but it is also highly scattered within the districts. It is not feasible to organize the farmers and get the scientific cultivation practices adopted in the entire area. Moreover, a very large quantity of planting materials would be required for rejuvenating the entire area and the production of a large quantity of planting material is also not possible with the available infrastructure.

Details of programmes implemented by different State governments with the assistance of Union Ministry of Agriculture are as follows:

1. *Production and distribution of planting material:* It is programmed to produce and distribute 88 million planting material during the VIII Plan period. The cost of production is Rs. 1.50 per rooted cutting. The nucleus planting materials of released varieties are obtained from research stations for large scale multiplication by the State Government agencies adopting rapid multiplication techniques.

2. *Rehabilitation of old pepper gardens:* This is a programme to rejuvenate the existing gardens and to step up productivity. A 25,000 ha area will be rehabilitated under this programme. Incentives will be provided to the farmers to buy the inputs for application. The rest of the fund is to be raised by the farmers through institutional credit.

3. *Distribution of input kits:* Each input kit contains fertilizers and plant protection chemicals sufficient for 20 bearing vines. The cost of the kit is limited to Rs. 125 per kit which is supplied to farmers at Rs. 25 to encourage farmers to adopt fertilizer application and check pests and diseases.

4. *Adoption of plant protection measures against Foot-rot disease:* The programme is to encourage farmers to adopt plant protection measures against foot-rot disease on compact area basis. As an incentive to the farmers plant protection chemicals are to be supplied at 50 per cent subsidized cost limited to Rs. 1,860 per ha considering the high cost of the chemicals.

5. *Eradication of little leaf disease:* This new disease noticed a few years back now assumed serious proportion in Wynad and Idukki districts of Kerala, the two major pepper production centres. It is proposed to remove 0.3 million disease affected vines by providing compensation at the rate of Rs. 25 per diseased vine. Rooted cuttings of high yielding varieties will also be given free of cost for replacement.

6. *Field demonstration plots:* The programme is intended to convince and motivate farmers to take up the cultivation of new varieties of pepper adopting scientific package of practices. Each plot will consist of 50 vines. The cost of inputs for establishing and maintaining each demonstration plot limited to Rs. 225 in the 1st year, Rs. 140 in the second year and Rs. 150 in the third year is given as incentive.

7. *Large scale demonstration of high production technology:* For the large scale demonstration of the high production technology developed by the National Research Centre for Spices in farmers fields, it is proposed to extend input subsidy at the rate of Rs. 5,000 in the first year, Rs. 3,300 in the second year and Rs. 2,500 in the third year per ha, which is 50, 33 and 25 per cent of the total cost of inputs required per ha respectively.

8. *Area expansion programme:* This programme is intended to encourage monocropping of pepper of the desired varieties. Farmers will be given financial assistance to the extent of Rs. 5,000 in the 1st year, Rs. 3,000 in the 2nd year and Rs. 2,000 in the 3rd year per ha. as incentive being 50, 40 and 25 per cent of the cost of inputs respectively to take up the programme which will also be linked with export and value addition.

In addition to the above programmes the Spices Board is implementing the following for increasing production of pepper:

1. *Scheme for the Production of Planting materials:* In order to make available quality rooted cuttings of pepper to the planting community, the Board encourages growers to take up nurseries under the certified nursery programme. Apart from this, the Board also encourages growers to plant rooted cuttings of high yielding varieties released by the National Research Centre for Spices and the Kerala Agricultural University. They have adopted the technique of rapid multiplication evolved by the National Research Centre for Spices. Under the certified nursery scheme, nursery owners are given a subsidy of Rs. 2,000 per nursery of 10,000 rooted cuttings as an incentive for production of quality rooted cuttings. On an average, 5 million rooted cuttings are produced annually for distribution among the growers. The high yielding varieties of pepper released by the Kerala Agricultural University and the varieties released by the National Research Centre for Spices are multiplied in these rapid multiplication units. As an incentive each unit having a production target of 50,000 rooted cuttings annually are offered an incentive subsidy of Rs. 12,500 released in two installments. Over the past 3 years the Board established 69 units with a production capacity of about 35 lakhs rooted cuttings.

2. *Scheme for control of foot-rot disease:* The Board has taken up a programme for control of foot-rot disease of black pepper in Idukki and Wynad districts of Kerala for large scale demonstration on the efficacy of the integrated management of the disease evolved by the Research organizations. The programme envisages prophylactic spraying of fungicides in 1,000 ha (500 ha each in Idukki and Wynad

districts) in contiguous blocks by supplying the plant protection chemicals at 50 per cent cost.

3. *Scheme for control of little leaf disease:* Little leaf disease can be found in North Wynad. The remedial measures suggested are uprooting the diseased plants and the replanting of healthy vines. As an incentive, the Board offers Rs. 25 per diseased vine for uprooting and destroying the affected vines. Subsequently healthy vines are supplied free of cost for replantation/gap filling. About 28,000 vines have been identified for uprooting.

F. Export

Pepper is the most traded commodity in the international spice market accounting for about 34 per cent in volume. A total volume of 155,000 tons of pepper was exported by the producing countries in 1992. Until the beginning of the nineties, Indian pepper exports constituted about 50 per cent of the quantity and around 70 per cent of the value earned through spices export. However, during the last three years, the situation has changed considerably. The severe competition in the international market as well as the low volume of exports to East European countries, especially the former USSR, resulted in a decline in India's pepper exports. India recaptured its position in 1993/94 when the export of pepper increased significantly. The decline in pepper production in other producing countries has resulted in an overall short supply in the international markets. However, India with considerable carry-over stocks from previous crops, was able to export more during that period.

The production of pepper by country during the last three years is given in Table 5.

In terms of production, India and Indonesia shared the top position for last 3 years. These two countries together contributed more than 50 per cent of the world supply.

Table 5. Production of pepper by country (Tons)

Country	1990	1991	1992
Brazil	30 514	50 000	27 500
India	65 000	55 000	60 000
Indonesia	53 000	61 000	62 000
Malaysia	31 000	29 000	26 000
Thailand	10 345	10 443	10 500
Sri Lanka	1 990	2 850	3 255
Viet Nam	8 623	8 900	7 830
China	10 993	13 108	12 321
Madagascar	3 380	3 380	3 380

Source: IPC, Pepper Statistical Yearbook, 1992.

In recent years, India's share in world pepper production has been between 20 per cent to 30 per cent. World production of pepper and India's share in the last few years are given in Table 6.

Table 6. World production of pepper and India's share

Year	World (tons)	India (tons)	Share of India (per cent)
1980	150 350	38 000	25
1981	158 100	40 000	25
1982	141 900	38 000	27
1983	146 960	45 000	31
1984	143 440	38 000	26
1985	127 960	27 000	21
1986	161 930	65 000	40
1987	142 380	45 000	32
1988	186 200	65 000	35
1989	182 680	45 000	25
1990	215 710	65 000	30
1991	234 580	55 000	23
1992	213 790	60 000	28
1993 (E)	167 291	55 000	33

(E) – Estimate.

Source: IPC, Pepper Statistical Yearbook (various issues), and Indian Pepper and Spices Trade Association, Cochin.

Trend in world export: Except India, all other major producing countries export more than 90 per cent of their production. India is only able to export nearly 50 per cent of its production because of the large domestic demand. The export of pepper by the producing countries for the last three years is given in Table 7.

Table 7. Export of pepper by producing countries (Tons)

Country	1990	1991	1992
Brazil	28 014	47 553	25 702
India	34 429	18 945	19 399
Indonesia	47 675	49 665	61 438
Malaysia	27 498	26 732	23 035
Thailand	4 042	3 838	6 158
Sri Lanka	2 609	2 058	2 127
Viet Nam	1 288	16 252	22 358
China	515	163	181
Madagascar	1 222	1 844	1 948

Source: IPC, Pepper Statistical Yearbook, 1992.

India's share in world pepper exports has been fluctuating in the last few years between 11 per cent to 40 per cent. India's highest export 49,800 tons was in 1986.

The world export of pepper and India's share from 1980 onwards is given Table 8.

Table 8. Trend in world export of pepper and India's share

Year	World export (tons)	India's share (tons)	India's share (per cent)
1980	122 800	26 300	21.4
1981	133 000	19 900	15.0
1982	131 600	20 500	15.6
1983	132 200	27 900	21.1
1984	119 200	24 500	20.6
1985	96 300	19 500	20.2
1986	124 900	49 800	39.9
1987	113 800	32 300	28.4
1988	142 300	47 300	33.2
1989	137 700	25 100	18.2
1990	150 000	34 400	22.9
1991	168 900	18 900	11.2
1992	165 800	19 400	13.5
1993 (E)	134 789	46 800	34.7

(E) – Estimate.

Source: IPC, Pepper Statistical Yearbook (various issues).

Noticeably, India's share in world pepper exports has declined considerably after 1988. The competition from other producing countries and the low exports to the East European region, especially the former USSR is the reason for the decline in India's share of total world exports of pepper in recent years.

Table 9 gives the trend of export of pepper from India.

India's highest pepper exports of 41,011 tons and valued at Rs. 2,406 million during the last decade was in 1987/88. The maximum f.o.b. unit value paid was also in that year. The drastic decline in world production during the mid eighties has resulted in a short supply in the international market and hence prices increased to a record level. However, India with a better production in 1987/88 could take advantage of the situation. The prevailing high price then has motivated other producing countries to increase the production and the result was an over-supply and a steady decline in price from 1988 onwards took place. In 1991, the production has reached the peak level of 234,580 tons. The price has also decreased to a lower level.

Table 9. Export of pepper, India

Year	Quantity (tons)	Value (Rs. million)	Unit value (Rs./kg)
1980/81	26 364	389	14.77
1985/86	37 620	1 725	45.85
1986/87	37 083	2 003	54.02
1987/88	41 011	2 406	58.66
1988/89	36 908	1 645	44.57
1989/90	34 650	1 533	44.24
1990/91	29 985	1 024	34.15
1991/92	20 535	743	36.18
1992/93 (P)	23 752	783	32.97
1993/94 (E)	46 650	1 797	38.51

(P) – Provisional; (E) – Estimate.

Source: Author's estimates.

G. Value added products

There are a number of products which can be made out of pepper. The most important is white pepper followed by oil and oleoresin.

White pepper: White pepper is usually prepared by keeping ripe berries in running water for seven to nine days to soften the pericarp or the skin. The pericarp is then removed by scrubbing and the corns are washed and dried. White pepper is used for light coloured food preparations, sauces and soups.

Indonesia is the leading producer of white pepper, followed by Malaysia and Brazil. Although India is one of the traditional producers of pepper, hardly any is converted into white pepper. Presently, Indonesia meets about 85 per cent of the world requirement of white pepper. Brazil and Malaysia account for six per cent and eight per cent of the world requirement respectively.

In some parts of the West European countries, there is a clear preference for white pepper over black. This is in contrast with the United States market which prefers black pepper.

Supply position: Production figures of white pepper in the pepper growing countries are not available. However, since these countries do not have domestic consumption the export figures can be taken as an indication as to the level of production. The export of white pepper from major producing countries from 1982 to 1992 are given in the Table 10.

It could be seen from the table that Indonesia is the major producer and exporter of white pepper. Until the mid-1980s, it supplied only 60-70 per cent of world exports

Table 10. Export of white pepper by producing countries

Year	Export (tons)			Total	Per cent share		
	Indonesia	Malaysia	Brazil		Indonesia	Malaysia	Brazil
1982	16 117	5 872	5 101	27 090	59	22	19
1983	15 077	6 263	3 886	25 226	60	25	15
1984	8 635	5 294	3 940	17 869	48	30	22
1985	12 120	5 118	2 108	19 346	63	26	11
1986	16 268	3 531	896	20 695	79	17	4
1987	19 600	2 397	1 001	22 998	85	10	4
1988	21 894	3 635	1 859	27 388	80	13	7
1989	24 833	3 057	1 134	29 024	86	11	4
1990	34 660	2 104	904	37 668	92	6	2
1991	30 641	1 809	2 108	34 558	89	5	6
1992	30 111	1 600	1 000	32 711	92	5	3

Source: Author's estimates.

of white pepper. The remaining 30-40 per cent were supplied by Brazil and Malaysia. From 1987, Indonesia steadily increased production and export. Indonesia was able to increase its market share to 92 per cent of world exports of white pepper.

Brazil and Malaysia reduced their production of white pepper for two reasons. First there was a general decline in pepper production, therefore conversion to white pepper was less. Second in the mid-eighties the black pepper price increased to unprecedented levels due to short supply while that of white pepper did not increase in a similar manner. In other words, the premium over black pepper was not much attractive to incur additional cost for conversion into white pepper.

Demand situation: As mentioned, West Europe is the major market for white pepper, accounting for about 50 per cent of the total world imports. Germany is the leading importer in this region and imports over 8,000 tons annually. Other major countries in this region are the Netherlands and France.

The United States is an important buyer of white pepper. However, of the 40,000 to 45,000 tons of its total pepper (black and white) imports, the share of white pepper is only 6,000 tons.

Japan also imports about 3,000 tons of white pepper annually. Import of white pepper by country from 1988 to 1992 is given in Table 11.

During the last five years, the highest white pepper imports at 37,669 tons was in 1990. Imports has stagnated to around 32,400 tons during 1991 and 1992. Judging from the current trend in import figures, volume of trade is likely to increase in the next few years.

Table 11. Import of white pepper by country
(Tons)

Country	1988	1989	1990	1991	1992
Singapore	1 594	1 545	9 708	10 534	19 827
Germany	5 760	3 338	10 309	8 565	7 957
Netherlands	8 013	3 786	7 814	6 748	4 809
United States	6 135	6 920	5 771	5 821	6 112
Japan	7 399	9 788	2 885	2 458	2 846
France	841	692	1 282	658	607
United Kingdom	910	204	1 404	1 084	1 181
Argentina	516	575	767	59	1 028
Belgium and Luxembourg	423	255	947	875	870
Spain	275	95	684	671	486
China	456	348	553	701	686
Australia	1 040	628	486	738	526
Canada	293	380	485	466	396
Hungary	855	675	150	80	467
United Arab Emirates	272	3	90	102	27
New Zealand	550	411	111	56	43
CIS	–	–	–	885	–
Others	777	846	2 848	3 517	3 195
Net Imports*	26 072	29 024	37 669	32 452	32 398

Source: IPC, Pepper Statistical Yearbook (various issues).

* Excluding re-exports from Singapore.

Oil and Oleoresin: There are about 15 units in India engaged in the production and export of pepper oil and oleoresin. Of this only 6 units can be considered to be active. The total production capacity of all the units put together is estimated at 400 tons of oil and about 2,000 tons of oleoresin. The internal demand for pepper oleoresin is negligible therefore the entire production is exported.

Exports of pepper oil and oleoresin from India during 1988/89 was only 247.3 tons valued at Rs. 93.72 million. Since then, there has been phenomenal improvement in exports. During 1993/94, exports of pepper oil and oleoresin was 448.3 tons valued at Rs. 167.31 million.

The annual trends in export of pepper oil and oleoresin are shown in Tables 12 and 13.

Pepper oil and oleoresin are exported to about 18 developed countries of the world. The major importers are the United States, Germany, the United Kingdom and the Netherlands. Pepper oleoresin accounts for about 50 per cent of the total spice oleoresin exports and pepper oil accounts for 56 per cent of the total spice oils exports from India.

Table 12. Export of pepper oil, India

Year	Quantity (tons)	Value (Rs. million)
1988/89	22.0	12.01
1989/90	21.5	10.70
1990/91	30.9	14.86
1991/92	33.1	20.62
1992/93	24.4	17.81
1993/94	22.0	14.50

Source: DGCI and S, Calcutta/shipping bills/exporters' returns.

Table 13. Export of pepper oleoresin, India

Year	Quantity (tons)	Value (Rs. million)
1988/89	225.3	81.71
1989/90	318.1	105.89
1990/91	292.9	91.43
1991/92	443.3	172.27
1992/93	426.3	152.81
1993/94	464.4	168.40

Source: DGCI and S, Calcutta/shipping bills/exporters' returns.

Green Pepper Products: Following are the major green pepper products exported from India, a) dehydrated green pepper, b) freeze dried green pepper, c) pepper in brine, d) frozen pepper and e) green pepper.

Among the green pepper products, dehydrated green pepper and pepper in brine are the largest items exported from India. Exports of these items go to Denmark, Germany, France, Netherlands and Spain. They are used in sausages, soups, pastes, meat and egg products.

There are 12 units who are active in the production and export of green pepper products from India. These units are mainly situated in Kottayam district in Kerala State. These items are produced mainly for export only. The total production of these items is around 1,200 tons per annum.

Export trend: India was exporting green pepper products such as dehydrated green pepper, freeze dried green pepper, pepper in brine and frozen pepper in the

amount of about 460 tons during 1988/89. However, the current level of exports has increased and is now over 1,100 tons. The details of exports from 1988/89 are shown in Table 14.

It can be noted from the above that the export of green pepper products is increasing. The exports of dehydrated green pepper and pepper in brine has increased dramatically in the recent years. It is necessary to identify new end-uses for these items in order to develop markets and increase exports.

Table 14. Export of green pepper products, India

Year	Quantity (tons)	Value (Rs. million)
1988/89	460	26.1
1989/90	756	35.4
1990/91	1 169	39.4
1991/92	949	38.2
1992/93	1 432	70.7

Source: DGCI and S, Calcutta/shipping bills/exporters' returns.

H. Value-addition — An Indian experience

The changes in every day life style, food habits, special preferences, leisure, growing number of working women are offering tremendous potential for technology promotion to develop new products and for value addition. Black pepper is a major spice with varied applications in processing industries. With the manufacturing capabilities and research support available, India adopted new technologies for developing different value-added pepper products. The products developed from pepper broadly fall into two groups.

1. Black pepper products, which include

Black pepper powder,
Pepper oil,
Pepper oleoresin,
Medicinal uses of pepper as in the ancient Indian system of medicine called Ayurveda.

The use of black pepper products goes back well in time. For example, the use of pepper in Ayurveda or Indian systems of medicine were known even before the Christian era. Black pepper is mostly used as powder. However, technology for the production of oil and oleoresin from black pepper and their uses in food and other preparations has since been developed.

Pepper Powder: Developed countries import black pepper mostly for grinding into pepper powder. In the past, due to lack of accepted sterilization technology to ensure quality, India could not explore the potential fully. However, India has now developed modern technologies and is able to supply pepper powder of any quality standard. With new technologies and raw material support, India plans to export a sizeable volume of pepper powder in the near future.

Pepper oil and oleoresin: With increased quality consciousness, preference for natural flavours and inconsistency in quality of raw materials, the food processing industries in the developed countries have been forced to standardize their products for obtaining uniform and contamination free products. Hence pepper oleoresin was developed and found usage in the food industry. New technologies for application of this product will lead to further development of the industry. The spice oils and oleoresins industry in India has been established to be world class manufacturers. Pepper oil and oleoresin were 38 per cent of India's total export of spice oils and oleoresins during 1993/94. Indian exporters have set up joint ventures and entered into marketing tie-ups for these products with major international companies.

During 1993/94, India exported 22 tons of pepper oil valued at Rs. 14.5 million and 464 tons of pepper oleoresin valued Rs. 168.4 million. The major markets for pepper oil and oleoresin are the United States, Germany and the United Kingdom.

Medicinal uses of pepper in Ayurveda: Pepper is one of the widely used medicinal plants in Ayurveda. Fruits, roots and leaves of pepper are used in Ayurvedic medicines. India has developed medicinal uses of different kinds of pepper:

(a) Black pepper is pungent, bitter, and destructive of worms. It is useful in cough, asthma, heart diseases, pains in various diseases of the throat and piles, urinary disorders and night blindness. It increases biliousness and brings in sleep. Yunani physicians consider black pepper as having a short, pungent and slightly bitter taste. It is carminative, aphrodisiac, purgative and antidote to poison. It is useful against tooth ache and inflammation and in general, pain in liver and muscles. Pepper is quite a popular remedy as an aromatic stimulant in cholera, weakness following fever, giddiness and coma or loss of consciousness. It is beneficial in indigestion and in removing abdominal morbid collection of gases. Externally, its application is preferred as a rubefacient and as a reliever of sour throat, piles and some skin diseases.

(b) White pepper is very useful in some eye diseases and in critical conditions of snake bite and also has an anti viral action. A notable use of white pepper is that it is a component in a pill reputed to be specific against constant attacks of fever in elephantiasis.

(c) Fresh pepper is sweet and it is good for digestion due to the enzymatic action. It is not too hot but slightly sharp.

(d) Pepper powder mixed with ghee, honey and sugar taken in small doses several times a day relieves all types of coughs. Pepper powder, honey and saliva of horse, if applied on eyes, is a good remedy for hypersomnia. Application of ground pepper with other spices/medicines rectifies/relieves different ailments.

2. Green pepper products, which include

Pepper in brine — canned, bottled and bulk,
Dehydrated green pepper,
Freeze dried green pepper,
Frozen pepper,
White pepper, whole, and
White pepper, powder.

Pepper corn in its natural state with its green colour and fresh green taste have always fascinated the Europeans. Due to different qualities like flavour and aroma and suitability for specific preparations, different green pepper products have been developed and exported from India.

Canned green pepper: The process consists of washing the separated berries or spikes, filling in cans containing dilute sodium chloride solution, with or without added acidity and sealing the cans. Cans are sterilized afterwards using autoclave and cooled in running water.

Canned green pepper is imported by Europe, the United States and Australia for flavouring and garnishing meat dishes. However due to the high cost of canning, packaging and freight charges, this product has not gained much popularity.

Green pepper in brine: The green colour of berries is maintained by high salinity of the steeping liquid. The liquid has a minimum salt level with slight acidity to help check microbial growth. Most of the preservation in producing countries are done in large high density polytene jerry cans of 20 to 25 kg. The importing countries repack this in small glass bottles. Brazil and India are the main producers and exporters of green pepper in brine.

Dehydrated green pepper: Dehydrated green pepper has green colour and almost fresh green flavour. On dehydration the product becomes full and soft, but does not get the texture of pepper in brine.

Better dehydration is obtained by freeze drying. Frozen green pepper is made by freezing in a brass freezer. Frozen green pepper is also exported to Europe. The dehydrated green pepper is exported in a polylined burlap bags and the gross weight is low. While green pepper products are popular in Europe especially in France and Germany, it is yet to be fully accepted by Americans. The fresh pungent flavour and soft texture make it ideal for garnishing meat dishes.

White Pepper: Traditionally, white pepper is made from optimum ripe pepper berries. Consumers in Europe do not prefer black spots appearing in their food especially in cream coloured soup and prefer softer pepper like white pepper. India has developed technologies for making white pepper from black pepper besides ripe berries and fully mature green pepper.

Due to increased demand and better prices, India produced and exported 32 tons of white pepper in 1993/94 against negligible exports in the past. Considering the additional cost of converting fresh pepper and black pepper, the production and export of white pepper depends upon the premium offered for the product over black pepper.

White pepper powder: White pepper powder is prepared by grinding white pepper. It is mainly done in the importing countries by the food processing industries. There are no white pepper powder exports from India. There is also no domestic market for it.

Export earnings from pepper products: The export of value added products increased considerably in the last few years. Quantity and value of export of various products since 1989/90 are given in Table 15.

Table 15. Export of pepper products from India during 1989/90 to 1993/94 (Quantity in tons, value in Rs. million)

Item	1989/90		1990/91		1991/92		1992/93 (P)		1993/94 (E)	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Pepper powder	82.34	2.96	34.56	1.12	10.12	0.45	99.07	3.69	75.22	2.84
White pepper	14.89	0.57	0.49	0.07	2.89	0.19	5.11	0.48	32.20	2.22
Dehydrated green pepper	137.06	18.78	170.22	19.43	144.90	19.16	243.29	30.58	193.41	28.04
Freeze dried green pepper	13.10	4.94	0.05	0.02	0.10	0.06	16.87	11.82	0.30	0.30
Pepper in brine	492.69	8.62	973.78	19.26	791.01	18.66	1 003.28	17.67	857.53	20.19
Frozen pepper	113.23	3.07	25.07	0.66	12.90	0.93	163.72	10.57	–	–
Pepper oil	21.51	10.70	30.92	14.86	33.09	20.62	24.44	17.81	21.95	14.50
Pepper oleoresin	318.10	105.89	292.89	91.44	443.35	172.27	426.34	152.81	464.40	168.40
Total	1 192.92	155.53	1 527.98	146.86	1 438.36	232.34	1 982.12	245.43	1 645.01	236.49

(P) – Provisional; (E) – Estimate.

Source: DGCI and S, Calcutta/shipping bills/exporters' returns.

The quantity and value of the pepper products exported stood at 1,192.92 tons and Rs. 155.53 million in 1989/90. Exports reached the record level of 1982.12 tons and Rs. 245.43 million in 1992/93. During 1993/94 exports declined by 17 per cent in quantity and by 3.6 per cent in value from the record levels in 1992/93. Lower

exports in 1993/94 were partly due to increase in price of raw material for processing black and green pepper and resultant increase in the finished products and some carryover stocks of the exports in 1992/93 in the importing countries.

Technology for increasing production and productivity of pepper has been developed to a great extent. A number of programmes are now under implementation to transfer the technology to the farmers. There is a conscious effort to supply quality pepper among producers, traders and exporters. Value-added pepper products is the goal of the industry. With the availability of cheap labour, strong R and D support and liberalization of Indian economy, it is possible to enhance export of processed products and earn more foreign exchange in future.

II. STUDY ON VOLATILE OIL AND PIPERINE CONTENT IN THAI BLACK PEPPER FOR QUALITY IMPROVEMENT[1]

Introduction

Pepper is one of the world's most important and oldest spices. Its aroma and pungency have been used in the food industry for flavouring sausages, table sauces, canned meats and salad dressings (1). The constituents of pepper responsible for its value as food additive are volatile oil (for aroma) and alkaloids (for characteristic pungency) (2, 3). Pepper normally contains 2-4 per cent volatile oil, 5-9 per cent alkaloids mainly piperine, 11 per cent protein and up to 65 per cent carbohydrate (4). The volatile oil can be obtained by steam distillation of the dried pepper berries. Most of pepper oil in commerce is distilled from black pepper. Pepper oil is comprised mainly of monoterpene hydrocarbons (50-80 per cent) with smaller amounts of sesquiterpene hydrocarbons (20-40 per cent) which appear to possess the main desirable attributes of pepper flavour and small amounts of oxygenated terpene compounds (5-9). The compositional variability of black pepper oil from different cultivars has been examined by several investigators (9-13). For the pungent principle in pepper, piperine together with other pungent substances present in small quantities such as chavicine, piperidine and piperettine are responsible for the sharp biting taste and pungency. Since piperine is universally accepted as the predominant pungent principle in pepper, the quality of pepper and also of its oleoresin is dependent largely on the piperine content.

Thai black pepper, as compared with other spices produced locally, has been a major exported spice of Thailand. Its total export volume has been increased from 2,000 tons in 1989 to 6,000 tons in 1992. The major site of pepper plantation in Thailand is at Chantaburi (about 78 per cent). Most of Thai pepper is the product obtained from both Sarawak and Sri Lankan cultivars. Very little information is available for the pepper quality of each cultivar, particularly its volatile oil content and composition and piperine content which contribute to the overall pepper quality.

This study, therefore, aimed at evaluating the quality of Thai pepper by carrying out the determination of pepper oil content, composition and peperine content.

[1] Based on the paper prepared by Ms. Waraporn Putalun and Dr. Wanchai De-Eknamkul, R and D Unit for Herbs and Spices, Faculty of Pharmaceutical Sciences, Chulalongkorn University, Bangkok, Thailand.

A. Materials and methods

1. Plant material

Samples of fresh ripe green pepper berries of Sri Lankan and Sarawak cultivars were harvested from six different gardens at Amphor Tamai, Chantaburi. Some black pepper samples were obtained from the warehouse station of Thai Commodities Co. Ltd. at Amphor Tamai, Chantaburi and were also purchased from various markets in Bangkok. Black pepper samples from Brazil, India and Malaysia were kindly provided by Mr. M. Rendlen of Gewürzmüller GmbH, Stuttgart, Germany.

Samples of green pepper were also collected every month during a six-month-period of maturation of pepper berries. The green pepper berries were dried by using hot air oven at 50°C for 12 hours to obtain black pepper. These samples were used for studying changes in volatile oil and piperine content during the maturation of pepper berries.

2. Chemicals

Authentic samples of α-pinene, β-caryohyllene, tridecane and piperine were purchased from Sigma (St. Louis, MO, United States), β-pinene was from Chem Service (West Chester, PA, United States), Δ^3-carene was from Fluka (Buchs, Switzerland), limonene and sabinene were from Extrasynthese (Z.I. Lyon Nord, Genay, France). Acetone, toluene and methylene dichloride were analytical reagent grade. Acetonitrile and methanol were HPLC grade. Water was distilled in glass.

3. Sample preparation

Black pepper samples were ground to a fine powder in a grinder connected to a cool water circulator. After passing the seive No. 20, each sample was weighed and immediately determined for its moisture, volatile oil and piperine content.

4. Moisture content determination

Moisture content was determined by the azeotropic volumetric method as described in AOAC's official methods of analysis, 1990 (14).

5. Determination of volatile oil content and composition

Volatile oil content was determined by the method described in British Pharmacopoeia, 1988 (15). For determination of volatile oil composition, 0.1 ml of each pepper oil sample obtained from the distillation was added with 20 μl tridecane (as internal standard) and diluted with 0.1 ml acetone before being injected (0.5 μl) into a gas chromatographic (GC) system. The GC system consisted of Varian 3400 gas chromatography (Walnut Creek, California, United States) equipped with 8100 autosampler, a 1077 split/splitless capillary injector, FID detector and a fused silica capillary column BP20 (50 m x 0.22 mm I.D.; film thickness 0.25 mm) (SGE, Victoria, Australia). The

operating parameters were as follows: nitrogen carrier gas flow rate 0.85 ml/min; injector temperature 250°C; hydrogen flow rate 30 ml/min, air flow rate 300 ml/min, detector temperature 250°C; initial column temperature 60°C, final temperature 200°C, rate 4°C/ min and hold 10 min at 200°C; split ratio 100:1; chart speed 0.5 cm/min; sample size 0.5 μl.

For calibration, various working standard solutions (15-350 μl/ml) were prepared. One hundred microliters of each solution were added with 20 μl tridencane as internal standard and diluted with 0.1 ml acetone. After mixing, 0.5 μl of the solution was injected into the GC column. The resulted chromatograms were used for constructing calibration graphs by plotting between the peak area ratios (peak area of authentic sample/ peak area of internal standard) and the amounts of the authentic samples (μl/ml).

6. Peak identification by gas chromatography-mass spectrometry (GC-MS)

The GC-MS system was Varian Saturn II (Walnut Creek, California, United States). The system was connected with a 30 m x 0.25 mm. (I.D.) capillary column DB-5, J and W (film thickness 0.25 μm). The operating parameters were as follows: helium carrier gas flow rate 1 ml/min; injector temperature, 250°C; initial column temperature 60°C, final temperature 180°C, rate 3°C/min; split ratio 100:1; accelerating voltage 170 volts, emission current 20 microamps. The spectra were recorded and compared in the Terpene library (RP Adams "The Analysis of Essential Oil by GC-MS").

7. Piperine content determination

Fifty-milligram amount of each ground pepper sample and 10 ml of methylene dichloride were put into a 50-ml tube and extracted under reflux at 50°C for 1 hour. The extract of each pepper sample was filtered through a membrane (0.45 μm) and the filtrate was readjusted with methylene dichloride in a 10-ml volumetric flask and injected into HPLC system. The HPLC was operated using Varian 9010 HPLC equipped with Varian 9095 Autosampler (Walnut Creek, California, United States). The column was Merck LiChro Cart RP-18 (125 mm x 4 mm, particle size 5 mm). The operating parameters were as follow: mobile phase 55 per cent acetonitrile in water; flow rate 1 ml/min; UV detector 336 nm; injection volume 10 ml; chart speed 0.25 cm/min. The resulted peak area of piperine in each extract was converted to piperine content using the standard curve of authentic piperine.

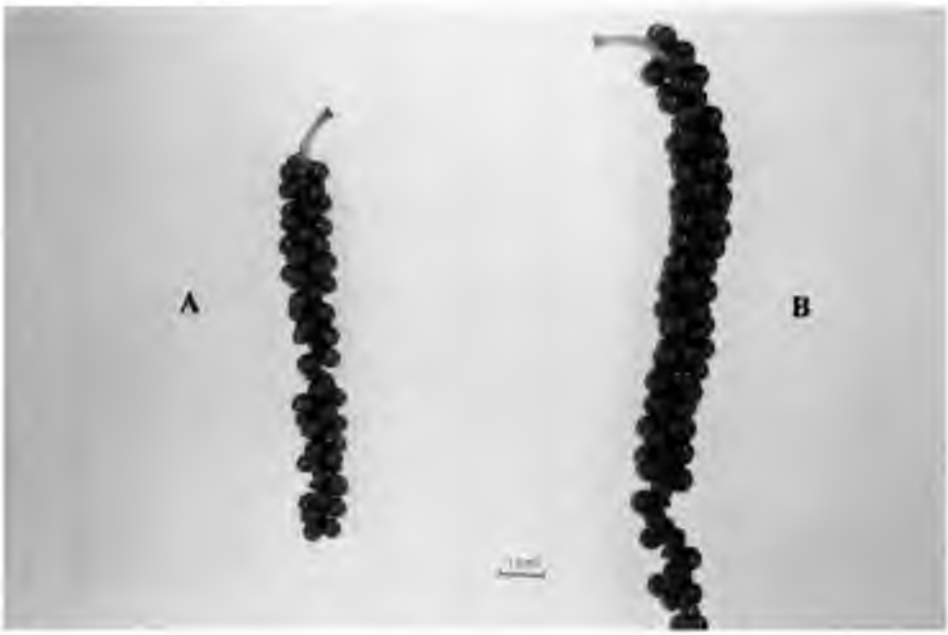
B. Results

1. Volatile oil content in Thai black pepper from various sources

Most pepper gardens at Chantaburi grow both Sarawak and Sri Lankan cultivars, in the ratio of approximately 70:30. The plants of both cultivars can be differentiated

from one another by their characteristic leaves and fruit berries. The Sarawak cultivar has smaller leaves and berries than the Sri Lankan's (Figure 1).

Figure 1. Fruit berries of Sarawak (A) and Sri Lankan cultivars (B)



Preliminary study on the volatile oil content of Chantaburi's black pepper (usually produced from the mixed berries of both Sarawak and Sri Lankan cultivars) showed that the product contained volatile oil up to 2.3 per cent (v/w). Similary, black pepper sold in Bangkok markets (mostly the products of Chantaburi) also showed their volatile oil content in the same range (Table 1). However, when the black pepper was prepared from the berries of separate Sri Lankan and Sarawak cultivars, it was found that the Sri Lankan cultivar (2.73 per cent) showed significantly higher volatile oil content than the Sarawak cultivar (1.78 per cent) (Table 1).

Table 1. Volatile oil content in Thai black pepper from various sources

Black pepper source	Volatile oil content (per cent v/w dry weight)*
Chantaburi black pepper (mixed cultivars)	2.32 ± 0.11
Black pepper from Bangkok markets	2.12 ± 0.25
Black pepper from Sri Lankan cultivar	2.73 ± 0.33
Black pepper from Sarawak cultivar	1.78 ± 0.26

* Each sample was subjected to moisture content determination and the volatile oil content was calculated based on its 10 per cent moisture content. Each value represents the mean ± SD of six separate determinations.

2. Volatile oil composition of Thai black pepper from different cultivars

In addition to the volatile oil content, the composition of the black pepper oil obtained from both Sarawak and Sri Lankan cultivars was also compared by using gas chromatography (GC). In this study, the conditions used for the GC system were developed carefully to maximize separation of all the volatiled oil components. The resulted GC-chromatograms are shown in Figure 2. It can be seen that both pepper oils were composed of some similar 30 components. Among these, peak numbers 1, 3, 4, 5, 8 and 19 were apparently the major components of the oil. To identify each of these components, the pepper oil samples were subjected to gas chromatography-mass spectroscopy (GC-MS) analysis. The results are shown in Table 2 which indicates peak number and name of each component as well as its chemical group.

Figure 2. Typical GC-chromatograms of Thai black pepper oil obtained from Sri Lankan (A) and Sarawak (B) cultivars

(Peak numbers are described in Table 2)

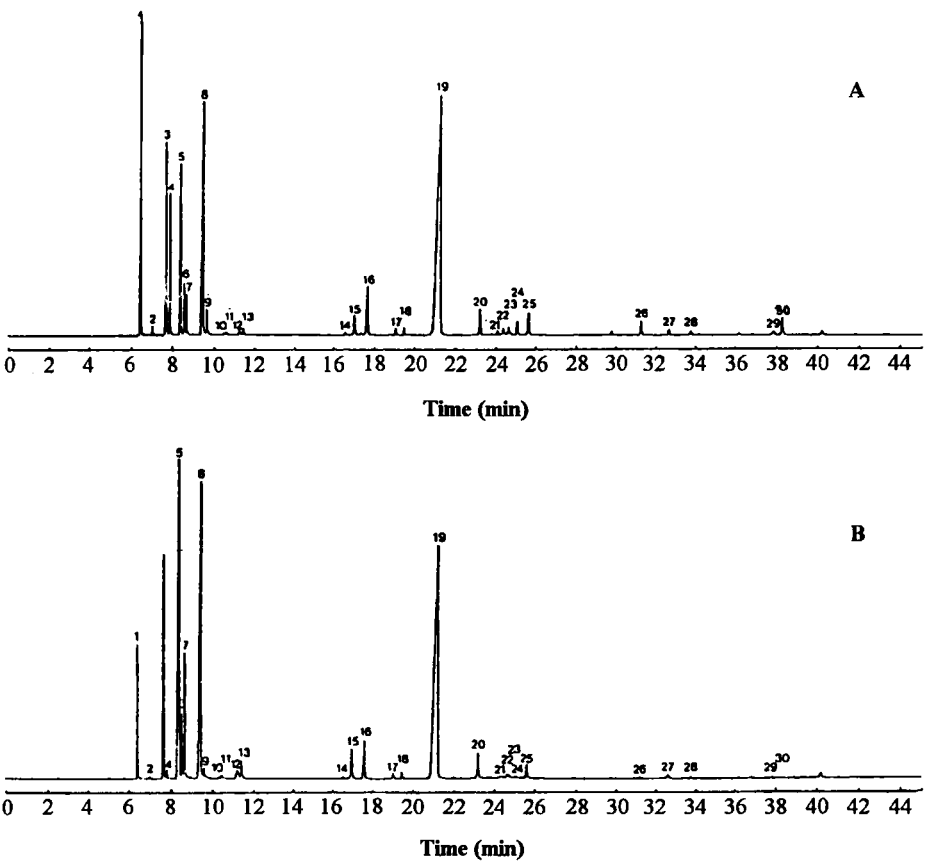


Table 2. Pepper oil components as separated by GC and identified by GC-MS

(Peak numbers and retention times correspond to those shown in Figure 2)

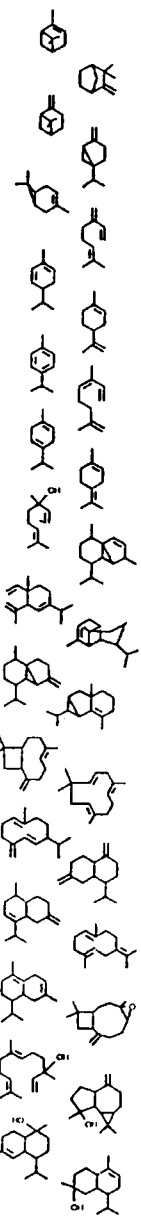
Peak No.	Retention time	Oil component	Structure	Chemical group
1.	6.44	α-Pinene		Monoterpene hydrocarbons
2.	7.02	Camphene		
3.	7.69	β-Pinene		
4.	7.89	Sabinene		
5.	8.39	Δ^3-Carene		
6.	8.57	Myrcene		
7.	8.70	α-Phellandrene		
8.	9.47	Limonene		
9.	9.66	*p*-Cymene		
10.	10.72	*trans*-Ocimene		
11.	10.82	γ-Terpinene		
12.	11.20	Terpinolene		
13.	11.44	Linlool		Oxygenated monoterpene
14.	16.53	α-Cubebene		Sesquiterpene hydrocarbons
15.	16.98	δ-Elemene		
16.	17.61	α-Copaene		
17.	19.01	β-Cubebene		
18.	19.43	α-Gurjunene		
19.	21.20	β-Caryophyllene		
20.	23.17	α-Humulene		
21.	24.05	Gemacrene D		
22.	24.34	α-Muurolene		
23.	24.62	γ-Cadinene		
24.	25.04	Germacrene B		
25.	25.60	δ-Cadinene		
26.	31.20	Caryophyllene oxide		Oxygenated sesquiterpenes
27.	32.59	*trans*-Nerolidol		
28.	33.74	Spathulenol		
29.	37.87	*tua*-Muurolol		
30.	38.26	Torreyol		

Table 3. Composition of Sri Lankan and Sarawak cultivar's black pepper oil

Constituent	Pepper oil composition (per cent relative)*	
	Sri Lankan cultivar	Sarawak cultivar
Monoterpene hydrocarbons		
α-Pinene	8.96	3.97
Camphene	0.28	0.08
β-Pinene	6.74	8.36
Sabinene	4.44	0.14
Δ^3-Carene	6.34	20.23
Myrcene	1.69	2.46
α-Phellandrene	1.10	4.32
Limonene	11.84	16.28
p-Cymene	0.94	0.29
trans-Ocimene	0.06	0.16
γ-Terpinene	0.13	0.03
Terpinolene	0.55	0.53
Total monoterpenes	43.07	56.85
Sesquiterpene hydrocarbons		
α-Cubebene	0.20	0.10
δ-Elemene	1.12	2.05
α-Copaene	3.66	2.28
b-Cubebene	0.46	0.28
α-Gurjunene	0.46	0.28
β-Caryophyllene	38.21	30.76
α-Humulene	1.97	1.91
Germacrene D	0.38	0.04
α-Muurolene	0.48	0.24
γ-Cadinene	0.74	0.35
Germacrene B	0.87	0.24
δ-Cadinene	1.47	1.04
Total sesquiterpenes	50.02	39.57
Oxygenated compounds		
Linalool	0.30	0.91
trans-Nerolidol	0.85	0.04
Caryophyllene oxide	0.71	0.34
Spathulenol	0.33	tr**
tua-Muurolol	0.37	tr**
Torreyol	1.30	tr**
Total oxygenated compounds	3.86	1.29
Unknown fractions	3.05	2.29

* Per cent relative = per cent integrated area.

** tr = Trace.

From these results, it was clear that the major components of peak numbers 1, 3, 4, 5, 8 and 19 were α-pinene, β-pinene, sabinene, Δ^3-carene, limonene and β-caryophyllene, respectively. Many other minor components in the volatile oils were identified as seven monoterpene hydrocarbons, eleven sesquiterpene hydrocarbons and six oxygenated terpene compounds (Table 2).

In spite of their similarily in the oil composition, the two cultivars were considerably different in their oil proportion of monoterpenes, sesquiterpenes and oxygenated compounds. As shown in Table 3, the Sri Lankan cultivar's pepper oil appeared to be composed of 43 per cent monoterpenes, 50 per cent sesquiterpenes and 3.9 per cent oxygenated compounds whereas the Sarawak cultivar's was composed of 57 per cent, 40 per cent and 1.3 per cent respectively. The higher proportion of the monoterpenes in the Sarawak cultivar's pepper oil appeared to be contributed mainly from Δ^3-carene and limonene which contained up to 20.2 per cent and 16.3 per cent respectively. These were much higher than the Sri Lankan cultivar's which contained only 6.3 per cent Δ^3-carene and 11.8 per cent limonene (Table 3). For the total sesquiterpene hydrocarbons, the higher content in the Sri Lankan cultivar appeared to be contributed mainly from β-caryophyllene which contained up to 38 per cent, compared with 31 per cent found in the Sarawak cultivar's pepper oil.

In terms of absolute amount of the major oil components, it was found that the levels of α-pinene, β-pinene, sabinene and the β-caryophyllene in Sri Lankan cultivar's black pepper were considerably higher than those in Sarawak cultivar's while the level of Δ^3-carene in Sri Lankan cultivar's was slightly lower than those in Sarawak cultivar's and the level of limonene in both samples appeared to be the same (Table 4). These suggested that the one per cent higher of the Sri Lankan cultivar (2.73 per cent v/w) over the Sarawak's (1.78 per cent v/w) was contributed mainly from α-pinene, β-pinene, sabinene and β-caryophyllene.

Table 4. The content of major pepper oil components

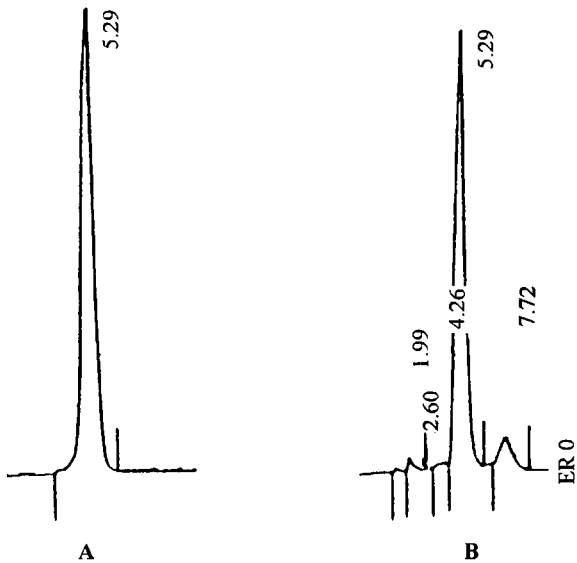
Major component	Content (per cent v/w dry weight)	
	Sri Lankan cultivar	Sarawak cultivar
Total volatile oil	**2.73 ± 0.33**	**178 ± 0.26**
α-Pinene	0.30 ± 0.01	0.06 ± 0.002
β-Pinene	0.24 ± 0.01	0.14 ± 0.01
Sabinene	0.13 ± 0.02	0.002 ± 0.0002
Δ^3-Carene	0.14 ± 0.01	0.22 ± 0.02
Limonene	0.32 ± 0.03	0.27 ± 0.01
β-Caryophyllene	0.87 ± 0.03	0.54 ± 0.03

Each value represents the mean ± SD of six separate preparations.

3. Piperine content in Thai black pepper

The content of piperine, the major pungent alkaloid in pepper, was determined by high performance liquid chromatography (HPLC). This method could separate piperine from other piperine derivatives in pepper extract. The chromatograms of standard piperine and pepper extract are shown in Figure 3.

Figure 3. HPLC chromatograms of piperine (A) and black pepper extract (B)



Using the developed HPLC method, it was found that piperine content in the pepper from Sri Lankan cultivar (4.96 per cent w/w) contained significantly higher level than that from Sarawak cultivar (3.82 per cent) (Table 5). The piperine content in Chantaburi's black pepper showed the intermediate value of 3.94 per cent. Similarly, various black pepper samples sold in Bangkok markets (mostly the products of Chantaburi) also showed the same range of piperine content (3.46 per cent).

Table 5. Piperine content in Thai black pepper obtained from various sources

Black pepper	Piperine (per cent w/w)
Chantaburi black pepper (mixed cultivars)	3.94 ± 0.10
Black pepper from Bangkok markets	3.46 ± 0.11
Black pepper from Sri Lankan cultivar	4.96 ± 0.19
Black pepper from Sarawak cultivar	3.82 ± 0.32

Each value represents the mean ± SD of six separate determinations.

4. Comparison of volatile oil composition and piperine content between black pepper of Thailand and other countries

(a) Volatile oil and piperine content

Table 6 shows the content of volatile oil and piperine in various black pepper products obtained from India, Brazil, Malaysia and Thailand. The black pepper from Malaysia (3.20 per cent v/w), India (3.19 per cent) and Brazil (3.10 per cent) appeared to have high level of volatile oil whereas Thai black pepper showed lower level, with 2.73 per cent for the Sri Lankan cultivars and 1.78 per cent for the Sarawak cultivars. For piperine content, on the other hand, the black pepper from Thailand's Sri Lankan cultivar was found to contain the highest level, with 4.96 per cent w/w. This was more than one per cent higher than the piperine level found in the black pepper from Malaysia, India, Brazil and Thailand's Sarawak cultivar (3.78, 3.71, 3.58 per cent of 3.82 per cent, respectively) (Table 6).

Table 6. Volatile oil and piperine content in black pepper obtained from Brazil, India, Malaysia and Thailand

Black pepper source	Volatile oil (per cent v/w)	Piperine (per cent w/w)
Brazil	3.10 ± 0.16	3.58 ± 0.10
India	3.19 ± 0.14	3.71 ± 0.14
Malaysia	3.20 ± 0.14	3.78 ± 0.14
Thailand		
– Sri Lankan cultivar	2.73 ± 0.33	4.96 ± 0.19
– Sarawak cultivar	1.78 ± 0.26	3.82 ± 0.12

Each value represents the mean ± SD of separate preparations.

(b) Volatile oil composition

The volatile oil composition of pepper oils obtained from the black pepper products of various countries were also compared by using gas chromatography (GC). The resulting GC chromatograms are shown in Figure 4 and their content of major oil components on the basis of per cent dry weight of black pepper is shown in Table 7.

The content of α-pinene in the black pepper of Brazil was found to be similar to that of Thailand's Sri Lankan cultivar (0.28 per cent v/w and 0.30 per cent v/w, respectively) while Thailand's Sarawak cultivar showed the lowest content of α-pinene (0.06 per cent). For β-pinene, the Brazil and India's contained higher level (0.36 per cent and 0.35 per cent, respectively) than the Malaysia's and Thailand's Sri Lankan's pepper (0.23 per cent and 0.24 per cent, respectively). The content of sabinene was

Figure 4. Typical GC-chromatograms of black pepper oils obtained from the black pepper products of Thailand, Brazil, India and Malaysia

(Peak numbers are described in Table 2)

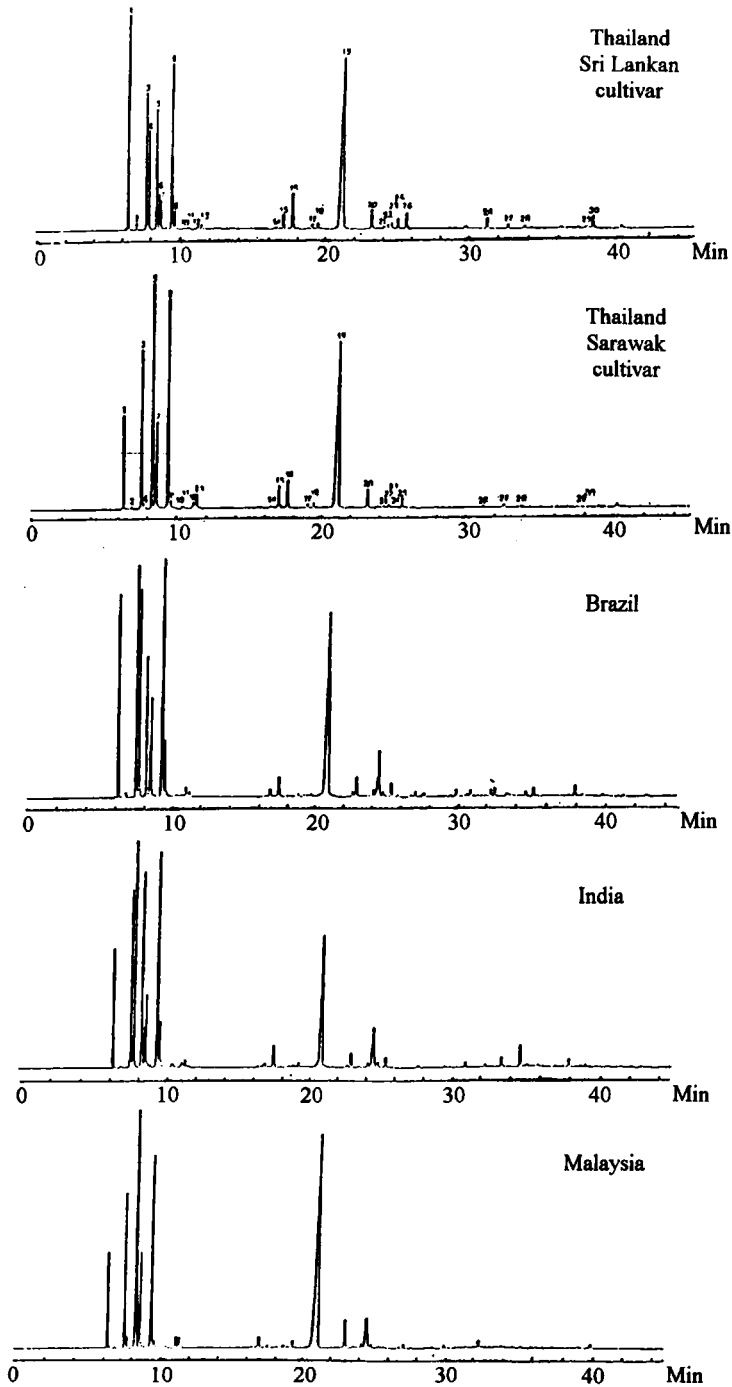


Table 7. The content of volatile oil major components obtained from the black pepper of Brazil, India, Malaysia and Thailand

Major component	Volatile oil content (per cent v/w dry weight)				
	Brazil	India	Malaysia	Thailand Sri Lankan cultivar	Thailand Sarawak cultivar
Total volatile oil	**3.10 ± 0.16**	**3.19 ± 0.14**	**3.20 ± 0.14**	**2.73 ± 0.33**	**1.78 ± 0.26**
α-Pinene	0.28 ± 0.02	0.23 ± 0.02	0.13 ± 0.01	0.30 ± 0.01	0.06 ± 0.002
β-Pinene	0.36 ± 0.02	0.35 ± 0.02	0.23 ± 0.01	0.24 ± 0.01	0.14 ± 0.01
Sabinene	0.22 ± 0.02	0.34 ± 0.02	0.01 ± 0.004	0.13 ± 0.02	0.002 ± 0.0002
Δ^3-Carene	0.15 ± 0.03	0.28 ± 0.03	0.47 ± 0.03	0.14 ± 0.01	0.22 ± 0.02
Limonene	0.50 ± 0.01	0.50 ± 0.02	0.34 ± 0.01	0.32 ± 0.03	0.27 ± 0.01
β-Caryophyllene	0.66 ± 0.01	0.47 ± 0.01	0.95 ± 0.04	0.87 ± 0.03	0.54 ± 0.03

Each value represents the mean ± SD of six separate preparations.

found to be highest in India's pepper (0.34 per cent) and lowest in the Thailand's Sarawak cultivar (0.002 per cent). For the level of Δ^3-carene, the Malaysia's pepper showed the highest content (0.47 per cent) while those from Thailand's Sri Lankan cultivar and Brazil were found to be relatively low (0.14 per cent and 0.15 per cent, respectively). The pepper from Brazil and India contained the same high level of limonene (0.50 per cent) while those from Malaysia, Thailand's Sri Lankan and Sarawak cultivars contained similar lower level of limonene. (0.34 per cent, 0.32 per cent, and 0.27 per cent, respectively) β-Caryophyllene showed its highest level in the pepper from Malaysia (0.95 per cent) and relatively high level in the pepper from Thailand's Sri Lankan cultivar (0.87 per cent) while the one from India contained the lowest level of β-caryophyllene (0.47 per cent).

From the chromatograms, the relative content of each component in the black pepper oils obtained from different sources was also determined. As shown in Table 8, the proportion of total monoterpene hydrocarbons in the pepper oil from India (61.54 per cent) appeared to be highest followed by those from Brazil (57.02 per cent), Thailand's Sarawak cultivar (56.85 per cent), Malaysia (48.78 per cent) and Thailand's Sri Lankan cultivar (43.07 per cent). For the total sesquiterpene hydrodcarbons, the pepper oil from Thailand's Sri Lankan cultivar (50.02 per cent) showed the highest level and the pepper oils from Brazil (38.52 per cent) and from Thailand's Sarawak cultivar (39.57 per cent) were found to have similar moderate contents. The pepper oil from India showed the lowest level of total sesquiterpene hydrocarbons (31.52 per cent).

Table 8. Composition of various pepper oils obtained from the pepper products of Brazil, India, Malaysia and Thailand

Constituent	Pepper oil composition (per cent relative)*				
	Brazil	India	Malaysia	Thailand Sri Lankan cultivar	Thailand Sarawak cultivar
Monoterpene hydrocarbons					
α-Pinene	7.04	5.45	3.14	8.96	3.97
Camphene	0.15	0.09	0.06	0.28	0.08
β-Pinene	9.61	8.74	6.15	6.74	8.36
Sabinene	7.64	11.04	0.28	4.44	0.14
Δ^3-Carene	5.77	11.18	20.12	6.34	20.23
Myrcene	1.79	1.99	1.94	1.69	2.46
α-Phellandrene	3.95	3.48	3.79	1.10	4.32
Limonene	17.92	16.07	11.71	11.84	16.28
p-Cymene	2.34	2.61	0.25	0.94	0.29
trans-Ocimene	0.08	0.17	0.10	0.06	0.16
γ-Terpinene	tr**	0.18	tr**	0.13	0.03
Terpinolene	0.73	0.54	1.04	0.55	0.53
Total monoterpenes	57.02	61.54	48.78	43.07	56.85
Sesquiterpene hydrocarbons					
α-Cubebene	tr**	0.12	0.09	0.20	0.10
δ-Elemene	0.50	0.35	0.73	1.12	2.05
α-Copaene	1.47	1.93	0.18	3.66	2.28
b-Cubebene	0.18	0.20	tr**	0.46	0.28
α-Gurjunene	0.09	0.24	0.24	0.46	0.28
β-Caryophyllene	28.54	19.86	39.20	38.21	30.76
α-Humulene	1.47	1.23	2.22	1.97	1.91
Germacrene D	0.10	0.10	tr**	0.38	0.04
α-Muurolene	0.43	0.51	0.30	0.48	0.24
γ-Cadinene	4.47	5.47	4.60	0.74	0.35
Germacrene B	0.40	0.58	0.32	0.87	0.24
δ-Cadinene	0.87	0.93	0.11	1.47	1.04
Total sesquiterpenes	38.52	31.52	47.99	50.02	39.57
Oxygenated compounds					
Linalool	0.37	0.55	0.73	0.30	0.91
trans-Nerolidol	0.31	0.34	tr**	0.85	0.04
Caryophyllene oxide	0.45	0.26	0.49	0.71	0.34
Spathulenol	0.20	0.85	tr**	0.33	tr**
tua-Muurolol	tr**	1.59	tr**	0.37	tr**
Torreyol	0.68	0.58	tr**	1.30	tr**
Total oxygenated compounds	2.02	4.17	1.22	3.86	1.29
Unknown fractions	2.45	2.77	2.01	3.05	2.29

* Per cent relative = per cent integrated area.
** tr = Trace.

5. Changes in volatile oil and piperine content during the maturation of pepper berries

During the six-month period of the maturation of pepper berries, the content of both volatile oil and piperine was found to fluctuate (Table 9). For Sri Lankan cultivar, the pepper berries showed a rise in volatile oil content, from 2.87 per cent in the first month of 7.13 per cent in the third month, and piperine content, from 0.51 per cent from the first month to 8.29 per cent in the third month. Therefore, the levels of both components decreased continuously until maturation of the berries which eventually contained 2.79 per cent volatile oil and 4.06 per cent piperine. For the Sarawak cultivar, its pepper berries also showed similar patterns of volatile oil and piperine accumulation except the levels of both components were lower than the Sri Lankan cultivar at all stages of the development. Again, the maximum volatile oil and piperine content was found in the third month with 5.30 and 6.42 per cent respectively. The mature 6-month-old berries finally contained 2.35 per cent volatile oil and 2.99 per cent piperine. In terms of density, the black pepper berries of both cultivars reached their maximum values during the fifth month (647.0 and 613.8 g/l in Sri Lankan and Sarawak cultivars, respectively) and declined after that. In the third month of the pepper berries, although the volatile oil and piperine content of both cultivars appeared to be high their density was significantly lower than the fifth month (Table 9). Therefore, the 5-month-old pepper berries were, considered to be suitable for harvesting although it contained volatile oil and piperine lower than the maximum.

Table 9. Volatile oil content, piperine content and density of pepper berries

Pepper berries (months)	Volatile oil (per cent v/w)	Piperine (per cent w/w)	Density (g/l of black pepper)
Sri Lankan cultivar			
1.	2.87 ± 0.07	0.51 ± 0.02	212.8 ± 7.9
2	5.80 ± 0.05	3.17 ± 0.15	216.2 ± 2.9
3.	7.13 ± 0.11	8.29 ± 0.24	422.3 ± 6.2
4.	5.22 ± 0.24	8.16 ± 0.18	533.2 ± 9.2
5.	3.74 ± 0.01	4.98 ± 0.25	647.0 ± 5.3
6.	2.79 ± 0.03	4.06 ± 0.19	631.5 ± 6.6
Sarawak cultivar			
1.	3.10 ± 0.05	0.83 ± 0.04	220.4 ± 3.6
2.	5.18 ± 0.13	5.30 ± 0.23	228.8 ± 5.9
3.	5.30 ± 0.15	6.42 ± 0.20	347.4 ± 3.4
4.	4.38 ± 0.08	3.40 ± 0.15	443.0 ± 2.3
5.	3.00 ± 0.12	3.24 ± 0.07	613.8 ± 5.9
6.	2.35 ± 0.08	2.99 ± 0.18	595.8 ± 5.8

Each value represents the mean ± SD of six separate preparations.

C. Conclusion

1. Volatile oil and piperine content in Thai black pepper

We have shown in this study that Thai black pepper obtained from Sri Lankan cultivar contains significantly higher level of volatile oil than that from Sarawak cultivar (2.73 per cent and 1.78 per cent, respectively). We have also shown that the pepper oils of both cultivars are similarly composed of some 30 volatile components. However, they are different in their oil proportion of monoterpenes, sesquiterpenes and oxygenated compounds. While Sri Lankan cultivar's pepper oil has relatively low monoterpenes (43 per cent), high sesquiterpenes (50 per cent) and high oxygenated terpenes (3.9 per cent) content, the Sarawak cultivar's pepper oil appears to be opposite (57 per cent, 40 per cent and 1.3 per cent, respectively). Study on the major volatile oil components of both cultivars indicates that the higher oil content of Sri Lankan cultivar's black pepper over the Sarawak was contributed mainly from the volatile components of α-pinene, β-pinene, sabinene and β-caryophyllene.

It is generally accepted that the level of monoterpene hydrocarbons is related to pepper oil's peppery notes while the level of sesquiterpene hydrocarbons contributes to pepper odous (12) and the level of oxygenated compounds makes an important contribution to the spicy notes, or overall odour quality of pepper oils (11, 12). In these aspects, the Sarawak cultivar's black pepper oil seems to be rich in peppery notes, moderate pepper odour and low odour quality of spicy notes. On the other hand, the Sri Lankan cultivar's has low peppery notes but is rich in pepper odours and hihgly aroma of spicy notes.

For piperine content, we have shown that Sri Lankan cultivar's black pepper (4.96 per cent) contains higher piperine level Sarawak cultivar's (3.82 per cent). The former is therefore more pungent than the latter.

2. Comparison of volatile oil composition and piperine content between black pepper of Thailand and other countries

In order to obtain more information on the standard quality of Thai black pepper, a comparative study was carried out. This was done by comparing the composition and content of volatile oil and piperined of Thai black pepper and other world's famous black pepper products (from India, Brazil, and Malaysia).

The results indicate that the black pepper of Thailand, both Sri Lankan and Sarawak cultivars, contain lower levels of volatile oil but higher level of piperine than those from India, Brazil and Malaysia. This suggests that Thai black pepper is more pungent but less aromatic than those from other countries. However, between the two cultivars, the Sri Lankan cultivar's black pepper seems to be only slightly inferior to the foreign pepper with respect to the aroma.

In terms of pepper oil composition, the results show relatively high variation of the pepper oil composition obtained from different sources of pepper. In general, however, it can be concluded that Thailand's Sri Lankan cultivar has a similar volatile oil pattern to Brazil's and India's pepper products while Thailand's Sarawak cultivar has the pattern similar to Malaysia's pepper.

3. Changes in volatile oil and piperine contents during the maturation of pepper berries

In Thailand, fully-matured pepper berries are normally obtained 6 months after their fruit setting. The berries at this stage are usually harvested for black pepper preparation. However, no information has been established whether the 6-month-old pepper berries in Chantaburi are suitable to be harvested, with respect to their accumulated levels of volatile oil and piperine. This study, therefore, aimed at investigating the changes in both constituents during the maturation of pepper berries under the environmental conditions of Chantaburi Province.

The results from the study indicate that the per cent contents (v/w) of volatile oil and piperine in the berries of both Sri Lankan and Sarawak cultivars are highest during the third month of maturation. Thereafter, these values decrease gradually. However, the pepper berries at 5-month-old appear to be relatively mature (based on their weight) with moderate levels of both piperine and volatile oil. Furthermore, the volatile oil composition of the 5-month-old berries appears to be similar to that of the fully-mature berries. Therefore, based on their chemical content and composition and the pepper yield it seems that 5-month-old Thai pepper berries are optimum for harvesting. However, between the Sri Lankan and Sarawak cultivars, it is clear that the former is superior to the latter, again, with respect to the volatile oil and piperine contents as well as the yield of the pepper berriers. There is no question that the Sri Lankan cultivar grown in Thailand give good quality of black pepper products.

Bibliography

1. Buckle, K.A., Rathnawathie, M., and Brophy, J.J. 1985. Compositional differences of black, green and white pepper (*Piper nigrum* L.) oil from three cultivars. *J. Food Tech.* 20: 599-613.

2. Govindarajan, V.S. 1977. Pepper-chemistry technology and quality evaluation. *Crit. Rev. Food Sci. Nutri.* 9: 155-171.

3. Purseglove, J.W., Brown, E.G., Green, C.L., and Robbins, S.R.J. 1981. Spices, Vol. 1. New York: Longman.

4. Yongken, H.W. 1950. Textbook of Pharmacognosy. 6th ed. New York: McGraw-Hill book company, Inc.

5. Hasselstrom, T., Hewitt, E.T., Konigsbacker, K.S., and Ritter, J.J. 1957. Pepper analysis: Composition of volatile oil of black pepper, *Piper nigrum. J. Agr. Food Chem.* 5: 53-55.

6. Ikeda, R.M., Stanley, W.L., Vannier, S.H., and Spitter, E.M. 1962. The monoterpene hydrocarbon composition of some essential oils. *J. Food Sci.* 27: 455-458.

7. Jennings. W.G., and Wrolstad, R.E. 1961. Volatile constituents of black pepper. *J. Food Sci.* 26: 499-501.

8. Wrolstad, R.E., and Jennings. W.G. 1965. The monoterpene hydrocarbon fraction. *J. Food Sci.* 30: 274-279.

9. Richard, H.M., Russell, G.F., and Jennings, W.G. 1971. The volatile components of black pepper varieties. *J. Chrom. Sci.* 9: 560-566.

10. Datta, P.R., Susi, H., Higman, H.C., and Filpic, V.J. 1971. Use of gas chromatography to identify the geographical origin of some spices. *Indian Spices.* 8(1): 2-5.

11. Lewis, Y.S., Nambudiri, E.S., and Krishnamurthy, N. 1969a. Composition of pepper oil. *Perf. Ess. Oil Rec.* 60: 259-262.

12. Lewis, Y.S., Nambudiri, E.S., and Krishnamurthy, N. 1969b. Essential oil of pepper. *Indian Perfumer.* 13(1): 22-25.

13. Russell, G.F., and Else, J.C. 1973. Volatile compositional differences been cultivars of black pepper (*Piper nigrum*). *J. Assoc. Offic. Anal. Chem.* 56: 344-351.

14. Association of Official Analytical Chemists, 1990. Official Methods of Analysis, 15tt Edition (ed. Kenneth Helrich). Moiture in Spices, method No. 986.21, pp. 999. Association of official Analytical Chemists, Inc, Virginia, USA.

15. British Pharmacopoeia 1988. Appendix XI E, Volatile Oil in Drugs, pp. A137-A138. London, Her Majesty's Stationery Office.

III. PEPPER — QUALITY REQUIREMENTS TODAY AND TOMORROW[1]

A. Current status and future outlook

The spice market is in the process of change. So far, this market has been determined by supply and demand and thus by price policy and speculation. In the future, the market will soon be determined by quality thinking and product safety.

It is greatly possible that the future spice market structure will be decisive with regard to future value and quality requirements in the year 2000. To explain this better, the German spice market can be taken as an example. This explanation, however, can be transferred to the European market without much difficulty.

In 1970, approximately 15 importers and brokers who supplied products to approximately 75 spice processing companies in Germany, were involved in the spice market. In 1994, the approximately 50 grinders in Germany are supplied by only about 5 traders. Although there was a decrease in the number of grinders or spice processing companies, 50 is still an impressive number. In countries such as the United Kingdom or France, only 4-5 grinders dominate the trade. Those 50 companies mentioned earlier, however, include grinders with only a small turnover. Approximately 75 per cent or 11,000 tons of the German annual pepper import of 15,000 tons is processed by only 12 companies.

Approximately 25 per cent of the annual requirement of 15,000 tons is purchased directly from grinders in the pepper producing countries and the remaining 75 per cent are still traded for by 5 importers. Out of these five, three dominate approximately 75 per cent of the market potential. The shrinking process over the past few years also confronted those companies not only with increasing market shares but also with greater risks in the speculative spice market.

As far as the spice industry is concerned, several important companies were taken over by large food groups in the past few years. This has continued increasingly so after the completion of the Common European Market.

At present, the following groups of companies active in the European spice market are, namely: Burns, Philps; Feruzzi; McCormick; CPC; and BSN. It is highly probable that further takeovers will follow within the next few years. Therefore, there will be a further shrinking in the process. It is likely that only 20-30 grinders will still be in business in Germany by the year 2000. Those companies will be supplied

[1] Based on a paper prepared by Mr. Karl-Gunter Jahn, Purchasing Manager, IBENA Gewurze Gmbh, Bremen, Germany.

by 2-3 remaining importing traders, who will, however, assume more and more service tasks. By the year 2000, 50-60 per cent of the annual pepper requirements will be purchased by the grinders directly in the countries of origin. Nevertheless, traders will certainly continue to assume a role as intermediaries. With the large food groups entering the spice trade, quality thinking has received new dimensions. These brand companies are increasingly interested, together with the partners in the countries of origin, in improving and securing quality. Indeed, purchasing anonymous commodities via importing traders involves too many risks and will increasingly recede into the background. The commodity "pepper" will become a branded article.

The spice business is likely to change even in the short-term future. Large companies will, with regard to pepper, conclude annual contracts at a fixed price with reliable suppliers in the exporting countries according to which monthly shipments will be effected, similar to today's contracts as far as products such as paprika, onions or garlic are concerned. The speculative part in the pepper business will thereby recede into the background. Such a market change would, however, offer more security to pepper growers, traders and the processing industry.

Figures A and B show how the spice market is working today and how it would be working in a few years' time.

Figure A.

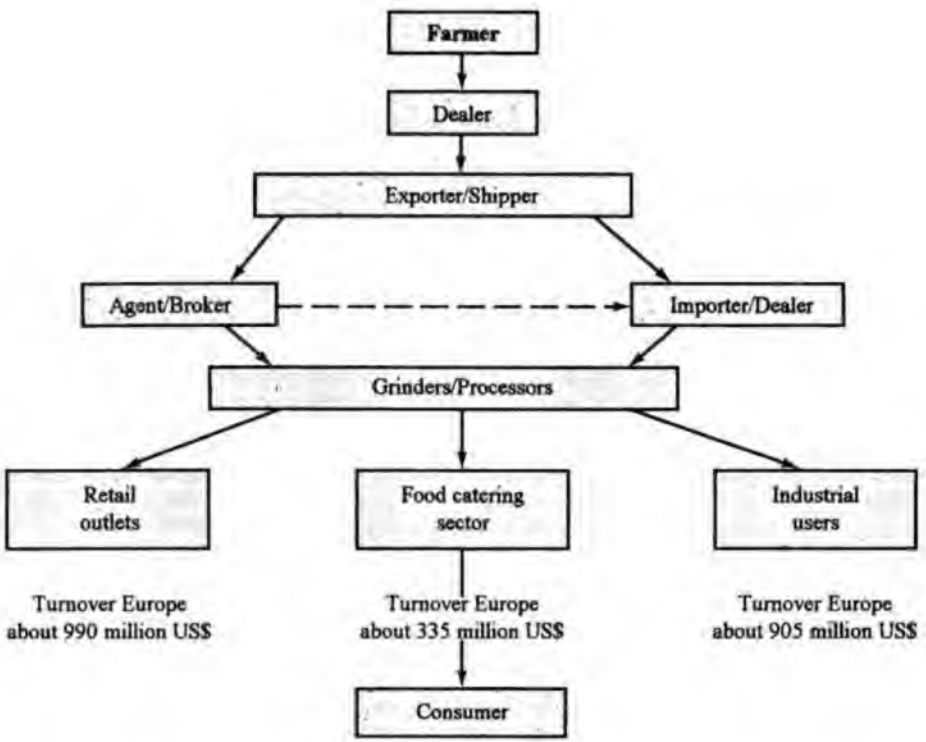
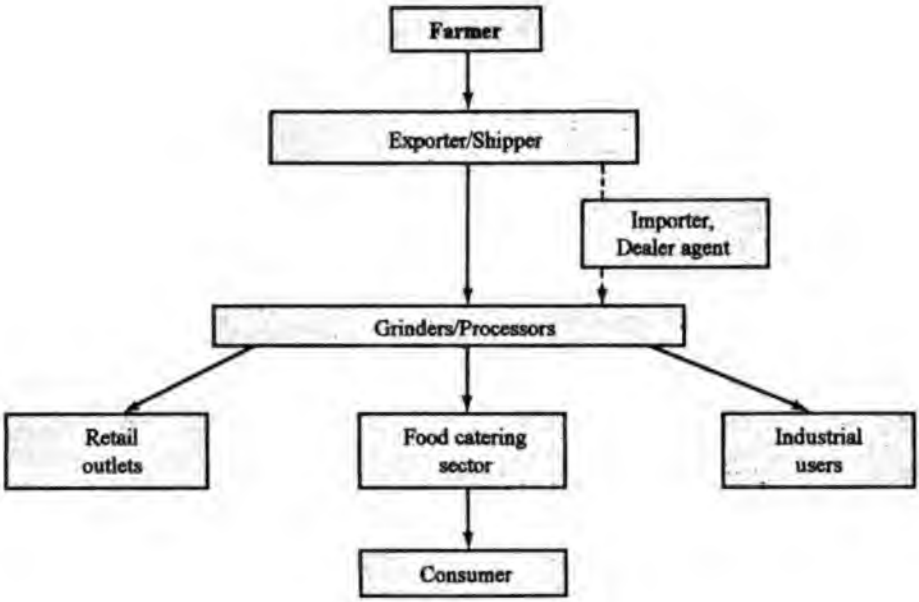


Figure B.



At present, the farmer sells the goods to a local collector (Figure A). The collector sells the pepper to the exporter, who grades and prepares the goods. The pepper is then sent to the grinders in Europe via agents or importers. The grinders clean, grind or mix and sell their finished products via 3 main distribution channels; namely, via retail outlets; via the food catering sector; or via industrial users. Finally the products reach the consumer.

In Figure B, the way from the grower to the final end user is likely to come closer together. Importers and traders will, as explained earlier, assume an important advising and mediating task within direct cooperation between exporters and grinders.

Table 1 gives an overview of the size and distribution in retail, catering business and industry of the European spice market. The figures here are given in million US dollars and are based on the grinders' selling prices of finished, packed products to their customers in the individual market sections. A turnover of approximately $US 2.2 billion is made with spices in Europe. The highest turnover is achieved in retail business with 44 per cent or $US 989 million, closely followed by industry with 41 per cent or $US 905 million. Further 15 per cent or $US 334 million are obtained on the spice market via catering organizations.

A large part of this market, about $US 2.2 billion is in the hands of large food groups operating world-wide. Their participation will increase further and thus the demand for good quality will grow.

Table 1. Spice trade in Europe
($US million)

Country	Total	Retail	Catering	Industry
United Kingdom	215	85	20	110
France	290	120	35	135
Germany	620	300	120	200
Belgium	70	30	7	33
Netherlands	257	110	27	120
Spain	163	75	18	70
Italy	93	40	8	45
Austria	95	40	10	45
Switzerland	117	50	12	55
Scandinavia	280	126	76	78
Ireland	7	3	0.7	3.3
Portugal	11	5	0.5	5.5
Greece	11	5	0.5	5.5
Total	2 229	989	334.7	905.3
(Per cent)	100	44	15	41

Source: Preliminary trade estimates.

As mentioned, large food groups demand good and quality standards for pepper.

1. The Consumers

On account of many so-called food scandals, which the European media has reported on in the past few years, the consumer has begun to feel very insecure. Pesticide residues in baby food or salmonella in eggs and chicken meat resulted in increased scepticism about products offered by the food industry. The spice industry in particular has been criticized, especially in Germany, in the last few years.

Reports on millions of bacteria in pepper, salmonella in paprika and aflatoxins in nutmeg and chilis have caused many consumers to become cautious in using spices.

For example, there was the case of a large German spice company which was selling paprika to industry as well as the public in consumer packages and had to withdraw all their paprika products after a vehement discussion in the media of salmonella infestation. This resulted in a two-figure million loss in US dollars.

A consumer magazine called "Öko-Test" recently examined pepper, paprika and nutmeg from various German spice companies with regard to their total bacterial count and presented the findings to the public. Consequently an evaluation was carried out and products were classified according to their respective bacterial count as follows: good (below 10,000), questionable (between 10,000 and 1 million) and extremely questionable (above 1 million). Only a few products were accorded the grade "good".

Pepper permanently has a total bacterial count between 10 and 100 million. This is not necessarily alarming. Those figures do, however, cause fear to consumers. With those values, ignorant consumers think they may, after eating pepper, at the same time infect themselves with cancer, TBC and AIDS. This is not necessarily the case, but total bacterial counts of millions and millions clearly prove unclean production. The extremely carcinogenic aflatoxin develops from mould, and mouldy products means that they have already reached a state of spoilage. E-Coli in pepper means faecal pollution. Certainly, this is not very appetizing. Salmonella in paprika or pepper lead to the serious assumption that contact with birds, fowl or other animals existed during pepper production.

The consumers' doubt with regard to the quality of spices is therefore justified to a large extent, and their demand for quality should merit immediate action.

2. Food control/governmental food authorities

Government food authorities increasingly check spices and spice products. They often discover pollution and complaints follow. For this reason, the authorities resolutely demand that the spice industry exert more influence in the countries of origin on clean production and enforce clean production procedures. What are the individual demands by the authorities in Germany and Europe? What is the present state of legislation?

(a) Maximum Pesticides Residues Regulation

Germany

The German Pesticides Residues Regulation dated 16 October 1989 has been superseded by a new regulation which has already been ratified by the legislative bodies in Germany and will come into force in the near future.

It will bring stricter regulations as far as spices are concerned. The maximum regulations effective so far are abolished and, in some cases, values have been fixed that are at the limit of analytical determination. Table 2 lists the former and future admissible maximum limits for those pesticides which have been found in spices in the last few years. Note that the individual permissible maximum limits have been drastically reduced.

Europe

The European Common Market has been effective since 1 January 1993. This means that, in principle, all goods of the European Community are to be freely traded, and internal borders no longer exist. In order to guarantee free trading of goods with different national legislations, various legal fields have to be harmonized, among them the regulations concerning pesticides. The basic directive for uniform application of the pesticide law is the EEC directive 90/642 dated 27 November 1990. This directive has, in the meantime, been complemented and widened. The chronology of these

Table 2. Admissible maximum levels of pesticides

Active substances	Old limiting value (ppm)	New limiting value (ppm)
HCH without Lindan	0.20	0.20
Lindan	2.00	0.01
HCB (Hexachlorobenzene)	0.10	0.10
Sum of DDT	1.00	1.00
Aldrin and Dieldrin	0.10	0.10
Diazinon	0.50	0.05
Chlorpyrifos	2.00	0.05
Quintozen	1.00	0.01
Sum of Endosulfane	30.00	0.10
Metacriphos	0.01	0.01
Chlordan	0.05	0.05
Pirimiphosmethyl	5.00	0.05
Parathionmethyl	1.00	0.10
Phosalon	2.00	0.05
Dicofol	0.05	0.05
Tetradifon	0.01	0.05
Omethoat	0.40	0.40
Mevinphos	0.50	0.05
Heptachlor and -epoxid	0.10	0.10
Fenitrothion	2.00	0.05
Dimethoat	1.00	0.05
Malathion	8.00	0.05
Profenofos	0.01	0.01
Bromophos	2.00	0.10
Bromophos-ethyl	2.00	0.05
Chlorfenvinphos	1.00	0.05
Chlorpyrifos-methyl	5.00	0.05
Dichlorvos	2.00	0.10
Ethion	2.00	0.05
Methidathion	2.00	0.02
Quinalphos	0.20	0.01
Methoxychlor	10.00	0.01
Tecnazen	0.30	0.05
Vinclozolin	40.00	0.05
Dicloran	0.10	0.1
Mecarbam	0.01	0.01

amendments shows the dynamics in this area. On the one hand, new scientific findings on pesticides and their decomposition products as well as the toxicological assessment are incorporated into legislation. On the other hand, different national legislative provisions are centrally harmonized from Brussels. The new German maximum values shown on Table 2 will be included in the EC law.

(b) Aflatoxins

Germany

The aflatoxin regulations of 1991 applicable in Germany designate maximum values for all foodstuffs including spices. They are 2 ppb per kg with aflatoxin B_1 and a total of 4 ppb per kg for the aflatoxins B_1, B_2, G_1 and G_2. In spices such as chili, paprika, nutmeg, but also sporadically in pepper, the values measured, in part, considerably exceeded these limits. As aflatoxins are highly toxic, the legislative rigorously rejects products not complying with these regulations.

Spice industry which determines non-permissible values upon receipt of a consignment may only send back such a lot to the previous supplier or destroy it. There is no possibility to neutralise aflatoxins by means of processing.

Europe

At present there is no uniform aflatoxin regulation in Europe. The German Spice Industry Association therefore intervened in Brussels together with the ESA (European Spice Association) and demanded a uniform EC regulation. Fortunately the agricultural directorate general of the EU Commission recognized the need to take action. They submitted a study document with the title "Reflection and preparation of Mykotoxin regulation" in June 1993. In this document they propose a uniform EC regulation for aflatoxin B_1 and M_1. As far as the other aflatoxins B_2, G_1 and G_2 are concerned, they do not, in contrast, consider maximum values to be necessary on account of their low significance with regard to consumers' health. The basis for future maximum values is a study on aflatoxins which was submitted by the International Agency of Cancer Research (IACR) and which includes data on "Risk Assessment" and "Maximum permitted levels".

(c) Microbiology

Both Germany and Europe have no regulations concerning maximum values of microbiological contamination in spices. However, complaints are made by food control authorities, e.g. by classifying high contamination with E-Coli as nauseating. The producer of the spice products may be ordered to recall the contaminated product without public announcement. The legislators are extremely strict where salmonella have been analysed in products. Salmonella are classified as health-hazardous. Where food control authorities discover salmonella in a product, this is usually connected with immediate recall of the product including public announcement. This means that the public is warned not to consume such goods via the media.

This does not only mean financial losses for the distribution industry but also considerable loss of image and damage to the brand.

(d) Quality assurance/Hygienics

Free trade of foodstuffs is an essential precondition for the European Common Market. This principle requires confidence in the standard of health safety and, above all, in the hygienic standards for the foodstuffs in free trade at any point of time, be it in preparation, processing, production, packing, storage, transport, distribution, treatment and offer for sale or delivery to the consumer. For this reason, the general hygienic standards for foodstuffs are being harmonized in the interest of consumers' health protection. The EU Commission submitted a directive on food hygienics. Among other things, they demand that food companies determine those points in the course of the process that are critical to food safety and that they ensure determination, execution, compliance with and control of adequate security measures. The concept "Hazard Analysis Critical Control Points (HACCP)" is hereby applied; it includes the following components:

— Analysis of potential risks for foodstuffs in food companies' processes

— Identification of those points in the processes where risks for foodstuffs may arise

— Determination of those points which are critical to food safety — the "critical points"

— Determination and execution of effective check and survey procedures for these critical points and — hazard-analysis of foodstuffs, its critical control points and the regular check and survey procedures along with their implementation after any change in the food companies' processes.

The EU Commission has submitted execution regulations, which are, in part, still being discussed, in order to make sure that these demands take shape. Part of these execution regulations are the directives of the Codex-Alimentarius-Commission for the application of the HACCP concept.

It is now evident that the legislative bodies in Germany and Europe do not only demand clean quality but are willing to enforce it by means of law. Whoever produces foodstuffs should make oneself familiar with such legal provisions in due time. The same applies to pepper producers in the countries of origin. It also offers the chance for those who meet such requirements, to gain market shares and "added value".

3. Spice industry

Due to customers' expectations, legislation and, above all, company philosophies and their implementation, the spice industry also demands the enforcement of good and safe raw materials. This demand has led to increased activities by quality controllers in spice associations' work. The German Spice Industry Association established a committee which deals with the determination of values for good quality standards. Minimum contents of essential oils or maximum contents of total ash, acid-

unsoluble ash and moisture are given there. These determined values are included in the ESA which is working out European quality criteria, which lead to a purchasing contract and set the minimum quality for purchased raw materials. This step will lead to standardization of quality requirements among the processing companies and to increased spice and herb qualities on the market.

In order to enforce those minimum values, it is necessary to use uniformly tested analysing methods as a basis. For this reason, the Spice Industry Association in Germany is working on creating new uniform methods. Those methods already developed were introduced to a newly-founded German Industrial Standards Committee (German Industrial Standards = German ISO). First experiments have already been conducted and revealed positive results. After successful completion of these tasks, suppliers, customers and food control laboratories will be able to analyse using the same method, thereby achieving better comparability of results. Table 3 lists the values of essential oil, total ash, acid-unsoluble ash and moisture that are proposed in the ESA draft. The list shows the minimum contents of essential oils of 2.0 per cent and 1.5 per cent which are fixed for black and white pepper respectively. Moisture should be a maximum of 14 per cent in black pepper and 15 per cent in white pepper. These are minimum requirements that do not correspond to each spice processing company's requirements in Europe.

Each individual company does whatever they think is necessary to implement their quality philosophy. The influence on suppliers or growers of raw materials purchased can only be as great as the company's economic importance allows it to be.

For this reason, individual spice companies in Germany cooperate closely on a national scale, and within the ESA on a European scale. Influencing the production of good and safe spices positively is only possible when taking joint action.

Quality Management, Total Quality Management, ISO certification and HACCP are concepts to implement and guarantee flawless quality which is being strived for by many European companies.

Most European companies in the spice industry should have established quality assurance systems by the end of 1996, which meet the ISO 9000 requirements. This results from the demands alone that have, for example, meanwhile become part of the EU hygienics directive.

Thereby *suppliers'* quality capacity and regular *supplier audits* are of enormous importance. European suppliers to the spice industry themselves are presently striving for certification of their quality assurance systems in order to show their willingness and ability for cooperation between partners.

Table 3. Minimum contents of essential oils

Product (whole form)	ASH per cent w/w maximum	AIA per cent w/w maximum	H_2O per cent w/w maximum	V/O per cent v/w minimum
Aniseed	9 (ISO)	2.5 (AFNOR)	12 (ISO)	1 (ISO)
Basil (BSI)	16	3.5	12	0.3
Bay (ISO)	7	2	8	1
Dill tops (ESA)	15	2	8	0.4
Dutch caraway (ISO)	8	1.5	13	2.5
Cardamom (ESA)	9	2.5	12	4
Celery seed (ISO)	12	3	11	1.5
Chervil (ESA)	17	2	8	–
Chilli (ISO)	10	1.6	11	–
Chives (ESA)	10	2	8	–
Cinnamon (ESA)	7	2	15	0.4
Cloves	7 (ISO)	0.5 (ISO)	12 (ISO)	14 (AFNOR)
Coriander	7 (ISO)	1.5 (ISO)	12 (ISO)	0.3 (ESA)
Cumin (ESA)	14	3	13	1.5
Dill seed (ESA)	10	2.5	12	1
Fennel seed (ISO)	9	2	12	1.5
Fenugreek (ISO)	7	2	12	–
Garlic powder	6 (ESA)	0.5 (ISO)	7 (ESA)	– (ISO)
Ginger	8 (ISO)	2 (ESA)	12 (ISO)	1.5 (ISO)
Mace (ISO)	4	0.5	10	5
Marjoram (ISO)	10	2	12	1
Mint (ISO)	12	2.5	13	0.5
Mustard (BSI)	6.5	1	10	–
Nutmeg	3 (ISO)	0.5 (ISO)	12 (ESA)	6.5 (ESA)
Onion powder (ISO)	5	0.5	6	–
Oregano (BSI)	10	2.5	12	0.5
Paprika powder (ESA)	10	2	11	–
Parsley (not English) (ESA)	14	1.5	7.5	–
Pepper black	7 (ISO)	1.5 (ESA)	14 (ESA)	2 (ISO)
Pepper white	3.5 (ISO)	0.3 (ISO)	15 (ISO)	1.5 (ESA)
Pimento				
Jamaica	5 (ESA)	0.4 (ISO)	12 (ISO)	3.5 (ISO)
Other origins	5 (ESA)	1 (ESA)	12 (ISO)	2 (ESA)

Supplier quality audits are increasingly carried out by the spice industry. These are still restricted primarily to European suppliers. However, the objective is to carry out such audits with overseas partners as well in order to find out on the spot whether production is clean and secure.

The significance of purchase and checks is explicitly appreciated in the ISO 9000. In accordance with ISO 9000, these audits are mandatory.

However, quality cannot be checked. It must be planned. It develops during the growth, processing or production of an end-product.

It is the objective of the European spice industry to receive hygienically produced, clean, high quality spices, and it will enforce this demand.

4. Food processing industry

Using uniformly clean, uncontaminated spices is indispensable for the food processing industry such as meat and sausage industry, dairies or delicatessen companies. A certain minimum durability has to be achieved while the distributed goods are stored in food retail shops. This can only be guaranteed when using such qualities. Pepper infested with salmonella used in a mayonnaise salad could lead to serious illness and even cause death. In order to supply the food industry with correspondingly safe spice qualities, the spice industry applies various processing stages, such as steam treatment, which guarantee that the demanded parameters are fulfilled, but do, in part, have quality reducing consequences. The bright colour of, for example, paprika or turmeric products and the fresh, piquant taste of herbs are lost.

The food processing industry therefore demands that clean and safe qualities be produced originally, which can be used without hesitation and do not have to be subjected to additional, quality-reducing treatment.

B. Medium and long-term measures

The above discussion has described how the spice market structure could possibly change. German and European intentions are aimed to bring stricter spice quality requirements according to the consumers' and industry demands. It is therefore necessary to recommend medium- and long-term measures to be taken by the spice growing countries, especially in pepper producing countries, in order to meet those high quality standards.

The demand for controlled application of pesticides and hygienic aspects when growing, drying, preparing and storing the goods should have top priority with the grower, i.e. the farmer. It is a fact that this demand cannot immediately be implemented. Many small steps are necessary to explain the corresponding changes in production to the pepper growers, and considerable financial expenses will become necessary to enforce them.

Increased and permanent dialogue between producers and processing companies will be necessary. The international spice industry has recognized this need and is increasingly seeking to communicate with the producers. They have already thought

about corresponding programmes and are working on the implementation of these measures. On the occasion of this year's ASTA conference, a meeting between the International Trade Center UNCTAD/GATT (ITC) and approximately 20 spice experts from the European Spice Association and the American Spice Trade Association took place. Mr. Fazli Husain took part in these talks on behalf of the ITC. On that occasion, Mr. Husain submitted a draft of a work and financing programme for spice quality assurance in the countries of origin. The draft's title was: "Cooperative Programme and Quality Insurance of Spices". This programme has been laid out over 3 years and is to have a budget of $US 460,000. The financial requirements are requested from the governments of the user countries. Germany, France and Great Britain have already shown their willingness to correspondingly support the programme. The activity is met with an extremely positive attitude on the German Spice Association's part. A steering committee will shortly be founded which will consist of experts from the ESA; ASTA and the ITC Secretariat.

The committee will determine the exact programme and appoint experts who will carry out "on the spot" workshops in the countries of origin.

It is therefore hoped that actions, like those aforementioned, will lead to the desired goal, i.e. production of clean, high quality spices. However, to reach this objective can only be a long-term goal. Meanwhile, short and medium-term activities are necessary to swiftly fulfill consumers' and legislators' demands.

It is the spice traders' and exporters' turn to take some action in the producing countries. Production-technological preconditions with the aim of achieving quality-improving results have to be created as soon as possible. Indeed, for example, more careful cleaning and bacteria-reducing treatment with steam are indispensable.

The following are the processing steps presently being taken in the country of origin and in the recipient country as far as pepper is concerned.

In the country of origin, the exporter presently grades and cleans the pepper with adequate measures. Thereafter, it is filled in jute or plastic bags and loaded in containers for shipment.

In the recipient country, the bags have to be unloaded from the container; they have to be opened and emptied for further treatment. This is followed by sifting coarse and fine parts by means of sieves and air. The pepper then goes through a stone-separator as well as magnets and metal detectors.

It is well-known that some organisations and companies have successfully carried out quality-improving measures or are striving to do so. As the majority at pepper arrive in Europe as anonymous lots, the spice industry is, thus, obliged to take all the cleaning steps mentioned before upon receipt of the goods. It should be noted that in this

manner another 1-2 per cent of polluting agents are discovered in the pepper. The goods often contain metal parts that are hardly visible.

After cleaning, the pepper is subjected to bacteria-reducing steam treatment. The total bacterial count may, on account of a properly-conducted steam treatment, be reduced from more than 50 million to a total of below 5,000 bacteria. Thereby, destruction of possible salmonella or E-Coli bacteria is guaranteed. After this phase of treatment, the pepper is filled into big bags for further processing.

It is recommended that measures influencing quality, which have so far been taken in the recipient country for security reasons, should in future be carried out by the exporter in the country of origin. This would avoid that some treatment measures be undertaken twice; and "manpower" be saved in the recipient countries which are almost without exception subject to high wage costs. The costs saved could then flow into the country of origin as "added value". In addition, the pepper should also be subjected to the following treatment measures such as cleaning by means of sieves and air; additional cleaning by means of stone separators, magnets and metal detectors; and, germ reduction by means of steam. This way, all treatment measures have been shifted to the countries of origin. The only step left to be taken in the recipient country is sieving in order to check the pepper for rubbings which may have developed during shipment and transport by sea. It is important that all these working processes are effected under hygienic conditions. If possible, the companies should be ISO certified. A company gaining ISO certification proves safe quality thereby obtaining a competitive advantage. All pepper consignments ready for processing should be examined with regard to pesticide residues and contamination with aflatoxin. Although these actions will entail considerable financial outlay, such commitment is indispensable to be competitive on the future pepper market.

With regards to packing, pepper is currently being packed and delivered in double jute bags of a net weight of between 50 and 80 kgs for many decades. This kind of packing has been sufficient enough until now, for as long as the jute bag has not been treated with chemical substances that may lead to pepper contamination. In view of the waste disposal problems that industrial countries are faced with, particular attention has to be paid to keep the waste of packaging material as low as possible. The jute bags in which pepper is delivered cannot usually be used further in Germany and have to be disposed of as *special waste.* A fee amounting to $US 195.00 per 1,000 kgs of jute has to be paid for the disposal. If one calculates one double bag in which 80 kgs of pepper are delivered, an amount of $US 0.39 per double bag is to be paid just for waste disposal. Thus, there are not only problems of waste disposal but also considerable expenses involved.

Furthermore, packing in jute bags also involves considerable cost-intensive working processes. The bags have to be filled in the countries of origin, sown up and stowed in containers. In the recipient country, the bags have to be unloaded from the containers only by manpower. Consequently the seams are undone, the bags are emptied. All

this represents, as already mentioned, considerable work, which, in wage-intensive recipient countries, considerably burdens the finances of the importing company.

It is therefore necessary to look for new means of packing pepper. This can be done with close cooperation between partners in the countries of origin and in the recipient countries.

In the meantime, there have been trial shipments with "big bags" which have been extremely satisfactory (Exhibit A). A big bag can, depending on the quality, be filled with 500 to 600 kgs. The big bag is placed on a wooden pallet — a Euro-pallet with the measurements 80 x 120 cm. On the wooden pallet there is a cardboard lining so that no wood splinters can enter. The filled big bag is placed on it and additionally secured with straps.

Exhibit A

Big bags can, in this way, ideally be stowed in containers (Exhibit B). Twenty-two pallets can be loaded into a 20-foot container. As the container space is not used in full this kind of packing involves minimal additional freight costs but also has considerable advantages.

Exhibit B

The pallets with big bags can be stowed in containers by fork-lift trucks without manpower within a very short time and without any problems. Unloading in the recipient country then becomes easy. Big bags are hung over the packing machine or filler neck for cleaning, the big bag is opened at the bottom and can be emptied without any problems (Exhibit C).

Exhibit C

This kind of packing represents a first step, but it still has to be improved. It may be possible to stack 2 bags above each other without the second bag being placed on a pallet. Thus, packing material would also be saved. Moreover, it would be possible to draw a plastic in-liner into the big bags so that the bags would not be spoiled and could be used several times. These are only examples of measures which could not only save costs but also help to reduce the remaining waste.

IV. RISING CONSUMER EXPECTATIONS: THE CHALLENGE OF CHANGE[1]

At the stroke of midnight on 9 November 1989, the world rejoiced. Berlin Wall, that ultimate symbol of an ideologic divide was demolished, opening up an era of exciting hopes and opportunities for a freer Europe. When world leaders put their final approval in Marrakesh, in the General Agreement on Tariffs and Trade, the final curtain fell on man-made market barriers.

The globalization process, however, has hiccupped a variety of economic, social and cultural problems, the recessionary impact of which continues to spread across the developing world. Severe price compressions have resulted in plunging margins that has necessitated the developed countries to reconsider their global options. Global competitive advantage derived from effective management of cost through economies of scale provided by regional efficiencies and least cost production strategies by blending global resources will certainly dictate the evolving business paradigm of the twenty-first century.

Well before the United States and European macroeconomics embarked on its precarious roller coaster run, the winds of change had begun to sweep across the world. A spate of consumer concern movements elevated a totally new dimension of quality consciousness to soaring heights. The nervous nineties that had been witness to devastating holocausts like Hiroshima and Chernobyl fostered a parallel stream of consumer concern movements that raised fundamental questions about the impact of development on the quality of life — primarily human health and environmental security.

The emerging borderless world is all set to witness the supremacy of the discerning consumer who aided with an abundance of information would ultimately dictate the standards of acceptable performance. Survival in such a critical environment would depend on the competence to evolve from the mundane levels of Standard Performance (of Quality, Cost and Delivery) to the higher levels of consumer delight while continuing to be a least cost producer.

It is amazing how the face of trade has metamorphasized in the last 40 years. Ever since the Portuguese explorer Vasco da Gama opened the sea routes to Southern India, the Malabar Coast had become the epicentre of spice trade, sought after and repeatedly ravaged for its natural wealth. Quality in these Middle Ages were one-to-one trade agreements based on mutual trust. Variability in quality were normally buffered within fat profit margins. The post world war period ushered in a new era of stan-

[1] Based on the paper prepared by Mr. Eapen George, Executive Director, A.V. Thomas Industrial Products Ltd., Cochin, India.

dardization with the consuming sector organizing into unified stands that formalized trade agreements to ensure legal protection against violations.

Perhaps, no other issue evokes as sensitive a consumer response as much as Food Safety. Over the years, food legislations have undergone dramatic changes under consumer pressure. With increased consciousness for health and the environment, the easily detectable physical and microbial contaminants were the first to get the axe. Today's food laws in importing countries are sensitive to microbial levels of biochemical contaminants that being systematic in nature cannot be recleaned. A wide array of new generation technologies now enable regulatory precision. Many state of the art decontamination technologies such as irradiation and ETO are being blacklisted for their known and assumed carcinogenic effects. The higher exacting standards dictated by German consumer corporations are on the verge of finding blanket acceptance across a unified Europe. Emphasis is now on that conscious design of raw material and processes must guarantee "zero damage" of the environment.

All these events fuelled by substantial media hype have generated an ever-increasing sensitivity towards health and environmental issues. Many concerns are genuine, backed by solid scientific proof. Others are pure emotional responses based on skimpy knowledge. In the face of such debates, consumers have shown scant patience for scientific logic and have understandably stonewalled into an "absolutely safe" approach. Such consumer concerns have reached a crescendo on the political agenda across Europe and the United States, quite often successfully forcing the very direction of governmental legislations. Yesterday's trade specifications are evolving into rising consumer expectations that today form the bottom line for even gaining entry into these markets.

For those in the Third World corporate sector, aiming to play in the global theater, these spiralling consumer trends represent excellent opportunities to evolve pro-active strategies and reap bountiful rewards. However, with macroeconomic inflation raging across the United States and Europe, it is now amply clear that the consuming sector would certainly not be willing to pay more towards the cost of meeting these newer standards. Consumer corporations, severely feeling the burden on their financial bottom lines are refocusing their business priorities to excel in specific areas of "core-competence". The challenge of change demands fundamental transformation from a trade culture to a technology culture that when combined on a format of business acumen and value based ethics can generate pro-active strategies to meet consumer responses at efficient cost levels.

Consumer corporations while exercising their core-competence strengths to further brand leadership, would search for global efficiencies across geographical borders to ensure competitiveness and consistency in quality and delivery. This search would necessitate strategic alliances between partners capable of successfully equating with each other in terms of value systems and technology culture. As a result, the consuming sector would gain an opportunity to integrate backwards so as to be able to design quality of raw materials that can even match up to Due Diligence. Such

strategic alliances exercising the core competence of corporate sectors in either worlds would ultimately generate a premium derived through brand leadership in an expanded market.

The synergy of these alliances would result in intense reviews of consumers trends creating yet higher standards that satisfy latent customer expectations leading ultimately to customer excitement. Success of such alliances would depend on the comfort levels attained by either partners in gain-sharing this premium in an equitable fashion. This would serve as the incentive for supplier corporations to strive for consistent performance and continuous improvement. These long term relationship would evolve as joint ventures resulting in build-up of asset bases cutting across geographical boundaries.

However, such trans-continental corporate marriages have never been easy propositions to manage. To a great extent, this has been due to the inadequacy of communication channels between consumer corporations and the suppliers. More often, the reaction of consumer corporations has bordered on paranoid technology and market protectionism, while the suppliers have continued to adopt an ostrich-like attitude to consumer expectations. In many ways the onus of opening up communication channels to evolve these equations onto a higher plain would rest on the shoulders of the corporate sector in the developed world. While consumer corporations continue to provide a rational balance to emotional consumer outbursts, the seriousness of such needs would have to be addressed in time by the supplier sector in order to effect a paradigm shift that can nourish pro-active strategies to meet the challenge of change.

PART FOUR

MARKETING

Photo by courtesy of IPC.

Pepper and pepper products in various consumer packs

I. THE MARKET POTENTIAL AND CONSTRAINTS IN MARKETING PEPPER TO THE ASIA-PACIFIC REGION[1]

Introduction

The Asia-Pacific region is a large and growing market. With total population in excess of 3 billion, GDP growth as high as 14 per cent per annum in some countries and averaging above 6 per cent, and generally greater market orientation of national economies, the potential for growth is undeniable. The region also produces over 80 per cent of the world's pepper, making the commodity relatively easier to bring to market. But the Asia-Pacific region is not a single homogenous market. There is diversity in terms of size, per capita GDP and income distribution (consequently differences in propensity to consume), political economy, cultural and social characteristics and tastes and preferences. Any plan to market pepper to the countries of the Asia-Pacific would need to identify and address the requirements of each country. This report seeks to examine each of these markets to identify countries with potential for growth in the region, and to suggest some approaches which may allow such potential to be exploited effectively.

A. A Survey of markets

1. South-East Asia

The countries of South-East Asia consume in total about 15,600 tons of pepper a year. With a total population of 472.2 million, the average annual per capita consumption is about 33 gms. This region, with Indonesia, Malaysia, Thailand and Viet Nam as major growers of pepper, produces up to 50 per cent of the world's supply of pepper. There are no major pepper consuming countries in the region at present as countries having high disposable incomes have low population while countries with high population have relatively low levels of disposable incomes.

Indonesia, with an official estimated consumption of 5,000 tons per year is by far the largest market. However, the population of 190 million brings per capita consumption to a relatively low 26 gms per annum. Imports are negligible and almost all pepper consumed are from domestic production.

Among the other pepper producing countries in South-East Asia, *Thailand* appears to have the highest consumption at 4,330 tons. As this figure is the residual between production and exports there may be some distortion because of stocks. This

[1] Based on the paper prepared by Mr. Anandan Adnan Abdullah, General Manager, Pepper Marketing Board, Ministry of Agriculture, Kuching, Sarawak, Malaysia.

Table 1. Pepper consumption in South-East Asia, 1992

Country	Population (million)	Apparent consumption of pepper (tons)	Per capita consumption (grams)	Sources of supply (per cent)
Producing countries				
Indonesia	190.0	5 000	26	–
Malaysia	19.4	800	41	–
Thailand	59.0	4 330	73	–
Viet Nam	73.0	2 000-3 000	35-45	–
Cambodia	8.9	500	35-45	–
Lao People's Democratic Republic	4.5	500	35-45	–
Consuming countries				
Brunei Darussalam	0.3	35	117	* Malaysia (69) * Singapore (18) * Indonesia (6)
Philippines	65.0	800-1 000	12-15	*Singapore (44) * Lao People's Democratic Republic (22) * United States (8)
Singapore	3.1	300-350	100-200	Malaysia (19) Indonesia (44)
Papua New Guinea	4.0	20	5	* Australia (72) * United States (19)
Myanmar	45.0	106	2	–
Total	472.2	15 641	33	–

* Based on 1991 imports.

level of retained production however, implies a respectable per capita consumption of 73 gms per annum. *Malaysian* per capita consumption is estimated at 41 gms from an apparent total consumption of 800 tons. Per capita consumption for *Viet Nam, Cambodia and the Lao People's Democratic Republic* is estimated at between 35-45 gms per annum, mostly from domestic production, with some movement between these countries and Thailand.

Among non-pepper producing countries in South-East Asia, *Brunei Darussalam* has the highest estimated per capita consumption, at 117 gms. However the country's market is very small with net imports, mostly from Malaysia only amounting to 35 tons. Philippines, Papua New Guinea and Myanmar have very low per capita consumption, estimated at 12-15 gms, 5 gms and 2 gms respectively. With pepper seen as a non-essential food item, the relatively low disposable income levels in these three countries have tended to keep consumption low. *Philippines* imports about 300 tons of pepper per year (mainly from Singapore) and produces between 500 to 700 tons

to give an estimated total consumption of 800-1000 tons. *Myanmar* imported 106 tons of pepper in 1992, while net imports into *Papua New Guinea* were about 20 tons.

Singapore is a major importer and exporter of pepper. It serves as an entrepot centre for Indonesia, Malaysia, Thailand and Viet Nam, channelling exports to all the major markets of the world. In 1992, total imports amounted to 36,828 tons with 39,800 tons of exports. Consumption within Singapore is estimated to be between 300-350 tons, giving a per capita figure of between 100-120 gms per annum. The urban lifestyle and the high level of processed foods consumed are reflected by the relatively high per capita consumption figures.

Imports into Singapore are very much handled by brokers or commission agents, who import for repackers, traders (who re-export) and grinders and processors. Re-export, often after cleaning and repacking is undertaken to meet the needs of importers in the United States, Europe, the Middle East and North Africa and Asia. The excellent communications network, port facilities, frequent sailings to all major destinations and facilities for storage, repacking and reprocessing give Singapore a distinct advantage as a hub for the pepper trade, with exports higher than from most producing countries.

2. The Far East

Apparent consumption of pepper by five countries in the Far East i.e. China, Hong Kong, Japan, the Republic of Korea and Taiwan Province of China is estimated to be 24,590 tons. With a total population of 1.4 billion, per capita consumption works out to an average of 18 gms per annum for these five countries. China is the only country which produces pepper, primarily for domestic consumption. The other countries in the region are importers of pepper, with Hong Kong functioning as a re-exporter for the Far East.

China is the largest consumer, as well as the most significant producer in the Far East. Official production estimates place annual production in 1992 at 12,300 tons of which 181 tons were exported. Domestic consumption derived from the residual between production and exports, is computed to be 12,140 tons. With a population of 1.19 billion, per capita consumption works out to a mere 10 gms per annum. This low figure is accounted for by the relatively low per capita income and low level of consumption of processed foods. In some parts of China, pepper is regarded as a medicine sold only in drug stores.

Japan is the largest importing market in the Far East as well as the whole Asia-Pacific region. In 1992, net imports amounted to 7239 tons of pepper, and assuming consumption to be equivalent to net imports, per capita consumption is about 58 gms a year. The main sources of imports are Malaysia (69 per cent) and Indonesia (21 per cent). Imports of black pepper exceed imports of white, with about 52 per cent of all pepper imported as black, 38 per cent as white and 10 per cent as ground pepper.

Table 2. Pepper consumption in the Far East, 1992

Country/Area	Population (million)	Apparent consumption of pepper (tons)	Per capita consumption (grams)	Sources of supplies (per cent)
Producing countries				
China	1 190	12 140	10	–
Consuming countries/areas				
Hong Kong	6	714	119	China (51) Singapore (24)
Japan	125	7 239	58	Malaysia (69) Indonesia (21)
Republic of Korea	44	3 136	71	Malaysia (79) Indonesia (11)
Taiwan Province of China	21	1 361	65	Malaysia (45) Indonesia (27) Singapore (21)
Total	1 386	24 590	–	–

The Japanese market for pepper is very much dominated by a few major traders who import pepper from origins. These importers have experience, have access to up-to-date market information and maintain a wide network which provides excellent links with suppliers in origins as well as domestic traders and end-users (grinders, manufacturers of food seasonings, noodle manufacturers, retail packers, food processors) in Japan. Some importers may process or grind pepper before distribution. They are able to source supplies at competitive prices and meet the specific needs of their clients. The links between traders and end-users are strong and access to the market almost invariably requires the cooperation of the major players.

Net imports of pepper into the *Republic of Korea* reached 3,136 tons in 1992. With a population of 44 million people, per capita consumption is computed at 71 gms for 1992. Import of pepper has shown steady increase over the last five years (1988-1992), from 2,083 tons to 3,137 tons, an average increase of 11 per cent per year. Most of the pepper imported is black pepper, with white pepper imports estimated at less than 10 per cent and just over 4 per cent is imported as ground pepper.

End-users tend to import most of the pepper used themselves, sometimes using the bigger trading houses as brokers to source from origins. End-users include grinders and retail packers (for household consumption), noodle manufacturers and manufacturers of processed foods. Most of the increase in consumption can be generally attributed to the growth of the processed foods industry.

Imports into *Taiwan Province of China)* came to a total of 1,391 tons in 1992 with 30 tons re-exported. With apparent consumption at 1,361 tons and a population of 21 million, per capita consumption is estimated at *65 gms* for 1992. The main source of imports is Malaysia (45 per cent) followed by Indonesia (27 per cent) and Singapore (21 per cent). While the breakdown of imports as black and white pepper is not given in the import statistics, it is estimated that over 60 per cent of imports are as black pepper and less than 4 per cent imported as ground pepper.

Net import figures over the last five years show an increase from 1,206 tons in 1989 to 1,361 tons in 1992. This implies a modest average increase of about 5 per cent per annum. Trading houses, the larger grinders and repackers source pepper directly from origins and Singapore. Importers also function as traders, taking positions and supplying to wholesalers, smaller grinders and retailers. The domestic price is high as there is a high import duty, with pepper being classified as a medicinal product.

3. Oceania

The pepper market in this region is relatively small, primarily made up of Australia and New Zealand and by the island states, such as Fiji, Tonga, Vanuatu and Polynesia. The total consumption for the region is estimated to be about 1,800 tons, with an average consumption of about 80 gms per capita.

Table 3. Pepper consumption in Oceania, 1992

Country	Population (million)	Apparent consumption (tons)	Per capita consumption (grams)	Sources of supply (per cent)
Consuming countries				
Australia	18.0	1 531	85	Indonesia (36) Malaysia (34) Singapore (11)
New Zealand	3.5	243	69	Malaysia (66) Australia (15) Singapore (8)
Other Oceania	1.2	56*	46	–
Total	22.7	1 830	80	–

* Imports

Australia is the largest market in the area, with pepper imports amounting to 1,594 tons in 1992. Some 63 tons are re-exported, mainly to New Zealand, Fiji, New Caledonia and Singapore. The main source of imports in 1992 was Indonesia (36 per cent), followed by Malaysia (34 per cent) and Singapore (11 per cent). Almost 20 per cent of all imports were as ground pepper, mainly from Malaysia. With a population of 18 million, consumption is estimated at 85 gms per capita. Consumption as evidenced

by net imports does not show any discernible trend; an increase in imports in 1991 could well be because of importers attempting to take advantage of low prices to hold stocks.

Importation of pepper is frequently undertaken by specialized importers who may also process and repack into retail or bulk packs. These repackers supply to food manufacturers and/or distribute through food chain stores. Increasingly, the larger chain stores are importing through agents, for repacking and distribution under house brands.

New Zealand is a relatively small market for pepper. Retained imports have ranged between 255 tons (1990) to 225 tons (1989), with 243 tons reported in 1992. Given a population of 3.5 million, per capita consumption for 1992 stood at 69 gms. The import of ground pepper amounted to 27.6 tons in 1992, with 216 tons of unground pepper, mostly black. The main country of origin for unground pepper is Malaysia (74 per cent) with Australia as the source for most of the ground pepper (67 per cent).

Pepper is imported into New Zealand by grinders and packers, either through agents or directly. These importers/grinders supply to industrial users, institutions and wholesalers who in turn supply to retail outlets. Freight and other costs are high and affect retail prices.

Oceania also covers the island states of the Pacific, the most important consumers of which are Fiji, Polynesia and Tonga. Per capita consumption is about 46 gms, from an estimated total of 56 tons imported, mostly from Australia and New Zealand.

4. Central and South Asia

This region is estimated to have consumed a total of 32,483 tons of pepper in 1992. With a population of 1.16 billion people, the per capita consumption is computed at 28 gms per year. This utilization figures could be underestimated, as trade within the region is not always fully documented. Traditionally, the people of the region favour the use of spices in cuisine as well as for medicinal and health purposes.

India, among the world's largest producers of pepper is also a major consuming country, second only to the United States in terms of total amount consumed annually. Annual consumption is estimated officially at 25,000 tons mostly as black pepper. With a population of 899 million, per capita consumption works out to 28 gms per year. There is some import of pepper estimated at 1,000 tons in 1992, mostly from Sri Lanka, presumably for processing and re-export.

Consumption of pepper in *Sri Lanka* is estimated at 1,125 tons in 1992, most of which is produced domestically. The per capita consumption works out at 64 gms per annum, from a population of 18 million.

Table 4. Pepper consumption in Central and South Asia, 1992

Country	Population (million)	Apparent consumption (tons)	Per capita consumption (grams)	Sources of supply (per cent)
Producing countries				
India	899	25 000	28	India
Sri Lanka	18	1 125	64	Sri Lanka
Consuming countries				
Bangladesh	121	2 000	17	India (Cross Border-trade)
Pakistan	125	4 358	35	Singapore (44) Malaysia (37) Indonesia (10)
Total	1 163	32 483	28	–

Of the two non-producing countries in the region, *Pakistan* is the more important market today. Apparent consumption is estimated at 4,358 tons in 1992. With a population of 125 million, per capita consumption is computed to be 35 gms per annum. Almost all imports are of whole black pepper, primarily from Singapore (44 per cent), Malaysia (37 per cent) and Indonesia (10 per cent). It is possible that there may be cross-border trade with India that does not appear on the official trade statistics. Official annual imports over the last five years show an increasing trend, from 1,562 tons in 1988 to 4,358 tons in 1992, though import figures for 1986 were high, at 3,173 tons. This works out to an average increase of almost 10 per cent per annum. It must be noted, however, that these figures do not reflect "imports" from India, and the actual consumption figures may be much more static, with Indian pepper supplementing consumption during periods when import from other sources were low.

Most imports are undertaken by spice merchants/importers who resell to wholesalers, who in turn distribute to retailers, small grinders, packers and institutions. Utilization by households tends to be in the form of whole pepper, though there is some increase in the use of spice/seasoning blends. Institutions such as hotels and restaurants do buy ground pepper from grinders/packers, but the quantity used in such form is limited.

Imports of pepper into *Bangladesh* are officially reported at 60 tons in 1992, but it is estimated that at least 2,000 tons come into the country from India. Given this apparent total consumption, per capita consumption works out to 17 gms per year, as opposed to a meagre 0.5 gms per year if the official estimate were used, for a population of 121 million. As most of the pepper is traded through non-official channels, there is little documentation of trade practices and channels.

B. Market potential

In general terms, the Asia-Pacific region has over 3 billion people with an estimated consumption of 74,500 tons of pepper. This gives a per capita consumption of just over 24 gms per capita for all countries. Developed countries such as the United States and Western European countries report consumption in excess of 150 gms per capita; the disparity is substantial and overall consumption in the Asia-Pacific region can be expected to increase substantially. This potential is all the more apparent given the current rates of growth experienced by countries in the region.

1. South East Asia

South East Asia's four main pepper producing countries, Indonesia, Malaysia, Thailand and Viet Nam, have potential to increase consumption. These four countries are experiencing rapid economic growth. Malaysia has a per capita GDP of $US 7,992, with GDP growth pegged at 8.5 per cent per annum. Thailand has a per capita GDP $US 5,665 growing at 7.4 per cent per annum. Indonesian per capita GDP is at $US 2,981, while growth is estimated at 6.7 per cent. And Viet Nam, though current GDP per capita is relatively low at $US 1,263 has 8 per cent per annum GDP growth.

Table 5. GDP per capita and GDP growth in South-East Asia

Country	Population (million)	GDP per capita ($US)	GDP growth (per cent)
Producing countries			
Indonesia	190.0	2 981	6.7
Malaysia	19.4	7 992	8.5
Thailand	59.0	5 665	7.4
Viet Nam	73.0	1 263	8.0
Cambodia	8.9	1 266	5.7
Lao People's Democratic Republic	4.5	2 071	4.0
Consuming countries			
Brunei Darussalam	0.3	14 420	3.0
Philippines	65.0	2 440	3.8
Singapore	3.1	16 674	11.0
Papua New Guinea	4.0	1 995	14.4
Myanmar	45.0	676	5.8
Total	472.2	–	–

Presently, only Thailand has a "respectable" per capita consumption for pepper estimated at 73 gms per annum. Indonesian and Malaysian consumption can be considered relatively low at 26 and 41 gms per capita respectively. With increasing urbanization and increases in disposable income, the trend is towards consumption of more processed foods and more dining out. These two countries have potential to increase pepper consumption at least at the rate of GDP growth.

It is likely that Viet Nam will develop pepper as an export crop, with emphasis on encouraging exports as a means of earning foreign exchange, rather than for domestic consumption, in the near future. Cambodia and Lao People's Democratic Republic are also likely to promote exports rather than domestic consumption, as the demand for foreign exchange for development increases.

Non-producing countries in South-East Asia, with the exception of Singapore and Brunei Darussalam, have relatively low consumption per capita. The Philippines with a per capita income of $US 2,440 (GDP) and a 3.8 per cent growth rate has some potential for growth. The present 12-15 gms per capita consumption can use with increasing efforts to industrialize, particularly in the food processing sector. With a population of 65 million, increases in the consumption of snack foods and other processed items present a good market for pepper. Papua New Guinea is another market that holds potential, even though it is a small market with a population of 4 million. Presently imports are very low and consumption per capita is estimated at only 5 gms per capita GDP is estimated at $US 1,995 and growing rapidly at 14.4 per cent per annum.

2. The Far East

With a total population of 1.39 billion and an estimated per capita consumption of 18 gms, the countries of the Far East have perhaps the greatest potential for increased consumption. With average per capita GDP at $US 4,368, the present level of consumption is relatively low. GDP growth rates in the region are good, with perhaps the exception of Japan, which already has a high per capita income.

Table 6. Population, GDP per capita and GDP growth in the Far East

Country/Area	Population (million)	GDP per capita ($US)	GDP growth (per cent)
Producing countries			
China	1 190	2 431	12.7
Consuming countries/areas			
Hong Kong	6	19 446	5.5
Japan	125	19 642	0.1
Republic of Korea	44	8 694	5.5
Taiwan Province of China	21	9 830	5.5
Total	1 386	–	–

Japanese per capita consumption of pepper stands at just 58 gms. From 1983 to 1992, the total market has increased by just over 2,000 tons, an increase of 40 per cent (an average of 4 per cent per annum) with a 20 per cent increase recorded between 1991 and 1992. Given the very high level of per capita income, which places Japan high on the list of developed countries, the relatively low level of consumption is surprising. Increased consumption of processed foods, increased consumption of meats,

familiarity with more spicy foods as more Japanese travel abroad, are all indications that the Japanese market can be developed effectively. The market potential is obvious. A thorough understanding of the distribution system, the roles played by numerous levels of intermediaries and the specific product requirements of the market are needed to exploit this potential.

The Republic of Korea has reported consistent increase in consumption for the last ten years, to arrive at an apparent consumption of 3,136 tons or 71 gms per capita. Over the last five years, (1988-1992) total apparent pepper consumption has increased at an average rate of 11 per cent, with an increase of 18 per cent recorded between 1991 and 1992. With per capita GDP at $US 8,694 and an impressive GDP growth (given its relatively high level) of 5.5 per cent per annum, there is no reason to assume that the market for pepper will not continue to grow. In addition to consumption by the food processing industry, (including manufacturers of noodles for export and domestic consumption) there is a potential for market expansion among younger consumers, who have acquired a taste for pepper given the Korean propensity to consume spicy foods.

Another country which has shown increase in pepper consumption over the last 10 years (1983-1992) is Taiwan Province of China. Taiwan Province of China's net imports rose from 548 tons in 1983 to 1,361 tons in 1992 representing an increase of 148 per cent or an average rate of increase of almost 12 per cent per annum. However, there was a fall in net imports between 1991 and 1992. Per capita consumption at 65 gms per annum is lower than for the Republic of Korea though per capita GDP is marginally higher at $US 9,830. GDP growth is pegged at 5.5 per cent, much the same as for the Republic of Korea, and there is every likelihood that consumption can increase to higher levels. The reclassification of pepper as a food item rather than a medicinal item with a relatively high import duty would provide a boost to consumption.

Trade figures for Hong Kong do not provide an accurate estimate for consumption trends, as these have included pimento. With a per capita GDP of $US 19,446, and a growth rate of 5.5 per cent the market has potential although the relatively small population (6 million) may not make it very attractive. It is a highly urbanized population however and the use of pepper in processed foods and in institutions can be increased. Hong Kong also serves as an entry point for the Chinese market, not for pepper only but also for a variety of processed foods and seasonings.

China, of course, is the market that appears to have the most potential in the region. While most of the requirement for pepper is met from domestic production at present, it is expected that consumption will grow substantially in the future. With a population of 1.19 billion even marginal increases in per capita consumption can mean substantial increases in total consumption.

Per capita GDP is estimated to be $US 2,413 and GDP is growing at 12.7 per cent per annum. Nominal GNP is estimated as being still relatively low, at $US 435 per capita per annum (at current prices, converted to US dollars) but exports for 12 months are valued at $US 90.3 billion, which compares favourably with most developing countries. Increasing prosperity in the urban centres has brought changes in tastes and preferences including consumption of fast foods and increasing consumption of prepared foods. There is no doubt that there is greater consumption of pepper imported in seasonings and processed foods, and that consumption is likely to increase as more of these products are produced domestically. The rate of increase, however, will depend very much on access to the market, the availability of foreign exchange for a non-investment purpose and the trade links that exist with exporting countries.

3. Oceania

The Australian and New Zealand market for pepper has not grown very much over the last five years. In 1988, net imports for these two countries amounted 1,764 tons while in 1992 net imports were 1,774 tons. Overall per capita consumption at 80 gms is relatively low for developed countries with Western food preferences, and an average per capita GDP of $US 15,875 per annum.

Table 7. GDP per capita and GDP growth in Oceania

Country	Population (million)	GDP per capita ($US)	GDP growth (per cent)
Consuming countries			
Australia	18.0	16 930	5.0
New Zealand	3.5	14 333	3.9
Other Oceania	1.2	4 555*	1.7*
Total	22.7	–	–

* Fiji, Polynesia, Tonga.

Australia, with a per capita GDP of $US 16,930, per annum and now GDP growth at 5 per cent per annum has good prospects for market expansion. Present per capita consumption at 85 gms does not compare favourably with countries with similar levels of development and income, and stepped-up efforts to promote pepper and pepper products in Australia should bring positive results.

New Zealand has an even lower level of per capita consumption. Although it is a relatively small market with a population of 3.5 million, there is room for growth as per capita consumption is a relatively low 69 gms. New Zealand is a major exporter of meat and dairy products and there may be some scope to introduce pepper in the processing of such products for export.

4. Central and South Asia

Consumption of pepper in the Indian Sub-continent is difficult to estimate accurately. The overall per capita consumption figure of 28 gms seems low, given the kind of cuisine prevalent in the countries concerned. The overall per capita GDP of $US 1,323 is relatively low, however, and the average consumption may reflect the low level disposable income.

Table 8. GDP per capita and GDP growth in Central and South Asia

Country	Population (million)	GDP per capita ($US)	GDP growth (per cent)
Producing countries			
India	899	1 198	4.2
Sri Lanka	18	2 772	6.9
Consuming countries			
Bangladesh	121	1 206	4.5
Pakistan	125	2 124	3.0
Total	1 163	–	–

Pakistan appears to have the brightest prospect for market growth. Per capita GDP stands at $US 2,124, with growth at 3 per cent per annum. Looking at the trend of reported imports, the market has increased at almost 10 per cent per annum and this trend can be expected to continue.

The prospects for increased consumption in India may be better in the processed foods and seasonings sector, as exports of these products increase. The relatively low per capita GDP of $US 1,198 means low levels of disposable income and perhaps less household expenditure on non-essentials. GDP growth estimated at 4.2 per cent holds some promise as the food processing industry grows. Increased exports of seasonings and blends will also mean greater utilization by this sector. Domestic household consumption, however, as always will depend on prices and availability of pepper after export sales.

C. Market constraints and problems

Generally, a major constraint when planning the marketing of pepper in the Asia-Pacific Region is the lack of data and market related information. Trade and industry statistics are less satisfactory and often do not seem to be consistent, e.g. export data is often inconsistent with import figures from the importing country. While the International Pepper Community (IPC) publishes trade and production data as and when available, there is no reconciliation of inconsistencies.

A constraint in actual trading is the lack of a common perception on sales contracts, arbitration, and quality. Differing views are held in different countries as to what constitutes a contract and the form of a contract. Though the American Spice Trade Association (ASTA) format document may be used in many instances, the steps leading up to the signing of the contract and the point at which a contract becomes binding can come into dispute. Even with a signed contract, there is no mechanism for arbitration in the event of disputes.

Perceptions of quality differ. Unless expressly stated, variations in light berries, as well as colour and size of berries, which may be acceptable in one market may be unacceptable in other countries; different perceptions may even exist among different buyers in the same country. This makes it necessary to spell out in detail the quality requirements for each transaction, particularly for new buyers.

In some markets, such as Taiwan Province of China, import duties are very high and restrict market expansion as consumers have to pay high prices for pepper and pepper products. High freight rates to certain destinations also hamper growth in some markets.

Table 9. MFN/GSP rates of duty for whole pepper in selected countries

Country/Area	Rate of duty	
	MFN (per cent)	GSP (per cent)
Philippines	30	–
Indonesia	30	–
Republic of Korea	–	8
Japan	Free	Free
Taiwan Province of China	100	–
Bangladesh	50	–
Australia	Free	–
New Zealand	Free	Free

Some Asian markets have distribution systems that are cumbersome, with too many levels of intermediaries. This makes it difficult for suppliers in producing countries to respond effectively to consumers' requirements. Contact between user and supplier is limited and intermediaries do not always provide positive feedback to suppliers nor convey information pertaining to products and market developments to users. Thus, while a variety of pepper products have come into the market in recent years, many users are not aware of their availability.

In most commodities markets, the existence of speculators tends to dampen the possibility of market expansion when prices are low. Speculators who buy during low price periods and sell at higher levels, or who hold stocks at times of scarcity tend to distort the market. In the absence of formal mechanism for hedging their requirements, users and producers, particularly small users who may source a variety of products for their manufacturing or processing needs are not always able to take advantage of market movements.

Generally, factors which tend to distort the market mechanism, either, through trade barriers, inefficiencies in marketing practices and systems or manipulation of the market can be viewed as constraints to market development and growth. Efforts to remove such constraints would be beneficial to both consumers and producers alike.

D. Conclusion

The Asia-Pacific region holds good prospects for increased consumption and market expansion. As a whole, the region is experiencing economic growth and most countries are reporting respectable increases in per capita income. Markets are becoming increasingly accessible, and tastes and preferences are changing in directions that are beneficial to the pepper industry. Among producing countries, Malaysia and Indonesia offer the best prospects to increase consumption in the near future. What is required is a focused effort to improve domestic distribution and market promotion to make pepper and pepper products more attractive to the household consumer as well as the industrial user. China, too has prospects for dramatic increases in consumption, either through increased domestic production or imports.

Among consuming countrie and areas, the markets with potential for expansion are Japan, the Republic of Korea, the Taiwan Province of China, the Philippines, Australia and Pakistan. Efforts to increase consumption in these markets would require active promotion in close cooperation with domestic partners who know the market. Improved trading facilities such as a common contract and standards, an effective mechanism for hedging and more competitive freight rates would also be beneficial in increasing market share.

Market related information is relatively scarce. It is suggested that a detailed study be undertaken to obtain reliable data on consumption, trade practices and market systems.

Net imports of pepper: consuming countries in the Asia Pacific Region (Tons)

Country/Area	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
South-East Asia										
Philippines	600	319	151	274	37	465	271	300	270	275
Far East										
Taiwan Province of China	548	689	577	732	836	818	1 207	1 221	1 498	1 361
Hong Kong	672	(31)	1 028	46	386	1 554	853	1 250	512	(418)
Japan	5 143	5 213	5 707	5 567	5 580	6 066	5 879	6 090	6 029	7 240
Republic of Korea	1 359	1 571	1 564	1 472	1 655	2 076	2 323	2 498	2 660	3 136
Oceania										
Australia	1 029	1 017	1 069	1 146	1 188	1 566	1 596	1 560	1 992	1 531
New Zealand	177	243	(4)	180	152	198	220	257	244	243
Central/ South Asia										
Pakistan	–	–	–	3 173	1 905	1 562	2 131	3 026	3 790	4 358
Total	9 528	9 021	10 092	12 590	11 739	14 305	14 480	16 202	16 995	17 726

II. THE MARKET POTENTIAL AND CONSTRAINTS IN MARKETING PEPPER: TRADER'S VIEWPOINT[1]

History shows that the fortunes of pepper, production, trade or prices have been fluctuating, at times in the producer's favour and at times in the consumer's. Traders, by and large, have been mere transmitters of goods from producers to consumers, with no significant direct involvement in stirring consumer demand.

The last three years have been particularly gloomy for the pepper economy as it has been characterized by sluggishness in demand, decline in international prices and fall in farmer's income.

This cycle of low demand, low prices, low incomes seems to be feeding on itself. Quite obviously, this vicious cycle needs to be broken and the pepper economy put on a path of sustained growth, with all participants — grower, trader or consumer — benefiting from it.

It is important to note that pepper is more of an international commodity and its prices at origin are no longer insulated from developments in other parts of the world.

Given this international nature of the commodity and the fact that five countries — Indonesia, Malaysia, India, Viet Nam and Brazil, four of which happen to be in the Asia-Pacific region, account for over 80 per cent of global output, it is quite logical, sensible and reasonable that issues relating to constraints in pepper marketing and ways and means to spur demand are examined, suggestions made and solutions pursued.

World trade data reveal that since 1990, pepper imports has stagnated at 165-170,000 tons per annum. Volume of world production and aggregate import/export figures for the last four years 1990-1993 seem to suggest that the pepper economy has got into what is called a "low-level equilibrium trap" a situation characterised by demand and supply equilibrium, but at a low level of production and consumption.

This is not a favourable situation to be in but how does one get out of this 'low-level equilibrium trap?' The issue must be judiciously addressed from the demand side as well as from the supply side.

[1] Based on the paper prepared by Mr. Kamlesh J. Tanna, Director, Jamnadas Madhavi International Ltd., Bombay, India.

On the supply side, there are ways and means of improving supply. It is common knowledge that in producing countries like India, pepper productivity or yield per unit area of land is low.

A host of reasons like use of marginal land, low level of input application, unscientific agronomic practices and so on cause low yields. If yield per unit of land is stepped up by removing farming weaknesses, it would ensure higher farm income to growers. Higher yields and production would also mean lower trade prices, which in turn would result in enlarged demand for existing usage and provide incentive for exploring new application.

However, under the present circumstances, increasing productivity and thereby production, by itself, would create more problems than it would solve. Because, larger production without a commensurate increase in demand will result in glut and lower farm prices. Therefore, it is necessary to first find avenues of raising demand for existing usage; assess the scope for enlarging the number of existing users and explore new applications for pepper.

As traders transfer producer's goods to consumers in an acceptable form, there are constraints that inhibit pepper trading in three areas, namely, physical constraints, fiscal constraints and policy constraints.

Physical constraints are those that impact the availability of pepper for export and retard free flow of goods from one country to another.

In the case of a large country like India, there is so much of internal demand for pepper that a genuine exportable surplus is not easily generated. Despite such high domestic demand, India has always been in the international trade with a respectable volume to offer. Larger production through increase in yield would obviously result in satiation of local demand and sufficient surplus to meet export demand.

The Indian Spice Board and other agencies are engaged in implementing schemes for productivity enhancement through use of improved seeds, application of appropriate inputs and adoption of suitable agronomic practices; results of which will be evident over a period of time.

However, the more important physical constraint relates to infrastructure like transportation, storage, port facilities and so on. Inadequacies in infrastructure facilities are seen to have a significant bearing on international trade, for, they not only decelerate free movement, but also add to the cost of the produce because of inefficiency.

In a country like India, transportation is time consuming and its costs are exorbitant. As production of pepper is location-specific, transportation is unavoidable. Decent warehousing facilities that meet western standards of hygiene and sanitation are hard to find, thus, storage becomes expensive.

Port services in India are under strain as there has been a massive increase in cargo movement, without commensurate upgrading of facilities and productivity. Undoubtedly, improvements are taking place continually but larger investment would be in order.

These physical limitations have to be overcome in every country that faces them in some degree or the other. This will result in cost saving and competitive pricing.

The second important constraint relates to fiscal controls. Restrictions and levies, not only in the exporting countries, but also in the importing countries, are seen to hamper exports. In India, pepper exports are subject to a levy of 2.5 per cent ad valorem duty, known as cess. Until 30 September 1994, while an exemption from levy of cess has been granted, it is uncertain whether the exemption will continue or duty will be imposed.

There are also restrictions on obtaining bank finance. Interest rates at 17 per cent per annum are far above the levels in advanced countries. As pepper production is seasonal, but marketing is a year round operation, traders and exporters need to build inventory and carry stocks over a period of time. Naturally, high cost of money acts as a constraint in offering larger volumes of pepper at competitive prices.

Restrictions on finance, high interest rates and fiscal imposts are not peculiar to India alone. Other origins must also be facing similar conditions in some degree or the other. However, from a trader's point of view, tariff walls erected by importing countries are far stronger barriers to larger international transactions in pepper.

Higher tariffs, particularly in case of value added, manufactured products like oleoresin discourage imports and consumption. Each government has its own peculiar logic for imposing duties and taxes on import. In case of food products, such duties sound so retrogressive and anachronistic that one is tempted to plead for total abolition of taxes on food products including pepper, in all exporting and importing countries.

Pepper trade promotion bodies all over the world must unite to lobby with different governments for a trade, free from choking fiscal constraints. The recently concluded Uruguay Round of multilateral trade negotiations (MTN) under the General Agreement on Tariffs and Trade (GATT), envisages a gradual reduction in tariffs. However, it is going to be a time-consuming process.

India has a system called market intervention wherein some designated bodies, armed with government funds, would step in to make large purchases of pepper, whenever domestic prices dip to low level, in order to prop up prices. The primary objective of the intervention operation of protecting farmer's income is commendable: but it has to be undertaken in such a manner that export interests are not overlooked or jeopardized. A judicious balance between farmers' and exporters' interests has to be struck.

Policy constraints often take the form of non-tariff barriers and generally relate to quality specifications of the traded goods as well as its packing material. It is well known that consumers throughout the world continue to place increasing demands, directly and through their governments, on the food industry to supply safe, healthy and clean food products at all times.

Public health concerns in importing countries are quite strong. It is no wonder then that governments throughout the world have continued to place restrictions on spices trade, especially in areas like use of pesticides, sterilants, labelling, sanitation, and so on. Of late, pesticide residue has become a contentious issue between exporting and importing countries. For instance, the United States and Japan have strict regulation as regards detection of undesirable pesticides like DDT and BHC.

It must also be noted that these pesticides were in extensive use in many of the developed countries until 10 or 12 years ago. These countries have now gone to a new generation of pesticides and quite naturally, the earlier ones are being condemned as toxic and hazardous.

As research gets sophisticated, analytical techniques get increasingly precise, and sampling methods more scientific, there will always be newer findings which either confirm the earlier ones or refute them. Therefore, what is not expected of consumer bodies and governments is a knee-jerk reaction to research findings. Sufficient time should be given for adjustments, particularly at the origin for the developing countries.

Some countries, such as Japan for instance, conduct strict official inspection for imported food stuff with respect to radioactivity, contamination with heavy metals, and so on. It would be desirable if uniform quality standards with reasonable tolerance limits are evolved through the joint efforts of exporting and importing countries.

While traders and trade bodies must continue to fight for redressal of grievance in the form of the aforementioned physical, fiscal and policy constraints, which inhibit the supply side, a series of measures are required to generate additional demand for pepper.

Spiced and seasoned foods represent one of the fastest growing segments. In Europe, consumption of spices and herbs is increasing due to innovations in food habits and introduction of new food products, although population is more or less static. Moreover, ethnic food habits, especially of Asian and Indian, are catching up fast in many parts of the world.

With increased employment for women and improving standards of living, there is a growing preference for natural food colour and flavours, fast-food, spice-mixtures, ready-to-eat instant food, etc. This trend indicates a tremendous potential for use of spices, in general, and pepper, in particular, in food processing industry which is the most significant end-user.

Given this encouraging global scenario, traders must transform and evolve from being mere transmitters of goods to being catalysts for generating higher demand. There is no escape from the fact that quality standards, health, hygiene and sanitation conditions are likely to become stricter by the day. Traders have to address this issue squarely. They have to upgrade their technology and improve hygiene conditions so as to meet buyer's requirements.

Therefore, quality improvement is the key to larger exports. This can be achieved through "total quality management". Pepper should no more be considered a mere commodity, it is an ingredient, a food ingredient — a volumetrically minor and yet important ingredient that enhances food value. It is this concept and the internalization of this concept that will bring about a slow revolution in pepper trade.

Issues relating to increasing the demand for pepper have to be addressed. Additional demand can be generated through increasing existing usage, enlarging the number of users, and popularising new applications.

For this purpose, publicity and propaganda, demonstration and food festivals and so on in existing and potential user-markets are called for. The accent has to be on the naturalness and health aspects of pepper usage. Some novelty has to be built into the use of pepper in markets which are not too familiar with the product.

The end-users of pepper fall into two broad categories. In household consumption, pepper outranks all other spices. Sales for the household sector are generally through retailers. There is a limit to which demand growth in this segment can occur, given the changing life-style and food habits of people with accent on eating prepared convenience foods.

The growth area therefore is the industrial segment. Food processing industries ought to be the target for products promotion. Meat processing industry is by far the largest user of pepper.

In the food processing industry, production schedules and raw material purchase decisions are taken several months in advance. Obviously, the buyers look for long-term commitment from sellers to supply unvarying quality at stable prices.

The measures to stir demand have to be concerted whereby producers should pool their resources together and mount a general campaign to popularize use of pepper. This unified approach is likely to yield better results.

There is potential for pepper usage in the Asia-Pacific region. From the import data available, Japan is a major consumer, followed by the Republic of Korea, Pakistan, Australia and Taiwan Province of China. Others in the region are New Zealand, the Philippines and Malaysia. Singapore and Hong Kong have not been mentioned, as they are mainly re-export markets.

Considering the population and per capita income of these countries, the per capita consumption of spices, particularly pepper, is still low compared to other spice importing countries. Import data for Japan, the Republic of Korea and Australia show that there is an increasing trend of spice consumption in these countries. It should be noted that even in the absence of a concerted or well thought-out marketing plan, these countries are importing increasing volumes. Active development of these markets through publicity and product promotion would go a long way in increasing consumption of pepper.

A suggestion that could possibly help promote pepper trade in a more favourable manner is an organized international pepper futures market. Future trading provides a hedge to growers and traders against future uncertainties. A healthy futures market acts as a barometer to adjust demand and supply imbalances through the pricing route.

At present, in the absence of an organized hedging facility, pepper traders are discouraged from taking positions which by itself acts as limiting factor for larger trade volumes. Futures trading is bound to encourage large volumes and forward contracting.

Another benefit would be the evolution of a dispute redressal mechanism or international arbitration in order to settle trade disputes expeditiously.

In summary, the producing countries need to:

— Encourage backward linkages with growers for yield and quality improvement;

— Establish scientific processing, storage and handling facilities so as to reduce human intervention;

— Improve infrastructure facilities;

Whereas the importing countries need to:

— Fix reasonable quality standards that are in the realm of possibility;

— Remove tariff and non-tariff barriers;

— Select shippers based on merit and track-record, rather than on price alone;

As mentioned earlier, traders need to change their role. They must become marketeers. Various constraints may continue to be present. They cannot be whisked away. But we can surely convert these challenges into greater trade opportunities.

ANNEXES

Table 1. Pepper production by origin
(Tons)

Country	1988	1989	1990	1991	1992	1993
Brazil	25 550	29 717	30 514	50 000	27 500	23 000
India	60 000	45 000	65 000	55 000	60 000	55 000
Indonesia	47 000	50 000	53 000	61 000	62 000	37 500
Malaysia	22 800	27 500	31 000	29 000	26 000	20 000
Thailand	4 765	7 610	10 345	10 443	10 500	9 000
Sri Lanka	3 440	2 600	1 990	2 850	3 255	3 400
Viet Nam	6 174	7 083	8 623	8 900	7 830	8 000
China	6 975	8 882	10 993	13 108	12 321	12 000
Madagascar	3 500	3 380	3 380	3 380	3 380	3 250
Mexico	1 000	903	868	894	1 000	1 000
Total	181 204	182 675	215 713	234 575	213 786	172 150

Note: Trade estimate – Official (Government) estimates are 10-15 per cent lower.

Table 2. Pepper exports from major producers
(Tons)

Country	1988	1989	1990	1991	1992
Brazil	23 550	27 717	28 014	47 553	25 702
India	47 258	25 120	34 429	18 945	19 399
Indonesia	41 152	42 136	47 675	49 665	61 438
Malaysia	18 641	26 271	27 498	26 732	23 035
Thailand	850	2 077	4 042	3 838	6 158
Sri Lanka	2 692	1 575	2 609	2 058	2 127
Viet Nam	2 612	7 551	1 288	16 252	22 358
China	38	1 490	515	163	181
Madagascar	2 497	1 417	1 222	1 844	1 948
Mexico	2 602	2 388	2 663	1 861	3 441
Total	141 892	137 742	149 955	168 911	165 787

Table 3. Global production, export and import of pepper (Tons)

Year	Production	Export	Import*
1988	181 204	142 252	165 000
1989	182 675	137 742	177 000
1990	215 713	149 955	165 000
1991	234 575	168 911	170 000
1992	213 786	165 787	165 000
1993	172 150	133 140	165 000

* Excludes Singapore's Import for Re-export.

Table 4. Import of pepper in Asia-Pacific region (Tons)

Country/Area	1990	1991	1992	1993
Australia	1 583	2 021	1 594	1 987
New Zealand	261	246	244	297
Hong Kong	1 134	1 134	845	n.a.
Japan	6 742	6 063	7 270	7 159
Republic of Korea	2 504	2 666	3 137	n.a.
Pakistan	3 026	3 790	4 358	n.a.
Taiwan Province of China	1 237	1 511	1 391	n.a.
Philippines	266	322	325	n.a.
Singapore*	35 490	41 063	49 576	n.a.
Total	52 243	58 816	68 740	9 443

* For Re-export.

III. FEASIBILITY STUDY ON PEPPER FUTURES CONTRACT*

Introduction

The International Pepper Community (IPC), an intergovernmental organization comprised of Brazil, India, Indonesia, Malaysia, Thailand, Sri Lanka and the Federated States of Micronesia, has for a long-time been strongly concerned with the continuing instability of pepper prices. Various ways to cope with this problem have been studied and discussed in the framework of the IPC.

Part of these efforts were oriented at increasing the stability of the market itself while others tried to help the various actors in the pepper economy to better manage their activities in an environment of unstable prices. Futures markets at least in theory offer the possibility for the latter. These markets serve a risk-shifting function, and can be used to "lock in" futures prices instead of relying on uncertain price developments.

The subject of futures market trading was explicitly discussed in the 16th Peppertech meeting in Cochin, India, 8-13 July 1991, to which the India Pepper and Spice Trade Association presented a paper on "Futures trading in pepper". The issue was again discussed in the marketing panel of the 17th Peppertech meeting in Madras, India, 18-19 August 1992, and the issue was again put on the agenda for the 25th meeting of pepper exporters in Bali, Indonesia, 7-9 June 1993. During this meeting, the Malaysian delegation presented a paper on the viability of a futures contract for pepper in the Kuala Lumpur Commodity Exchange and the possibility of having futures trade in pepper regionalized in Kuala Lumpur for neighbouring producing countries.[1]

During the Bali meeting, the governments expressed a need for further studies, and the IPC secretariat contacted UNCTAD to carry out a study on the viability of an international pepper futures contract. A first result of this work, made possible thanks to funding by the United Nations Development Programme through the Asia Pacific Regional Programme for strengthening capacities for growth through trade and investment (RAS/92/034), is presented here pending the preparation of the final report. This report sets out to describe the pepper economy in general including the integration of the various markets; the economic functioning of the main players, as well as the risks to which they are exposed; and the potential economic benefits of enhanced access to futures contracts. Also, the conditions for such a contract are examined in light of the characteristics of the pepper economy, and conclusions are formulated on bottle-

* Based on a paper prepared by the UNCTAD Secretariat, Geneva, Switzerland.

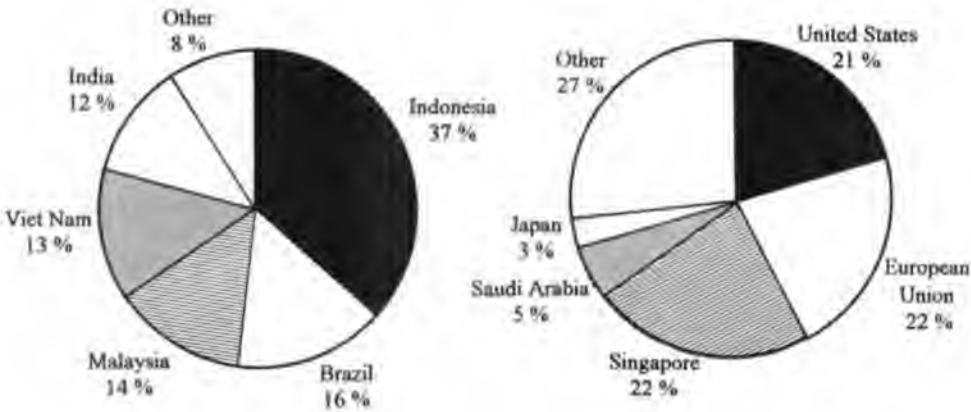
[1] IPC/25-93/Exp. 05.

necks and possible policy solutions. This report is based on in-house econometric analysis by the UNCTAD secretariat, and by field work in India, Indonesia, Malaysia and Singapore[2] by Mr. P. Nandakumar, consultant, Kochi, India.

A. The Economic role of pepper

Since its discovery by the European consumers in the 17th century, pepper is the main spice produced and traded worldwide. The two major types are black and white pepper and both are generally traded whole spice. As shown in Figure 1, world production and exports of pepper are quite concentrated in India, Indonesia, Malaysia, Thailand and Brazil. These countries account for 87 per cent of world production and 82 per cent of world exports. Other potential, exporters include Sri Lanka, Viet Nam, China, Lao People's Democratic Republic, Cambodia and Madagascar.

Figure 1. Main exporters and importer of pepper in 1992



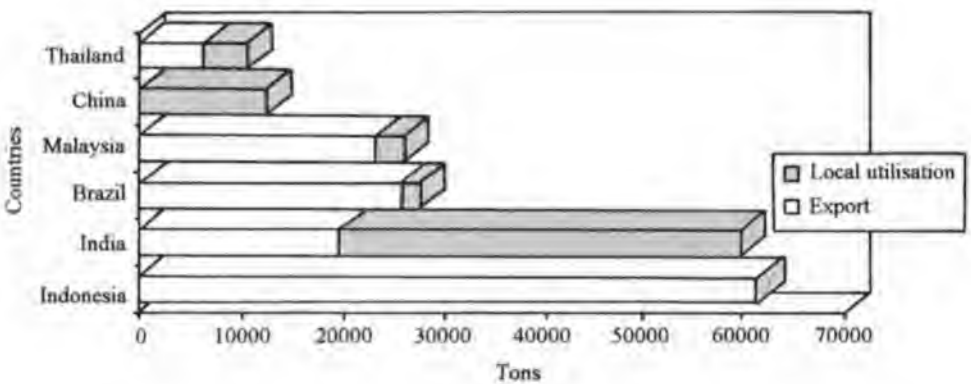
Source: UNCTAD secretariat, based on figures from IPC, Pepper Statistical Yearbook, 1992.

The total value of pepper exported in 1992 was $US 154 million. In terms of the total export proceeds of the countries concerned, this is a minor figure (the highest share of pepper in export proceeds is in Indonesia and India, where it accounts for 0.15 to 0.20 per cent), but pepper production and trade are of major importance for some regions within these countries, and for a large number of farmers. In India, the state of Kerala accounts for 96 per cent of production, similar to the share of Sarawak in Malaysia's production. In Indonesia, the island of Bangka (white pepper cultivated as monoculture commodity) and Lampung (black pepper) together account for 82 per cent.

[2] Even though according to some figures Viet Nam is a major exporter of pepper, the country has been excluded from this study because of contradictory and unreliable data.

Most pepper is grown by smallholders, who, except in Indonesia and in Malaysia, combine the crop with various other products, e.g. as an intercrop in coffee plantations. Nevertheless, even if it is grown through intercropping, pepper is often considered as a vital cash crop. In Indonesia, some 95,000 smallholders, or around 300,000 people, are estimated to be involved in pepper plantations; in Malaysia, there are some 150.000 smallholders; and in India, about half a million. With the possible exception of Thailand, pepper-growing smallholders in India and South-East Asian countries are generally small and marginal farmers, unable to absorb the brunt of unstable pepper prices without major financial difficulties. Only in Brazil pepper is predominantly produced on large specialized pepper plantations.

Figure 2. Distribution of production over local utilisation and exports



Source: UNCTAD secretariat based on figures from IPC, Pepper Statistical Yearbook 1992.

B. Trade channels

Generally, with the exception of China, the major part of pepper production is for exports. In fact, Figure 2 shows that 99 per cent of the 1992 Indonesian pepper production is for export while India exported roughly one third of its 1992 production. Hence, the pepper market has a more international orientation than a national one.

The major market for black pepper is the United States of America while the major market for white pepper is the European Union. These two countries account for around 50 per cent of the total world pepper imports. More than 120 other countries import pepper, and pepper exporters are trying to diversity their export destinations. It should be noted here that Singapore, which is the third biggest importer in the world, re-exports nearly all its pepper. Also in the Netherlands about 78 per cent of pepper imports are re-exported. Trade flows have shifted in recently years. As an example traditionally, half of Indian pepper was exported to the USSR and Eastern Europe, but most goes to Europe and the United States.

Within the major producing and exporting countries, pepper normally does not go directly from farmer to wholesaler/exporter, but passes through one or more intermediaries. There are two major types of intermediaries, namely private traders and farmers' organizations. There are also two major types of exporters, namely, state marketing boards and private exporters.

At the domestic level, trade is often rather concentrated, with only a few dozen wholesalers functioning in each country. For example in Indonesia, there are only some 30-40 active dealers concentrated in Jakarta, Lampung and Pangkal Pinang (Palembang), handling some 5,000 tons per month. In Malaysia, there are three levels in the domestic marketing chain. Farmers, scattered throughout Sarawak, sell to primary dealers, mostly village shopkeepers or boat/lorry operators. These sell to dealers, who in turn sell to exporters. There are some 30 dealers, of which 15 are active. They are concentrated in Kuching and Sarikei, and handle some 2,000 metric tons per month.

Export structures are similarly concentrated. In some countries, exporters cooperate in order to market their products. For instance, all Indonesian exports to Western Europe are traded by BV UNIPRO in Amsterdam, all exports to Canada and the United States by the Central Indonesian Trading Incorporate (CITC) in New York; both companies are owned by Indonesia's largest exporters of pepper. In Thailand, there are only four exporters of pepper. The largest, Thai Commodities, accounts for half of Thailand's total exports. There are some 10 international traders in Singapore, each handling some 3,000 tons per month.

On the importing side, the concentration of trade is also fairly strong. Brokers, trade houses and pepper grinders are active. Most of the major trade houses and brokers are in a few large ports: New York/New Jersey, Hamburg/Rotterdam.

In the United States, some two thirds of imports are handled by the grinders themselves. McCormick, the world's largest grinder, buys most of its supplies directly from exporters, and has linked up with some export companies, including Ms. Kanji Morarji of India. The remainder of imports is done by trade houses, including European trade houses.

Three trading companies dominate in Europe: Man Producten and Catz International (both in Rotterdam), followed by Daarnhouwer (Hamburg). Much of international pepper trade passes through Rotterdam. These three companies are estimated to trade over 15,000 to 20,000 tons a year or, together, about one quarter to one third of world trade. In Japan, three importers dominate.

There is active intertrade among trade houses, and also among international brokers. There appears to be a strong speculative element, with forward positions being taken by various segments of the trade, even though in the United States, speculative fervour has somewhat abated after the collapse of one company in the 1980s. It is also reported that, in particular in the United Kingdom, there is a strong paper trade

in pepper, with the same lot changing hands more than once; which, effectively, amounts to over-the-counter futures market trading.

C. Government pepper policies

The fact that pepper is such an important cash crop for a large number of relatively poor smallholders has led governments to intervene in the pepper market in several ways. In India, Indonesia, Malaysia and Thailand, governments have operated several programmes for the intensification of production, such as the Pepper Intensification Programme and the Programme of New Planting, Replanting and Rehabilitation Project of the government of Indonesia; or Malaysia's Pepper Maintenance Scheme and similar programmes exist in other countries.

On some occasions, governments have also intervened with prices, often taking on price risks (the risk of having to subsidize production/exports) itself. For example, in 1992 and 1993, the Thai government applied export subsidies, which proved expensive (export subsidies were around $US 30/kg). It is reported that for this reason, the government decided to shift for the period 1994 to 1996 to production control measures, instead of export subsidies, with the price of pepper being determined by the market. In other countries, governments have only taken measures to reduce the cost of pepper marketing by export deregulation, while supervising prices to ensure that farmers receive a fair share.

D. Pepper price and price volatility

Like the majority of other soft commodities, pepper prices tend to move in a cyclical way, and price volatility can be very different from one year to the next. Nevertheless, pepper prices tend to be much more volatile than those of other commodities. In the group of food commodities, only sugar at times shows more volatility.

Table 1 shows, as an example, the extent of price shifts from one month to another.

Table 1. Frequency distribution of pepper price changes from one month to the next, January 1991 to May 1994

(Singapore, White Sarawak 100 per cent, closing quotations)

Percentage price change (per cent)	0-2	2-5	5-10	10-15	15-20	> 20
Frequency (per cent)	15	33	35	5	5	8

Source: UNCTAD Monthly commodity price bulletin, Vol. XIV, No. 6 (June 1994).

As can be noted, pepper prices can change dramatically from one month to the next. In more than half of the months in the period 1991 to mid-1994, pepper prices changed by more than 5 per cent from the previous month. In 7 out of 40 months,

the change was larger than 10 per cent. In an additional one third of this period, price changes were between 2 and 5 per cent, which can already be sufficient to wipe out the profit margins of a trader. Only one out of six months that prices remained relatively stable.

Table 2 shows the instability of pepper export prices during different periods, using monthly average prices, for the main exporting countries.

Table 2. Instability of FOB prices of black and white pepper in the main IPC countries, 1970-1992

(Standard variation, per cent)

	Brazil	India	Indonesia	Malaysia	Thailand
Black pepper instability					
Indice 70-92	61.5	49.2	53.8	53.3	55.9
Indice 70-75	30.7	29.6	24.7	21.2	–
Indice 76-81	20.8	17.7	16.4	24.1	15.5
Indice 82-87	61.9	48.7	60.0	55.8	52.8
Indice 88-92	40.9	42.9	43.2	48.8	59.3
White pepper instability					
Indice 70-92	65.2	–	54.8	50.1	–
Indice 70-75	34.8	–	22.7	–	–
Indice 76-81	18.0	–	15.6	16.3	–
Indice 82-87	65.6	–	53.2	48.9	–
Indice 88-92	41.4	–	55.9	55.4	–

Source: UNCTAD Secretariat calculation based on IPC, Pepper Statistical Yearbook, 1992.

Pepper price instability differs from country to country. In particular, long-term variability (the average deviation from the trend from 1970 to 1992) is quite high. It can also be noted that instability varies from period to period depending on various endogenous or exogenous factors. It was very high between 1982 and 1987, two to three times higher than in the early 1970s and even three to four times higher than in the second half of 1970s. Volatility only declined slightly between 1988 and 1992. Black and white pepper price fluctuations were more or less similar during the period 1970-1988 but in recent years, white pepper price instability seems to be slightly higher than that of black pepper.

Week-to-week price volatility for 1992 and 1993 is shown in Annex 1. For both black and white pepper, weekly volatility of FOB prices is high in Indonesia and Malaysia, at around 25 per cent, slightly lower in Brazil (19 per cent), and lowest in India (15 per cent). It is not unlikely that the low FOB price volatility in India is linked to the existence of a pepper futures contract in that country considering that one of the functions of a futures market is to reduce intra seasonal price variation. The volatilities of weekly CIF prices in the main markets are rather close, with a

slight tendency for higher instability in the Rotterdam market. As concerns the various origins, Sarawak pepper prices are notably more unstable than Malabar prices, with the volatility of Lampung prices in between.

E. Market integration

The discussion of this section is based on an analysis of the correlation between price movements for pepper in several countries, as well as the correlation of price movements for several grades of pepper. Two types of correlation have been analyzed. First long-term correlation over the period 1970-1992 using monthly average prices, which should show the "structural" integration of the various pepper markets, and also, whether markets have become more or less integrated over time; and secondly, weekly prices over 1992 and 1993 to estimate the integration of markets for risk management purposes. The main results of this analysis are presented in tabular form in Annexes 2 and 3.

The FOB prices of black pepper of the major producing countries have been examined in order to assess to what extent they move in similar ways. An extremely high degree of correlation can be observed. Moreover, over time the black pepper market has become increasingly integrated. In fact, coefficients of correlation in the period 1970-1980 are significantly lower than those in the 1981-1992 period. It can thus be concluded that long-term FOB black pepper prices quoted in the different markets are moving in parallel, the two closest price series being those for Indonesian and Malaysian pepper.

The correlation of weekly FOB prices for black and white pepper prices from January 1992 to December 1993 among the different exporting countries is slightly weaker than the long-term correlation, but is still quite high. The lowest coefficient of correlation for black pepper prices is 84 per cent, between India and Malaysia and the lowest correlation for black and white pepper prices is between Brazil and Malaysia at 63 per cent. In general, a correlation of more than 80 per cent is considered sufficiently high to allow for the use of the other commodity as a financial substitute for the commodity one intends to trade; or in other words, a correlation of one's prices with futures market prices of more than 80 per cent is sufficient to use the futures market for hedging purposes.

The correlations of CIF prices in the major importing countries, namely the United States, Germany, the Netherlands and Japan, have been calculated for the three main type of pepper traded worldwide, namely Lampung, Malabar and Sarawak (see Table 5 in Annex 3). These calculations are based on weekly CIF black pepper in 1992 and 1993. Again, with one exception, price correlations appear to be good.

In the case of Malabar and Sarawak origins, CIF pepper prices across the different markets are well correlated. Each coefficient calculated is above 92 per cent, with the exception of the correlation between Malabar pepper in the Japanese market and that in the Netherlands, Germany and the United States which is somewhat lower.

The correlation of Lampung black pepper between the Netherlands, Germany and the United States markets is good (the coefficients are above 91), but is very low (around 35) when these countries are compared with Japan. Japanese CIF prices for Lampung black pepper effectively do not move in tandem with other pepper prices, be it within Japan or with prices for Lampung pepper in other markets. In Japan, CIF Lampung prices tend to remain stable over periods of several months, then change, and again remain stable for a longer period. This might be due to the fact that Japan has not been a traditional market for Indonesian black pepper exporters (the 1992 share of Lampung black pepper exported to Japan in total Indonesian black pepper exports was only 0.1 per cent), and hence that one or more companies either in Japan or in Indonesia are absorbing black pepper price fluctuations, e.g. to gain market share.

Vertical price integration, between the country of origin and the country of destination, is again very strong (with the exception, to some extent, of Japan). As Annex 4 shows, the coefficient of correlation of FOB prices of Indonesian, Indian and Malaysian black pepper with the CIF prices for each of these three origins in Holland, Germany and the United States are 90 per cent or higher.

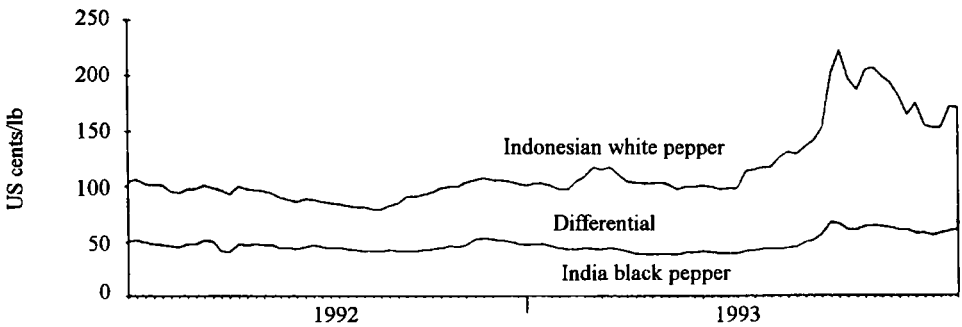
One interesting question is the market integration of black and white pepper. These two types of pepper come from the same bush. The difference in taste and colour is created through different harvesting methods. For white pepper, only ripe berries are picked, and are then processed in a way that is more labour-and time-intensive than the processing of black pepper. One hundred kilos of berries yields about 36 kg of black pepper or 24 kg of white pepper. Hence, as the two products are interchangeable, price relations should be rather close and if prices move too far apart, farmers can shift their production from black to white pepper.

Analysis appears to confirm this close price correlation. The white pepper price level is twice that of black pepper, but as Figure 3 shows, the two move more or less in parallel. The price correlation between black and white pepper in Indonesia, as well as in Malaysia and Brazil is 97-98 per cent for the period 1980 to 1992 (see Table 3, Annex 2), sufficient for, say, a white pepper producer to use a black pepper futures contract for risk management purposes.

In conclusion, the black pepper market appears to be extremely well integrated. Prices are moving in parallel both in the producing and the consuming countries, and for white as well as black pepper. The world market for pepper is not, like the markets for many other commodities, segmented. Hence, one international futures pepper market would appear to be relevant for virtually all of the pepper producers, traders and consumers, and it would appear that a futures contract standard can be found which would provide all these actors with the possibility to effectively manage their price risks.

Figure 3. India black and Indonesian white pepper price differential

(January 1992 to December 1993)



Source: UNCTAD secretariat based on figures from 1993 data provided/by IPC.

F. The economic rationale for pepper future trade

A pepper futures market would serve two basic functions; namely, as a means for price risk management and as a forum for price discovery. Hence, to decide whether there is need for such a market for the world pepper economy, first, the risks that farmers, traders (and eventually government entities) run need to be analyzed; and it should be determined whether there is actually a lack of price transparency.

1. The need for risk management[3]

Agricultural commodities, including pepper, move through a chain of value-adding activities, beginning with the farmer and ending with the consumer: each segment of the chain derives revenue and profit by adding value to the product. This, rather than speculating on price movements, is their economic function. Most economic actors are exposed to price movements. Experience shows that many actors who successfully create value within a marketing chain have gone bankrupt due to adverse price movements of the commodities and products they handle. Economic actors who successfully add value to a commodity will be intent on reducing their exposure to price risks. But in many cases, they are forced into speculative positions because there is no viable way to manage price risks, or because, for any of a number of reasons, they do not wish or are being prevented from using potential price risk management instruments.

Farmers have to make investment decisions, and decisions on the use of inputs and labour power. Their decisions are based on their risk-averse attitude, and on the information that is available to them. In cases where there is no organized futures market and there are no government-guaranteed forward prices, information on likely

[3] The discussion in this section is based on UNCTAD/World Bank, Joint study on risk management in Southeast Asia, UNCTAD/COM/MISC. 56, paper prepared for the Regional Workshop on Commodity Exchanges, Jakarta, May 1994.

future prices will be in short supply. When prices turn out to be lower than expected, farmers will suffer: *ex post,* their investment decisions will have been bad ones. Access to futures markets would enable farmers to **lock in** the profitability of their decisions. In addition, futures markets provide farmers with extra flexibility, in particular if they have been organized into farmers' associations. For example, when they think that prices are low, but they need to sell, they can sell their physical commodities and buy futures contracts in the expectancy of price increases. Holding commodities in inventory and holding futures contracts are, to a large extent, interchangeable economic actions. In addition, they can play on the "basis", the difference between the price of their commodity in their region, and the price of the futures contract. When this difference is considered large (that is, their products are unfairly discounted), they can sell futures contracts and keep their commodities in stock, in expectancy of a time when price differences come closer to their normal level.

Pepper producers, especially those who rely on pepper for a major part of their cash earnings, are particularly exposed to price fluctuations because any drop in pepper price is finally (and according to data on Indonesia and Thailand, immediately) passed on to grower's level. In fact, even if the margin between FOB export price and farm gate price is believed to be around 30 per cent in Indonesia[4] and in Thailand, or even smaller in the case of Malaysia where difference between export price and price paid to growers is estimated to be around 7 to 8 per cent, smallholders are in the forefront of the chain and are generally too small to have either the adequate knowledge or the sufficient power to pass on price risks to other entities. This is also illustrated by the fact that in some countries, such as Indonesia and Malaysia, they are forced to sell a large part of their crop directly after harvest, irrespective of the price. In Indonesia, it is reported that about one fifth of pepper farmers sell their pepper prior to harvesting at a fixed price; others sell their pepper prior to harvesting by accepting a small advance with the final price being determined after the harvest. In Viet Nam, farmers behave in the same manner.

These risks can be taken over by farmers' organizations, if they decide to guarantee their members certain minimum prices, or if they borrow money on the basis of expected prices. Experience in other commodities shows that farmers' organizations, rather than individual farmers, are in the best position to manage such price risk, on their members' behalf. However, it appears that in the countries studied, farmers' organizations avoid price risks. The farmers organizations in Malaysia, which cover some 130,000 farmers, basically work on a back-to-back basis and only occasionally stock pepper for short periods. These associations are presently in no position to take over farmers' price risks even if a futures market would exist, as they are debarred by their constitution form the use of futures markets for the purpose of price risk management. In India, where cooperative societies play an important role in pepper trade and carry at times large stocks, the situation is slightly different, in that farmers' organizations can use the Kochi market for hedging purposes.

[4] And even in this case, deregulation of exporters may, however, result in progressive decline of exporters margins.

Domestic traders/intermediaries as well as exporters are exposed to a number of price risks. A trader will normally create value by moving pepper from a surplus area to an area where there is demand, or by storing pepper from a period when demand is insufficient to a period when demand is better. In fulfilling these economic functions, they run major price risks.

Some domestic traders run few price risks because they work on a back-to-back basis. Other run larger risks — it is reported that large town dealers in Malaysia (of which there are about thirty) regularly carry stocks of 200-300 tons, financed through bank loans. As their reported margin is rather low (8-10 per cent), this group of traders is strongly exposed to risks. The larger domestic traders in Indonesia (the district traders) hold much lower stocks, of only 5-10 tons, often financed through bank loans. The price risks of these traders are still large; as a reference, several similar traders in India, town dealers who hold 5-10 tons, are members of the Kochi futures exchange and extensively utilize it for hedging purposes.

In some countries government agencies play a major role in pepper trade. For example in Malaysia, the Pepper Marketing Board (PMB) is a large buyer and exporter of pepper, and at times carries large inventories. This puts it into a largely speculative position, but its constitution prevents it from managing these price risks. Under current rules, the PMB is unable to enter into hedging operations. In India as well, two government agencies, one under the central government and one under the state government, are active on the market, buying when market prices are deemed too low. One of these organizations, the KSCMF which is operated by the Kerala state government, is a member of the Kochi futures market and used to be quite active, but it halted its activities some ten years ago.

Price risks are especially severe for exporters, who, in order to remain competitive, have to be extremely flexible in their international trade. Exporters must bridge the gap between demand by importers and the directly available supply. On the domestic market, they buy on a day-to-day basis, for immediate delivery, while in the international market, forward delivery is more common. In many cases, they will be forced to sell "short", that is, to sell commodities they do not yet own for future delivery in the hope they will be able to buy these commodities at the time required. This exposes them to the risk of price increases. Because turning down a request from a buyer is not very good for long-term business, sellers prefer to be in a position where they are able to sell short without running major price risks: that is, to be able to hedge these risks through futures contracts or, when these are not available, by building inventories beyond the level necessary for their immediate working needs. The latter solution not only freezes up their scarce working capital, but also causes storage costs. It should also be noted that longer-term fixed price contract increase counterparty risks. Singapore exporters have had several bitter experiences with sellers backing out from long-term contracts when prices increased.

The extent of price risks that traders run depends largely on the length of the fixed price contracts that they enter into. Currently, based on exports from the countries studied, such forward contracts are almost absent. It is reported that in Malaysia, there are no exporters willing to sign contracts for over 6 months, and that the majority of deals are on a 1-2 months basis. Deals on a 1-2 month basis are normally covered by existing physical stocks to which exporters run no price risks, but are, as mentioned above, confronted with storage costs and having a part of their capital frozen in physical goods. In several countries including Indonesia and Malaysia, this is reported to cause difficulties for exporters. Forward contracts for a period of over 2 months are normally short sales, and covered only at the time of shipment. This causes large price risks for exporters. Exporters' profit margins, reported to be 8-10 per cent in Malaysia, are barely sufficient to cover such risks. It is reported that Sarawak exporters for this reason reduced their exports to the United States, where buyers prefer 5-6 months forward contracts. Singapore exporters normally sell 2-3 months forward, at times up to 6 months. Considering that their profit margins are reported to be no more than 1-2 per cent, they run large price risks. To avoid the risks of short sales, they normally carry very large inventories, and they also try to buy for several months forward from producing countries. Indonesian exporters sign fixed-price contracts up to 15 months out; e.g. one contract for 120 tons implies shipment of 10 tons every month, starting the fourth month of the date of the contract. In 1993, this created major difficulties for exporters. Indian exporters appear to enter into the longest forward contracts, as much as 18 months, mainly with United States buyers. As these forward contracts are also fixed-price contracts, rather than being based on the exchange prices, exporters run major price risks (even though most exporters are active on the exchange to cover part of these risks).

Importers and **buyers** like a steady supply of the commodity they desire at predictable prices. Unfortunately, forward contracts are not good means for reaching these goals. When actual prices move away from the price agreed in the forward contract, default becomes likely. International trade houses reckon that about one quarter of fixed-price commodity forward contracts needs to be renegotiated following an unwillingness of the seller to deliver. On the other hand, if prices increase, buyers tend to invoke severe quality penalties or stick rigidly to contract conditions (in practice, very few sellers are able to comply with all the conditions of a commodity trade contract), thus effectively forcing down the purchasing price. Ultimately, the sanctity of forward contracts is dependent on the level of trust between the buyer and the seller. In contrast, futures contracts do not require such trust, as a clearinghouse interposes itself between the buyer and seller.

There are a number of ways to manage price risks.[5] Price risk management tools allow economic actors to concentrate on their relative strengths and build up their competitiveness in an increasingly competitive world economy. The larger business security which they obtain through the use of risk management tools allows them

[5] See UNCTAD/COM/15, "A Survey of risk management instruments", 15 March 1993.

easier access to more capital, both working capital and investment capital, and in many cases, they can help others profit from their access to risk management markets. For example, traders will be in a better position to offer fixed-price forward contracts to farmers.

2. Price discovery

Apart from being a vehicle for risk transfer among hedgers and from hedgers to speculators, futures exchanges also play a major role in price discovery. Price information is an important aspect of any market system, and well-functioning futures exchanges are the most reliable price discovery mechanism available. Futures markets have a strong interest in publicizing price information in the widest way possible.

Speculators play a major role in this price discovery function. Speculators make a living by trying to correctly predict future price movements. They thus draw a significant economic benefit from investing in obtaining market information, more so than market parties who are only interested in managing their risks. Speculators help to get information to the market in the fastest way possible. They also provide the liquidity that hedgers need to properly use the market. Even though massive speculative participation can at times, for short periods, distort the markets, on the overall they play a very useful role.

Prices for pepper are available from a number of sources, both within countries and internationally; e.g., the International Trade Centre UNCTAD/GATT (ITC) publishes weekly pepper prices in a number of markets. However, contrary to futures markets (which give updated prices every second as long as the markets are open), such price reporting is normally only from day to day or, more frequently in the case of pepper, from week to week. The time delay in getting price information to the potential users is also long (prices are normally identified through telephone conversations with a number of traders). For pepper, there is now only one "immediate" and open price discovery mechanism, namely the Indian futures market. In other markets, price publications are based on interviews or officially-reported prices. In the past, the Singapore Chinese Produce Exchange used to have an active pepper price formation system, with samples brought to the exchange, and most transactions taking place on the exchange and thereafter prices were distributed to the media. Now, the Produce Exchange is not very active, and prices are decided on by a committee, rather than through actual transactions on the floor.

A comparison of the various pepper producing countries appears to show that access to price information enhances farmers' bargaining power, and that the best price information appears to exist in India from the Kochi market. In Malaysia, farmers depend on prices published by local newspapers and price bulletins over the radio. These prices are released by the Pepper Marketing Board. In Indonesia, export prices for pepper are published and broadcasted over the radio; but this information is of limited value to farmers who rather need data on unprocessed and processed pepper prices.

In Kerala, farmers have direct access to the futures market prices broadcasted on the radio, and know how to interpret these (Kerala has a very high literacy rate, considerably higher than the other pepper-producing regions). Thus, for essentially the same black pepper, it is reported that in June 1994, the Indonesian farmer received 108 cts/kg; the Malaysian farmer 124 cts/lb; and the Indian farmer 147 cts/kg.

3. Access to credit

Futures contracts enhance the financial viability of firms that use them for hedging purposes. It is often difficult to find bank financing for an inventory because the value of the inventory fluctuates rapidly. An economic actor that can show that it uses futures contracts is in a better position to obtain credits for the working capital needs of its operations as banks are often willing to increase their financing from some 40-50 per cent of the value of the stock to over 90 per cent. This issue of relevance considering that pepper exporters in several countries carry large stocks financed of ten times by expensive bank loans.

Futures contracts normally define delivery possibilities. The delivery standards thus provide a quality benchmark against which physical trade can be set. This quality guarantee creates a stable market environment for market participants, and provides an incentive for market participants (including warehouse operators and shippers) to upgrade their services to meet minimum specifications. The warehouse warrants given out by certified warehouses can be traded, which considerably improves the flexibility of the market. In pepper, such delivery standards appear to be quite useful as there are some identified quality problems.

G. The basic requirements for success for a world-wide pepper futures contract

In general, for a commodity futures contract to be successful, several conditions need to be met:

- Supply and demand for the underlying commodity needs to be large, there should be many potential players, and the commodity needs to be fairly important in the players' operations.
- The commodity traded must be well-standardized and storable.
- The pricing must be determined by free market forces, without monopolistic or government control.
- Free market prices should fluctuate.
- The contract should be supported by major commercial interests.
- There should be enough potential interest from the speculative community.

- Well-functioning services and infrastructure facilities are necessary (administration, warehousing, clearing, data processing, telecommunications, etc.)
- Government support is needed, including a willingness to adopt appropriate new regulation/legislation and an appropriate oversight over trade on futures markets.

These conditions are examined below.

1. Supply and demand for pepper, number of players; and the importance of pepper in these players' operations

There has to be sufficient speculator and hedging interest to assure that no group or firm is dominant. This hinders manipulation, and helps the liquidity of the exchange. Inadequate market liquidity is the principal reason for new contracts to fail.

World pepper production is around 220,000 tons while world trade is around 150,000 tons. As the analysis of market integration above has shown, domestic and international markets appear to be well-integrated in most countries. Thus, a futures market could normally serve to hedge not only international trade, but also domestic trade price risks. Experience from other futures markets shows that futures (paper) turnover is most often around ten times the underlying volume of commodities traded. For some commodities, however, this is much lower (and at times much higher). For crude oil and robusta coffee, for instance, futures turnover is only five times the volume of the underlying physical market; for palm oil it is about equal. A conservative, but not overly pessimistic estimate would thus be that the "paper" turnover of pepper futures would be between 220,000 and 1.1 million tons.

One could envisage a futures contract size of 5 tons. This appears to be quite reasonable as the nominal value of such contract is $US 7,000-10,000, slightly lower than that of most commodity futures contracts (most are in the $US 10,000-30,000 range), but similar to the contract value of palm oil on the Kuala Lumpur Commodity Exchange, and still two-three times as large as the nominal value of the London robusta coffee contract. At this contract size, the number of futures contracts to be traded yearly would be between 44,000 and 220,000, or, with 220 working days, 200 to 1,000 contracts a day.

It may be useful to compare this with the futures contract traded in Kochi, by the India Pepper and Spice Trade Association. This contract has a size of only 100 kg., which appears to be very small (overly small contracts create extra transaction costs). On the average, more than 1 million contracts were traded each year in the early 1990s, or 100,000 tons of "paper" pepper. This is roughly twice of India's production.

A daily turnover of even 1,000 contracts would be low, in international terms. Nevertheless, there are a few futures markets which are considered sufficiently liquid

by trade participants and which trade, on average, 500 to 1,000 contracts a day: for example, the New York domestic raw sugar market; the Paris white sugar market; the New York orange juice market; or the Singapore rubber market.

In terms of likely liquidity, a new internationally-oriented pepper futures contract would thus be uncertain. While it is not impossible that sufficient market liquidity will be reached, participation will need to be maximized in order to make this likely. This implies, *inter alia,* that the contract will need to draw participation from a wide group of potential market users from as many countries as possible.

Possible speculative interest will be discussed under point 6. With regards to hedging interest, potential users include farmers; farmers' organizations; various domestic and exporting traders; importers, including grinders; and government agencies. Their price risks have been discussed above. The other group which was examined further in terms of potential interest in futures trade were exporters.

In Indonesia as well as Malaysia, most of the larger pepper exporters are also exporters of coffee, and actively use the robusta futures contract in London through brokers in Singapore; many have access to Reuter screens. While on the one hand, this reduces their dependency on pepper and thus increases their capacity to take risks in pepper trade, on the other hand, this should give them the knowledge and the motivation to use a pepper futures contract, once established. Large Malaysian exporters indicate that liquidity would be the main issue for considering use of such a contract.

2. The standardization of pepper trade; the storability of pepper

While storability of pepper appears to be no problem, the standardization of physical pepper trade is still not complete. This makes it essential to analyze physical trade practices and determine the most common denominator.

For a commodity futures contract to be viable, codified standards that govern trade, must be available, especially for commodities that have premiums and discounts for different deliverable grades. If not, the delivery process will start to wreck havoc with the price formation process on the exchange and the exchange will be used as a dumping ground for unwanted qualities. It should be noted that while the ability to physically deliver commodities is not an essential argument for potential futures market users, there are futures contracts without delivery possibilities. For example in Malaysia, Sabah palm oil producers actively use the Kuala Lumpur market, even though all delivery locations are on peninsular Malaysia. Nevertheless, delivery specifications can play a major role in preventing manipulation and in assuring that futures market prices truly reflect physical market conditions.

In the major importing countries, there is a general move towards codified standards, with the ASTA grade as a minimum requirement. In the United States,

this is the only legal minimum standard. Nevertheless, it is still not the standard grade of international pepper trade — indeed, a large part of pepper production does not conform to ASTA standards. A pepper futures contract would have to define the ASTA grade as the minimum deliverable quality; premiums would have to be determined for eventual superior qualities. But at the same time, in order to prevent market squeezes due to a lack of deliverable quality, efforts need to be made to upgrade pepper production to ASTA standards. It is probably preferable to make only black pepper deliverable, not white pepper, even though the market would want to attract white pepper producers, traders and buyers as hedgers.

3. Pepper pricing

In order for a futures market to provide a viable price discovery and risk management mechanism, the pricing of both the futures contract and the underlying physical commodity must be determined by free market forces, without monopolistic or government control.

Pepper trade is concentrated, but not more so than trade in other soft commodities in effect, concentration appears to be somewhat lower for sugar and coffee. On the side of importers, three European trading companies account for one third of world trade, and there is also one major United States buyer. But there are some 40 other American buyers, 3-5 large buyers in the Netherlands market, 3 large buyers in Germany, some 10-15 small buyers in the United Kingdom market, a dozen Japanese importers, and dozens of importers in the Republic of Korea, Pakistan and Spain.

On the side of exporting countries, concentration is also fairly strong. In Indonesia, where there are 34 registered exporters of black pepper, six traders account for 80 per cent of black pepper exports from Lampung. In Malaysia, there are about 15 pepper exporters. In Singapore, there are 10-15 exporters, some of which have offices in Sarawak. With this kind of concentration, the chances of success of a domestic pepper futures contract in, for example, Indonesia or Malaysia are rather remote.

Government intervention in pricing is a major problem only in India, where it is a major hindrance to the well-functioning of the pepper futures market. This problem needs to be resolved before this market can become useful for international participants.

4. Pepper price volatility

As noted before, the volatility of pepper prices is high, one of the highest of all agricultural commodities. Hence, price risks are sufficiently large to warrant risk management strategies.

5. Support by major commercial interests

Information about support by the major commercial interests, in particular, the main importers is scarce. Before launching an international pepper futures contracts,

an explicit commitment of the importers to use these contracts will be necessary. Among the main exporters, many have experience in the management of price risks for coffee, cocoa and other crops, and therefore have the capacity and the contracts necessary to use an eventual pepper futures contract. Exporters in Malaysia and Indonesia have expressed their interest in a pepper futures exchange.

6. Support by the speculative community

Support by the speculative community depends, firstly, on the contract's liquidity, and secondly, on the extent of price volatility. Large speculators are likely to remain absent due to a probable low liquidity; but smaller speculators and floor traders are likely to be interested as shown by the fact that in India, a large share of turnover is by speculators.

7. Services and infrastructure facilities.

The availability of the necessary facilities for futures trade, including administrative capacity, warehousing, clearing services, data processing and telecommunications, is one of the essential aspects to be taken into account when selecting the site for a futures market and its service centers. Market participants must also a have confidence in a exchange's governing board, in that it represents a balanced and neutral view. For instance, Malaysian exporters rule out Kuching as a site for a futures market because of the town's poor infrastructure.

Another aspect is the likely participation in the exchange. Again, Malaysian exporters, even though the Kuala Lumpur Commodity Exchange has all the necessary infrastructure and skills to introduce and operate a pepper futures contract, feel that in Kuala Lumpur there are not sufficient potential domestic users, also taking into account the decline of Malaysia's role in black pepper trade. In Jakarta as well, exporters feel that liquidity would be too low (Singapore appears to be the preferred location of a commodity exchange for Indonesian exporters).

Concerning exchange warehouses, these have to be located so that they are in the natural "flow path" of the physical commodity, and they need to be capable of handling adequate volumes. This is essential in order to ensure that cash and futures prices converge. The delivery location thus is a problem. Currently, most contracts appear to be 1-2 month forward contracts, C and F.[6] Hence, it would appear to make most sense to install the exchange warehouses in the **importing** countries, not in the exporting countries (there are also a number of theoretical arguments indicating that this would help to keep prices up, as the market cannot be used as a market of last resort for producers); delivery would then be on a CIF basis, relatively close to C and F standards. Hence, an exchange in India, Malaysia, Indonesia or any other country in the region would have to contract warehouses in Europe and the United States. This

[6] There are some exceptions, e.g. for sales from Sarawak to Singapore or Egypt (on a prompt basis), and for sales from Sarawak to the United States (5-6 months forward).

is not a novelty as exchanges regularly have warehouses in other countries. As an example, the Manila International Futures Exchange accepts only Japanese delivery locations for some of the commodity futures contracts it trades.

8. Government support for pepper futures trade

There are two aspects to governmental support for pepper futures trade. First, the market must have confidence that the futures market's host government will not interfere with the "price discovery" mechanism of the market. Therefore, the market must be located in a country with a stable government that is not subject to sudden shifts in regulatory policy. Second, governments should not unnecessarily interfere with the risk management transactions of its producers, traders and others; that is, it should not unnecessarily restrict movements of goods and finance. Nor should there exist other obstacles which prevent the use of foreign risk management markets (e.g., non-convertibility of currency).

The first aspect would be of large concern if the international futures market were to operate in India under the same conditions as those governing the current domestic futures market. The Indian government has a large discretionary power over the functioning of the exchange, including the possibility to prevent the trading in certain contract months, and to impose price ceilings and floors. Even though the government may not use this discretionary power often, foreign participants may be hesitant to take the risk of government intervention. This risk also arises out of possible government actions in the physical market. For example, in April 1993 when prices stood at 26 Rs/kg, the government started buying at 33 Rs/kg. It appears that if futures markets in India are to play an international role, the Indian government will have to adapt its regulatory policies to a model more similar to that followed by, for example, the Malaysian and Singaporean governments. In Malaysia and Singapore, the regulatory framework is relatively well-suited to the functioning of internationally-oriented futures exchanges. In Indonesia, some problems remain, which could to a large extent be resolved through new draft legislation which is now under discussion. Thus, from the point of view of regulatory environment, Malaysia and Singapore would be well suited for a pepper futures market although sufficient liquidity may only be obtained if such a market is linked to the Indian one. In Indonesia, the proper conditions may be created soon, but in India the government would have to review its interventionist policies towards futures markets in general in order to allow the present pepper futures market to play an important international role.

In some countries in the region, there are no real problems concerning the use of futures markets. In Malaysia as well as Singapore, for example, the government has a favourable approach towards price risk management, and the movement of funds for risk management purposes is not restricted. In Indonesia, the movement of funds for risk management purposes is not forbidden, but there are some other major regulatory barriers. In particular, the lack of proper brokerage regulation. Without an Indonesian brokerage network, medium-sized entities (including farmers associations) will be

unable to use a foreign exchange because they will not be able to develop and maintain contacts with foreign brokers (which involves, among other things, the maintenance of a foreign bank account). In Thailand, the legal status of margin payments is not clear — thus Thai companies are forced to find innovative ways to finance their operations on futures exchanges. This is no real obstacle to large, experienced companies, but may hinder the participation in a pepper futures market by smaller entities. In India, capital flows are also strongly restricted, which again would make the use of foreign futures exchanges very difficult as foreigners are also banned from using Indian futures exchanges. In Brazil, the main potential obstacle to the use of an eventual pepper futures market is the policy of the Central Bank. It appears that exporters need permission from the Cartiera do Comercio Exterior, a branch of the Bank of Brazil, to export pepper, and that this permission is not given when the export price is below a certain minimum export price (which is linked to current market prices). If a contract is hedged, the effective export price (corrected for the results of hedging) may be below this price (as would also be the case for fixed-price forward contracts). Under this condition, and without a specific exemption for risk management transactions, it would be difficult for Brazilian producers and exporters to manage their price risks.

H. Conclusions, and plan of actions

Price risks in the world pepper economy are large. Pepper is one of the most volatile commodities traded internationally, with prices more often than not changing by more than 5 per cent from one month to another. This creates large risks for farmers, traders, and buyers of pepper, as well as governments intent on protecting their farmers' incomes. Farmers run large risks because they do not know what price they will receive for the pepper they are producing — current prices offer meager guidelines for decisions on the allocation of labour or on the purchasing of inputs. Traders often carry large inventories, the value of which can be significantly affected by price changes, and moreover, are often forced to enter into uncovered fixed-price forward contracts for relatively long durations, which puts them at the risk that prices will increase before they can cover their physical obligations. Buyers of pepper try to a large extent to lay off their price risks to the producing countries (through longer-term fixed-price forward contracts), but this is an imperfect protection, and also, exposes them to the risk of counterpart default. Governments occasionally feel obliged to make up for the deficits of their country's pepper sector when there are large price declines, at often high costs. In conclusion, without the existence of a risk management market, the production and trade of pepper is quite a speculative undertaking.

Objectively, there appears to be a need for a risk management mechanism. Such a mechanism can come in the form of intergovernmental control over production and prices, e.g. through production management schemes and coordinated pricing policies. However, such arrangements are notoriously difficult to negotiate and to implement. Action also needs to be given to the creation of a mechanism which allows the various actors in the pepper economy to lay off their risks to the extent that they wish; that is, a pepper futures market.

Econometric analysis appears to show that there is truly one international pepper market which covers all major origins and both black and white pepper. Hence, one pepper futures market would be in a position to meet the risk management needs of all those exposed to pepper price risks, irrespective of their country of origin. A further argument for an international pepper futures market, rather than a series of independent national markets, is that the physical transaction volume is relatively limited. Rough estimates would indicate that if all of world market trade is accumulated, just enough volume would exist to support a futures market.

Thus, it seems that the way forward is to evaluate whether such an international pepper futures contract is viable, and if so, how it can be organized in such a way that a maximum number of participants is tapped.

The conditions for a successful futures contract have been examined in section G above. As mentioned already, it appears that liquidity can be sufficient, but only if a large cross-section of the pepper market is in a position and is interested in using the market. Many of the larger traders (who often take the initiative in getting a futures market off the ground) have the necessary prior knowledge on futures market trade, are interested in using risk management markets (as shown by the fact that they use futures contracts for the other commodities that they trade), and have indicated that a pepper futures market would, for them, be an attractive idea. Some other potential users, in particular farmers' organizations and state entities, need a change in their status before they would be legally allowed to use futures markets. In particular, they will need to develop guidelines for a prudent use of futures markets and for preventing their traders from speculating on these markets (such guidelines, developed for entities trading commodities other than pepper, exist and are available). It is difficult to estimate possible speculative interest, but it should be noted that the speculative pool of money in the region is rather large, and that the experience of the Indian futures market would tend to indicate that pepper, with its high price volatility, is indeed interesting to speculators.

Contract specifications may be a problem. Futures markets need to follow the habits of the physical market to large extent. This would appear to imply a CIF contract, with warehouses in the consuming countries. In this context, it should be noted that the existing Indian futures market operates on an FOB basis. Also, quality standards need to be sufficiently high (ASTA standards appear a logical choice) to avoid the use of the exchange as a dumping ground, which would depress prices. However, currently too little high quality pepper is produced, and this would pose the risk of delivery squeezes. This aspect needs further study, and it would appear that an effort should be made to upgrade quality. Once a futures market exists, there will automatically be an incentive to improve quality, as non-deliverable grades normally trade at relatively large discounts to deliverable commodities.

The practical organization of the exchange could also pose some problems, including government policies. An international pepper futures market could be structured in

two ways: first, by internationalizing and upgrading the pepper contract presently traded on the Kochi pepper futures exchange, and then creating the means of international access to this futures market; or, alternatively, by opening up trading floors for pepper futures contracts in more than one country and linking these through electronic means. Given the limited size of the pepper market, it is highly unlikely that more than one pepper futures exchange can operate effectively at any one time. A domestically-oriented futures exchange for pepper already operates in India, and any plans for a new international pepper futures contract need to take the existence of this exchange into account. A new, independent pepper futures exchange in, for example, Malaysia or Singapore will only have a chance of surviving if it makes the Indian exchange obsolete. The likelihood of such an aggressive, competitive approach succeeding is small, and hence, not further discussed in this report.

The first option would imply some modifications in the current Kochi pepper futures contract (of which changes in delivery and quality specifications might cause the largest problems). International experience would tend to indicate that opening an international pepper contract next to the existing domestic pepper contract would have little chance of success, as existing market users will prefer to remain in the more liquid domestic market. More importantly, the Indian market needs to be opened up to foreign participants. Necessary measures would include the freeing of capital flows linked to risk management (models on how to do this without losing full control over capital flows are available from other countries) and the creation of a brokerage network which links the Indian market to foreign brokers, and thus, potential clients. The exchange would have to contact Reuters and other large quote vendors to ensure that prices are instantly distributed worldwide. Infrastructure in Kochi would need to be sufficiently well-developed to support international telecommunications. Also, a large promotional effort would need to be made to convince South-East Asian traders and others to use the Kochi market.

While this option could conceivably work, it is not clear whether South-East Asian traders are ready to use a futures market in India in a direct manner, placing orders through brokers. Geographical distance would create a lack of close experience with the functioning of the Indian exchange, and hence (even if the market functioned perfectly and equitably, with a minimum of government intervention) a lack of trust in the operation of the exchange. To ascertain whether this would be so, more study is necessary. Therefore, it may be worthwhile to contemplate a second solution, in which a proper trading floor would be established in one of the South-East Asian countries, for instance in Kuala Lumpur or Singapore as part of the commodity futures exchanges existing there. Traders and others in Indonesia, Malaysia, Singapore and Thailand all have experience in using the Kuala Lumpur Commodity Exchange and the Singapore Commodity Exchange. They know how these markets function, trust the exchanges' management, and know how to use these markets, including how to identify brokers. If pepper futures contracts were to be traded at any one of these exchanges, there would be no real barriers to the trade in these contracts by South-East Asian companies. However, as discussed above, the likely liquidity of a contract without Indian participation

is low. Therefore, the logical idea is to link up with the Indian exchange, trading the same contract on what would effectively be one global market with two trading floors. There already exist such markets, and the necessary expertise, information and software to operate such a market are available. With a trading floor in South-East Asia, it would also be easier to attract Brazilian interest: Brazilian producers would be able to tap into Singapore's or Malaysia's brokerage network (indirect links already exist for trade in palm oil and rubber futures contracts). Again, pursuing this option would appear to rely on the willingness of the governments in the region to support this initiative, and in particular, the lifting of regulatory barriers which currently impinge on the international participation in futures markets, including capital controls.

ANNEXES[7]

Annex 1

Table 1. Short-term instability based on weekly prices from January 1992 to December 1993

Country	Weekly instability index
FOB black pepper price	
Brazil	18.8
Indonesia	24.6
India	15.4
Malaysia	23.6
FOB white pepper price	
Brazil	20.2
Indonesia	41.7
Malaysia	36.5
Type of pepper	
CIF black pepper price	
Sarawak	
Netherlands	22.3
Germany	21.3
United States	18.1
Japan	22.7
Lampung	
Netherlands	18.7
Germany	20.8
United States	18.3
Japan	7.4
Malabar	
Netherlands	14.2
Germany	16.2
United States	16.1
Japan	15.9

[7] Table 1 to table 6 are UNCTAD secretariat calculation based on data provided by the International Pepper Community and by (IPC) and by the International Trade Center (ITC).

Annex 2

Table 2. Coefficient of correlation of FOB price of black pepper among different origins

(The period analysed is 1970-1992)

	Year	Brazil	India	Indonesia	Malaysia	Thailand
Brazil	1970-1992	100	90	96	97	–
	1970-1980	100	87	95	94	–
	1981-1992	100	92	96	97	95
India	1970-1992	–	100	95	94	–
	1970-1980	–	100	84	78	–
	1981-1992	–	100	98	98	96
Indonesia	1970-1992	–	–	100	99	–
	1970-1980	–	–	100	93	–
	1981-1992	–	–	100	99	97
Malaysia	1970-1992	–	–	–	100	–
	1970-1980	–	–	–	100	–
	1981-1992	–	–	–	100	98
Thailand	1970-1992	–	–	–	–	100
	1970-1980	–	–	–	–	100
	1981-1992	–	–	–	–	100

Table 3. Coefficient of correlation between black and white pepper in Indonesian, Brazilian and Malaysian

(The period analysed is 1970-1992)

	Indonesia	Brazil	Malaysia
Correlation from 1970 to 1992	97	98	98
Correlation from 1970 to 1980	88	98	98
Correlation from 1980 to 1992	97	98	97

Table 4. Coefficient of correlation based on weekly FOB prices from January 1992 to December 1993

Black pepper	Black pepper				White pepper		
	Brazil	Indonesia	India	Malaysia	Brazil	Indonesia	Malaysia
Brazil	100	88	80	90	66	84	85
Indonesia	–	100	85	92	73	90	92
India	–	–	100	84	72	78	81
Malaysia	–	–	–	100	63	91	93

Annex 3

Table 5. Coefficient of correlation of weekly CIF prices among different grade and markets, based on the period 1992/93

	Lampung				Malabar				Sarawak			
	Nether-lands	Germany	United States	Japan	Nether-lands	Germany	United States	Japan	Nether-lands	Germany	United States	Japan
Lampung												
Netherlands	100	91	95	38	91	87	90	86	96	94	94	91
Germany		100	95	35	94	91	93	85	96	96	95	94
United States			100	33	93	89	94	85	96	96	95	95
Japan				100	–8	–8	1	46	25	38	32	44
Malabar												
Netherlands					100	92	94	82	95	93	93	91
Germany						100	91	80	91	90	89	88
United States							100	84	93	93	93	92
Japan								100	85	88	87	89
Sarawak												
Netherlands									100	98	96	94
Germany										100	96	97
United States											100	94
Japan												100

Annex 4

Table 6. Cofficient of correlation between CIF prices for Lampung, Malabar and Sarawak quality in the different importing countries and FOB prices of the main producers of the type of pepper concerned

FOB prices	Netherlands	Germany	United States	Japan
CIF Lampung prices				
Indonesia	95	94	95	48
CIF Malabar prices				
India	93	90	92	74
CIF Sarawak prices				
Malaysia	95	95	90	90

IV. BLACK PEPPER FUTURES TRADING IN INDIA[1]

Established in the 1957, the Pepper Exchange in India has been conducting future trading in black pepper without any interruption since its inception. The contribution of this Exchange towards the development and improvement of pepper exports during its long innings of thirty-seven years has been extensive.

Black pepper futures trading was conducted in Bombay in an unorganized manner until 1944 when it was banned under the Defence of India Rule 1944. After the Second World War, the price of agricultural commodities increased by 3.5 times whereas the price of pepper rose by a staggering 36 times. On account of this, the Spices Enquiry Committee was constituted in 1953 to keep an eye on the black pepper prices.

The futures market in black pepper fulfills four vital requirements namely, hedging, stability, liquidity and price efficiency.

The principal justification for futures market in pepper is the facility of hedging. Since the price of pepper fluctuates widely and wildly, the risk involved in holding huge stock is very great. The buyers and sellers, therefore, enter into opposite sales and purchases in the futures market so that their loss in one market due to adverse price change is offset by the gain in the other. In times of shortage the need for hedging is more keenly felt by exporters and forward sellers. In a commodity like pepper, export sales are often made months in advance of actual shipments. Today the need for effective hedging by exporters has assumed significance in view of the importance of export promotion in our economic policies. Again, owing to severe competition from other countries, the exporters may not be able to keep big profit margins. In these circumstances, no exporter will generally prefer to bind himself to deliver abroad for long periods unless he is able to have a prior hedge against the possibility of either his commodity advancing in price locally or the sellers refusing to give him delivery.

The organized futures market takes care of both the contingencies and to that extent it serves as a useful instrument in export promotion. Through price forecasting and hedging, the futures market facilitates the even flow of goods from the period of peak season to that of lean months without causing violent variation in prices. In effect, contrary to the popular notion, a commodity futures market has a built-in mechanism for unpredictable shifts in marketable supplies. When supplies are plentiful the futures price invariably exceeds ready price by an amount approximating to storage

[1] Based on the paper prepared by Mr. T. Vidyasagar, President, India Pepper and Spice Trade Association.

cost and interest. This mechanism works inversely if there is a shortage of supply. Thus by transferring to some extent at least the minimum demand from the ready market to the futures market, it helps to arrest the galloping prices.

The futures markets give a high degree of liquidity. A futures market is generally broad and continuous in its operation in view of the presence therein of floor traders and speculators who are always ready to buy and sell commodities for a small "turn" in prices. Large quantities can be purchased and sold in the futures market with much smaller variation in the prices than it is possible if the operations have to be done in the ready market.

However, futures market not only attracts a large number of buyers and sellers handling physical commodities, but also encompasses considerable outside competition from those who have market information and price judgement but lack the necessary infrastructure to enter the ready market.

Since such people are solely interested in price changes, no effort is spared by them to gather every piece of important market information like changes in consumer purchasing power and personal taste, growth of alternative products, weather reports, reports of plant diseases and insect infestation, reports of arrivals and stock at different up-country and terminal point, crop reports from competing countries, etc. without loss of time. Futures prices are, by and large, economic prices determined under conditions of near perfect competition. Hence it is known as a barometer of real price.

Futures trading also known as hedge trading is a sophisticated risk management vehicle which assist farmers, town traders, commission agents, interstate dealers, exporters and end-users in their market operation of buying and selling commodities by protecting them from adverse price fluctuations. Historically, futures trading was developed because of a need felt by various trading interest in commodities to insure themselves against adverse price fluctuations in commodities acquired by them. To put it simply, futures trading does not involve buying or selling commodities, but merely entering into agreements or contracts to buy and sell commodities at a future date. There is no delivery, payment or change of ownership until buyer and seller decide to do so.

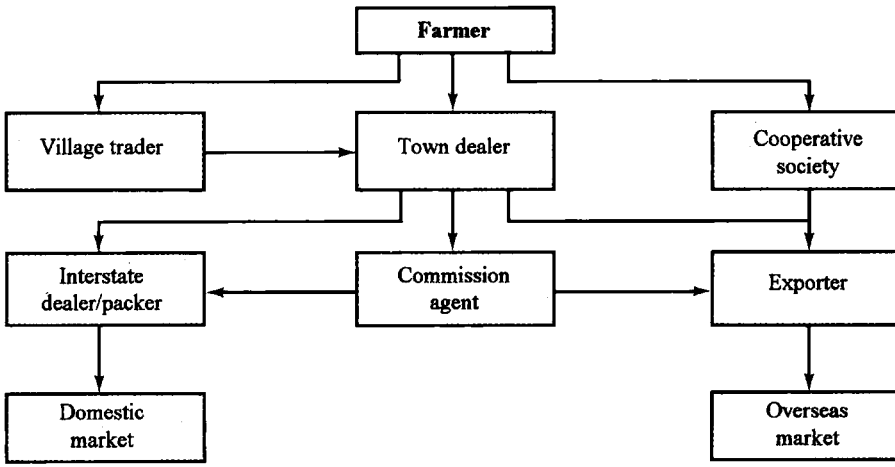
The development of futures trading in black pepper was mainly because of the risk involved by the exporters on their forward sales. Forward sales in pepper is entered up to six months and no insurance company has devised any mechanism to cover this risk. Financial futures and commodity futures are the two risk management mechanisms available to the exporter to cover his risks.

For the success of any Exchange, the commodity should be reasonably free from Government control. The production of pepper which was under the government control in the early days became free in the hands of small cultivators. Since 1957, the government came out with many levies on export of black pepper. On all occasions,

the government's decisions were sudden and it was in the futures exchange which rescued the exporters from unforeseen financial burdens.

There are six channels of trade prevalent in India at present. A chart depicting the trade channel is given in Figure 1.

Figure 1. Trade channels in India



Farmer — The average size of holding in Kerala is around 1 to 2 hectares. The yield per hectare is estimated to be 300 to 350 kgs. The state of Kerala where pepper is produced is the first state in India to attain 100 per cent literacy. There are farmers with reasonably large holdings that take advantage of the Exchange facilities.

Village trader — A village trader is the one who buys pepper from the farmer and sells it to the town trader. His operations are mostly on a back to back basis. Due to the minimum risk involved in his trading he does not utilize the Exchange facilities.

Town trader — A town trader is considered as the main artery between the terminal market and the upcountry market. He buys from the farmers as well as the village trader and sells to the exporter, interstate trader or the commission agent in the terminal market. Many upcountry traders are members of the exchange. He is prone to high price fluctuation and the Exchange is the only alternate source for him to cover the risk of his inventory getting reduced in value.

Commission Agent — A commission agent is considered as a market maker by the town traders. The town traders bring the goods to the terminal market and keeps it with the commission agent by taking a small advance. A commission agent

disposes the goods at the behest of the principal. While doing this function, a commission agent is exposed to the price risk. In case of adverse movement of price he will be forced to carry the inventory of the principal for a longer period, thus crippling his market activities and blocking his capital. In order to overcome this precarious situation he covers the quantity in the futures market and disposes the stock ending with a saving in capital as well as entertaining more physical commodities. He is also thus a beneficiary of the Exchange activities.

Interstate Dealer — An interstate dealer is the one who despatches pepper to the domestic market. His operations are mainly on buying against firm orders and hence profit margins are reasonably good. However, considering the price volatility of pepper, he can also face the consequence of adverse movement in prices. An interstate dealer also carries a minimum inventory.

Exporter — Export has been made a national goal. The government now is very keen on promoting the export of agricultural commodities. The emphasis is on promotion of export of agro based products. While this seems to be a good mission of the government, it has to be noted that production of agricultural commodities are still based on the uncertainties of monsoon. This being the case it would be in the interest of the export community as well as the nation to promote futures exchanges in as many commodities as possible. At present exporters are utilizing the Exchange to cover their forward sales. It would not be prudent for an exporter to cover his forward sales with physical inventory. An exporter's profit margin is very low and hence it would not be possible for him to cover his commitments by physical stocks especially in the light of the high cost of finance. All the leading exporters of black pepper are members of the Exchange.

Fuelled by the encouraging results that recent liberalization policies have brought to the Indian economy, the Government is now looking forward to opening up new sectors to overseas participation. A proposal has been made accordingly to the Government of India to upgrade the Pepper Exchange in India into an international one. A final decision in this regard is still pending.

The above analysis have been given only to highlight the useful functions of the pepper exchange and its various utility in the conduct of trade.

Annex 1

Salient features of the pepper forward contracts

Contract size	2.5 tons
Contract Month	January/February/March/May/July/August/October/December
Last Trading day of the Contract	15th of all Contract Months
Tender Periods	16th to 21st
Trading Hours	9.30 a.m. to 4.30 p.m.
Tenderable Variety	MG-I ASTA (SGS Certified)
Delivery points	Cochin, Alleppey, Calicut
Daily Price Fluctuation	Rs. 200 per quintal
Exchange Levy	Rs. 2 per contract
Margin Payable	Rs. 10,000 per contract
Limit on open Position	100 tons

V. MARKETING AND PROMOTION OF PEPPER[1]

A. International market situation

1. Supply and exports

Pepper, *piper nigrum*, both black and white, is a principal spice being traded in the international market. Majority is traded in whole, unground state, though in recent years there has been a significant increase in the trade of pepper oils and oleoresins from producing countries.

India, Malaysia (Sarawak), Indonesia and Brazil are the major producers and exporters of pepper, with the latter three countries supplying both black and white pepper. During the last three years, Viet Nam has emerged as the fifth largest producer and exporter of pepper. Other producers are Thailand, Sri Lanka, Madagascar, China and Costa Rica. The exportable production in 1992/93 reached an estimated 164,000 tons.

During the period 1988-1993, world exports averaged 147,000 tons annually. Following the high prices prevailing in the mid-1980s, production increased substantially during the subsequent years, thereby depressing prices drastically during 1991-1993 to unprecedented low levels. In the past, some 20,000 tons of pepper were consigned to the former Soviet Union and East European countries, particularly from India, under bilateral arrangements. With the break-up of the Eastern bloc countries and the lack of hard currency, imports into these countries have been reduced drastically, thereby leaving a vacuum which resulted in accentuating surplus supplies over demand.

Approximately 80 per cent of pepper entering international trade is black. Most of the pepper consumed in the household sector in Western European countries is white. Although market share varies from country to country, white pepper probably accounts for an average of 60 to 65 per cent of total annual pepper imports into Western European countries. However, there has been a tendency during the last five years to import greater quantities of black pepper.

Extraction of pepper oleoresin by using solvents began on a large scale in the United States and the United Kingdom during the 1960s. Extraction capacity was subsequently developed in Canada and Germany. Since the 1970s, however, production facilities, developed from local know-how, were increasingly located in the pepper producing areas, and plants are now found in India, Malaysia, Indonesia and Singapore. These four countries are believed to have an annual extraction capacity exceeding 1,000 tons. India is the largest producer and exporter of pepper oleoresin

[1] Based on the paper prepared by Mr. Fazli A. Husain, Senior Commodity Marketing Officer, ITC UNCTAD/GATT, Geneva, Switzerland

with the United States and the industrialized countries in Western Europe as its main markets. In 1993, the United States imported 287 tons of black pepper oleoresin valued as $US 2.9 million, of which 220 tons were supplied by India. Although the volume was higher, the value was considerably lower than the high of $US 5.0 million achieved in 1991. During the last five years, demand for pepper oleoresin has shown rapid increase primarily because of concern over bacteria levels by the food processing industry, in particular, the meat processing sector.

An important but low volume item entering international trade is green pepper. The major producers and exporters of green pepper are Brazil, Madagascar and India and, to a lesser extent, Thailand, Malaysia and Indonesia. World production is currently estimated at between 2,000 and 2,500 tons. The bulk of green pepper exports is canned in brine or some other preservative, although increasing quantities are also exported in dehydrated form or freeze-dried, particularly from India. Table 1 shows statistics on exportable production and exports of pepper from major producing countries.

2. Demand

Annual imports of pepper into the major consuming countries averaged 151,000 tons during the period 1990-1992 with a high of 168,000 tons in 1991.

The United States is the largest single market importing over 40,000 tons of pepper annually, during the last five years, with around 90 per cent being black pepper. The Western European countries together import over 50,000 tons annually, with Germany accounting for around a third of the total. The former Soviet Union and countries in Eastern Europe were significant importers, but since 1992, following the break-up, imports have reduced drastically. The rapid increase in consumer purchasing power in some Middle East and North African countries has given rise to a sharp increase in consumption of pepper in recent years. This was evident in the period when prices were low.

Pepper is the most important spice imported into most countries. The pattern of use of this spice is fairly well established. In the industrialized countries, the food processing industries, and in particular, their meat sectors, are the biggest users of pepper.

The sharp differences in the preferences of end-users have an important bearing on the purchasing decisions of importers. Although the white pepper from Brazil is not considered to be at par with that of Malaysia (Sarawak) or Indonesia (Muntok), several importers tend to prefer Brazilian white pepper on account of its clean appearance and uniform size. Spice extractors generally favour Lampung and Malabar black pepper from India.

At the consumer level, little attention is paid to the origin of supply; nor is there any attempt on the part of the producing countries to promote their quality of pepper

among consumers. Spice grinders and packers, therefore, hold that pepper from various origins are generally interchangeable (with adjustments in flavour strengths) and that the determining factor in selection is price.

Green pepper products, which total some 2,000 to 2,500 tons annually, are still considered as luxury items and thus have a limited market. Most green pepper is used by the catering sector to be served with steaks and in cheese and pate. Accounting for over three-quarters of the total market, preserved green pepper is the most popular type. Both preserved and dehydrated green pepper originate in the pepper producing countries while freeze-dried green pepper is produced mainly in Germany and Denmark and more recently in India.

The principal markets for green pepper are Germany and France. Other markets, though on a smaller scale, are the Netherlands, Sweden, Switzerland and the United States. Table 2 shows imports of pepper for the period 1980-1992.

3. Price trends

Pepper prices fluctuate substantially, largely because of variations in supply in major producing countries. These price swings were accentuated by speculative trading in the past, but this has been less evident in recent years. Pepper prices reached a peak during 1986/87. They declined to their lowest levels during 1991/92. Although prices picked up during the latter part of 1992, they are still below levels achieved in 1986/87. White pepper commands a price differential over black, but during 1990 and 1991, the spot price for white fell below that for black for the first time. This was because Indonesia, the largest producer of white pepper, produced a record 31,000 tons in 1991 as against 16,000 tons in 1986.

The continual wide price movements on the world market have had a disruptive effect on pepper growers. The high prices prevalent during 1986/87 encouraged planting, leading to over supply during 1991/92. This depressed prices to low levels during that period. Table 3 shows spot prices in New York.

4. Market access

The norms used to indicate quality specifications for pepper pose no particular problem in international markets. Description such as f.a.q., which are extensively used, generally correspond to accepted standards of quality that determine the purity required and the limits of extraneous specifications of the American Spice Trade Association, referred to as ASTA standards in trade circles. For instance, the Indian AGMARK grade MG 1 (Malabar Garbled 1) corresponds to the ASTA pepper standard (i.e., less than 1 per cent of light berries, 0-5 per cent of extraneous matter, and 11 per cent moisture).

5. Trading

The major trading centers for pepper are New York, Amsterdam/Rotterdam, Hamburg and Singapore. An estimated 20,000 tons of pepper still pass through Singapore, despite the general decline in spice transhipments through this entrepot center.

Trading is generally carried out by dealers operating in the above mentioned centers who buy pepper from producers or from each other on spot, afloat, or through future delivery contracts for eventual sales on the market. It is not uncommon for a "parcel" of pepper to change hands several times before it reaches the ultimate buyer. In recent years, however, significant changes have taken place in the structure of the pepper trade. Direct contact between exporters in the supplying countries and importers in the consuming markets has been increasing and most major spice packers have established their own buying arrangements with the sources of supply.

Major dealers in the importing countries are now getting closer to the end users to emphasize their "service" function in the market, as distinct from pure speculative trading.

6. International development and outlook

At the international level, the traditional pepper producers, India, Malaysia and Indonesia, formed the International Pepper Community (IPC) in March 1972 to promote, coordinate and harmonize activities of the pepper industry with a view to achieving maximum economic development. Brazil joined the Community in 1981, and Sri Lanka and the Federated States of Micronesia joined as associate members in 1992. The headquarters of the IPC secretariat is in Jakarta, Indonesia.

World trade of whole pepper is likely to continue to increase at a steady rate over the next few years. The traditional markets of North America and Western Europe are expected to maintain their moderate growth rate in demand. On the other hand, there is potential for increased imports in the Middle East, former Soviet Union and Eastern bloc countries.

The use of pepper oleoresins in developed markets, with a small number of exceptions, appears to be depended on end-user requirements. Current oleoresin extraction capacity in pepper producing countries alone covers market needs, and consequently, further investments in extraction capacity should be viewed with caution.

B. Promotion

1. General

Promotion of spices is mainly confined to point-of-sale advertising, such as the display counters at retail outlets, on behalf of brand names by individual spice processors and packers.

On the producers' side, promotional efforts have been extremely limited. For example, the erstwhile Spice Export Promotion Council in India and now the Spices Board of India, have collaborated with the American Spice Trade Association on publicity programmes for pepper. One of the main functions of the Pepper Marketing Board in Sarawak has been the promotion of pepper in overseas markets.

Although pepper is a spice that is universally known and used, data suggest that there may be a scope for further expansion in demand, e.g. in countries where per capita consumption is at present low, and in the convenience food and industrial food processing sectors. National promotion activities, whereby the product of a single producer country is promoted, could be complemented by a multinational campaign. The International Pepper Community (IPC), with technical support from the International Trade Centre UNCTAD/GATT (ITC), could be the body under whose aegis such a cooperative venture on behalf of pepper and pepper products could be initiated.

2. ITC proposal

At the request of the member countries of IPC, ITC presented a proposal/outline of "Formulation of an Export Development Project for Pepper and Pepper Products: Promotion" in 1986. The proposal is found in Annex 1.

C. Conclusions

1. In view of the imbalance between supply and demand, expansion in production should not exceed 4 per cent per annum — in line with the annual rate of growth in consumption — from present levels and thereby reduce/minimize wide price fluctuations.

2. To make available to IPC more accurate and timely production statistics by member countries in order that any analysis and forecasts can become more meaningful.

3. Take steps to widen the membership of IPC by endeavouring to include Viet Nam since that country has emerged as the fifth largest producer of pepper.

4. Resurrect the promotion programme and initiate activities to introduce a campaign — even on a limited scale — within 1 to 2 years.

5. Strengthen the professional capacity of IPC and introduce an annual work programme to meet specific needs of member countries.

Annex 1

The ITC Proposal

ITC presented the following proposal/outline of "Formulation of an Export Development Project for Pepper and Pepper Products" in 1986. It was determined that countries selected within the framework of the project should be selected on the basis of two key criteria:

1. To select markets where it should be possible for a suitably defined and executed programme to achieve visible and, ideally, measurable results; and

2. To select markets from which more generally applicable lessons might be learned.

With regard to these criteria and the known characteristics of import markets for pepper, it was proposed that the project should concentrate on two markets in developed countries, and one developing country market. The chosen countries were the United States, Germany and Turkey. In addition, the Netherlands and the United Kingdom were included because of their important role in certain aspects of the international market for pepper. The reasons for this selection of markets were as follows:

United States

The United States is the largest single importer of pepper, importing an average of some 40,000 tons annually. In addition, it has several key characteristics that can influence and guide any promotional programme for pepper:

- It is a lead market for many mass consumption markets, especially for processed and packaged foods.
- It is a market that is especially receptive to new ideas.
- It is the home market of many international food corporations, both in manufacturing and the food service industry. It is, thus, a "taste leader" on a world-wide basis.
- It is one of relatively few markets where there is a long-established programme of generic promotion for herbs and spices, from which lessons may be learned.

Germany

Germany is the largest Western European market for pepper, and in spite of the relatively high per capita consumption the market has grown in volume since 1975.

Within the market, significant changes in market structure are occurring, and it is important that the strength of this large and growing market for pepper should be maintained in these changing circumstances.

United Kingdom

As has been noted in the ITC spice surveys, United Kingdom initiated the development of the use of pepper oleoresins, a market sub-sector that, in the late 1970s, showed signs of rapid development. It was considered desirable, therefore, to investigate subsequent developments in this sector.

Netherlands

In the Netherlands are the two largest pepper importers in Europe, with world-wide interests in pepper handling. These companies are, therefore, important sources for an overview of trends in the market.

Turkey

The selection of a single developing country inevitably raises wide-reaching issues of the extent to which conclusions may be generalized to other markets. With this in mind, Turkey was selected because it qualified against a selection of relevant operational criteria:

— A medium level of per capita GNP among developing countries;

— A small but growing processed food manufacturing industry with ambitions to export;

— A significant but not a typically high level of pepper consumption;

— A national cuisine in which pepper has a role;

— Not a producer of pepper.

A. Project focus

1. Developed markets

A key characteristic of developed country food markets is a shift in consumption from in-home to catering outlets and towards processed food products. This shift affects, naturally, the place and nature of pepper utilization.

This means, in marketing terms, that decisions to use pepper, and how much to use, have particularly shifted, and are still shifting, from the individual consumer to executives in manufacturing or food service companies. There is clearly a need to ensure that this change in the location of decision-making does not lead to a decline in pepper consumption.

The project has, therefore, concentrated to a large — but not exclusive — extent on the "industrial" uses of pepper rather than the retail consumer markets, in the developed country markets.

2. Developing countries

Generally, in developing country markets, and Turkey in this instance, the situation was expected to be rather different, even though trends might be similar. The project has, therefore, had to cover the whole spectrum of the market in order to identify positively in which sector or sectors of the market promotional activity for pepper might most effectively be deployed for the longer term.

B. Considerations affecting pepper promotion

In major import markets for pepper, the pattern of consumption is relatively complex, in terms of processing and marketing channels, and end-users include consumers, processed food manufacturers and catering establishments.

This complexity of the market makes it relatively difficult both to define market development and promotional programmes that could lead to significant volume increases in pepper consumption, and to measure the results of any such activity.

Measurability is, in any event, going to be a problem, given the lack of any adequate measure of consumption beyond import figures, which fluctuate widely, since the stocking policy of importers enables them to vary the volume of imports in response to the sharp upward price movements that result from production shortfalls. These fluctuations in import levels tend, however, to equalize over time.

This consideration serves merely to emphasize an important and fundamental point about any promotional activity that may be undertaken for pepper. For any food commodity with a more or less established usage pattern, consumption levels are slow to change (relative to any established trend). This means that a promotional campaign has to be seen as a long-term commitment. Not only may results be hard to discern in the short term but, more importantly, the effects of a successful campaign are cumulative; while a single year's effort will be forgotten, a 5-year campaign can have an effect far in excess of what may be expected from a single year.

C. Possible sources of financing

Pepper is a commodity with a relatively high price per ton and relatively modest requirements in terms of potential promotional budgets. For example, the commitment by producer countries of as little as $US 5.00 per exported ton would yield over $US 500,000, and could be expected to attract, at least, matching funds from donor sources.

It is strongly recommended that IPC should adopt an export levy on these lines as a major contribution to pepper market development, and should recognize that this must be a commitment for the longer term. Without this commitment, it is unlikely that international agencies and donors will be willing to support this type of activity.

D. The proposal programme: activities and budgets

Promotional programmes proposed for pepper in the United States and Germany are set out below.

1. Activities

The proposed objectives and programmes are as follows:

(a) United States

Objectives: To increase the average rate of growth of consumption of pepper from 2-3 per cent annually to 4-5 per cent, representing an increase of some 500-700 tons annually.

Focus: Promotion to food technologies in food service and food processing industries, with the aim of increasing and maintaining their knowledge and awareness of pepper.

Limited additional activity directed against consumers if funds permit.

Activities: A combination of activities using specialist journals and direct contact with relevant executives in food service and food processing companies.

Content: An emphasis on pepper's value as an acceptable, completely natural source of enhanced flavour — especially important in a market where a reduction in salt in the diet is widely recommended.

(b) Germany

Objectives: To sustain the growth of pepper consumption at a rate of 1-2 per cent per annum over the longer term representing an increase over anticipated volumes of some 300-500 tons annually.

Focus: Promotion to key executives in the food services and food processing industries, to ensure that pepper is fully utilized in developing sectors of the market.

Activities: A combination of activities involving principally specialist journals, direct mail, and participation in seminars. In addition, participation in biennial ANUGA trade fair.

Content: An emphasis on pepper's value as a traditionally acceptable natural, safe source of enhanced flavour: an essential part of quality cuisine.

2. Budgets

Annual budgets for the programmes will depend, ultimately, on detailed discussion with the publicity agencies appointed to handle the campaigns.

On an annual basis, however, the indicative budgets for the two markets and the necessary administrative support are as follows:

		$US '000
United States:	Food service	100-150
	Food processing	60-75
	Consumer	75-100
	Fees to ASTA	50
	Total	285-375
Germany:	Press relations	50-75
	Leaflets, etc.	10-15
	Mailings	10
	ANUGA (biennial)	50-60
	Total	120-160
Other costs:	Travel	30
	Misc.	25
		55
	Grand Total	460-590

Over a five-year period, the budget for these two countries would total a minimum of $US 2.3 million, and more realistically $US 2.95 million. However, a more modest programme could be developed to meet a reduced budget.

E. The future development of the programme

Given the levels of budget set out above, and the proposed method of financing this budget through a combination of a levy in exports plus donor funds, there is evident scope for a more extensive programme of activity, though it seems clear that effective activity of this kind for pepper must remain confined to, at most, a relatively small group of markets.

The next stage of pepper development programme is likely, therefore, to involve:

1. The extension of activity to one or more developed countries with medium per capita consumption — for example, France and Italy;

2. Investigation of one or more other developing country markets.

Unfortunately, there was no commitment from the member countries of IPC and the project was not implemented even on a modest scale.

It is now time to reconsider the above and take steps to implement a promotional programme albeit on a limited scale.

Annex 2

Table 1. Exportable production and exports of major producing countries ('000 tons)

	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1887/88	1988/89	1989/90	1990/91	1991/92(P)	1992/93(F)
Exportable production												
Brazil (1)	42.4	40.0	19.0	32.5	24.0	22.0	24.0	26.0	28.0	33.0	45.0	24.0
India (2)	25.0	31.5	24.0	13.0	50.0	31.7	52.0	28.0	45.0	25.0	35.0	25.0
Indonesia (3)	38.0	38.0	30.0	25.0	16.0	25.0	30.0	35.0	45.0	48.0	45.0	63.0
Malaysia (4)	25.0	21.0	18.0	17.0	16.0	16.0	18.0	19.9	25.0	32.0	29.0	23.0
Viet Nam	..	..	..	..	..	..	..	..	..	..	12.0	21.0
Other (5)	4.0	4.0	6.0	9.0	10.0	9.0	7.0	7.0	15.0	17.0	6.0	8.0
Total	**134.4**	**134.5**	**97.0**	**96.5**	**116.0**	**103.7**	**131.0**	**115.9**	**158.0**	**155.0**	**172.0**	**164.0**
	1982	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992(P)**	**1993 (F)**
Exports January/December												
Brazil	46.1	30.4	37.2	24.6	22.1	24.7	23.5	27.7	28.0	47.7	25.7	20.0
India	20.2	27.5	24.1	19.0	49.3	31.7	46.3	25.1	36.2	20.1	19.4	40.0
Indonesia	36.3	45.0	33.8	26.2	29.6	30.0	41.5	42.1	47.7	46.0	61.4	25.0
Malaysia	24.8	23.3	16.4	18.9	15.3	14.0	18.4	25.5	29.2	26.7	23.0	18.0
Viet Nam	0.1	0.1	0.2	1.3	3.1	4.3	2.6	7.6	11.0	16.3	22.4	17.0
Other	3.3	6.4	8.8	9.2	8.4	3.7	4.4	5.4	7.0	–	8.0	8.0
Total	**130.8**	**132.7**	**120.5**	**99.2**	**127.8**	**108.4**	**136.7**	**133.4**	**159.1**	**164.3**	**159.9**	**128.0**

(1) Crop year August/July.
(2) Crop year November/October.
(3) Crop year July/June.
(4) Crop year May/April.
(5) Thailand, China, Madagascar, Sri Lanka, etc.
(P) Preliminary.
(F) Forecasts.

Annex 3

Table 2. Gross imports of pepper by major consuming countries, 1981-1992 ('000 tons)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992(P)
Germany (1a)	13.8	14.0	15.6	15.5	14.3	15.5	15.7	16.3	18.6	18.5	17.6	16.0
France (1)	7.0	7.7	8.2	7.6	8.0	7.9	8.9	10.7	11.5	9.2	8.7	8.7
Netherlands (1)	1.7	1.7	3.1	2.1	2.7	3.9	4.2	3.8	6.5	7.5	6.5	9.2
Italy	2.5	2.8	3.1	3.3	3.2	3.4	3.1	3.7	3.1	3.8	3.5	2.9
United Kingdom (2)	3.7	4.2	4.5	5.0	3.6	3.5	2.9	3.9	4.7	4.6	4.5	4.7
Belgium-Luxembourg	2.0	1.9	1.7	2.2	2.2	2.7	3.7	2.2	2.9	3.0	3.1	2.7
Spain/Portugal	1.6	1.8	1.9	1.8	1.9	2.5	2.3	2.3	2.4	2.8	2.4	2.5
Scandinavia	1.9	2.2	2.1	2.0	1.8	2.3	2.3	2.1	2.1	2.6	2.9	2.9
Others (3)	2.8	3.0	3.0	2.7	3.1	3.0	3.0	2.4	2.7	3.3	3.2	3.2
Total Western Europe	**37.0**	**39.3**	**43.2**	**42.2**	**40.8**	**44.7**	**46.1**	**48.6**	**56.0**	**56.5**	**52.4**	**51.0**
CIS	14.1	13.4	13.3	13.1	13.8	16.0	12.3	15.2	17.4	14.9	14.0	2.5
Poland	2.8	2.5	2.0	1.6	2.4	1.8	2.0	2.7	1.3	0.6	0.9	2.0
Hungary	1.4	1.2	2.3	1.4	1.7	2.2	1.7	1.4	1.8	1.7	1.6	1.8
Others (4)	4.6	4.1	4.1	2.3	3.1	4.3	3.5	5.4	3.2	3.0	2.8	3.5
Total Eastern Europe	**22.9**	**21.2**	**21.7**	**18.4**	**21.0**	**24.3**	**19.5**	**24.7**	**23.7**	**20.2**	**18.2**	**9.1**
United States	31.3	30.5	31.5	38.1	32.2	41.3	36.3	31.6	37.8	39.4	44.7	46.6
Canada	2.6	2.9	3.0	2.8	2.7	3.0	2.7	3.5	3.1	3.5	3.4	3.9
Total North America	**33.9**	**33.4**	**34.5**	**40.9**	**34.9**	**44.3**	**39.0**	**35.1**	**40.9**	**42.9**	**48.1**	**50.5**

Table 2 *(Continued)*

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992(P)
Japan	5.2	4.7	5.1	5.2	5.7	5.6	5.6	6.1	5.9	6.7	6.1	7.3
Australia	1.3	1.3	1.4	1.5	1.7	1.7	1.7	1.6	1.6	1.6	2.0	1.6
Saudi Arabia	3.9	5.4	5.3	4.9	4.5	5.1	6.5	4.5	2.6	2.2	2.1	2.0
Turkey	1.0	0.6	0.8	1.3	0.5	0.8	0.8	1.2	1.1	2.1	2.0	2.0
Egypt	2.9	2.9	4.9	2.6	1.1	3.1	1.6	2.7	1.9	3.1	4.9	4.2
Morocco	2.7	3.7	2.7	2.8	2.1	2.1	2.0	1.6	3.0	3.1	5.2	5.5
Pakistan	1.8	3.3	2.5	2.2	3.2	1.9	1.6	1.2	2.1	3.0	3.8	4.4
Argentina	2.3	1.8	1.3	1.5	0.7	0.9	1.7	1.0	1.3	1.3	1.8	1.8
Others (5)	20.0	16.0	17.7	8.1	8.0	6.2	7.7	12.8	15.8	35.1	37.3	40.1
Total world	**134.9**	**133.6**	**141.1**	**131.6**	**124.2**	**140.7**	**133.8**	**141.1**	**155.9**	**177.8**	**183.4**	**181.4**
Re-export												
France	0.3	0.8	0.5	1.1	1.8	0.9	1.7	2.3	5.3	2.3	1.0	0.4
Germany	0.5	0.3	0.5	0.8	0.9	1.0	1.5	1.4	1.7	2.0	1.7	1.0
Netherlands	0.4	0.5	2.0	0.8	1.2	2.4	2.7	2.1	4.4	6.3	3.8	7.2
Others	2.2	2.9	3.7	4.3	1.6	6.2	4.6	4.2	6.2	9.8	9.3	8.8
Net world imports	**131.5**	**129.1**	**134.4**	**124.6**	**118.7**	**130.2**	**123.3**	**131.1**	**138.3**	**157.4**	**167.6**	**164.0**

(1) Significant increase in re-rexports, see specification at bottom of table.
(1a) Since 1991 figures refer to the unified Germany.
(2) Also long pepper, capsicum and chilies are included.
(3) Greece, Ireland, Austria, Switzerland.
(4) Bulgaria, Romania and Czechoslovakia.
(5) Mexico, South Africa, Republic of Korea, etc.
(P) Preliminary.

Annex 4

Table 3. Black and white pepper: approximate average monthly New York spot prices, 1980-1992 (US cents per pound)

Type and year	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Annual
Indonesian:													
Lampung black													
1980	104.5	97.9	94.0	88.5	85.4	82.5	80.5	79.0	85.5	85.4	85.3	82.6	87.6
1981	79.8	77.8	73.5	71.0	73.0	78.8	61.2	58.8	59.8	64.6	62.3	64.4	68.8
1982	70.3	72.8	73.8	70.0	64.3	61.0	60.1	63.8	66.8	64.0	64.0	65.0	66.3
1983	66.0	66.3	64.3	64.0	65.3	68.5	67.6	66.8	68.4	75.0	94.3	99.2	72.1
1984	99.5	96.5	89.4	93.9	96.4	96.2	91.3	96.6	105.5	113.5	103.6	100.8	98.6
1985	111.5	122.8	140.4	170.5	173.8	189.0	187.0	177.2	173.8	192.2	201.6	195.3	169.6
1986	204.4	217.5	256.8	207.3	199.6	195.0	194.0	192.2	206.0	226.8	234.0	246.2	215.0
1987	242.0	232.0	219.0	232.8	245.6	243.3	234.6	234.3	251.7	243.0	239.5	227.6	237.1
1988	246.3	238.0	217.5	193.8	186.0	191.5	183.8	142.5	101.2	99.5	139.8	147.0	173.9
1989	156.8	165.8	163.0	161.7	156.5	142.4	118.7	110.7	109.4	127.7	131.3	113.8	138.2
1990	111.0	116.8	119.2	116.3	107.0	91.0	83.0	86.0	88.9	93.0	92.4	84.3	99.1
1991	84.5	86.0	85.4	79.3	71.0	71.5	71.0	66.0	61.8	58.8	59.0	59.0	71.1
1992	59.6	59.5	59.0	58.0	55.8	54.0	50.8	49.0	50.2	58.2	61.0	58.0	56.1
1993	56.0	56.8	55.0	51.2	50.0	51.5	56.4	65.0	84.0	79.0	74.2	71.0	62.5
Muntok white													
1980	133.3	132.2	128.3	120.8	115.2	113.8	110.5	112.0	138.8	130.2	111.8	104.3	120.9
1981	99.3	98.0	97.5	100.3	106.0	112.0	111.6	108.5	98.5	99.8	94.0	92.2	101.5
1982	94.0	93.8	92.8	90.4	86.0	82.5	78.4	79.3	81.0	79.3	77.0	83.6	84.8
1983	86.0	86.3	84.8	81.5	84.3	88.5	87.8	86.5	84.0	96.3	144.5	150.0	96.7
1984	148.8	154.3	148.0	144.8	147.3	148.2	142.0	157.2	165.0	169.5	164.8	157.0	153.9
1985	158.3	160.0	163.6	181.5	179.4	194.8	196.8	182.0	188.3	210.6	229.0	242.5	190.6
1986	298.6	300.0	295.8	260.8	239.6	238.8	240.5	250.0	287.5	298.0	300.0	294.0	275.3
1987	288.2	280.3	263.3	244.5	257.8	251.3	246.8	257.0	285.0	280.0	283.8	273.8	267.7
1988	273.3	275.0	277.5	285.0	291.3	296.3	262.0	235.0	204.0	172.5	177.8	171.2	243.4
1989	176.3	178.8	179.8	169.2	156.3	147.6	141.5	135.0	125.6	121.2	116.0	107.6	146.2

Table 3 *(Continued)*

Type and year	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Annual
1990	102.3	100.5	99.2	95.5	93.8	82.8	80.0	88.2	91.5	88.0	83.2	78.0	90.3
1991	77.0	72.5	71.4	70.0	67.4	66.0	66.3	63.2	67.0	70.8	78.6	71.5	70.1
1992	70.0	70.0	70.0	70.0	68.0	65.0	64.2	65.0	72.7	79.2	78.5	77.4	70.8
1993	79.0	89.0	85.3	84.0	81.3	87.3	97.0	121.5	181.3	172.6	154.7	142.4	114.6
Brazilian black													
1980	95.5	94.8	92.3	85.3	83.6	81.4	79.5	76.5	81.5	79.8	76.3	73.5	83.3
1981	69.5	67.0	65.0	65.0	69.2	65.8	56.2	55.3	56.8	60.6	57.8	59.4	62.3
1982	64.3	66.3	70.3	68.8	60.5	58.8	58.0	62.0	65.3	57.8	57.5	55.2	62.1
1983	53.0	55.3	54.3	52.5	52.8	62.0	61.4	61.5	65.2	74.5	94.3	98.6	65.5
1984	99.5	96.5	89.4	93.9	96.4	96.2	89.3	94.8	104.0	110.5	100.0	97.5	96.5
1985	108.0	119.3	137.6	167.5	170.4	188.0	186.0	175.8	172.5	190.8	199.8	192.5	167.4
1986	197.6	210.5	250.0	206.0	198.2	193.8	193.8	190.8	204.8	226.0	232.0	246.2	212.5
1987	241.4	231.0	218.8	232.5	245.2	241.8	232.6	232.5	251.5	241.4	238.5	233.8	235.9
1988	233.3	228.8	210.5	190.3	184.3	190.5	182.8	141.5	100.2	99.5	138.3	143.0	170.3
1989	156.8	161.8	159.0	160.0	154.5	141.8	115.5	108.0	108.2	124.7	131.3	112.4	136.2
1990	107.0	110.8	115.4	115.0	106.0	91.0	82.3	85.8	88.5	92.3	89.6	81.8	97.1
1991	79.0	78.5	78.6	74.5	66.8	70.0	68.8	61.6	59.5	56.8	55.8	55.0	67.1
1992	55.6	54.5	56.0	55.3	54.0	54.0	50.8	49.0	50.0	57.8	61.0	58.0	54.7
1993	56.0	56.5	54.3	51.2	50.0	51.5	55.8	64.8	84.0	79.0	74.2	70.8	62.3
Indian:													
Malabar black													
1980	104.5	97.9	94.0	88.5	85.4	82.5	80.5	79.0	85.5	85.4	85.3	82.6	87.6
1981	79.8	77.8	73.5	79.5	81.2	82.0	81.6	82.0	82.0	82.0	82.0	81.2	80.4
1982	78.5	75.0	74.8	73.2	69.5	63.3	61.0	66.0	67.3	68.0	67.0	66.8	69.2
1983	67.0	66.5	64.3	64.3	65.3	68.5	79.0	79.0	79.0	79.8	96.3	102.4	76.0
1984	100.0	99.0	89.6	93.9	96.4	96.2	91.3	96.6	105.5	113.5	103.6	100.8	98.9
1985	111.5	122.8	140.4	170.5	173.8	189.0	187.0	177.2	173.8	192.2	201.6	195.3	169.6

Table 3 *(Continued)*

Type and year	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Annual
1986	204.4	217.5	256.8	207.3	199.6	195.0	194.0	191.2	204.8	226.4	232.4	246.2	214.6
1987	242.0	231.0	219.3	232.5	245.2	241.8	232.6	232.5	251.5	241.4	238.5	223.8	236.0
1988	233.3	228.8	210.5	190.3	184.3	190.5	182.8	141.5	100.2	99.5	138.3	143.0	170.3
1989	153.8	161.8	159.0	160.0	154.5	141.8	115.5	108.0	108.2	124.7	131.3	112.4	135.9
1990	107.0	110.8	115.4	115.0	106.0	91.0	82.3	85.8	88.5	92.3	89.6	81.8	97.1
1991	79.0	78.5	78.6	74.5	66.8	70.0	68.8	61.6	59.5	56.8	55.8	55.0	67.1
1992	55.6	54.5	56.0	55.3	54.0	54.0	50.8	49.0	50.0	57.8	61.0	58.0	54.7
1993	56.0	56.5	54.3	51.2	50.0	51.5	55.8	64.8	84.0	79.0	74.2	70.8	62.3
Indian:													
Tellicherry extra bold													
1980	109.0	106.4	103.8	98.8	98.0	100.0	101.5	101.2	102.0	101.2	104.0	104.3	102.5
1981	105.0	105.0	102.0	103.5	110.0	110.0	109.0	103.8	100.0	100.0	99.0	98.0	103.8
1982	89.8	88.0	87.0	83.6	80.0	80.0	80.0	80.0	81.5	86.5	86.0	82.0	83.7
1983	82.0	82.0	81.0	80.0	80.0	81.5	83.0	83.0	83.0	84.8	102.8	115.0	86.5
1984	112.0	112.0	112.0	112.0	112.0	110.0	110.0	110.0	112.5	119.5	125.0	135.0	115.2
1985	135.0	140.0	150.2	182.5	185.0	196.3	200.0	200.0	195.0	201.0	218.6	220.0	185.3
1986	220.0	223.7	245.0	243.8	220.0	220.0	220.0	232.0	235.0	252.0	255.0	255.0	235.1
1987	259.0	260.0	260.0	260.0	260.0	260.0	260.0	260.0	265.0	270.0	270.0	270.0	262.8
1988	272.5	280.0	275.0	267.5	245.0	245.0	245.0	193.8	157.0	135.0	161.3	170.0	220.6
1989	177.5	183.8	181.3	185.0	182.5	179.0	162.5	170.0	166.0	163.7	175.0	171.0	174.8
1990	165.0	165.0	153.0	150.0	150.0	132.0	128.8	125.0	125.0	125.0	125.0	125.0	139.1
1991	125.0	130.0	130.0	130.0	128.0	120.0	116.3	110.4	108.0	105.0	105.0	105.0	117.8
1992	105.0	105.0	105.0	95.0	85.0	75.0	75.0	75.0	75.0	78.0	80.0	80.0	86.1
1993	80.0	80.0	80.0	80.0	80.0	75.0	75.0	78.8	93.8	95.0	95.0	95.0	84.0

Source: New York market area spice brokers.

ESCAP STUDIES IN TRADE AND INVESTMENT

No. 1 Strengthening Capacities in Trade, Investment and the Environment for the Comprehensive Development of Indo-China (ST/ESCAP/1482)

No. 2 Regional Cooperation in Export Credit and Export Credit Guarantees (ST/ESCAP/1438)

No. 3 Expansion of Manufactured Exports by Small and Medium Enterprises (SMEs) in ESCAP Region (ST/ESCAP/1457)

Volume I: Regional Study
Volume II: National Studies

No. 4 Towards a More Vibrant Pepper Economy (ST/ESCAP/1494)

COPIES OF THIS PUBLICATION MAY BE OBTAINED FROM:

International Trade and Economic Cooperation Division
Economic and Social Commission for Asia and the Pacific
United Nations Building
Rajadamnern Avenue
Bangkok 10200
Thailand