



**UNIVERSITI PUTRA MALAYSIA**

**EFFECTS OF PRETREATMENTS ON THE STORAGE  
CHARACTERISTICS OF FRESH AND DRIED GUAVA  
(PSIDIUM GUAJAVA L)**

**KHIN MA MA KYI**

**FSMB 1991 2**

EFFECTS OF PRETREATMENTS ON THE STORAGE  
CHARACTERISTICS OF FRESH AND DRIED GUAVA (PSIDIUM GUAJAVA L)

By

KHIN MA MA KYI

Thesis Submitted in Fulfilment of the Requirements for  
the Degree of Master of Science in the Faculty  
of Food Science and Biotechnology,  
Universiti Pertanian Malaysia

December 1991



## ACKNOWLEDGEMENTS

I wish to thank the Dean and the entire members of the Faculty of Food Science and Biotechnology at Universiti Pertanian Malaysia for providing facilities and assistance during my graduate study. I would like to extend my thanks to Mr. Abdul Aziz Bahsir for checking my thesis format.

I extend my sincere gratitude to my chief supervisor, Dr. Suhaila Mohamed, for her understanding, patience, guidance and supervision throughout the preparation of this thesis. My deep appreciation and gratitude go to Dr. Salmah Yusof and Dr. Azizah Osman, my co-supervisors, for guidance and suggestions. I would like to thank again to Dr. Salmah Yusof for using her computer to analyse the data by SAS programme. My gratitude is also due to Dr. Fauziah Othman and Mr. Ho who has given guidance for using Electron microscope.

My sincere gratitude is also extended to Malaysian Technical Cooperation Programme (MTCP) for providing financial support and Ministry of Industry No. (1) for granting the study leave.

My special thanks also convey to my Malaysian friends for their understanding, cooperation and moral support throughout



my study here. My thanks also extended to research assistants of Faculty of Food Science and Biotechnology especially those who are working under my chief and co-supervisors. All my foreigner friends especially in the same Faculty at Universiti Pertanian Malaysia are remembered for their friendship and encouragement during the study.

Last but not least, my sincere appreciation goes to my parents, brothers and sisters for their all round support throughout my study life.



## TABLES OF CONTENTS

ACKNOWLEDGEMENTS .....	iii
LIST OF TABLES .....	ix
LIST OF FIGURES .....	x
LIST OF PLATES .....	xi
ABSTRACT .....	xiii
ABSTRAK .....	xv
CHAPTER	
I. INTRODUCTION .....	1
II. LITERATURE REVIEW .....	15
Guava .....	15
Biochemical and Nutrient Composition .....	15
Physiology and Biochemistry .....	17
Harvesting and Handling .....	19
Storage .....	19
Pest and Disease .....	20
Fruit Ripening and Senescence .....	21
Ripening .....	21
Senescence .....	23
Postharvest Treatments .....	23
Cool Storage .....	24
Precooling .....	26
Surface Coating .....	30
Modified or Controlled Atmosphere Storage .....	33



Chemical Treatment .....	34
Packaging .....	34
Irradiation .....	38
Drying .....	39
Drying and Dehydration .....	39
Water Activity ( $a_w$ ) .....	41
Browning Reactions .....	42
Osmotic Drying .....	44
Sweating .....	46
III. EFFECTS OF PRECOOLING ON STORAGE OF <u>GUAVA (PSIDIUM</u> <u>GUAJAVA L)</u> AT 5°C AND 10°C .....	47
Introduction .....	47
Materials and Methods .....	48
Materials .....	48
Methods .....	48
Sampling .....	48
Physical and Chemical Analysis .....	49
Sensory Evaluation .....	50
Statistical Analysis .....	50
Results and Discussion .....	50
Weight Loss .....	51
Colour Change of Skin .....	51
Hardness .....	54
Soluble Solids Content .....	58
pH and Titratable Acidity .....	58
Ascorbic Acid Content .....	61



Sensory Evaluation .....	64
Correlation Studies .....	66
Summary .....	66
IV. EFFECTS OF VARIOUS SURFACE TREATMENTS ON THE STORAGE LIFE OF GUAVA ( <u>PSIDIUM GUAJAVA</u> L) AT 10°C ..	68
Introduction .....	68
Materials and Methods .....	69
Materials .....	69
Methods .....	69
Sampling .....	70
Physical Analysis .....	70
Chemical Analysis .....	71
Sensory Evaluation .....	71
Scanning Electron Microscope .....	71
Statistical Analysis .....	72
Results and Discussion .....	72
Weight Loss .....	72
Colour Change of Skin .....	74
Hardness .....	76
Soluble Solids Content .....	83
pH .....	83
Titratable Acidity .....	86
Ascorbic Acid .....	86
Correlation Studies .....	89
Sensory Evaluation .....	90



Scanning Electron Microscopic Studies .....	92
Summary .....	100
V. DEHYDRATION OF GUAVA ( <u>PSIDIUM GUAJAVA</u> L) .....	102
Introduction .....	102
Materials and Methods .....	103
Materials .....	103
Methods .....	103
Measurement of Colour .....	106
Measurement of Hardness .....	107
Measurement of Water Activity .....	107
Sensory Evaluation .....	107
Statistical Analysis .....	108
Results and Discussion .....	108
Water Activity ( $a_w$ ) .....	108
Colour Change .....	108
Hardness .....	110
Ascorbic Acid Content .....	110
Sensory Evaluation .....	111
Summary .....	111
VI. CONCLUSIONS AND RECOMMENDATIONS .....	113
BIBLIOGRAPHY .....	115
APPENDICES .....	124
PUBLICATIONS .....	136
BIOGRAPHICAL SKETCH .....	137





## LIST OF TABLES

Table		Page
1	Area Under Guava Cultivation (Hectares) According to States and Years in Malaysia .....	3
2	Area Under Guava Cultivation (Hectares) According to Districts and States in Malaysia .. .....	5
3	Total Production of Guava (Metric Tonnes) According to States and Years in Malaysia .....	9
4	Total Production of Guava (Metric Tonnes) According to Districts in Malaysia .....	10
5	Changes that may Occur During Ripening of Fruit ...	22
6	Approximate Water Activity Values Below which Growth of Organisms does not Usually Occur .....	41
7	Mean Score Values of Sensory Evaluation of Precooled Guava .....	65
8	Mean Score Values of Sensory Evaluation of Various Surface Treated Guava .....	91
9	Physico-chemical Changes of Dried Guava Held at Room Temperature .....	109
10	Mean Score Values of Sensory Evaluation of Dried Guava .....	112
11	Mean Values for the Physico-chemical Characteristics of Precooled Guava at 5°C and 10°C During Storage ..	127
12	Correlation Coefficient (R square values) for Physico-chemical Characteristics of Precooled Guava at 5°C and 10°C Storage .....	129
13	Mean Values for the Physico-chemical Characteristics of Various Surface Treated Guava Held at 10°C .....	131
14	Correlation Coefficient (R square values) for the Physico-chemical Characteristics of Various Surface Treated Guava .....	133



## LIST OF FIGURES

Figure		Page
1	Weight Loss of Guava Stored at 5° and 10°C (Precooled at 0-4 hr) .....	52
2	Colour Change of Guava Skin at 5° and 10°C (Precooled at 0-4 hr) .....	53
3	Hardness of Guava Stored at 5° and 10°C (Precooled at 0-4 hr) .....	55
4	Soluble Solids Content Change in Guava Stored at 5° and 10°C (Precooled at 0-4 hr) .....	59
5	pH Change in Guava on Storage at 5° and 10°C (Precooled at 0-4 hr) .....	60
6	Titratable Acidity of Guava at 5° and 10°C (Precooled at 0-4 hr) .....	62
7	Ascorbic Acid Change in Guava at 5° and 10°C (Precooled at 0-4 hr) .....	63
8	Weight Loss of Guava Stored at 10°C (LDPE, Paraffin, Palm Oil, Semperfresh and Starch Coating)	73
9	Colour Change of Guava Skin at 10°C (LDPE, Paraffin, Palm Oil, Semperfresh and Starch Coating)	75
10	Hardness of Guava Stored at 10°C (LDPE, Paraffin, Palm Oil, Semperfresh and Starch Coating) .....	82
11	Soluble Solids Content Change in Guava Stored at 10°C (LDPE, Paraffin, Palm Oil, Semperfresh and Starch Coating) .....	84
12	pH Change in Guava on Storage at 10°C (LDPE, Paraffin, Palm Oil, Semperfresh and Starch Coating)	85
13	Titratable Acidity of Guava at 10°C (LDPE, Paraffin, Palm Oil, Semperfresh and Starch Coating)	87
14	Ascorbic Acid Change in Guava at 10°C (LDPE, Paraffin, Palm Oil, Semperfresh and Starch Coating)	88
15	Flow Chart for Processing of Dehydrated Candied Guava .....	104
16	Flow Chart for Processing of Dehydrated Pickled Guava .....	105



## LIST OF PLATES

Plate		Page
1	Control (Untreated) Guavas Stored for 5 weeks at 5°C and 10°C .....	56
2	Guavas Precooled at 0 hr, Stored for 5 weeks at 5°C and 10°C .....	57
3	Guavas Precooled at 4 hr, Stored for 5 weeks at 5°C and 10°C .....	57
4	Control (Untreated) Guavas Stored for 3 weeks at 10°C .....	77
5	Shrink Wrapped and Cling Wrapped Guavas Stored for 3 weeks at 10°C .....	77
6	1% and 5% Paraffin Treated Guavas Stored for 3 weeks at 10°C .....	78
7	10% and 20% Paraffin Treated Guavas Stored for 3 weeks at 10°C .....	78
8	10% and 20% Palm Oil Treated Guavas Stored for 3 weeks at 10°C .....	79
9	0.75% and 1% Semperfresh Treated Guavas Stored for 3 weeks at 10°C .....	79
10	2% and 3% Starch Treated Guavas Stored for 3 weeks at 10°C .....	80
11	10% and 20% Palm Oil Treated Guavas Stored for 7 weeks at 10°C .....	80
12	Shrink Wrapped and Cling Wrapped Guavas Stored for 7 weeks at 10°C .....	81
13	0.75% and 1% Semperfresh Treated Guavas Stored for 7 weeks at 10°C .....	81
14 & 15	Surface of Control (Untreated) Guava at Week 0 (x 60, 660 respectively) .....	95
16 & 17	Surface of Control (Untreated) Guava Stored for 3 weeks at 10°C (x 60, 660 respectively) .....	95



<b>Plate</b>	<b>Page</b>
18 & 19 Surface of 5% Paraffin Treated Guava at Week 0 and Week 3 at 10°C (x 60) .....	96
20 & 21 Surface of 20% Paraffin Treated Guava at Week 0 (x 60, 660 respectively) .....	96
22 & 23 Surface of 20% Paraffin Treated Guava Stored for 3 weeks at 10°C (x 60, 660 respectively) .....	97
24 & 25 Surface of 20% Palm Oil Treated Guava at Week 0 (x 60, 660 respectively) .....	97
26 & 27 Surface 20% Palm Oil Treated Guava Stored for 3 weeks at 10°C (x 60, 660 respectively) .....	98
28 & 29 Surface of 1% Semperfresh Treated Guava at Week 0 (x 60, 660 respectively) .....	98
30 & 31 Surface of 1% Semperfresh Treated Guava Stored for 3 weeks at 10°C (x 60, 660 respectively) ..	99
32 Surface of 2% Starch Treated Guava Stored for 3 weeks at 10°C (x 60) .....	99



Abstract of the Thesis Submitted to the Senate of the  
Universiti Pertanian Malaysia in Fulfilment of the  
Requirements for the Degree of Master of Science

**EFFECTS OF PRETREATMENTS ON THE STORAGE CHARACTERISTICS  
OF FRESH AND DRIED GUAVA (PSIDIUM GUAJAVA L)**

By

KHIN MA MA KYI

December, 1991

Supervisor: Suhaila bt. Mohamed Ph. D.

Faculty : Food Science and Biotechnology

The studies on guava (var. Vietnamese) precooled at 0 hr (immediately) and 4 hr after harvest, and stored at 5°C and 10°C were carried out. Guava stored at 10°C was able to undergo a ripening process. Chilling injury was observed at 5°C storage. Precooling did not seem to have any beneficial effect on guava. The characteristics considered were weight loss, colour change of skin, hardness, soluble solids content, pH, titratable acidity and ascorbic acid content.

The effects of various surface treatments on 'Vietnamese' guava with LDPE shrink and cling wrap packaging, 1%, 5%, 10% and 20% liquid paraffin, 10% and 20% palm oil, 0.75% and 1% semperfresh (fatty acid sugar ester), and 2% and 3% starch on the storage life at 10°C were studied. LDPE shrink wrap packaging was most effective in reducing the weight loss and



maintaining the hardness of guava. The skin colour of guava was maintained by 20% palm oil until 8 weeks storage. Among the treatments, only cling wrap packaging could maintain the ascorbic acid content of the guava until 8 weeks storage. Twenty percent palm oil surface coating was found to be the most effective treatment for maintaining the quality of fresh guava stored for 8 weeks at 10°C, followed by shrink wrap and cling wrap packaging. Semperfresh was less effective and paraffin was not suitable for guava, as it caused skin lesioning and impart an unfavourable flavour to the fruit. Starch surface coating caused greater deterioration of guava than in control, untreated fruit.

At room temperature, the effects of cysteine HCl and sodium metabisulphite on candied and pickled dried guava were studied. Higher ascorbic acid retention and less colour change were observed in candied dried guava than pickled dried guava. 0.024% cysteine HCl was found to be more effective at maintaining the ascorbic acid content and colour compared to 1% sodium metabisulphite.



Abstrak Thesis Yang Dikemukakan Kepada Senat Universiti  
Pertanian Malaysia Sebagai Memenuhi Syarat  
Keperluan Untuk Ijazah Master Sains

**KESAN PRA PERLAKUAN KE ATAS SIFAT-SIFAT JAMBU SEGAR  
DAN JAMBU KERING SEPANJANG TEMPOH PENYIMPANAN**

Oleh

KHIN MA MA KYI

Disember, 1991

Penyelia: Suhaila bt. Mohamed, Ph. D.

Fakulti : Sains Makanan dan Bioteknologi

Kajian telah dibuat terhadap jambu (var. Vietnamese) yang dipra-dinginkan sebaik sahaja (0 jam) selepas dituai dan 4 jam selepas dituai kemudian disimpan pada suhu 10°C. Jambu yang disimpan pada suhu 10°C didapati berjaya melalui proses peranuman. Kecederaan penyejukan didapati berlaku pada jambu yang disimpan pada suhu 5°C. Proses pra-pendinginan didapati tidak memberi kesan yang bermanfaat kepada penyimpanan buah jambu segar. Sifat-sifat yang telah diselidiki semasa penyimpanan adalah seperti berikut; kehilangan berat, perubahan warna kulit, kepejalan, kandungan pepejal larut, pH, asid yang boleh dititrat dan kandungan asid askorbik.

Pengkajian terhadap kesan-kesan perlakuan yang berbeza ke atas permukaan kulit jambu bagi meningkatkan tempoh penyimpanan pada suhu 10°C telah dijalankan. Perlakuan-perlakuan tersebut



adalah seperti berikut; pembungkusan dengan 'LDPE shrink' dan 'cling wrap', penyalutan permukaan dengan 1%, 5%, 10% dan 20% parafin cecair, 10% dan 20% minyak sawit, 0.75% dan 1% 'semperfresh' (ester gula asid lemak), dan 2% dan 3% kanji. 'LDPE shrink wrap' didapati paling berkesan bagi mengurangkan kehilangan berat dan mengekalkan kepejalan buah jambu. Warna kulit jambu yang diperlakukan dengan 20% minyak sawit dapat dikekalkan sehingga tempoh 8 minggu penyimpanan. Di antara perlakuan-perlakuan yang dikaji, hanya pembungkusan 'cling wrap' yang dapat mengekalkan tahap kandungan asid askorbik dengan baik sehingga tempoh 8 minggu penyimpanan. Dua puluh peratus minyak sawit didapati paling berkesan dalam mengekalkan mutu buah jambu segar dalam tempoh 8 minggu penyimpanan pada suhu 10°C, diikuti oleh pembungkusan 'shrink wrap' dan 'cling wrap'. 'Semperfresh' didapati kurang berkesan, dan perlakuan dengan parafin cecair didapati tidak sesuai untuk mengekalkan mutu buah jambu segar kerana ia menyebabkan kerosakan pada kulit jambu dan memberikan rasa yang kurang menyenangkan terhadap buah jambu segar. Perlakuan pencelupan kanji telah menyebabkan lebih kerosakan ke atas buah jambu segar bila dibandingkan dengan buah kawalan.

Penyelidikan terhadap kesan-kesan 'cysteine HCl' dan 'sodium metabisulphite' ke atas halwa dan jeruk jambu telah dijalankan pada suhu bilik. Jambu yang dihalwakan dapat





mengkalkan kandungan asid askorbik yang lebih tinggi dan warna asal dengan lebih baik dari jambu yang dijerukkan. 0.024% 'cysteine HCl' didapati paling berkesan dalam mengkalkan kandungan asid askorbik dan warna berbanding dengan 1% 'sodium metabisulphite'.



## CHAPTER I

### INTRODUCTION

The common guava (Psidium guajava L) is the most important pomological fruit of the Myrtle family. It is a native of tropical America and seems to have been growing from Mexico to Peru. Now it is grown commercially throughout the tropics and subtropics. Guava is quite hardy, prolific bearer and highly remunerative even without much care.

The genus Psidium consists of about 150 species. The fruit of common guava has a thin rough greenish yellow skin and is round, ovoid, or pyriform in shape, 5-13 cm in diameter and weighs up to 700 g. The fruit has many small hard seeds (153 to 664 per fruit) located in the centre of the flesh (Palaniswamy and Shanmugavelu, 1974). There are two major types of guava, the white flesh, sweet, dessert type and the pink flesh, sour type commonly processed into juice or jelly (Jagtiani et al., 1988). The numerous stone cells in the fleshy portion of the fruit impart a gritty texture to the flesh. The fruit colour varies from white to deep pink to salmon red. The flavour has been described as sweet, musky and highly aromatic (Popenoe, 1920; Malo and Campbell, 1968; Bailey and Bailey, 1976). Guava of the Vietnamese variety is commercially grown in Malaysia. The most outstanding feature of this variety when compared with



the recommended varieties is its fruit quality. The fruits are larger in size, with thick flesh, sweet taste and crispy texture. Due to these special characteristics, it is a common belief among the growers that the fruits are only suitable for fresh consumption. However, the fruits could also be processed into jam and juice, and canned in syrup (Yusof and Mohamed, 1987).

Guava is a rich source of vitamin C. It contains three to six times more vitamin C than oranges, 10-30 times more than bananas, and about ten times that in papaya. Guava can be promoted as a healthy fruit equal or even superior to imported fruits in taste and texture and overall nutritive quality. The fruit has a characteristic odor and is eaten fresh or cooked, but it is principally used for the preparation of jams, jellies, pastes and similar products.

The major producers of guava in the world are India, Brazil and Mexico. In Asia, guava is found in Pakistan, India, Sri Lanka, Bangladesh, Taiwan, South China, and in the Southeast Asian countries of Myanmar, Thailand, Kampuchea, Vietnam, the Philippines, Malaysia, Singapore and Indonesia. Guava (Psidium guajava L) has been cultivated in Malaysia for a long time (Allen, 1969). Although guava has been planted in Malaysia for a long time it was only in recent years that the crop attracted a great deal of attention.



**Table 1**  
**Area Under Guava Cultivation (Hectares) According**  
**to States and Years in Malaysia**

Year	1988	1989	1990*
State	Area (ha)	Area (ha)	Area (ha)
Selangor	152.62	168.00	185.00
Pahang	104.59	115.00	127.00
Pulau Pinang	28.92	32.00	35.00
N. Sembilan	62.05	68.00	75.00
Malacca	2.71	3.00	4.00
Terengganu	46.41	52.00	56.00
Johore	327.10	360.00	400.00
Kedah	6.58	7.00	8.00
Perak	357.00	393.00	432.00
<b>Total</b>	<b>1087.98</b>	<b>1198.00</b>	<b>1322.00</b>

\* estimate

Source: Malaysia, 1989.

Table 1 shows until 1988 an area of 1057.98 ha was planted with guava, with Perak having the largest cultivation area (357 ha) followed by Johore (327 ha), Selangor (153 ha), Pahang (105 ha), Negeri Sembilan (62 ha) and Terengganu (46 ha). In 1989, the estimated guava cultivation area was to be about 1,200 ha. By 1990, the guava cultivation area have increased to 1,300 ha. The slow increase in guava cultivation area was due to the consumer preference for other fruits such as starfruit, papaya and durian over guava. The district of Kinta and Batang Padang (Perak) and Kota Tinggi (Johore) were the most popular area for guava cultivation in 1988 with Batang Padang covering 202 ha, Kinta 155 ha and Kota Tinggi 161 ha (Table 2).

The production of guava in 1988 was 13,063 mt and in 1989, it was estimated to be 17,970 mt and in 1990, it was expected to increase 25,200 mt. Perak was the largest guava producing state, producing about 4292.40 mt in 1988, an estimated 5,895 mt in 1989 and expected to produce of 7,420 mt of guava in 1990 (Table 3). Johore, Selangor, Pahang and Negeri Sembilan produced more than 1,000 mt of guava yearly. The districts which produced more than 500 mt of guava per year were Kinta and Batang Padang in Perak, Kota Tinggi in Johore, Raub in Pahang, Jempol in Negeri Sembilan and Malacca Tengah in Malacca (Table 4).

Table 2

**Area Under Guava Cultivation (Hectares) According  
to Districts and States in Malaysia**

Year	1988	1989	1990*
State District	Area (ha)	Area (ha)	Area (ha)
<u>Terengganu</u>			
Kemaman	18.29	20.00	22.00
Ulu Terengganu	3.64	4.00	4.00
Marang	20.83	23.00	25.00
K. Terengganu	1.87	2.00	2.00
Besut	1.80	2.00	2.00
<b>Total</b>	<b>46.41</b>	<b>51.00</b>	<b>57.00</b>
<u>Johore</u>			
Kota Tinggi	161.08	178.00	195.00
Kluang	39.12	43.00	48.00
Johore Bharu	45.40	50.00	55.00
Pontian	11.40	13.00	14.00
Mersing	0.40	1.00	1.00
Segamat	15.50	17.00	19.00
Batu Pahat	22.60	25.00	28.00
Muar	31.60	35.00	38.00
<b>Total</b>	<b>327.10</b>	<b>362.00</b>	<b>398.00</b>

Table 2 (cont'd)

Year	1988	1989	1990*
State District	Area (ha)	Area (ha)	Area (ha)
<u>Kedah</u>			
Kulim	1.60	2.00	2.00
Sik	4.00	5.00	5.00
Langkawi	0.71	1.00	1.00
Perlis	0.57	1.00	2.00
Total	6.58	9.00	9.00
<u>Selangor</u>			
Gombak	11.69	13.00	15.00
Kelang	10.00	11.00	12.00
Kuala Langat	23.26	25.00	28.00
K. Selangor	16.40	18.00	20.00
Petaling	12.10	13.00	15.00
Sabak Bernam	2.20	2.00	3.00
Sepang	35.30	39.00	43.00
Hulu Langat	11.15	13.00	14.00
Hulu Selangor	30.50	34.00	37.00
Total	152.62	168.00	187.00

Table 2 (cont'd)

Year	1988	1989	1990*
State District	Area (ha)	Area (ha)	Area (ha)
<u>Pahang</u>			
Bentong	13.32	15.00	16.00
Raub	74.55	83.00	91.00
Jerantut	1.20	2.00	2.00
Maran	6.60	7.00	8.00
Kuala Lipis	5.41	6.00	7.00
Rompin	3.20	4.00	5.00
Total	104.59	117.00	129.00
<u>Malacca</u>			
Malacca Tengah	48.55	54.00	59.00
Alor Gajah	1.00	1.00	1.00
Jasin	2.50	3.00	3.00
Total	52.05	58.00	63.00
<u>Palau Pinang</u>			
Seb. Perai (S)	0.42	1.00	2.00
Seb. Perai (T)	8.00	9.00	10.00
Seb. Perai (U)	11.00	12.00	13.00
P. Pinang B/D	9.00	10.00	11.00
Total	28.92	32.00	35.00



Table 2 (cont'd)

Year	1988	1989	1990*
State District	Area (ha)	Area (ha)	Area (ha)
<u>Negri Sembilan</u>			
Seremban	3.70	4.00	5.00
P. Dickson	5.40	6.00	7.00
Jempol	38.00	42.00	46.00
Jelevu	10.90	12.00	13.00
Tampin	4.05	5.00	5.00
Total	62.05	69.00	76.00
<u>Perak</u>			
Kinta	155.50	171.00	188.00
Batang Padang	202.70	222.00	244.00
Total	357.70	393.00	432.00

\* estimate

Source: Malaysia, 1989.