THE MALAYSIAN SMALLHOLDER RUBBER SECTOR: IMPLICATIONS OF ETHREL STIMULATION AND THE NEW PROCESSING TECHNOLOGY

Thesis for the Degree of Ph. D.
MICHIGAN STATE UNIVERSITY
MOHAMED HASHIM NOOR
1972

This is to certify that the

thesis entitled

THE MALAYSIAN SMALLHOLDER RUBBER SECTOR:
IMPLICATIONS OF ETHREL STIMULATION AND THE
NEW PROCESSING TECHNOLOGY

presented by

Mohamed Hashim Noor

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in Agricultural Economics

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Major professor

Date October 20, 1972

O-7639

ABSTRACT

THE MALAYSIAN SMALLHOLDER RUBBER SECTOR:
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By

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The natural rubber industry plays an important role in the Malaysian economy in terms of acreage, employment, foreign exchange earnings, and export tax revenue. Recently, major technological developments have been introduced in the Malaysian natural rubber industry, including the introduction of the yield-stimulant ethrel which can substantially increase the yields of rubber trees, and the new methods of processing natural rubber.

Presently, most smallholder rubber is of inferior quality, and the rubber is marketed through a chain of agencies before it is exported. A reorganization of the traditional smallholder processing and marketing system, could reduce marketing costs and increase the smallholder income. The introduction of the central processing and marketing scheme to process smallholder rubber by the new processing methods represents a major reorganization of the traditional processing and marketing system.

The objectives of this study are to analyze for the period 1975-80: (1) the potential impact of the yield-stimulant ethrel on the Malaysian and world natural rubber output, (2) the effect of the potential increase in output on the world and Malaysian natural rubber prices, (3) the traditional and reorganized processing and marketing system for smallholder rubber, (4) the Malaysian smallholder income with and without yield stimulation and reorganization of the traditional processing and marketing system, and (5) the implications of the study for smallholder rubber policy.

An economic model of the world rubber market is developed in order to facilitate an understanding of the linkages between the various segments of the market. Due to the data and time constraints, it is not possible to include, in this study, all the variables presented in the model. However, the model provides a framework for policy makers to trace the consequences of alternative policies to be pursued on rubber, and is useful for future researchers on the rubber industry as it provides a framework to absorb new and more complete data on the various aspects of the industry as they become available.

The study indicates that, with the adoption of the yield-stimulant ethrel, the Malaysian natural rubber output will be approximately 12 to 15 per cent higher in 1975 (than the output without yield stimulation), and in 1980,

it will be approximately 34 to 36 per cent higher depending on the assumed levels of adoption of the yield-stimulant. The corresponding increases for the world natural rubber output are approximately 6 to 9 per cent in 1975 and 21 to 27 per cent in 1980.

The increase in output through yield stimulation will have a depressing effect on natural rubber prices. Based on the assumed levels of adoption of the yield-stimulant,and the resulting output, prices can be expected to decline by 3 to 8 cents/lb. (Malaysian) during the 1975-80 period. This is the decline from prices based on output without stimulation.

Comparing the Malaysian smallholder income with and without yield stimulation and central processing and marketing (under the reorganized processing and marketing system), indicates that both yield stimulation and central processing and marketing will increase smallholder income during the period 1975-80. However, the comparison indicates that central processing and marketing has greater potential in increasing smallholder income than yield stimulation.

An attempt is made to estimate the gains (in cents/lb.) by smallholders under the central processing and marketing scheme by comparing the prices received for ribbed smoked sheet (RSS), unsmoked sheet (USS), and scrap rubber under this scheme,and the corresponding prices

received under the traditional processing and marketing system. The comparison indicates that smallholders currently producing RSS could expect to gain little (about 0.8 cents/lb.) under the central processing and marketing scheme. For the USS producers however, the price gains could be substantial and average about 5.3 cents/lb. The highest potential gain from central processing and marketing is achieved from the sale of scrap rubber. The gain is estimated to average about 5.8 cents/lb.

The introduction of yield stimulation and central processing and marketing has various implications for the Malaysian natural rubber industry. The possible reduction in production costs resulting from yield increases through yield stimulation, and the improvements in the technical properties embedded in the new process rubbers could play a major role in maintaining the competitive position of natural rubber against synthetic rubber. Output increases through yield stimulation have been estimated to substantially increase natural rubber's contribution to Malaysian foreign exchange earnings, export tax revenue, and research and replanting cesses. The use of the yield-stimulant is also likely to increase the short run price responsiveness of natural rubber supply and reduce price instability.

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A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Agricultural Economics

1972

ACKNOWLEDGMENTS

I wish to express my sincere appreciation and gratitude to Dr. Carl K. Eicher, my major professor and thesis supervisor, for his untiring assistance in this study, and throughout my doctoral program at Michigan State University. I am deeply grateful to Dr. Lester V. Manderscheid for reviewing and criticizing the manuscript. His valuable comments have contributed greatly to the improvements of this study. My deep gratitude also goes to Dr. Robert D. Stevens for his painstaking reading, constructive comments and suggestions.

I am indebted to the officials of the Smallholders' Advisory Service, and the Economics and Planning Divisions of the Rubber Research Institute of Malaya for their assistance and cooperation during my data collection for this study in Malaysia. Much appreciation is also due to Tan Sri Mohamed bin Jamil, Director-General of Agriculture, West Malaysia, for providing students at the Institute of Agriculture at Serdang, as enumerators for the survey.

My sincere gratitude also goes to the Ford Foundation for the fellowship which makes my undergraduate and graduate studies possible, and for the sympathy, understanding and efficiency of its officials.

Finally, I express my deep gratitude to my wife, Filipinas, for her patience, understanding and encouragement throughout my entire doctoral program.

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CHAPTER I

THE MALAYSIAN RUBBER INDUSTRY

Introduction

Early Development of the Industry

The rubber tree, Hevea brasiliensis, is not indigenous to Malaya.[1] The history of rubber in Malaya has its beginnings in 1877 when some seedlings were brought to the country from Kew Gardens in England. These seedlings, in turn, originated from seeds exported from Brazil.[2]

Though the tropical Malayan climate was suitable for rubber, several decades elapsed before rubber began to be grown as a commercial crop. The lack of interest in

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[1] In this section, Malaya rather than Malaysia is used. Malaysia (which includes Malaya, Sabah and Sarawak) was only formed in 1963.

[2] For more information on the early developments of the Malaysian and world rubber industry, see P. T. Bauer, The Rubber Industry: A Study in Competition and Monopoly (Cambridge, Mass.: Harvard University Press, 1948); Ooi Jin-Bee, Land, People and Economy in Malaya (London: Longmans, 1963); K. E. Knorr, World Rubber and Its Regulations (Stanford, Calif.: Stanford University Press, 1948); and H. N. Ridley, The Story of the Rubber Industry (London: L. Reeve Press, 1913).

rubber in the early days was largely due to the prosperity enjoyed by coffee and the lack of knowledge about rubber cultivation, latex collection, and processing and the uncertainty about its prospects as a commercial commodity.

However, in the 1890s, the development of the automobile industry greatly increased the demand for rubber causing prices to rise to levels which made it highly profitable to grow the crop. As a result, rubber acreage steadily expanded from 350 acres in 1897 to about 50,000 acres in 1905 and 290,000 in 1909. By 1920, Malaya contributed to one-half (200,000 tons) of the total world exports of natural rubber. The steady expansion of rubber acreage and production in Malaysia has continued to the present period and has made rubber currently the most important crop in the Malaysian economy.

Importance of Rubber in the Malaysian Economy

Malaysia is the world's largest producer of natural rubber. In 1970 she produced 1.3 million long tons and this represented more than 44 per cent of the world total output of natural rubber.[3]

Rubber plays an important and vital role in the Malaysian economy. It is the largest single crop by acreage. Out of some 6.9 million acres under cultivation,

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[3]Malaysia, Department of Statistics, Monthly Statistical Bulletin (Kuala Lumpur, Malaysia, December, 1971), p. 43.

about 4.2 million acres or 61 per cent are under rubber.[4] Because of this extensive acreage, rubber also provides an important means of employment. Employment in rubber accounts for 32 per cent of the total labor force of 2.3 million and about 50 per cent of the 1.2 employed in agriculture.[5]

Apart from being a major source of employment, rubber represents the largest export item accounting for 47 per cent of the total value of exports in 1969 (Table 1.1). Rubber has also been a major contributor to federal revenue accounting for about 16 per cent of the federal taxes over the 1959-63 period. Over the last few years, however, its contribution to federal revenue has been declining. In 1969, duties from rubber exports made up only about 6 per cent of all revenue.[6] This declining contribution of rubber to federal revenue can be largely attributed to the decline in natural rubber prices and the graduated export duty on the commodity.

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[4]Malaysia, Department of Agriculture, Annual Report of the Department of Agriculture 1969 (Kuala Lumpur, Malaysia), p. 47.

[5]Malaysia, Department of Statistics, Federation of Malaya Report on Employment, Unemployment and Under-employment (Kuala Lumpur, Malaysia, 1965), p. 24.

[6]Malaysia, Department of Statistics, Monthly Statistical Bulletin (Kuala Lumpur, Malaysia, March, 1970), p. 171.

Table 1.1.--Malaysia: Rubber Exports, Export Earnings and Rubber Earnings as a Per cent of all Export Earnings: 1961-70.

Year	Quantity of Rubber Exported (long tons)	Earnings		Rubber Earnings as Per cent of all Export Earnings
		Rubber	All Exports	
		($Mil)	($Mil)	
1961	725,613	1347.1	2,622.4	51.4
1962	723,713	1272.8	2,620.6	48.6
1963	788,303	1300.4	2,698.9	48.2
1964	847,804	1303.4	2,780.9	46.9
1965	886,915	1368.3	3,102.9	44.1
1966	939,778	1395.8	3,119.5	44.7
1967	974,632	1216.0	2,918.8	41.7
1968	1,104,789	1300.9	3,203.4	40.6
1969	1,264,857	1940.1	4,061.4	47.7
1970	1,271,282	1663.3	4,169.1	39.8

Source: Malaysia, Department of Statistics, Monthly Statistical Bulletin (Kuala Lumpur, Malaysia, December, 1971), pp. 149-51.

Estates and Smallholdings

The rubber industry is essentially comprised of two main sectors, the estate sector and the smallholding sector. A smallholding is defined as any planted area of rubber under one management and less than 100 acres and an estate is defined as any planted area of rubber with 100 acres or more. However, over 50 per cent of the smallholding acreage, and about 80 per cent of the 400,000 odd smallholdings are less than 10 acres in extent.[7] It must be noted at the outset that statistics relating to the smallholding sector are at best estimates. There are an estimated 400,000 smallholdings. The average smallholding is about six acres in size. As a result, it is difficult to collect data on the smallholder sector. Collection of statistics from estates is much less of a problem as there are only 2,100 estates. Furthermore, these estates maintain records of their operations and regularly submit various data to the department of statistics.

In terms of acreage, the smallholdings cover a wider area than estates. Out of the 4.2 million acres under rubber, 2.6 million acres (62 per cent) are under smallholdings and 1.6 million acres (38 per cent) are under estates in 1969. In terms of production, however,

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[7] C. Barlow and S. C. Lim, "Natural Rubber and West Malaysia" (paper presented at the Singapore Meeting of the S.E. Asia Business Committee, May, 1968), p. 6.

the smallholdings account for only about 49 per cent of the total output[8] (Table 1.2). The discrepancy between the acreage occupied by the smallholding sector and its share of the total output is attributed to the lower yields on smallholdings as compared to those on estates.

As shown in Table 1.2, there has been a steady decrease in planted acreage on estates. This decrease is mainly due to the fragmentation of estates, the conversion of rubber land to oil palm, and the reduced rate of new planting on estates. The smallholding acreage, however, has been increasing steadily to more than offset the decline in estate acreage. This increase is due to the vast acreages of new plantings on land development schemes. In 1970, the smallholding acreage constituted 63 per cent of the total rubber acreage as compared with 51 per cent in 1961.

Recent Developments in Malaysian Rubber Yield-Stimulants

Yield-stimulants have been used to increase yields at some stage in the life of the rubber trees. So far, only two yield-stimulants 2,4,5 - T and 2,4,-D have been found suitable for commercial use. Other compounds under

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[8]Malaysia, Department of Statistics, Rubber Statistics Handbook (Kuala Lumpur, Malaysia, 1969), p. 61.

Table 1.2.--Malaysia: Rubber Acreage and Production on Estates and Smallholdings, 1961-70.

Year	Acreage ('000 acres)				Production ('000 long tons)			
	Estates	Smallholdings	Total	Smallholdings as Per cent of Total Acreage	Estates	Smallholdings	Total	Smallholdings as Per cent of Total Production
1961	1937	2035	3972	51.2	428.5	278.2	706.7	39.4
1962	1926	2224	4150	53.6	438.3	276.6	714.9	38.7
1963	1919	2332	4251	54.8	458.3	294.7	753.0	39.1
1964	1893	2411	4304	56.0	476.8	314.4	791.2	39.7
1965	1859	2469	4328	57.0	490.9	347.6	838.5	41.4
1966	1813	2529	4342	58.2	513.9	386.4	900.3	42.9
1967	1746	2552	4298	59.4	525.8	397.5	923.3	43.1
1968	1676	2582	4258	60.6	563.0	471.7	1034.7	45.6
1969	1623	2625	4248	61.8	604.5	587.0	1191.5	49.3
1970	1575	2729	4304	63.4	638.0	635.0	1273.0	49.9

Source: Malaysia, Department of Statistics, Monthly Statistical Bulletin (Kuala Lumpur, Malaysia, December, 1971), p. 43.

experiment include copper, ethylene oxide, glutaraldehyde and formaldehyde. One of the more recent chemicals under experiment by the Rubber Research Institute of Malaya (RRIM) is ethrel.

Ethrel is mixed in palm oil and applied to the scraped bark below the tapping cut at intervals of two months. Thus far, the application of ethrel is recommended by the RRIM for trees about fifteen years old and above. Results so far indicate that ethrel has no deleterious effects on the trees applied and on the quality of the latex produced.[9] Experiments conducted with ethrel on estates and smallholdings since the last three years or so indicated that yields of certain clones increased by about 60 per cent, and with two widely planted clones (Tjir 1 and PB 86), yields were about doubled. In the absence of any long-term deleterious effects emerging, the use of ethrel provides a means of substantially raising the yields of the lower-yielding clones.

Standard Malaysian Rubber (SMR) Scheme

The Standard Malaysian Rubber Scheme was introduced by the RRIM in 1965 in order to improve the quality of natural rubber by ensuring that it meets specified

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[9] P. D. Abraham, T. C. P'ng, and E. K. Ng, "RRIM Ethrel Trials: Progress Report," Preprint No. 1, Rubber Research Institute of Malaya Planters' Conference, Kuala Lumpur, Malaysia (July, 1971), p. 29.

technical specifications.[10] A prime objective of the SMR scheme is to provide a uniform and simplified set of standards for grading rubber; it is hoped that this new grading method will eventually replace the traditional method where grading is based on visual appearance of the rubber.

Before the introduction of the scheme, the RRIM carried out a world-wide inquiry to ascertain the consumers' views as to which technical properties should be specified and how the product should be packed and presented. On the basis of the collected data, the specifications were formulated as follows:

1) dirt content of rubber
2) copper and manganese content
3) ash, nitrogen, and volatile matter content
4) an oxidizability index to determine the intrinsic quality of the polymer itself.

Certain packing requirements are also laid down by the RRIM and these requirements must be met by producers before their product can be exported as Standard Malaysian Rubber (SMR). These requirements include the following:

1) the weight of each bale must not exceed 112 lbs.

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[10]The introduction of the Standard Malaysian Rubber (SMR) Scheme was announced by the Hon'ble Minister of Commerce and Industry on March 3, 1965.

2) the bale must be wrapped in polyethylene or other suitable wrapping material

3) no bale coating in any form may be used.[11]

The above requirements satisfy the consumers' need to have small, easily handled bales free from adulterating bale coating solutions and packed in such a way that dirt and other foreign materials are not picked up in transit. Conformity with the technical specifications and the packing requirements is checked by the RRIM which is responsible for authorizing the marking of bales with the trade mark "ESEMAR" and the specification of grades.

Grading of rubber under the SMR scheme is in sharp contrast to the traditional method. The latter method recognizes a multiplicity of grades based on subjective judgment and this results in subtle distinctions between grades which have little or no technical significance and lowers the grading of certain rubber unwarrantably. Under the SMR scheme, there were initially three grades of rubber exported, SMR 5, SMR 20, and SMR 50 indicating maximum dirt content limits of 0.05 per cent, 0.20 per cent and 0.5 per cent respectively. Recently, two new grades have been introduced, SMR EQ and SMR 10. SMR EQ is

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[11]For a more detailed information on the technical specifications and packing requirements, see "Standard Malaysian Rubbers," Planters' Bulletin, No. 78, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (May, 1965), p. 75.

an extra clean grade of rubber suitable for specialized products such as the manufacture of rubber thread while SMR 10 is an intergrade between SMR 5 and SMR 20, and indicates a maximum dirt content limit of 0.10 per cent. There has been a rapid increase in the export of SMR since its inception in 1965. Exports of SMR increased from 700 tons in 1965 to 139,000 tons in 1969 and about 250,000 tons in 1970.[12]

New Process Rubbers[13]

The introduction of the SMR scheme has generated changes in the processing methods which produce rubber in block form in contrast to the conventional method of processing the rubber into sheets. The main types of block rubbers produced are Heveacrumb, Comminuted, and Pelletized rubbers. The general principle behind the new processes producing the above block rubbers is essentially the same. All these new processing methods offer a quick and easy way for converting latex or coagulum into solid granular form and for efficient cleaning, easy drying, compacting and better presentation of natural rubber to the consumers.

The Heveacrumb process was developed by the RRIM. In this process the raw coagulum is successively crumbled

[12]Malaysia, Department of Statistics, Monthly Statistical Bulletin (Kuala Lumpur, Malaysia, July, 1970), p. 60.

[13]New Process Rubbers refer to the block natural rubbers produced by the new processing methods.

by a mechano-chemical granulation process, vigorously washed, rapidly dried by hot air, and compressed into polythene-wrapped bales of standard sizes. Comminuted rubber is produced by feeding the coagulum to a rotating knife set against a stationary one causing the coagulum to be cut into small pieces while pelletized rubber is produced by extruding the coagulum through the pelletizer and chopping the threads of rubber into granules with a rotating blade.[14]

The introduction of the new process rubbers has been favorably received by the natural rubber consumers. The conventional grades, unlike the synthetic rubber, have to undergo a series of pre-treatments before use in the consuming factories thus involving extra processing operations and costs. The advantage of the new process rubbers is that, no pre-treatments before use are required thus cutting down costs to the consumers.[15]

Summary

Malaysia is the world's largest producer of natural rubber. The rubber industry comprising of estates and smallholdings plays an important role in the

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[14]For a technical discussion of the new processing methods, see Planters' Bulletin, No. 86, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (September, 1966), pp. 106-30.

[15]A technical discussion of the pre-treatments is given in B. C. Sekhar, "Malaysian Natural Rubber--New Presentation Methods," Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (1967), pp. 3-10.

Malaysian economy. Apart from being the largest single crop by acreage, rubber provides the largest source of employment and rubber exports represent the largest source of Malaysian foreign exchange earnings. Rubber has also been a major contributor to federal revenue, but over the last few years, its contribution has declined due to the decline in natural rubber prices and the graduated export duty on the commodity.

Recently, certain major technological developments have been introduced in the Malaysian rubber industry, including the introduction of the yield-stimulant ethrel, the Standard Malaysian Rubber (SMR) Scheme and the new processing methods. The introduction of the yield-stimulant ethrel has the potential of substantially increasing the current yields of rubber trees. The SMR Scheme enables Malaysian natural rubber to be graded on technical specifications in contrast to the conventional method where grading was based on visual appearance of the rubber. With the development of the new processing methods, natural rubber can now be produced in block form which can be easily handled in the consuming factories.

CHAPTER II

THE PROBLEM AND OBJECTIVES OF THE STUDY

Introduction

The Malaysian rubber industry has been subject to several major technological changes as a result of research carried out by the Rubber Research Institute of Malaya (RRIM) and the private estates. As was indicated in the preceding chapter, the more recent technological changes in the industry are the introduction of the yield-stimulant ethrel; the Standard Malaysian Rubber (SMR) Scheme, and the new processing methods for the production of the new process rubbers.

The Problem

The greater part of the smallholders' rubber is of inferior quality due to inadequate care taken in latex collection, processing, drying and storage. Apart from yielding lower prices, production of inferior quality rubber reduces natural rubbers' competitiveness against synthetic rubber.

The methods of grading smallholders' rubber are unsatisfactory. The absence of a uniform standard based on technical specifications for grading has led to the subjective method of grading based on thickness, size, shades of color, presence of bubbles and mold growth. Estimation of moisture content is also arbitrary and is based on length of drying time and thickness of the sheets. It is common among buyers to record the weight of the rubber sheets to the nearest one-half pound downwards as the weight on which payment is to be made.[1] Thus, if a succession of small quantities are purchased, the buyer would receive an unusually large profit.

Smallholders' rubber is marketed through a chain of agencies consisting of the local dealers, middle dealers, remillers and exporters. Each agency in the marketing chain makes certain charges to cover the cost of its services and to make a profit. About 70 per cent of the smallholders' latex is sold to first level buyers (the local dealers) as unsmoked sheet (USS) and the remaining 30 per cent is sold as ribbed smoked sheet (RSS). A recent study on the marketing margins (or the difference between the f.o.b. price and the smallholders' price) indicated that the average marketing margin was

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[1] H. G. Biggs, "Report on the Marketing of Agricultural and Other Rural Produce in Malaysia" (London: Department of Technical Cooperation, 1964), p. 24.

2.8 cents/lb for RSS and 9.1 cents/lb for the USS.[2] In the case of rubber sold as scrap, the marketing margin was about 13 cents/lb.[3] The prices received by smallholders could be increased through a reduction in the marketing margin if this chain of marketing agencies could be reduced.

Natural rubber faces strong competition from synthetic rubber and is losing out to synthetics in the world elastomer market. For example, in 1950, 78 per cent of the world elastomer supply came from natural rubber as compared to 37 per cent in 1970. Hence, in order for natural rubber to compete with synthetic rubber, it is imperative that the smallholders adopt the new technologies in production, processing and marketing to drive down the cost of production, processing and marketing. With the development of the new process rubbers, the conventional form of rubber (sheet rubber) is likely to phase out of the international rubber market. However, the smallholders cannot be expected to adopt the new technologies in processing and marketing individually as the new forms

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[2]S. C. Lim, "A Study of the Marketing of Smallholders' Rubber at the First Trade Level in Selangor," Economics and Planning Division Report, No. 4, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (September, 1968), Table 24, p. 39.

[3]S. T. Cheam, "A Study of the Marketing of Smallholders' Lower Grade Rubber," Economics and Planning Division Report, No. 8, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (July, 1971), Table 26, p. 50.

of rubber are processed and marketed along lines too specialized for them to perform competently on an individual basis. On the other hand, the estate sector has little or no difficulty in adopting the new technologies as this sector is better organized and more productive in both production and marketing operations. In fact, production of the new process rubbers is presently mainly confined to estates and remillers.

The reorganization of the traditional smallholder processing and marketing system, insofar as it involves a reduction in the chain of agencies in marketing channel, is likely to result in an increase in smallholders' income. This increase in income could result from the reduction in the marketing margin and the subsequent increase in the prices received by smallholders for their product.

The introduction of the yield-stimulant ethrel has the potential of substantially increasing the Malaysian rubber output. Given the inelastic demand for natural rubber and the strong competition from synthetic rubber, the increase in output is likely to have a depressing effect on the already declining natural rubber prices. The effect of the decline in prices on smallholders' income is dependent on the relative increase in yields and the decline in prices.

In the face of the declining natural rubber prices, the adoption of the yield-stimulant by the smallholders could provide a means of maintaining or even possibly increasing their income through output increases despite the more rapid decline in prices which is likely to result from the adoption.

Objectives

The objectives of this study are to:

1. Analyze the potential impact of the yield-stimulant ethrel on the Malaysian and world natural rubber output over the period 1975-80.

2. Assess the effect of the potential increase in output on the world and Malaysian natural rubber prices for the period 1975-80.

3. Analyze the traditional and reorganized processing and marketing system for smallholder rubber.

4. Compare estimates of Malaysian smallholders' income for 1975-80 under the following alternatives:
   (a) Without yield stimulation and with the traditional processing and marketing system (Alternative I)
   (b) With yield stimulation and traditional processing and marketing system (Alternative II)

(c) Without yield stimulation and with reorganized processing and marketing system (Alternative III)

(d) With yield stimulation and reorganized processing and marketing system (Alternative IV)

5. Assess the implications of yield stimulation and reorganization of the smallholder processing and marketing system for:
   (a) The competitive position of the natural rubber industry
   (b) Malaysian foreign exchange earnings from rubber
   (c) Rubber export tax revenue
   (d) Supply elasticity and price fluctuations

6. Assess the implications of the study for government smallholder rubber policy.

Sources of Data

Data for this study are mainly from secondary sources because a wealth of data is available over a wide range of the various aspects of the Malaysian natural rubber industry. The data were obtained through the publications of the various institutions connected with the rubber industry, namely, the Rubber Research Institute of Malaya (RRIM), the Rubber Replanting Board (RRB),

the Malaysian Rubber Fund Board (MRFB), and the Malaysian Rubber Development Corporation (MRDC) and Malaysian Department of Statistics.

Supporting information was obtained mainly through interviews with officials of the Economics and Planning Division and the Smallholders' Advisory Service Division of the RRIM and through recent studies conducted by these divisions. Interviews with officials of the MRDC and with managers of the corporations' central processing factories also provided valuable information.

A survey of 178 smallholders was undertaken in October 1971 in order to ascertain the views of smallholders on the potential adoption of the new production, processing and marketing technologies; to identify the factors associated with their willingness to participate in the reorganization of the processing and marketing system of their product, and to gain some insight into the problems likely to be associated with the above reorganization.

The smallholder survey was conducted in two areas in the state of Selangor. In the first area, the smallholders were then selling their rubber to a central processing factory established by the MRDC. In the second area, the MRDC has proposed to set up a central processing factory. Eighty-seven smallholders from three

villages constituted the sub-sample in the first area while ninety-one smallholders from four villages constituted the sub-sample in the second area.

The questionnaires for the survey in both areas were prepared with the cooperation of the officials of the Smallholders Advisory Service and the Economics and Planning Divisions of the Rubber Research Institute. The questions were pre-tested by the author and a colleague from the Faculty of Agriculture at the University of Malaya. The questionnaires were subsequently revised before the actual survey was conducted.

The final year students of the Institute of Agriculture in Serdang conducted the survey over a two-week period. Three briefings were given to the enumerators to explain the objectives of the survey and the procedures to be followed.

An attempt was made to collect data on the prices paid by the dealers for smallholders' ribbed smoked sheet (RSS), unsmoked sheet (USS) and scrap by interviewing the dealers in both areas with the help of the Assistant Rubber Instructors in the areas.[4] However, this attempt proved more difficult than had been anticipated as

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[4]Assistant Rubber Instructors are the extension officers in the Smallholders Advisory Service Division of the Rubber Research Institute. They form the grass-root contact between the Institute and the smallholders and are generally familiar with the rubber dealers in their respective areas.

almost all the dealers interviewed were reluctant to divulge the required information, let alone to give access to records of their transactions.

Previous Research

Economic research on the smallholder sector has been mainly confined to the processing and marketing aspects of the smallholder rubber. These studies in general concluded that the existing patterns of processing, grading and marketing of smallholder rubber are far from desirable. Biggs, in his study of the marketing of agricultural produce in Malaysia observed that "it is in the fields of processing and primary marketing of the latex of scattered smallholders that the least satisfactory features of the existing marketing set-up are to be found."[5] Similarly, Lim,[6] Voon[7] and Cheam[8] in their studies of the various aspects of the smallholder processing and marketing system expressed dissatisfaction with the system mainly with respect to grading, marketing margins and moisture content determination. The studies concluded

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[5]Biggs, op. cit.

[6]Lim, op. cit.

[7]P. K. Voon, "Chinese Rubber Smallholding Industry in Selangor" (unpublished M.S. thesis, University of Malaya, April, 1967).

[8]Cheam, op. cit.

that there is a need for the reorganization of existing smallholder processing and marketing system.

Another study on the marketing of smallholder rubber was made by Agoes Salim.[9] Salim analyzed the structure of sixty-eight district markets by considering the number of dealers in each district and the size of their respective businesses. Salim also attempted a measure of market imperfections by the degree of rigidity in prices paid by the dealers in the districts. This was achieved by examining the relationship between the prices paid by dealers and the f.o.b. prices (f.o.b. Singapore). This study found that the number of dealers in a district was for the most part relatively small and the concentration of business in each district was relatively low indicating substantial competition among the dealers. The study also found that, using average monthly prices, the prices in the districts are not rigid or sticky, that is, prices in the districts and the f.o.b. prices are very highly correlated with the coefficient of determination (R^2) ranging from 0.9873 to 0.9948. Using daily prices however, it was found that the correlation between the district prices and the f.o.b. was less with the R^2 ranging from 0.9772 to 0.9916. Salim noted that his study has labored under fairly severe data limitations and

[9]Agoes Salim, "The Market for Small Farm Rubber in Malaya" (unpublished Ph.D. dissertation, Department of Agricultural Economics, University of Wisconsin, 1967).

cautioned against any sweeping conclusions being made from his study.

A study of the short-run supply response of Malaysian rubber was made by Wharton.[10] The study indicated that the supply response of Malaysian rubber was low. Wharton found that the response was lower for estates than for smallholdings. The estimated price elasticities of supply of estates ranged from +0.03 to +0.12 and were not significantly different from zero. For the smallholders, the elasticity estimates ranged from +0.20 to +0.37 and all the coefficients significantly different from zero.

The classic work on the economics of the Malaysian rubber industry is by Bauer in 1948.[11] In his study, Bauer noted that before World War II the assistance given to smallholders by the Rubber Research Institute in terms of research and technical advice was of a minor order compared to the assistance provided to the estates though about one-half of the Institute's revenue came from the smallholder sector. The reason for the heavy emphasis on estates in providing assistance was that the estates were mostly European-owned and the officials of the Institute

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[10] C. R. Wharton, Jr., "Malayan Rubber Supply Conditions," Reprint No. 3 (New York: Agricultural Development Council, 1964).

[11] P. T. Bauer, The Rubber Industry: A Study in Competition and Monopoly (Cambridge, Mass.: Harvard University Press, 1948).

itself were then mostly Europeans. Institute officers were also not familiar with the conditions and problems on smallholdings. Bauer also noted that new plantings by smallholders were discouraged through the imposition of various restrictions which were applicable to the smallholdings but not to the estates. These factors have been mainly responsible for the smallholdings lagging behind the estates in production, processing and marketing.

There is a dearth of literature on the analysis and projections of natural rubber prices. Two reasons account for this dearth of literature. First, analysis of future natural rubber prices is beset with complexities arising from the problems involved in predicting the behavior of the multiplicity of variables that determine the world price of rubber. Second, though studies on rubber prices have been made by international agencies and institutions connected with the rubber industry, results of these studies are generally not available for fear of being published.

An attempt was made by Crosson to forecast natural rubber prices based on qualitative analysis of several factors which are likely to influence the prices.[12] Crosson predicted that the Malaysian price of natural

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[12]Pierre R. Crosson, Economic Growth in Malaysia: Projections of Gross National Product and of Production, Consumption, and Net Imports of Agricultural Commodities, Planning Methods Series, No. 2 (Jerusalem: National Planning Association, Center for Development Planning, 1966).

rubber will decline in even steps from 70 cents/lb (Malaysian cents) in 1965 to 55 cents/lb in 1975.

More recent attempts to project natural rubber prices have been made by Behrman,[13] Dayal[14] and Hague.[15] Behrman constructed an econometric model of the world rubber market and utilized the model in simulations over a decade of the sample period (1955-1964) and over a sixteen-year forecast period (1965-1980) in order to project natural rubber demand, supply, and prices. Similarly, Dayal constructed an econometric model of the world rubber market. The model was designed to produce integrated projections of supply, demand, and prices of natural rubber for individual years up to 1980. The model was first used to attempt separate analysis of supply, demand and prices. These separate analysis were then put together into a single framework to generate an integrated picture of the three segments of the rubber market. Hague projected natural rubber prices for the period 1975-85. His projection is based on the trend in the cost of synthetic

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[13] Jere R. Behrman, "An Econometric Study of the World Rubber Market: 1950-1980," Discussion Paper No. 85, Department of Economics, University of Pennsylvania, July, 1968.

[14] R. Dayal, "Econometric Model of the World Rubber Market," Commodities Division, UNCTAD, Geneva, May, 1970. (Mimeographed draft.)

[15] Irfan, Ul, Hague, "Efficiency in Resource Allocation: The Case of Natural Rubber," Economics Department, IBRD, July, 1971.

rubber and assumes that the future synthetic rubber production cost will serve as a ceiling for natural rubber prices.

CHAPTER III

MALAYSIAN AND WORLD NATURAL RUBBER SUPPLY PROJECTIONS WITH YIELD STIMULATION: 1975-80

Interrelationships Between Variables in the World Natural Rubber Market

The world natural rubber market is influenced by a multitude of variables which interact to determine the supply, demand, and prices of this commodity. In view of the close substitutability between natural and synthetic rubber, the world market for natural rubber cannot be studied in isolation but has to be studied in the context of the simultaneous analysis of the synthetic rubber market, particularly, an analysis of the nature and significance of the competition between the two elastomers.

In order to facilitate an understanding of the linkages between the various segments within the Malaysian natural rubber industry; between the Malaysian and world natural rubber industry, and finally the linkages between the natural and synthetic rubber industries, an economic model of the world rubber market (natural and synthetic) is

developed and presented in Figure 3.1. The model has been presented in the form of a flow diagram so that the various linkages in the industry can be made apparent. A detailed discussion of the model and equations specifying the relationships between the variables will be presented when each segment of the rubber market is analyzed--in this and the ensuing chapters. However, due to the paucity of data and the time constraint for this study, it is not possible to include all the variables in the model and quantify all the relationships between the variables in this study. In cases where quantification of the relationships between certain variables is not possible, a qualitative analysis of their impacts on the parameters of interest is attempted.

The inability to quantify all the relationships between the variables in the model does not discredit the usefulness of the model itself. It provides a framework for policy makers to trace the consequences of alternative policies to be pursued on rubber, particularly on the major segments of the rubber market such as costs, supply, demand and prices. The model can also be useful for future Malaysian and other researchers on the rubber industry as it provides a framework to absorb new and more complete data on the various aspects of the industry as they become available. The model will be used in my study as a framework to analyze the impacts of the new technologies in Malaysian natural rubber production, processing, and

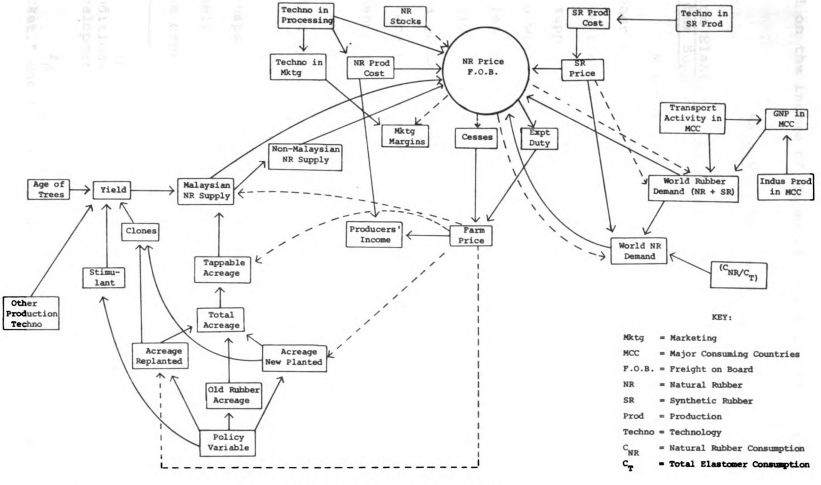

Figure 3.1.--An Economic Model of the World Rubber Market.

Note: Arrows indicate the direction of influence. Continuous lines indicate major paths of influence. Broken lines indicate minor paths of influence.

marketing on the different segments of world rubber market and on the income of Malaysian natural rubber producers.

Malaysian Natural Rubber Supply

Price Elasticity of Natural Rubber Supply

Most studies of the supply response of natural rubber have indicated that the supply of natural rubber is price inelastic. Wharton found that the price elasticity of supply of estates does not differ significantly from zero while price elasticity of supply of smallholders varies between 0.20 and +0.37.[1] Dayal, in his study of the supply function of natural rubber found that the addition of a price variable has almost no effect on the supply. His analysis also shows that there is practically no influence of prices on the yield and acreage of replantings and new plantings in any of the major natural rubber producing countries.[2]

The price inelasticity of natural rubber supply can perhaps be attributed to the perennial nature of the crop itself. At any given time, there is a fixed rubber productive capacity dependent on the stock of mature trees and

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[1] C. R. Wharton, Jr., "Malaysian Rubber Supply Conditions," Reprint No. 3 (New York: Agricultural Development Council, 1964), p. 146.

[2] R. Dayal, "Econometric Model of the World Rubber Market," Commodities Division, UNCTAD, Geneva, May, 1970. (Mimeographed draft.)

the yield levels of the planted material. Since rubber has a long gestation period (6-8 years), there is a lapse of several years before the producers can increase the stock of his mature trees.

In the short run (when the stock of mature trees is fixed), producers may respond to higher prices within certain limits by increasing the frequency of tapping and size of tapping cuts and changing the area or number of trees being tapped. However, the above response has been very limited and upward price movements, even for sustained periods, have not resulted in large increases in production. Wharton indicates that, as far as smallholders are concerned, the low response to upward price movements can be attributed to the fact that the smallholders are operating at "normal" capacity levels, that is, at high frequency and intensity of tapping and the acreage tapped is close, or equal, to the mature acreage.[3] The extreme price inelasticity of estate supply can be attributed to the rather fixed tapping schedule followed by the estates.

In the case of a price decline, producers may respond in the short-run by decreasing the frequency and intensity and the number of trees tapped. However, this response is also limited. The estates can be expected to continue tapping so long as their variable costs of operation can be covered with the prevailing rubber prices.

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[3]Wharton, op. cit., p. 147.

In the case of smallholders, a drop in prices means a drop in family income especially for those smallholdings where the source of labor is the family labor. Producers with alternative crops or employment opportunities may reduce production and supplement their income from these sources. However, given the limited employment opportunities, the majority of producers would probably continue their regular tapping schedule or may even increase the frequency and intensity of tapping in order to maintain their family income.

In the long run, the estates and smallholdings could respond to price changes through an increase or decrease in replanting and new plantings if producers expect the prices to increase or decrease accordingly. Thus, the long run supply elasticity is likely to be much larger than the short-run elasticity. Furthermore, the long run elasticity is probably larger for estates than for smallholdings as is evident from the decrease in replanting and new planting on Malaysian estates and the decrease in estates acreage in response to the declining natural rubber prices.[4]

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[4]The Malaysian estate acreage declined from about 2 million acres in 1955 to 1.6 million acres in 1970. During the same period natural rubber prices declined from 114 cents/lb (Malaysian cents) to 56.4 cents/lb.

Natural Rubber Supply Function

Before proceeding with supply projection, a model of the Malaysian natural rubber supply is presented and discussed to provide an insight into the various factors affecting the supply of this commodity. This model is an elaboration of the supply segment of the model of the rubber industry presented in Figure 3.1. The Malaysian rubber supply model is, however, equally applicable in analysis of supplies for other natural rubber producing countries.

The supply function of natural rubber can be represented by the following equation:

1. $SNR_t = f(PNR_t, M_t, YLD_t, U_t)$

where SNR = supply of natural rubber

PNR = price of natural rubber

M = mature acreage

YLD = yield per unit area

U = random error

t = time period, year

The yield per unit area is a function of several variables and can be summarized by the equation:

2. $YLD_t = g(Act, Cct, Ast, T, Ut)$

where Ac = age composition of the mature acreage

Cc = clonal composition of the mature acreage

As = acreage stimulated

T = a time trend

U - random error

A time trend has been included in the second equation as a proxy for other factors which are likely to influence the yield trend (e.g., fertilizers and changes in tapping system, etc.). The inclusion of Ac as an independent variable reflects the fact that the yield of rubber trees varies with age. The yield generally increases following the gestation period of the trees, reaches a peak about eighth to tenth year of tapping and then declines. The clonal composition of the mature trees also affects the average yield as yields vary with the types of clones planted. Another factor which could significantly affect the yield of the trees is the acreage of mature trees under yield stimulation (As). Reference to the effect of the yield-stimulant ethrel on the yields of different clones have been made in the preceding chapter.

The average yield of Malaysian rubber has been increasing steadily since 1955 as a result of replantings and new plantings. Replantings and new plantings affect the yields through their effects on the clonal composition of the acreage resulting in higher proportions of acreage being under high-yielding clones. Due to the gestation period of the rubber trees, there is a lag of six to eight

years before the replanted and new planted trees affect the clonal composition of the mature acreage, thus the yield and output.

In view of the inelasticity of natural rubber supply and the rationale for this inelasticity, most studies on supply projections of this commodity have excluded price as one of the variables affecting supply thereby assuming a perfectly inelastic supply response to price. In this study, the same assumption is made when projections for Malaysian and world natural rubber output are attempted.

Output Projection of the Rubber Research Institute of Malaya

The Rubber Research Institute of Malaya (RRIM) makes periodic projections of Malaysian rubber output. The most recent projection made in 1970 covers a period of ten years (1971-80).[5] The RRIM projection used essentially the same variables that were specified in the supply model presented earlier and assumed that prices have no effect on the supply. The projection, however, did not incorporate the potential use of ethrel and its effect on future output. In my attempt to project the Malaysian rubber output with the use of ethrel, the RRIM projection will be used as the benchmark or control. Thus, my projection essentially

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[5]P. O. Thomas, "Malaysian Natural Rubber in the Seventies: A Forecast of Production Trends," Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (July, 1970).

entails a revision of the RRIM projection by incorporating the potential use of ethrel and its effect on the latter projection. A brief summary of the methodology used in the RRIM projection is presented to help understand how the various statistics presented later in the chapter are arrived at. The RRIM projection for the Malaysian rubber output is based on separate projections for estates and smallholdings.

Estates

For the estates, all planted rubber are classified into three categories: unselected seedlings, pre-war high-yielding clones, and post-war high-yielding clones. Acreages of each of these categories are estimated for each year. For purposes of production forecast, it is necessary to estimate the mature acreages of each category as immature acreages have no effect on production and have to be subtracted from total acreage. Mature acreages are estimated by calculating the acreage coming into maturity annually and this is obtained by subtracting the immature acreage for a given year from the sum of the acreage planted in the same year and the immature acreage of the previous year. The immature acreage for any given year is a summation of the acreage new planted or replanted during the previous six years (which is the average gestation period for rubber trees). With the mature acreages of each

category for a given year estimated, yield estimates are then calculated in order to arrive at the production estimates.

For the unselected seedlings and pre-war high-yielding clones, the assumption made in the RRIM projection is that these two categories will have a declining yield trend as these categories mainly consist of old trees. However, in estimating the yield for the post-war high-yielding clones, this category is grouped into three classes as there are substantial differences in yield performance of different clones in this category. Yield curve for each of these classes based on the latest data collected through the Commercial Registration of Estates by RRIM is then derived. Given the yield curve and the acreage planted to different clones for each class, a weighted average yield for the post-war high-yielding category is derived.

Smallholdings

Projecting future production on smallholdings is beset with some difficulties due to the lack of reliable and comprehensive statistics on this sector. Thus, the projection made had to be based on the best possible approximations, from data available, on acreage and yield.

Total planted acreage is initially derived from the Rubber Statistics Handbook of the Department of

Statistics and revised in accordance with the data collected by the Smallholders' Advisory Service Division of the RRIM and the aerial survey conducted by the Ministry of Agriculture. Using this acreage estimate as the basis, mature acreages are computed by taking into consideration the past and future rates of new planting and replanting.

The yield on smallholdings has been increasing during 1960-69 due mainly to the higher proportion of high-yielding trees coming into maturity annually. The yield per acre is estimated by a multiple regression of average yield per acre on cumulative acreage maturing annually and a time trend. The last variable is used to include other factors contributing to the steady increase in yield. The results of the forecast made for both estates and smallholdings up to 1980 are summarized in Table 3.1. With the brief discussion on the methodology used in the RRIM projection of the Malaysian natural rubber output, an analysis of the potential impact of ethrel on the output is now attempted. The analysis is carried out separately for estates and smallholdings.

Projections of the Impact of Yield Stimulation With Ethrel on Malaysian Natural Rubber Output: 1975-80

Assumptions Regarding the Use of Ethrel

In projecting the Malaysian natural rubber output with the use of the yield-stimulant ethrel, certain

Table 3.1.--Recent and Projected Malaysian Rubber Acreage ('000 Acres) and Production ('000 Long Tons), 1955-80.

Year	Acreage		Production		Total Acreage	Total Production	Annual Increase in Production (Per cent)
	Estates	Smallholdings	Estates	Smallholdings			
1955	2015	1783	352	285	3798	637	8.9
1956	2008	1816	351	255	3824	606	4.9
1957	2011	1843	368	250	3854	618	2.0
1958	1981	1915	389	249	3896	638	3.2
1959	1942	2008	407	263	3950	670	5.0
1960	1935	2099	413	272	4034	685	2.2
1961	1937	2202	428	278	4139	706	3.1
1962	1927	2322	438	277	4249	715	1.3
1963	1919	2415	458	295	4334	753	5.3
1964	1893	2487	477	314	4380	791	5.1
1965	1859	2525	491	348	4384	839	6.1
1966	1813	2571	514	386	4384	900	7.3
1967	1746	2604	526	397	4350	923	2.5
1968	1676	2615	563	472	4291	1035	12.1
1969	1623	2625	603	587	4248	1190	15.0
1970	1575	2677	638	635	4252	1273	7.0
1971	1532	2729	672	717	4261	1389	9.1
1972	1492	2781	701	786	4273	1487	7.1
1973	1452	2833	724	846	4285	1570	5.6
1974	1437	2885	740	894	4322	1634	4.1
1975	1437	2937	751	934	4374	1685	3.1
1976	1437	2989	764	977	4426	1741	3.3
1977	1437	3041	775	1030	4478	1805	3.7
1978	1437	3093	785	1095	4530	1880	4.2
1979	1437	3145	791	1162	4582	1953	3.9
1980	1437	3197	800	1231	4634	2031	4.0

Source: P. O. Thomas, "Malaysian Natural Rubber in the Seventies: A Forecast of Production Trends," Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (1970), Tables 1, 4, and 5.

assumptions regarding the use of the stimulant are made. These assumptions, listed below, hold for both estates and smallholdings.

1. The use of ethrel has no deleterious short- or long-term effects on the trees and on the technical qualities of the rubber produced.

2. Ethrel is applied to trees seventeen years old and above; that is, ethrel is applied on renewed bark.

3. Tapping system used is alternate daily and half-spiral length.

4. Ethrel strength used is 6.7 per cent active ingredient in palm-oil and applied every two months to the lightly scraped bark below the tapping cut.

5. The stimulated trees are adequately fertilized in accordance with the amount recommended by the RRIM.

6. There are no differences in response to ethrel based on age of trees.

The last assumption is based on the fact that experiments have shown that there are marked differences in response to ethrel between younger trees tapped on virgin bark and the trees tapped on renewed bark, with the response being greater with the latter. However, no

marked differences in response are observed between trees of different age when they are tapped on renewed bark.[6]

The first assumption is the most crucial to the whole analysis. The results of field trials with ethrel over the last three years or so have thus far supported this assumption.[7] Assumptions two to five are in accordance with the RRIM current recommendations regarding ethrel stimulation.

Estimation Procedure

Though the estimation for estates and smallholdings are done separately, the procedure used is essentially the same for both sectors. Listed below are the steps involved in the procedure for both estates and smallholdings.

1. Estimate the acreage expected to be stimulated annually for the period 1975-1980.

2. Calculate the weighted average response to stimulation based on the responses of the different clones and the acreage planted with each clone.

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[6]P. D. Abraham, "Field Trials with Ethrel," Planters' Bulletin, No. III, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (November, 1970).

[7]P. D. Abraham, T. C. P'ng, and E. K. Ng, "RRIM Ethrel Trials: Progress Report," Preprint No. 1, Rubber Research Institute of Malaya Planters' Conference, Kuala Lumpur, Malaysia (July, 1971).

3. Calculate the expected incremental output resulting from stimulation and project the total Malaysian output for 1975-1980.

Estimating the Estate Acreage to be Stimulated: 1975-1980

The basis for this estimate is the total estate acreage for 1975-1980. Since it has been assumed that only trees seventeen years old and above will be stimulated, it is necessary that the acreage under seventeen years old be deducted from the total annual acreage. This is achieved by deducting from the total acreage each year the acreage new planted and replanted since the last seventeen years. For example, the acreage seventeen years and above in 1975 will be the total acreage for that year less the total acreage new planted and replanted since 1958, and the acreage seventeen years old and above in 1976 is the total acreage for that year less the total acreage new planted and replanted since 1959 and so on. Table 3.2 shows the acreage new planted and replanted since 1958,and from this table, acreage of seventeen years and above for each year from 1975-1980 is calculated. The next step in the estimation of acreage to be stimulated is to estimate the proportions of the acreage seventeen years and above that is expected to go into stimulation.

Since ethrel stimulation is still in the experimental stage, it is difficult to obtain data on the acreage

Table 3.2.--Recent and Projected Rubber New Planting and Replanting on Malaysian Estates: 1958-80. ('000 Acres)

Year	New Planting	Replanting	Total	Cumulative Total
1958	14	65	79	79
1959	14	68	82	161
1960	22	75	97	258
1961	18	70	88	346
1962	10	63	73	419
1963	9	59	68	487
1964	6	59	65	552
1965	5	53	58	610
1966	3	50	53	663
1967	2	28	30	693
1968	1	13	14	707
1969	-	12	12	719
1970	-	12	12	731
1971	-	12	12	743
1972	-	10	10	753
1973	-	10	10	763
1974	-	10	10	773
1975	-	10	10	783
1976	-	10	10	793
1977	-	10	10	803
1978	-	-	-	803
1979	-	-	-	803
1980	-	-	-	803

Source: P. O. Thomas, "Malaysian Natural Rubber in the Seventies: A Forecast of Production Trends," Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (1970), Table 1.

going into stimulation during the period under study. Interviews were conducted with managers of several estates in July, 1971 with the object of securing some information on the present estate acreage under stimulation and the proportions of acreage expected to be stimulated.[8] The interviews, however, failed to secure the required information as the respondents were both unable and unwilling to divulge the information at this stage.

In view of this difficulty, the alternative is to make assumptions regarding the levels of adoption of the yield-stimulant by the estates. For the purpose of projecting the output, two levels of adoption are assumed, the low and high levels of adoption. For the low adoption level, it is assumed that by 1975, 50 per cent of the estate acreage of seventeen years old and above will be stimulated and that there will be a 10 per cent increase in the acreage stimulated annually so that by 1980, all the estate acreage of seventeen years and above will be stimulated. In the case of the high level of adoption, the assumption is that 60 per cent of the estate acreage of seventeen years and above will be stimulated by 1975, and that there will be a 10 per cent increase in the acreage stimulated annually. With the "high level adoption" assumption, all the estate acreage of seventeen years old

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[8]The interviews were conducted during the Rubber Research Institute of Malaya Planters' Conference held in Kuala Lumpur, Malaysia, in July, 1971.

and above will be under stimulation by 1979. Both assumptions are based on the belief that in the initial stages, the estates are more cautious in their ethrel application, and that the acreage stimulated will increase as more is known about the long-term effects of the stimulant. Based on these assumptions, the estate acreages to be stimulated during the 1975-80 period are estimated. These estimated acreages are shown in Table 3.3.

Response to Stimulation

From the total estate acreage expected to be stimulated, an estimate is made of the acreage under the different types of clones. This estimate is based on the results of the survey of estates conducted by the RRIM in 1967. For the purpose of computing the weighted average response to stimulation, it is assumed that as of 1967, the proportion of each clone in the total planted acreage remains approximately the same throughout the projection period.

The RRIM Survey indicates that there are some forty different clones planted on estates. However, data on the response to stimulation based on the RRIM field trials are available for only nine clones (Table 3.4). These nine clones cover about 43 per cent of the total planted estate acreage. In computing the weighted average response, it is then necessary to estimate the response of other clones to stimulation and this estimate is arrived at

Table 3.3.--Projected Malaysian Estate Rubber Acreage Seventeen Years Old and Above and Estimated Acreage to be Stimulated: 1975-80.[a] ('000 Acres)

1	2	3	4	5			
Year	Projected Total Planted Acreage	Projected Acreage Under 17 Years	Projected Acreage 17 Years and Above	Estimated Acreage to be Stimulated			
				(As per cent of 4)		Absolute Acreage	
				Low[b]	High[c]	Low	High
1975	1437	783	654	50	60	327	392
1976	1437	714	723	60	70	434	506
1977	1437	642	795	70	80	557	636
1978	1437	545	892	80	90	714	803
1979	1437	457	980	90	100	882	980
1980	1437	384	1053	100	100	1053	1053

[a]Calculated from data in Tables 3.1 and 3.2.

[b]Under the "low" assumption, 50 per cent of the estate acreage of 17 years old and above will be stimulated by 1975. The acreage stimulated will increase annually by 10 per cent, so that by 1980 all the estate acreage of 17 years old and above will be stimulated.

[c]Under the "high" assumption, 60 per cent of the estate acreage of 17 years old and above will be stimulated by 1975. The acreage stimulated will increase annually by 10 per cent, so that by 1979 all estate acreage of 17 years old and above will be stimulated.

Table 3.4.--Malaysia: Response to Ethrel Stimulation, by Types of Clones[a] (lbs/acre).

Treatment	Types of Clones									
	RRIM 600	RRIM 605	RRIM 612	RRIM 623	GT. 1	PR 107	PB 86	Tjir 1	RRIM 501	Weighted Average
Control (lbs/ac)	1415	1288	1119	1326	1995	1090	1187	1174	1876	1385
With Ethrel Stimulation (lbs/ac)	1997	2265	1884	2152	2327	1595	2399	2207	2160	2121
Response (lbs/ac)	582	977	765	826	332	505	1212	1033	284	724
Percentage Response	41.1	75.9	68.4	62.3	16.6	46.3	102.1	88.0	15.1	57.4

Source: T. Y. Pee and P. D. Abraham, "Economic Analysis of R.R.I.M. Field Trials," Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (July, 1970), Table 2.

[a]The observations are for one year. Ethrel is applied every two months and tapping system used is alternate daily, half-spiral tapping. Ethrel concentration used is 6.7 per cent active ingredient in palm-oil.

by taking the simple average response of the nine clones for which data on the response are available. Given the clonal response to stimulation and the estimated acreage planted with each clone, the weighted average response to stimulation is computed, and this works out to be 770 pounds per acre (above control) or approximately 61 per cent response. Table 3.5 gives a summary of the projections for the estate sector for the period 1975-1980.

Estimating the Smallholding Acreage to be Stimulated

Smallholding acreage of seventeen years and above is estimated by subtracting the acreage below seventeen years from the total planted acreage. Data on the smallholding acreage new planted and replanted since 1958 (Table 3.6) provide the basis for calculating the acreage under seventeen years for the period 1975-1980.

The next step involves the projections of the proportions of smallholding acreage (seventeen years old and above) that is expected to be stimulated. As with the estates, data on these proportions are hard to come by. Discussions with officials of the Smallholders' Advisory Service and the Economics and Planning Divisions of the RRIM failed to yield the required information as these officials were hesitant to make any estimate. This hesitancy is due to the fact that ethrel stimulation is still in its experimental stage and that the long-term

Table 3.5.--Projections of Rubber Output on Malaysian Estates With and Without Yield Stimulation: 1975-80.[a]

1	2	3		4	5				6	
		Estimated Acreage to be Stimulated ('000 Acres)			Projected Incremental Output					
Year	Projected Output Without Stimulation ('000 Long Tons)			Weighted Average Response to Stimulation (lbs/acre)	Absolute Increase ('000 Long Tons)		Percentage Increase (as Per cent of 2)		Projected Output With Stimulation (2+5) ('000 Long Tons)	
		Low[b]	High[c]		Low	High	Low	High	Low	High
1975	751	327	392	770	112	134	14.9	17.8	863	885
1976	764	434	506	770	149	174	19.5	22.7	913	938
1977	775	557	636	770	191	218	24.6	28.1	966	993
1978	785	714	803	770	245	276	31.2	35.1	1030	1061
1979	791	882	980	770	303	337	38.3	42.6	1094	1128
1980	800	1053	1053	770	362	362	45.2	45.2	1162	1162

[a]Calculated from data in Tables 3.1 and 3.3.

[b]See footnote b in Table 3.3.

[c]See footnote c in Table 3.3.

Table 3.6.--Recent and Projected Rubber New Planting and Replanting on Malaysian Smallholdings: 1958-80. ('000 Acres)

Year	New Planting	Replanting	Total	Cumulative Total
1958	31	57	88	88
1959	44	69	113	201
1960	66	69	135	336
1961	96	57	153	489
1962	109	69	178	667
1963	85	83	168	835
1964	61	79	140	975
1965	33	91	124	1099
1966	27	49	76	1175
1967	19	75	94	1269
1968	14	39	53	1322
1969	15	36	51	1373
1970	60	45	105	1478
1971	60	45	105	1583
1972	60	45	105	1688
1973	60	45	105	1793
1974	60	45	105	1898
1975	60	45	105	2003
1976	60	45	105	2108
1977	60	45	105	2213
1978	60	45	105	2318
1979	60	45	105	2423
1980	60	45	105	2528

Source: Thomas, op. cit., Table 4.

effects of stimulation, and the receptivity of smallholders toward this new technology are yet unknown.

In order to estimate the acreage going into stimulation, several questions pertaining to the attitudes of smallholders toward this new technology were included in the smallholder survey conducted by the author in October, 1971 in the State of Selangor. Out of the 178 smallholders interviewed, 79 (45%) responded that they will use ethrel when their acreage is old enough to be stimulated. Forty-four (24%) responded that they will not use the stimulant and for 29 respondents (16%), the response given was "uncertain." Fifteen per cent of the respondents have not heard of the new yield-stimulant. The main reasons given by respondents who either will not use ethrel or express uncertainty about the use are the fear that use of ethrel might damage and/or kill the trees; the lack of knowledge about methods of ethrel application, and the effect of ethrel on output.

A summary of the response is given in Table 3.7.

Table 3.7.--Responses of a Sample of Smallholders in Selangor to the Potential Use of Ethrel in October, 1971.

Type of Response	No. of Respondents	Per cent
Not heard of ethrel	27	15
Will use ethrel	79	45
Will not use ethrel	43	24
Uncertain	29	16
Total	178	100

Though the survey indicated that 45 per cent of the smallholders interviewed will be using ethrel, it is difficult to generalize from the results for the smallholder sector as a whole. It is very likely that, for the smallholder sector as a whole, the response to the potential use of ethrel would be lower than that obtained from the sample survey in Selangor for several reasons. First, the Rubber Research Institute is situated in Selangor and early experiments and field-trials with ethrel have been mainly confined to this state. Second, the sample of smallholders interviewed were from areas close to the Institute (approximately 20-40 miles from the Institute). These two factors are likely to cause an upward bias in the responses obtained as the smallholders in the survey areas are probably more informed about ethrel and hence are more willing to adopt the stimulant as compared to smallholders in other states in Malaysia.

Based on the response obtained from the survey, and the reasons for the probable upward bias in the response pertaining to the potential adoption of ethrel, it can be expected that the potential rate of adoption by the smallholder sector as a whole would be lower than the 45 per cent indicated in the survey. Thus, in estimating the smallholding acreage to be stimulated during 1975-80, the rate of adoption is assumed to be lower than that indicated by the survey. Two levels of adoption of the

stimulant (the low and high levels of adoption) by the smallholder sector are assumed. With the "low" assumption, it is assumed that by 1975, 30 per cent of the smallholding acreage of seventeen years old and above will be using ethrel,and that the acreage stimulated will increase annually by 10 per cent, so that by 1980, 80 per cent of the acreage will be stimulated. Based on the "high" assumption, 40 per cent of the smallholding acreage will be stimulated with the acreage stimulated increasing by 10 per cent annually, so that by 1980, 90 per cent of the acreage will be stimulated. Based on these assumptions, the smallholding acreages to be stimulated for the period 1975-80 are estimated (Table 3.8).

The levels of adoption of the stimulant have been assumed to be higher for estates than for smallholdings. The reason for this assumption is that it would require more time for the approximately 300,000 scattered smallholders to gain sufficient knowledge about ethrel, particularly knowledge pertaining to costs of the stimulant, method of application, fertilizer requirements, and the effect of the stimulant on the yield. On the other hand, the estates are likely to have quicker access to the necessary information about the stimulant as there are only 2,100 estates, and furthermore, some of these estates are currently conducting their own field-trials with the stimulant.

Table 3.8.--Projected Malaysian Smallholding Rubber Acreage Seventeen Years and Above and Estimated Acreage to be Stimulated: 1975-80.[a] ('000 Acres)

1	2	3	4	5			
				Estimated Acreage to be Stimulated			
Year	Projected Total Planted Acreage	Projected Acreage Under 17 Years	Projected Acreage 17 Years and Above	(As per cent of 4)		Absolute Acreage	
				Low[b]	High[c]	Low	High
1975	2937	2003	934	30	40	280	373
1976	2989	2020	969	40	50	388	485
1977	3041	2012	1029	50	60	515	618
1978	3093	1982	1111	60	70	667	778
1979	3145	1934	1211	70	80	848	969
1980	3197	1861	1336	80	90	1069	1203

[a]Calculated from data in Tables 3.1 and 3.6.

[b]Under the "low" assumption, 30 per cent of the smallholding acreage of 17 years old and above will be stimulated by 1975. The acreage stimulated will increase annually by 10 per cent, so that by 1980, 80 per cent of the smallholding acreage of 17 years old and above will be stimulated.

[c]Under the "high" assumption, 40 per cent of the smallholding acreage of 17 years old and above will be stimulated by 1975. The acreage stimulated will increase by 10 per cent annually, so that by 1980, 90 per cent of the smallholding acreage of 17 years old and above will be stimulated.

Response to Stimulation

Data on the response of smallholding to ethrel stimulation are not available at the time of writing this thesis. The RRIM launched a large smallholding ethrel-stimulation trial in 1970 involving some 8,000 smallholdings and covering an area of 15,000 acres.[9] Results of these trials are currently not available.

To arrive at the response to stimulation on smallholdings, the response on estates will be used as the basis of comparison. The weighted average estate response is reduced by 100 lbs. per acre to yield a response of 670 lbs. per acre on smallholdings. The reduction is made in view of the generally lower standards of agricultural practice on smallholdings as compared to the estates. The above derived estimate is consistent with the results of a small scale trial (involving only fifty-four smallholdings) carried out in 1970. The results show that on 80 per cent of the holdings, the yield increased by about 70 per cent in response to ethrel.[10] Based on the estimated acreage to be stimulated and the assumed response (lbs/acre) to stimulation, the smallholding output with yield stimulation

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[9] P. D. Abraham, "Ethrel Trials on Smallholdings: Preliminary Results," Preprint No. 2, Rubber Research Institute of Malaya Planters' Conference, Kuala Lumpur, Malaysia, July, 1971, p. 14.

[10] Ibid., p. 11.

is projected for the period 1975-80 (Table 3.9). A summary of the output projections for both estates and smallholdings is shown in Table 3.10.

Impact of Yield Stimulation on World Natural Rubber Output: 1975-80

The estimate of the impact of yield stimulation on natural rubber output has thus far been confined to Malaysia. However, we cannot overlook the possibility of other natural rubber producing countries (mainly Indonesia, Thailand, Ceylon) adopting yield stimulation if this new technology is proven to have no long-term deleterious effects on the trees and on the qualities of the rubber produced. Based on the probable spread of this new production technology, an attempt will be made to approximate the impact of the technology on the world natural rubber output. Since the Malaysian output with yield stimulation has already been projected, the impact of the stimulant on the world output then involves the estimation of its impact on the other (rest of world) natural rubber producing countries.

No objective estimate of the impact of yield stimulation on output for other natural rubber producing countries can be made due to the paucity of the relevant data. These data include the past and future rates of new planting and replanting, types of clones planted, clonal response to stimulation and the proportions of acreage

Table 3.9.--Malaysian Smallholding Rubber Output Projections With and Without Yield Stimulation: 1975-80.[a]

1	2	3		4	5				6	
Year	Projected Output Without Stimulation ('000 Long Tons)	Estimated Acreage to be Stimulated ('000 Acres)		Weighted Average Response to Stimulation (lbs/acre)	Projected Incremental Output				Projected Output With Stimulation (2+5) ('000 Long Tons)	
					Absolute Increase ('000 Long Tons)		Percentage Increase (as Per cent of 2)			
		Low[b]	High[c]		Low	High	Low	High	Low	High
1975	934	280	373	670	84	112	9.0	12.0	1018	1046
1976	977	388	485	670	116	145	11.9	14.8	1093	1122
1977	1030	515	618	670	154	185	15.0	18.0	1184	1215
1978	1095	667	778	670	200	233	18.3	21.3	1295	1328
1979	1162	848	969	670	254	290	21.9	25.0	1416	1452
1980	1231	1069	1203	670	320	360	26.0	29.2	1551	1591

[a]Calculated from data in Tables 3.1 and 3.8.

[b]See footnote b in Table 3.8.

[c]See footnote c in Table 3.8.

Table 3.10.--Natural Rubber Output Projections for Malaysian Estates and Smallholdings With and Without Yield Stimulation: 1975-80.[a] ('000 Long Tons)

Year	Projected Output Without Stimulation			Projected Incremental Output								Projected Output With Stimulation (Estates and Smallholdings)	
				Estates		Smallholdings		Total		Percentage Increase			
	Estates	Smallholdings	Total	Low[b]	High[c]	Low[d]	High[e]	Low	High	Low	High	Low	High
1975	751	934	1685	112	134	84	112	196	246	11.6	14.6	1881	1931
1976	764	977	1741	149	174	116	145	265	319	15.2	18.3	2006	2060
1977	775	1030	1805	191	218	154	185	345	403	19.1	22.3	2150	2208
1978	785	1095	1880	245	276	200	233	445	509	23.7	27.1	2325	2389
1979	791	1162	1953	303	337	254	290	557	627	28.5	32.1	2510	2580
1980	800	1231	2031	362	362	320	360	682	722	33.6	35.5	2713	2753

[a]Calculated from data in Tables 3.5 and 3.9.

[b]See footnote b in Table 3.3.

[c]See footnote c in Table 3.3.

[d]See footnote b in Table 3.8.

[e]See footnote c in Table 3.8.

expected to go into stimulation for each country. In view of these data limitations, only very rough approximations are possible in projecting the impact of the yield-stimulant in these countries.

The estimation will be based on the assumption that the output of these countries, taken as a whole, will increase by a certain percentage with the adoption of the yield-stimulant. Two sets of assumptions are made, the "low" assumption and the "high" assumption. These assumptions, listed below, show the percentage increase in output (over the unstimulated output for each year) for the period 1975-80.

Year	1975	1976	1977	1978	1979	1980
"Low" Assumption (%)	2	5	7	9	10	10
"High" Assumption (%)	5	10	15	18	20	20

The assumptions regarding the increase in output in other rubber producing countries are substantially lower than the projected increase in Malaysian output. The reasons for these low assumptions are two-fold. Firstly, there is likely to be a time lag involved in the spread and adaptation of this technology from Malaysia to other natural rubber producing countries. Secondly, the standards of agricultural practice in these countries are generally lower than those in Malaysia, and as such, it can be reasonably assumed that the response to stimulation would be lower.

Both sets of assumptions show that there is a decline in the marginal percentage increase in output from 1977, and for the period 1979 to 1980 the marginal percentage increase in output is zero. This aspect of the assumptions is made in view of the fact that after a few years of stimulation, the response will decline, as is assumed here, due to the inadequate fertilizers being applied to the stimulated trees. The assumption of zero marginal percentage increase in output for the period 1979-80 implies that any increase in the acreage stimulated for this period is offset by the generally lower responses obtained from areas stimulated in the previous years. Based on these assumptions, estimates of the impact of yield stimulation on the world natural rubber output (excluding Malaysia) are attempted.

In making these estimates, the UNCTAD (United Nations Conference on Trade and Development) projection of the world natural rubber output (without yield stimulation) is used as the benchmark.[11] The UNCTAD projections for Indonesia, Thailand, Ceylon, and the rest of world category are shown in Table 3.11. The data for Malaysia in the table are based on the RRIM projection. Table 3.12 shows the world output projections with and without yield stimulation for the period 1975-80.

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[11]Dayal, op. cit., p. 18.

Table 3.11.--Projection of World Natural Rubber Output Without Ethrel Stimulation: 1975-80. ('000 Long Tons)

Year	1 Malaysia	2 Indonesia	3 Thailand	4 Ceylon	5 Rest of World[a]	6 Total
1975	1685	809	342	195	709	3740
1976	1741	817	365	202	741	3866
1977	1805	825	388	210	774	4002
1978	1880	833	411	213	807	4144
1979	1953	842	435	226	839	4295
1980	2031	850	462	235	871	4449

Sources: R. Dayal, "Econometric Model of the World Rubber Market," Commodities Division, UNCTAD (1970), Table 4, p. 18; and P. O. Thomas, "Malaysian Natural Rubber in the Seventies: A Forecast of Production Trends," Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (July, 1970), Table 5, p. 8.

[a]Production for East Malaysia (Sabah and Sarawak) is included in the rest of world category.

Table 3.12.--World Natural Rubber Output Projections With and Without Yield Stimulation: 1975-80.[a]
('000 Long Tons)

Year	Projected Output Without Stimulation 1	Projected Output With Stimulation						Projected Increase in Output			
		Malaysia		Rest of World		Total		Absolute Increase		Percentage Increase (as Per cent of 1)	
		Low[b]	High[c]	Low[d]	High[e]	Low	High	Low	High	Low	High
1975	3740	1881	1931	2096	2158	3977	4089	237	349	6.3	9.3
1976	3866	2006	2060	2232	2338	4238	4398	372	532	9.6	13.8
1977	4002	2150	2208	2351	2526	4501	4734	499	732	12.5	18.3
1978	4144	2325	2389	2468	2671	4793	5060	649	916	15.7	22.1
1979	4295	2510	2580	2576	2810	5086	5390	791	1095	18.4	25.4
1980	4449	2713	2753	2660	2902	5373	5655	924	1206	20.8	27.1

[a]Calculated from data in Tables 3.10 and 3.11 and assumptions on page 60.

[b]See footnote b in Tables 3.3 and 3.8.

[c]See footnote c in Tables 3.3 and 3.8.

[d]See assumptions on page

[e]See assumptions on page

Summary

In this chapter, I have attempted to project the Malaysian and world natural rubber output for the period 1975-80 based on the potential adoption of the yield-stimulant ethrel by the natural rubber industry. Two levels of projections (low and high projections) were made for both Malaysian and world output based on the assumption of low and high levels of adoption of ethrel by the natural rubber industry. In estimating the impact of the yield-stimulant on the Malaysian and world output, the projections of Malaysian and world output made by the RRIM and UNCTAD respectively were used as the benchmark as these projections did not include the potential use of the yield-stimulant. Thus, the projections of the output with yield stimulation essentially involves a revision of the RRIM and UNCTAD projections by incorporating the potential use of ethrel by the natural industry and estimating its effect on the latter projections.

The analysis indicates that, with the use of the yeild-stimulant, the Malaysian natural rubber output will be approximately 196,000 to 246,500 long tons (or 11.6 to 14.6 per cent) higher in 1975 than without the use of the stimulant, and by 1980, it will be approximately 682,000 to 722,000 long tons (or 33.6 to 35.5 per cent) higher depending on the assumed levels of adoption (low or high) of the stimulant by the natural rubber industry. The

corresponding increases for the world natural rubber output are 237,000 to 349,000 long tons (or 6.3 to 9.3 per cent) in 1975, and 924,000 to 1,206,000 long tons (or 20.8 to 27.1 per cent) in 1980. The analysis in this chapter thus indicates that the adoption of the yield-stimulant ethrel by the natural rubber industry can be expected to result in substantial increases in natural rubber output.

CHAPTER IV

NATURAL RUBBER PRICE PROJECTIONS WITH AND WITHOUT YIELD STIMULATION: 1975-80

In this chapter, an attempt is made to analyze the effect of the potential increase in output resulting from yield stimulation on the world and Malaysian natural rubber prices for the period 1975-80. However, for the purpose of analyzing and projecting prices, it is essential to analyze the factors affecting the demand for rubber with the object of projecting the demand for this commodity. The result of this demand analysis and the supply analysis from the previous chapter will be utilized in the analysis and projections of the world and Malaysian natural rubber prices.

Any analysis of the demand for, and prices of, natural rubber needs to include an analysis of the competition between natural and synthetic rubbers to illuminate the nature and significance of this competition and its effect on the demand and prices of natural rubber. In view of the importance of this competition on the world

elastomer market, my attempt to analyze natural rubber demand and prices will be preceded by a brief discussion of the competition between the two types of rubbers. This discussion will also facilitate an understanding of the relationship between the variables in the model presented in Chapter III.

Competition Between Natural and Synthetic Rubber

Like many other agricultural raw materials, natural rubber faces competition from its substitute, in this case the synthetic rubber. Synthetic rubber was established during the Second World War during which a disruption of trade occurred between the principal natural rubber producing countries of Southeast Asia and the consuming areas of Europe and North America. During and following the war, natural rubber production could not keep pace with the total demand for rubber resulting in a rapid expansion of synthetic rubber capacity. As a result of the expansion, the rates of increase in production and consumption of synthetic rubber have outpaced those of natural rubber, and the latter's share in the total elastomer consumption has been declining steadily though its absolute amount is increasing. From the period 1956-69, synthetic rubber production increased by 188 per cent while consumption increased by 190 per cent. Natural rubber production and consumption for the same period increased by 30 per cent and 34 per cent respectively and

the share of natural rubber in total elastomer consumption dropped from 71 per cent in 1956 to 41 per cent in 1969.[1]

The natural-synthetic competition has occurred in the form of both price and non-price basis with the latter being on the basis of quality, marketing facilities, grading methods and supply conditions.

Competition Based on Quality

During the war and early post-war period, the synthetic rubber produced was almost entirely the styrene butadiene rubber (SBR) which is a general purpose synthetic rubber employed mainly in the manufacture of tires. However, SBR can also be substituted for natural rubber in many other uses and is currently still the most widely consumed rubber. Concomitant with the expansion of the synthetic rubber production capacity, large scale expenditures on research and development were incurred by the industry resulting in the development of new types of synthetic rubbers. More importantly, successive developments have added improvements in the technical qualities thus making each new type of synthetic rubber produced a closer substitute to natural rubber. The new types of synthetic rubbers produced are the special purpose rubbers and the stereo-regular rubbers.

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[1] International Rubber Study Group, Rubber Statistical Bulletin, London (October, 1971), Table 27, p. 28.

The special purpose synthetic rubbers include primarily polyiobutylene, polychloroprene, and co-polymerized butadiene and acrylonitrile. These rubbers have certain properties (such as heat, weather, and oil resistance) which make them more suitable than natural rubber and SBR for some special uses as in high voltage power cables, oil hose and mine conveyor belts. The stereo-regular rubbers include polybutadiene and poly-isoprene and have only been available since 1959. These rubbers have certain technical properties superior to those of the SBR and the special purpose synthetic rubbers. Prior to the development of the stereo-regular rubbers, natural rubber was used in a large portion of the total elastomer consumption because the irregular linkages in the polymer chains which characterize the SBR and the special purpose rubbers limited their degree of substitutability with natural rubber which is characterized by regular linkages. Since stereo-regular rubbers are also characterized by regular linkages, their development has posed the greatest threat to natural rubber as these rubbers have bridged the gap between any technical superiority of natural rubber over its synthetic substitutes. So far, this threat has remained more potential than real because of the difficulties involved in duplicating the

laboratory characteristics of these rubbers on a commercial scale and the difficulties in processing.[2]

Price Competition

Since the new types of synthetic rubber have a high degree of substitutability for natural rubber, the ratio of prices of these two rubbers (especially the ratio of natural rubber price to the price of its closest substitute) becomes an important factor in determining the relative share of natural and synthetic rubbers in the total elastomer consumption, as small changes in this ratio will result in a shift in consumption to the cheaper alternative.

Though synthetic rubber production costs are hard to acquire, it can be reasonably assumed that technological changes in the synthetic rubber industry are likely to continue to reduce production costs and improve the quality of the synthetic rubbers. Both these developments will enhance the position of the synthetic rubber at the expense of natural rubber unless corresponding developments occur in the natural rubber industry.

Projections of Total Elastomer Consumption

The preceding analysis of the nature of competition between natural and synthetic rubbers brings to light

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[2] J. R. Behrman, "An Econometric Study of the World Rubber Market," Department of Economics, University of Pennsylvania, 1968, p. 23.

the close substitutability between the two rubbers. In view of this close substitutability, the factors affecting the demand for natural rubber are likely to be identical to those affecting the demand for synthetic and thus, the market for the two rubbers can be considered as a single market. It follows that in analyzing the factors affecting the demand for rubber (natural or synthetic) and in projecting the demand, it is more meaningful to attempt a simultaneous analysis of demand for both natural and synthetic rubber, rather than attempting a separate analysis for each elastomer. Once the demand for total elastomers has been analyzed and projected, its allocation between natural rubber and synthetic rubber will be mainly determined by the ratio of their prices and other non-price factors. Among the non-price factors, Dayal found the ratio of natural rubber consumption to total elastomer consumption in the preceding year to be most important. This factor signifies the fact that, other things being equal, the current year's shares of natural rubber and synthetic rubber in the total demand for elastomers would be equal to their respective shares in the preceding year.[3]

Rubber is an important raw material in the manufacture of a variety of industrial products. Demand for rubber is thus a derived demand, derived from the demand

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[3]R. Dayal, "Econometric Model of the World Rubber Market," Commodities Division, UNCTAD, Geneva, May, 1970, p. 7.

for the industrial products. However, the most important market for rubber is in the transportation equipment industry where the manufacture of tires and tire products account for approximately 60 per cent of the total elastomer consumption. In view of the importance of rubber in industrial production, particularly in the transportation industry, its demand will be highly dependent on the growth of the overall industrial production and on some measure of the activity of the transportation sector. More specifically, the demand for rubber can be represented by the following:

$$C_T = f(I_{PROD}, I_{TRAN}, P_{NR}, P_{SR}, u)$$

where,

C_T = Total elastomer consumption taken to represent the demand for the elastomer,

I_{PROD} = Index of industrial production

I_{TRAN} = Some measure of the activity of the transportation sector

P_{NR} = Price of natural rubber

P_{SR} = Price of synthetic rubber

u = random error

This model is an elaboration of the demand segment of the flow diagram of the world rubber industry presented in Figure 3.1.

The growth in industrial production and the growth in the transportation sector are highly correlated and

hence one of these variables can be dropped from the model. Since it has been observed that the growth in industrial production and the growth in elastomer consumption in major consuming countries and for the world as a whole are highly correlated, the variable I_{TRAN} can be dropped from the model.

Synthetic rubber price serves as one of the explanatory variables in the model. However, the data on this variable are inadequate and unreliable. The United States is the only country with published data on synthetic rubber prices.[4] However, the quoted prices have been stable for the past decade and a half. The quoted prices are not those prices at which transactions take place. Discounts of 10 per cent or more from the quoted prices are often given and these discounts are only known to the buyers and sellers.[5] Thus, statistics on the prices at transactions actually take place are not available. In view of this general unavailability of synthetic rubber prices, most studies on the demand for rubber have excluded this variable from the analysis. The demand model can be written as,

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[4] Ibid., p. 36.

[5] C. Barlow and S. C. Lim, "Natural Rubber and West Malaysia," Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (paper presented at the Singapore Meeting of the South-East Asia Business Committee, May, 1968), p. 12.

$$CT = g(I_{PROD}, P_{NR}, u)$$

where,

CT = Total elastomer consumption taken to represent the demand for the elastomer

I_{PROD} = Index of industrial production

P_{NR} = Price of natural rubber

u - Random error

For the purpose of this chapter, i.e., to project natural rubber prices, the total elastomer consumption projection made by Hague[6] will be used as one of the explanatory variables in the price model. A brief summary of Hague's approach to the analysis and the subsequent projection of total elastomer demand is now presented. In his model, Hague hypothesized that the total elastomer demand outside the centrally planned economies is a function of the growth in world industrial output represented by the index of industrial production. The model assumes that rubber prices have no effect on the total elastomer demand or that the demand is perfectly inelastic. However, these prices (natural and synthetic prices) do affect the allocation of total elastomer demand between natural and synthetic rubber. This assumption is based on the fact that rubber essentially forms a small component of the final goods and the value of the rubber

[6] I. U. Hague, "Efficiency in Resource Allocation: The Case of Natural Rubber," Economics Department, IBRD, July, 1971, p. 4.

input as a proportion of the total value of the rubber-using goods is very small. For example, the cost of rubber for the tires of an automobile represents a small proportion of its total cost and an increase in the cost of tires would have little effect on the cost, price, and demand for automobiles.

Regression of total elastomer consumption on the index of industrial production for the period 1951-69 gives the following result:

$$\text{Log } Y = 1.19148 + 1.13300 \log X \qquad R^2 = 0.993.$$

where,

Y = Total elastomer consumption

X = Index of industrial production

The result shows that 99 per cent of the variations in elastomer consumption is explained by variations in industrial production. Based on this relationship, and on the basis of projection of GNP and industrial production in the OECD countries, Hague projected the elastomer consumption outside the centrally planned economies (Table 4.1).

The exclusion of the natural and synthetic rubber consumption in the centrally planned economies from the projection is due to the paucity of data on the consumption in these countries. In the case of natural rubber, only estimates of imports are available while no data are available on synthetic rubber consumption in these

Table 4.1.--Total Elastomer Consumption: 1971-1980.[a]
('000 Long Tons)

Year	Consumption
1971	6935
1972	7400
1973	7896
1974	8417
1975	8800
1976	9370
1977	9980
1978	10629
1979	11320
1980	12100

Source: I. U. Hague, "Efficiency in Resource Allocation: The Case of Natural Rubber," Economics Department, IBRD, May, 1971, Table 1, p. 4.

[a]Excluding consumption in centrally planned economies.

countries. Moreover, the centrally planned economies are largely self-sufficient in synthetic rubber.[7] In this case, exclusion of synthetic rubber consumption in these countries from the total elastomer consumption will not significantly affect the analysis of natural rubber prices. For these reasons, other studies of the world rubber market that the author is familiar with have excluded synthetic rubber consumption in the centrally planned economies in their analysis and projections of the world elastomer consumption.[8] In my analysis of natural rubber prices, the estimates of natural rubber imports into the centrally planned economies will be included in the total elastomer consumption variable to represent the demand for natural rubber in these countries.

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[7]Dayal, op. cit., p. 36.

[8]Dayal also excludes both the natural and synthetic rubber consumption in the centrally planned economies from his analysis and projections of world elastomer consumption. The reason given for this exclusion is that, apart from the lack of data on elastomer consumption in these countries, his model of the world rubber market relates basically to the countries whose rubber markets are free partially or wholly, from government regulation. In his price analysis, Dayal deducts estimates of natural rubber imports into the centrally planned economies from the total natural rubber supply to arrive at estimates of supply to the market economy countries only.

Analysis and Projections of World Natural Rubber Prices: 1975-80

The Price Model

For the purpose of projecting natural rubber prices, the price model developed by Dayal in his study of the world rubber market will be used with some slight modifications.[9] Dayal's price analysis is based on the assumption that natural rubber prices are dependent on the supply and demand for this commodity and is represented by the following model.

$$P_{NR}(NY) = f[C_{TR},\ (C_{NR}/C_{TR})_{-1},\ Q_{NR},\ Rsp, u]$$

where,

$P_{NR}(NY)$ = The price of natural rubber in New York

C_{TR} = Total elastomer consumption

$(C_{NR}/C_{TR})_{-1}$ = Previous year's ratio of natural rubber consumption to total elastomer consumption

Q_{NR} = Output of natural rubber

R_{sp} = Natural rubber stockpile releases

u = random error

In the above model, the supply of natural rubber is represented by the output (less exports to the centrally planned economies) and the rubber stockpile releases, while the demand is represented by the total elastomer consumption outside the centrally planned economies, and the

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[9] Dayal, op. cit., p. 46.

previous year's ratio of natural rubber consumption to total elastomer consumption. Since Dayal's analysis is confined to the market economy countries, the exports of natural rubber to the centrally planned economies are deducted from the total natural rubber output to yield the supply available to the market economy countries only. The price variable is the price of ribbed smoked sheet grade 1 (RSS 1) in New York. Since the United States had traditionally been the largest consumer of natural rubber, the New York price is taken as representative of the world price.

For the purpose of analyzing and projecting natural rubber prices in this study, slight modifications of the above model are attempted. An additional explanatory variable is included in the model, the additional variable being the proportion of Technically Classified Rubber (TC rubber) in the total natural rubber output.

TC rubber was introduced in 1949 as an effort to classify ribbed smoked sheets and air dried sheets according to their vulcanization characteristics or the rate of cure.[10] The introduction of this rubber was the first attempt by natural rubber producers to satisfy the consumers' requirement of consistency in the rate of cure in order to be able to fit the rubbers into their specified

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[10]For a detailed information on TC rubber and method of testing for its vulcanization characteristics, see Natural Rubber Producers' Research Association, Technical Information Sheet No. 2, Technically Classified Rubber, London, 1965.

production schedules. Thus, information on the vulcanization characteristics is of prime importance to the consumers. Prior to the introduction of the TC rubber, the natural rubber exported was visually graded and no specification of the technical properties was made. The TC rubber exported is marked with colored circles of red, yellow and blue indicating slow, normal and fast rate of cure respectively. However, there is no guarantee the rubber will meet the cure specifications indicated.

The introduction of the Standard Malaysian Rubber (SMR) in 1965 and the subsequent increase in its exports, have diminished the importance of the TC rubber, and it is anticipated that SMR will ultimately replace the TR rubber. The reason for this anticipation is that SMR is classified for rate of cure by a more exact, less variable test method than TC rubber, and the specification is guaranteed. Moreover, SMR is not only classified by the rate of cure but by other technical properties such as dirt, volatile matter, ash and nitrogen content, plasticity retention index and viscosity.[11]

Since TC rubber and the SMR can be considered as improvements in the technical properties of natural rubber over the visually graded rubber, the proportion of these

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[11]For a technical discussion of the SMR specifications and the test methods involved in classifying these specifications, see Rubber Research Institute of Malaya, SMR Bulletins, Nos. 3-8, Kuala Lumpur, Malaysia, 1970.

two types of rubber in the total natural rubber output has been included in the model as a proxy for quality improvements in natural rubber.

The second modification of Dayal's model involves the treatment of natural rubber consumption in the centrally planned economies (USSR, China and Eastern Europe). As noted earlier, Dayal deducted exports to centrally planned economies from the natural rubber output to arrive at the supply available only to the market economy countries. These estimated exports to the centrally planned economies also represent their consumption as there is practically no domestic production of natural rubber in these countries. However, in view of the increasing importance of the centrally planned economies as consumers of natural rubber (particularly USSR and mainland China),[12] and the likely impact of this consumption on natural rubber prices, consumption of natural rubber in these countries has been included in my analysis. The estimated exports to these countries have not been deducted from the supply but are instead added to the total elastomer consumption variable.

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[12]In 1970, the USSR was the second major consumer of natural rubber with 316,000 long tons (next to the United States with 568,000 tons) followed by Japan (283,000 tons), Federal Republic of Germany (201,000 tons), United Kingdom (188,000 tons), Mainland China (181,000 tons), France (156,000 tons), and Italy (113,000 tons).

Consumption of synthetic rubber in the centrally planned economies has not been included in the analysis as these countries are largely self-sufficient in the consumption of this rubber. Secondly, data on synthetic rubber consumption in these countries are not readily available. Consumption data available are mainly estimated imports into these countries. Unlike the case with natural rubber, the centrally planned economies are also producers of synthetic rubber, though production data are also not available. As such, estimated imports into these countries do not approximate their consumption of synthetic rubber. Given the severe lack of data on consumption, there is no basis for projecting synthetic rubber consumption in these countries.

Two price equations presented below represent the modification of Dayal's model. For both equations, linear relationships are assumed. These relationships are determined using annual data over a sixteen-year sample period (1955-70).[13]

1. $P_{NR(NY)_t} = f\ [O_{NR_t},\ C_{TR_t}\ (C_{NR}/C_{TR})_{t-1}\ \ (TCR/O_{NR})_t,\ Rsp_t]$

2. $P_{NR(NY)_t} = g\ [O_{NR_t},\ C_{TR_t}\ (C_{NR}/CTR)t-1,\ (TCR/O_{NR})t,\ Rsp_t\ D]$

where

$P_{NR(NY)t}$ = Price of Ribbed Smoked Sheet (RSS 1) in New York in U.S. cents/pound

[13]The data used in the analysis and their sources are given in Appendix A, Table 1.

O_{NRt} = World natural rubber output in '000 long tons

C_{TR_t} = World total elastomer consumption (excluding synthetic rubber consumption in the centrally planned economies) in '000 long tons

$(CNR/C_{TR})_{t-1}$ = The previous year's ratio of natural rubber consumption to total elastomer consumption in percentage points

$(TCR/O_{NR})_t$ = Ratio of Technically Classified Rubber (including SMR from 1965 onwards) to total natural rubber output, in percentage points.

Rsp_t = Net releases from government natural rubber stockpiles (mainly releases from United States) in '000 long tons

C = Dummy variable (equals 1 in 1955-56 and 1959-60, and 0 for other years).

In equation (2) a dummy variable is included to represent the unusual circumstances in 1955-56 and 1959-60 which led to sharp increases in total elastomer demand and resulting in high natural rubber prices in those years. The inclusion of the dummy variable increases the R^2 from 0.76 to 0.86.

The two functions are estimated and the results are presented below. The figures in parentheses below each coefficient are the standard errors of the coefficients.

1. $$P_{NR(NY)t} = 4.5868 + \underset{(0.0254)}{0.0228(O_{NR})_t} - \underset{(0.0064)}{0.0091(C_{TR})_t}$$

$$+ \underset{(0.4677)}{0.1602(C_{NR}/C_{TR})_{t-1}} + \underset{(1.3355)}{1.2020\ (TCR/O_{NR})_t} + \underset{(0.0308)}{0.0505(Rsp)_t}$$

$$R^2 = 0.76$$

2. $$P_{NR(NY)t} = 11.7725 + \underset{(0.0197)}{0.0104}(O_{NR})_t - \underset{(0.0052)}{0.0038}(C_{TR})_t$$

$$+ \underset{(0.3537)}{0.1574}(C_{NR}/C_{TR})_{t-1} + \underset{(1.0862)}{0.0379}(TCR/O_{NR})_t + \underset{(0.0269)}{0.0115}(Rsp)_t$$

$$+ \underset{(2.4029)}{7.0000}(D)$$

$$R^2 = 0.86$$

The results obtained have not been satisfactory. A priori, we would expect that increases in output will adversely affect the price and thus the coefficient for the output variable would be negative. On the consumption side, we would expect that increases in total elastomer consumption to favorably affect the price and thus the coefficient for the consumption variable would be positive. However, as can be seen from the estimates, the signs obtained for the output and the consumption variables are contrary to our prior belief.

As for the variable Rsp_t, we would also expect that its coefficient would be negative since net stockpile releases can be considered as an element of supply and these releases tend to adversely affect prices. However, the positive coefficient obtained for this variable is not so disturbing as it can be argued that since stockpiles are generally released when prices are high, positive coefficient for this variable can be expected. [To analyze the

effect of stockpile releases on natural rubber prices, use of monthly data would perhaps be more appropriate than annual data that have been used in the above analysis.]

The inclusion of the dummy variable in the second equation increases the R^2 but does not change the signs of the coefficient for the output, consumption, and the stockpile release variables. In both equations, it was found that the problem of multicollinearity exists. High correlations were found between the output and the total elastomer consumption variables (correlation coefficient: 0.98) and between the total elastomer consumption variable and the lagged variable $(C_{NR}/C_{TR})t\text{-}1$ (correlation coefficient: 0.94). The presence of the multicollinearity has resulted in large standard errors of the coefficients. It is also possible that the positive and negative coefficients obtained for the output and the total elastomer consumption variables respectively are the result of the collinear variables.

Since the total elastomer consumption variable (C_{TR_t}) is correlated with both the output variable (O_{NR_t}) and the lagged variable, it was decided to drop the variable from the equation. The new function was estimated and the following results were obtained.

$$3.\quad P_{NR(NY)t} = 15.5821 - 0.0015(O_{NR})_t + 0.2746(C_{NR}/C_{TR})_{t-1}$$

$$(0.0106) \qquad (0.3072)$$

$$- 0.1155(TCR/O_{NR})_t + 0.0003(Rsp)_t + 7.6156\ (D)$$

$$(1.0399) \qquad (0.0215) \qquad (2.1944)$$

$$R^2 = 0.87$$

The results obtained from equation (3) are still unsatisfactory. The coefficient for the stockpile release variable (Rsp) is still positive while the coefficient for the variable (TCR/O_{NR}) is negative. As regards the variable (TCR/O_{NR}), if there were to be any relationship at all between this variable and natural rubber prices, a priori, we would expect the relationship to be positive for reasons discussed earlier. The partial correlation coefficient for this variable is very low (-0.0351) implying a very poor relationship between this variable and prices. This low degree of relationship can be attributed to the fact that SMR prices are quoted in terms of ribbed smoked sheet grade 1 (RSS 1) prices with certain grades of SMR fetching a price premium of about 2 U.S. cents/lb. over the RSS 1 prices. Since in the analysis, the RSS 1 price has been used as the price variable, variations in the ratio (TCR/O_{NR}) would have no direct effect on RSS 1 prices. In view of this lack of relationship between the two variables, and the reason for this lack of relationship, the variable (TCR/O_{NR}) was dropped

from equation (3). The new function was estimated and the following results were obtained:

$$4.\quad P_{NR(NY)t} = 18.3676 - \underset{(0.0055)}{0.0025(O_{NR})_t} + \underset{(0.2467)}{0.2561(C_{NR}/C_{TR})_{t-1}}$$

$$-\underset{(0.0073)}{0.0016(Rsp)_t} + \underset{(1.9791)}{7.5361\ (D)}$$

$$R^2 = 0.87$$

The unsatisfactory feature of this function is that the estimated coefficients, except the coefficient for the dummy variable, are not significantly different from zero. However, the coefficients obtained are consistent with our prior belief about the relationship between these variables and the price variable. In the case of the output variable (O_{NRt}), we would expect that increases in output, other things constant, would have a negative effect on prices. The negative coefficient obtained for the output thus confirms our belief.

The positive coefficient for the variable $(C_{NR}/C_{TR})_{t-1}$ is also consistent with our prior expectation. With the availability of synthetic rubber, there have been substantial substitution in consumption of synthetic rubber for natural rubber resulting in the steady decline in the share of natural rubber in the total elastomer consumption. As natural rubber loses its dominance in the world elastomer market, that is, as the ratio (C_{NR}/C_{TR}),

declines, we would expect the price of natural rubber to decline and hence the expectation of the positive relationship between this ratio and natural rubber prices.

Natural rubber net stockpile releases essentially represent an element of supply and these releases can be expected to have a depressing effect on prices. Moreover, not only the releases of the stockpile itself, but rumors about the impending releases, particularly from the United States stockpile, could have a depressing effect on prices as these rumors lead to a rush for the disposal of stock inventories by those holding these inventories mainly for speculative purposes. The belief in the depressing effect of stockpile releases on prices is widely shared by natural rubber producers who have often voiced their opposition to the stockpile releases. From the above discussion, it follows that the negative coefficient obtained for the stockpile releases variable (Rsp) is not only consistent with, but confirms the belief that stockpile releases depress prices.

The results obtained in the estimated regression have thus confirmed our belief about the relationship between the explanatory variables and the dependent variable though the confirmation is weaker than we would like. This weak confirmation could be attributed to the fact that the sample period has not been sufficiently long causing the

standard errors of the estimated coefficients to be larger and the t-value to be statistically insignificant.

Projecting World Natural Rubber Prices: 1975-80

The estimated equation (4) has been used to project natural rubber prices for the period 1975-80. The projection is made for three projected levels of natural rubber output; output without the use of yield-stimulant; "low" projected output with use of yield-stimulant, and "high" projected output with use of the stimulant (see Table 3.12 for the projected output).

For the purpose of price projections, the projected ratio of natural rubber to total elastomer consumption is based on projections made by Hague[14] and these projections are corrected for estimated natural rubber consumption in the centrally planned economies. The rubber stockpile net releases have been assumed to be fixed at 50,000 long tons per year.[15] The projection is also based on the assumption that, during the projection period, no unusual circumstances occur which might cause sudden major shifts in rubber consumption. Thus, in the projection, the dummy variable takes on the value of zero.

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[14]Hague, op. cit., p. 4.

[15]Private communication with S. T. Semegen, President, Natural Rubber Bureau, Hudson, Ohio, in April, 1972.

Natural rubber price projections based on the estimated equation (4) are presented in Table 4.2. The values of independent variables used for projecting the price are given in Appendix B, Table 1.

Table 4.2 shows that, based on the estimated equation (4), natural rubber prices have been projected to be as low as 13.95 and 13.41 U.S. cents/lb. with the low and high output projections respectively. The question arises as to whether natural rubber prices could decline to such low levels without adversely affecting the supply of synthetic rubber.

Since natural and synthetic rubbers (especially polyisoprene which is the closest synthetic approximate to natural rubber) are close substitutes, then theoretically, any price of natural rubber well below that of synthetic rubber could drive the latter out of the market. The ability of the synthetic rubber industry to remain in the market will depend on its ability to reduce its production costs (and hence prices) in line with the projected natural rubber prices.

The general unavailability of data on current synthetic rubber production costs presents a problem in attempting to make any meaningful estimate of the future trend in the costs. However, information gathered by the International Rubber Study Group (IRSG) in 1968 on representative costs of production for several important types

Table 4.2.--Projected Natural Rubber Prices in New York With and Without Yield Stimulation: 1975-80 (Low Price Projection).[a] (U.S. cents/lb.)

Year	Without Yield Stimulation	With Yield Stimulation	
		Low Output Projection[b]	High Output Projection[c]
1975	18.93	18.33	18.05
1976	18.61	17.68	17.28
1977	18.10	16.77	16.20
1978	17.50	15.78	15.31
1979	16.78	14.97	14.23
1980	16.13	13.95	13.41

[a]Assuming that the share of natural rubber in the total elastomer consumption declines from 39 per cent in 1975 to 34 per cent in 1980. See Appendix B, Table 1.

[b]Based on low adoption level of the yield-stimulant. See footnote b in Tables 3.3 and 3.8.

[c]Based on high adoption level of the yield-stimulant. See footnote c in Tables 3.3 and 3.8.

of synthetic rubber showed that production cost for the styrene butadiene rubber (SBR) is between 15.5 to 16.5 U.S. cents/lb. and production cost for polybutadiene (a type of the stereo-regular synthetic rubbers) range between 16.5 to 18.0 U.S. cents/lb.[16]

Though the development of the stereo-regular synthetic rubbers almost reduces the qap for which synthetics could not be substituted for natural rubber in all uses, the degree to which these rubbers would in practice be substituted for natural rubber is still uncertain due to the difficulties involved in duplicating the laboratory characteristics of these rubbers on a commercial scale and the difficulties in processing. It has been estimated that the share of stereo-regular rubbers in the total United States synthetic rubber production in the seventies would be about 14 per cent and that of SBR to be about 67 per cent.[17]

From the above, it follows that during the projection period (1975-80), SBR would still be the major source of substitution and competition for natural rubber. Thus, for purposes of determining the likelihood that natural

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[16]United Nations Conference on Trade and Development, Review of Problems and Policies for Specific Commodities Facing Competition from Synthetics and Substitutes, UNCTAD Document TD/B/C1/SYN 56, Geneva, May, 1971, p. 24.

[17]Behrman, op. cit., pp. 22-23.

rubber prices could actually drop to as low a level as has been projected, SBR production costs will be used as the basis.

Technological changes in the synthetic rubber industry can be expected to continue due to large scale expenditures on research and development expended by the industry. These changes, besides improving the qualities of the synthetic rubbers are also likely to lead to potential reductions in production costs. Moreover, production in this industry has been substantially below capacity with capacity utilization averaging between 75-80 per cent.[18] Thus, possibilities of cost reductions also exist through increases in capacity utilization by enabling the industry to realize further economies of size in production. Based on the possibilities of the potential cost reductions in the synthetic rubber industry, it is assumed that the SBR production costs would decline to about 15.00 and 14.00 U.S. cents/lb. by 1975 and 1980 respectively. The price projections in Table 4.2 show that natural prices with yield stimulation can be expected to decline to 13.95 and 13.41 cents/lb. in 1980 based on the low and high output projections respectively. Thus the projected natural rubber prices in 1980 are lower than the assumed SBR production costs for the same year.

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[18] UNCTAD, op. cit., p. 16.

It can be reasonably assumed that the synthetic rubber industry is a high fixed-cost industry. In the short run, production will continue so long as the industry can recover its variable costs of production. However, to continue production in the long run, all costs must be recovered. Since synthetic and natural rubbers are close substitutes, both rubbers have to be priced at about the same levels in order to remain competitive in the market. It follows that by 1980, SBR (which is expected to be the major source of substitution and competition for natural rubber during the 1975-80 period) needs to be priced around the levels projected in Table 4.2. However, at these prices, the synthetic rubber industry is not likely to recover its total production costs but only its variable costs. Persistence of this situation in the long run would theoretically drive the synthetic industry out of the market. Natural rubber output, however, cannot be expected to bridge the gap in elastomer supply created by the cut back in the synthetic production. Given the total elastomer demand, an excess demand for rubber is created and the resulting pressure of demand would exert an upward pull on prices. This upward pressure on prices can be expected to continue until prices reach a level high enough for synthetic rubber to come back into production. The analysis thus shows that, in the long

run, there should exist an equilibrium between natural rubber prices and synthetic production costs.

Based on the above analysis, the projected prices for the latter part of the projection period are adjusted to bring them in line with the SBR production costs. The adjustments are made for the projected prices with the low and high output projections for the last two years (1979 and 1980) of the projection period. With the low output projection, it is assumed that natural rubber prices will decline to 15.0 U.S. cents/lb. and with the high output projection, prices will decline to 14.5 U.S. cents/lb. during the 1979-80 period. The fact that the projected prices for the latter part of projection period have to be adjusted to bring them in line with synthetic production costs reflects a major weakness of the price model used in making the projections. This weakness arises from the non-inclusion of either synthetic rubber prices or production costs as one of the explanatory variables due to the unavailability of data on these variables.

Projecting Malaysian Natural Rubber Prices: 1975-80

Thus far, only the New York prices (taken to represent the world price) have been projected. Since a major objective of projecting the prices is to project the income of Malaysian smallholders based on the projected

prices, an attempt is now made to project the Malaysian natural rubber prices.

It has been observed that Malaysian rubber prices are highly correlated with the New York prices,and thus the Malaysian prices can be determined in relation to the New York prices. This relationship is determined for the period 1955-70 and the result is given in equation (5) below.

$$5.\quad P_{NR(M)} = -2.5644 + \underset{(0.0204)}{0.9985}(P_{NR(NY)})$$

$$R^2 = 0.99$$

where $P_{NR(M)}$ and $P_{NR(NY)}$ are the Malaysian and New York prices of RSS 1 in U.S. cents/lb. respectively.[19]

The figure in parentheses below the estimated coefficient shows the standard error of the coefficient. The coefficient of determination (R^2) shows that 99 per cent of the variations in Malaysian prices is explained by variations in New York prices. The above estimated relationship has been used to project Malaysian rubber prices for the period 1975-80 (Table 4.3).

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[19]The data used in the analysis and their sources are given in Appendix A, Table 1.

Table 4.3.--Projected Natural Rubber Prices in Malaysia With and Without Yield Stimulation: 1975-80 (Low Price Projection).[a]

Year	Without Yield Stimulation		With Yield Stimulation			
			Low Output Projection[b]		High Output Projection[c]	
	U.S.¢/lb.	M¢/lb.	U.S.¢/lb.	M¢/lb.	U.S.¢/lb.	M¢/lb.
1975	16.33	50.00	15.77	48.26	15.49	47.40
1976	16.05	49.11	15.12	46.27	14.72	45.04
1977	15.54	47.55	14.21	43.48	13.64	41.74
1978	14.94	45.72	13.22	40.45	12.75	39.02
1979	14.22	43.51	12.54	38.55	12.00	36.82
1980	13.57	41.52	12.54	38.55	12.00	36.82

[a]Assuming that the share of natural rubber in the total elastomer consumption declines from 39 per cent in 1975 to 34 per cent in 1980. See Appendix B, Table 1.

[b]Based on low level of adoption of the yield-stimulant. See footnote b in Tables 3.3 and 3.8.

[c]Based on high level of adoption of the yield-stimulant. See footnote c in Tables 3.3 and 3.8.

Standard Malaysian Rubber (SMR) and Natural Rubber Prices

It was shown earlier that the introduction of the SMR would not likely have a direct effect on natural rubber prices. However, it can be argued that the availability of SMR would have an indirect effect on prices through its effect on natural rubber consumption, and thus affecting the share of natural rubber in total elastomer consumption.

Since its inception in 1965, SMR production has increased from 700 tons (.08 per cent of Malaysia's total production) to 310,000 tons in 1971 (representing about 21 per cent of total Malaysian production). Equally important, all the SMR produced was sold. It has been estimated that by 1975, a million tons of SMR would be produced.[20] SMR represents an improvement in the qualities and grading of natural rubber, and thus, its production is likely to revive the consumers' interest in natural rubber. As Malaysia increases its SMR production and as other natural rubber producing countries go into production of this new form of rubber, it can be reasonably assumed that the rate of increase in natural rubber consumption in the seventies would be higher than would otherwise have been.

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[20] Natural Rubber Bureau, Natural Rubber News, Washington, D.C. (March, 1972), p. 3.

The above price projections have been based on the declining share of natural rubber in the total elastomer consumption with the share declining from about 40 per cent in 1971 to 34 per cent in 1980. In view of the likely impact of SMR (and other similar forms of rubber likely to be produced by other natural rubber producers) on the consumption and prices of natural rubber, another set of price projections is attempted. These projections are based on the assumption that, with the anticipated increased production of SMR and other similar forms of natural rubber, this elastomer would be able to maintain its current share of total elastomer consumption (40%) throughout the projection period (1975-80). The projections are shown in Tables 4.4 and 4.5.

Summary

In this chapter, an attempt has been made to analyze the potential impact of the adoption of the yield-stimulant ethrel by the natural rubber industry on the world and Malaysian natural rubber prices during the period 1975-80. The analysis indicates that potential increases in output resulting from yield stimulation will have a depressing effect on the world and Malaysian natural rubber prices. Based on the assumed levels of stimulation and the resulting output, prices can be expected to decline by one to three U.S. cents/lb. during

Table 4.4.--Projected Natural Rubber Prices in New York With and Without Yield Stimulation: 1975-80 (High Price Projection).[a]

Year	Without Yield Stimulation		With Yield Stimulation			
			Low Output Projection[b]		High Output Projection[c]	
	U.S.¢/lb.	M¢/lb.	U.S.¢/lb.	M¢/lb.	U.S.¢/lb.	M¢/lb.
1975	19.18	58.69	18.59	56.89	18.31	56.03
1976	18.87	57.74	17.94	54.90	17.54	53.67
1977	18.53	56.70	17.28	52.88	16.62	50.86
1978	18.17	55.60	16.55	50.64	15.88	48.60
1979	17.79	54.44	15.82	48.41	15.06	46.08
1980	17.41	53.27	15.10	46.21	14.50	44.37

[a]Assuming that natural rubber maintains its share in the total elastomer consumption at 40 per cent during the projection period (1975-80).

[b]Based on low level of adoption of the yield-stimulant. See footnote b in Tables 3.3 and 3.8.

[c]Based on high level of adoption of the yield-stimulant. See footnote c in Tables 3.3 and 3.8.

Table 4.5.--Projected Natural Rubber Prices in Malaysia With and Without Yield Stimulation: 1975-80 (High Price Projection).[a]

Year	Without Yield Stimulation		With Yield Stimulation			
			Low Output Projection[b]		High Output Projection[c]	
	U.S.¢/lb.	M¢/lb.	U.S.¢/lb.	M¢/lb.	U.S.¢/lb.	M¢/lb.
1975	16.62	50.86	16.03	49.05	15.75	48.20
1976	16.31	50.00	15.38	47.06	14.98	45.84
1977	15.97	48.87	14.72	45.04	14.16	43.33
1978	15.61	47.77	14.00	42.84	13.42	41.07
1979	15.23	46.60	13.30	40.70	12.50	38.25
1980	14.85	45.44	12.74	39.15	12.00	36.82

[a]Assuming that natural rubber maintains its share in the total elastomer consumption at 40 per cent during the projection period (1975-80).

[b]Based on low level of adoption of the yield-stimulant. See footnote b in Tables 3.3 and 3.8.

[c]Based on high level of adoption of the yield-stimulant. See footnote c in Tables 3.3 and 3.8.

the 1975-80 period from prices based on output without stimulation.

Two sets of price projections were made. The first set (Tables 4.2 and 4.3) was based on the continuing decline in the share of natural rubber in the total elastomer consumption with the share declining from 39 per cent in 1975 to about 34 per cent in 1980. The second set of projection (Tables 4.4 and 4.5) was based on the assumption that natural rubber will maintain its share of the total elastomer consumption at 40 per cent throughout the projection period (1975-80). For each set of projections, two levels of prices were projected based on the assumed low and high adoption levels of the yield-stimulant by the natural rubber industry.

The first set of projections shows that, with yield stimulation, prices will decline from 18.93 U.S. cents/lb. to 18.33-18.05 cents/lb. in 1975 and from 16.13 cents/lb. to 15.00-14.50 cents/lb. in 1980 depending on the assumed adoption levels (low or high) of the yield-stimulant.

As would be expected, the projected prices in the second set are higher than those of the first set. This set of projection shows that, with yield stimulation, prices will decline from 19.18 U.S. cents/lb. to 18.59-18.31 cents/lb. in 1975, and from 17.41 cents/lb. to

15.10-14.50 cents/lb. in 1980 again depending on the adoption levels of the stimulant by the natural rubber industry.

CHAPTER V

AN ANALYSIS OF THE TRADITIONAL AND REORGANIZED PROCESSING AND MARKETING SYSTEM FOR SMALLHOLDER RUBBER

In the preceding two chapters, the impact of yield-stimulation on world natural rubber output and prices has been analyzed. However, in analyzing prices, I have also considered the effect of changes in processing technology, that is, the production of block rubbers under the Standard Malaysian Rubber (SMR) Scheme. The analysis thus far has been in the context of the world natural rubber industry. In this and the following chapters, the analysis will be restricted to the Malaysian rubber industry; more specifically, to the Malaysian smallholder sector, as the main objective is to analyze the impact of changes in production and processing technologies on the Malaysian smallholders.

Traditional Smallholder Processing and Marketing System

Processing of smallholder rubber involves the following operations: dilution, sieving, coagulation,

pressing, mangling, drying, and smoking. These stages require the use of simple equipment such as buckets, sieves, coagulating pans, tables and mangles.

Dilution and Sieving

The fresh latex brought in from the field is diluted with water to facilitate sieving. The diluted latex is then sieved to remove any impurities that might be present.

Coagulation

The diluted and sieved latex is placed in coagulating pans where formic acid is added to facilitate the coagulating process which takes approximately thirty minutes.

Pressing and Mangling

The coagulum is placed on a table and pressed (usually by hand) to a thickness of about one-half of an inch and then put through the mangles. Normally two types of mangles are required, the plain and the grooved mangles. The pressed coagulum if first put through the plain mangle with the mangle adjusted to give a thickness of about one-eighth of an inch. The use of the grooved mangle further reduces the thickness of the sheets and facilitates drying.

Drying and Smoking

The sheets are now hung in the open air for three to four hours to drain off the moisture present in them. For smallholders producing unsmoked sheets, the sheets are now ready for sale. However, for those producing and selling smoked sheets, the air-dried sheets are placed in a smokehouse for further drying before sale.

Processing is mostly carried out individually by smallholders. However, it is also carried out on a group basis with the establishment of group processing centers (GPC).[1] These centers are either owned by smallholders themselves or privately owned, in which case the users are charged for the use of the processing facilities with the charge varying with the extent of the facilities used. The methods of processing involved are, however, similar for both individual and group processing.

The greater part of the sheets made an individual holdings are of inferior quality and the sheets produced mostly fall in the third and fourth grade.[2] This

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[1]A group processing center is defined as "a shed which contains equipment used for processing latex by a group of eight or more individuals, most of whom operate separately-owned rubber holdings. Such a center may or may not be run in conjunction with a smokehouse." C. Barlow and S. C. Lim, "A Report on the Survey of Malay Group Processing Centers," Statistics Division, Economic Report No. 1, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (1965), p. 4.

[2]Rubber Research Institute of Malaya, Kertas Sharahan Kursus Latehan Getah, Kuala Lumpur, Malaysia (undated), p. 1.

inferiority of the sheets produced is due to the inadequate care taken in latex collection, and during the various stages in processing (particularly in sieving, coagulation, drying and storage), and the poor maintenance of processing equipment. As a result, the sheets produced tend to be excessively high in moisture content and contain varying amounts of air bubbles, various impurities and mold growth.

The sheets made at the GPC's are generally of a higher quality than those made on individual holdings with the sheets being mostly of first and second grade. The higher quality rubber produced at these centers can be attributed to the fact that the members of the GPC's have normally undertaken courses in processing techniques offered by the extension officers of the Rubber Research Institute. Moreover, processing at these centers is carried out under the close supervision and advice of the extension officers. A major disadvantage of processing on individual holdings is the difficulty involved in providing effective supervision and advice on the processing operations of individual smallholders compared to groups of smallholders.

Smallholder rubber is marketed through a chain of agencies consisting of first level dealers, middle dealers, remillers, and exporters; this traditional marketing system has remained largely unchanged since

rubber was first planted on smallholdings.[3] The traditional marketing channel is shown in Figure 5.1. The first level dealers are scattered in small towns and villages and act as the first buyers of smallholder rubber. About 70 per cent of the smallholders' latex is sold to the first buyers as unsmoked sheets (USS), and these sheets are smoked by the first level dealers before sale to the dealers next in the marketing channel. The remaining 30 per cent is made into ribbed smoked sheet (RSS) before sale by the smallholders. The first level buyers also form an important source of smallholder credit. Lim,[4] in his survey, found that over 90 per cent of these buyers in the state of Selangor provide cash and in-kind credit to smallholders. The in-kind credit is provided by the dealers who also own provision stores.

The middle dealers operate in larger towns and purchase rubber from the first level dealers for sale to the exporters. In certain areas, the middle dealers purchase rubber directly from smallholders, especially those with larger sized holdings. The remillers are also located in large towns and purchase scrap and cuplump from

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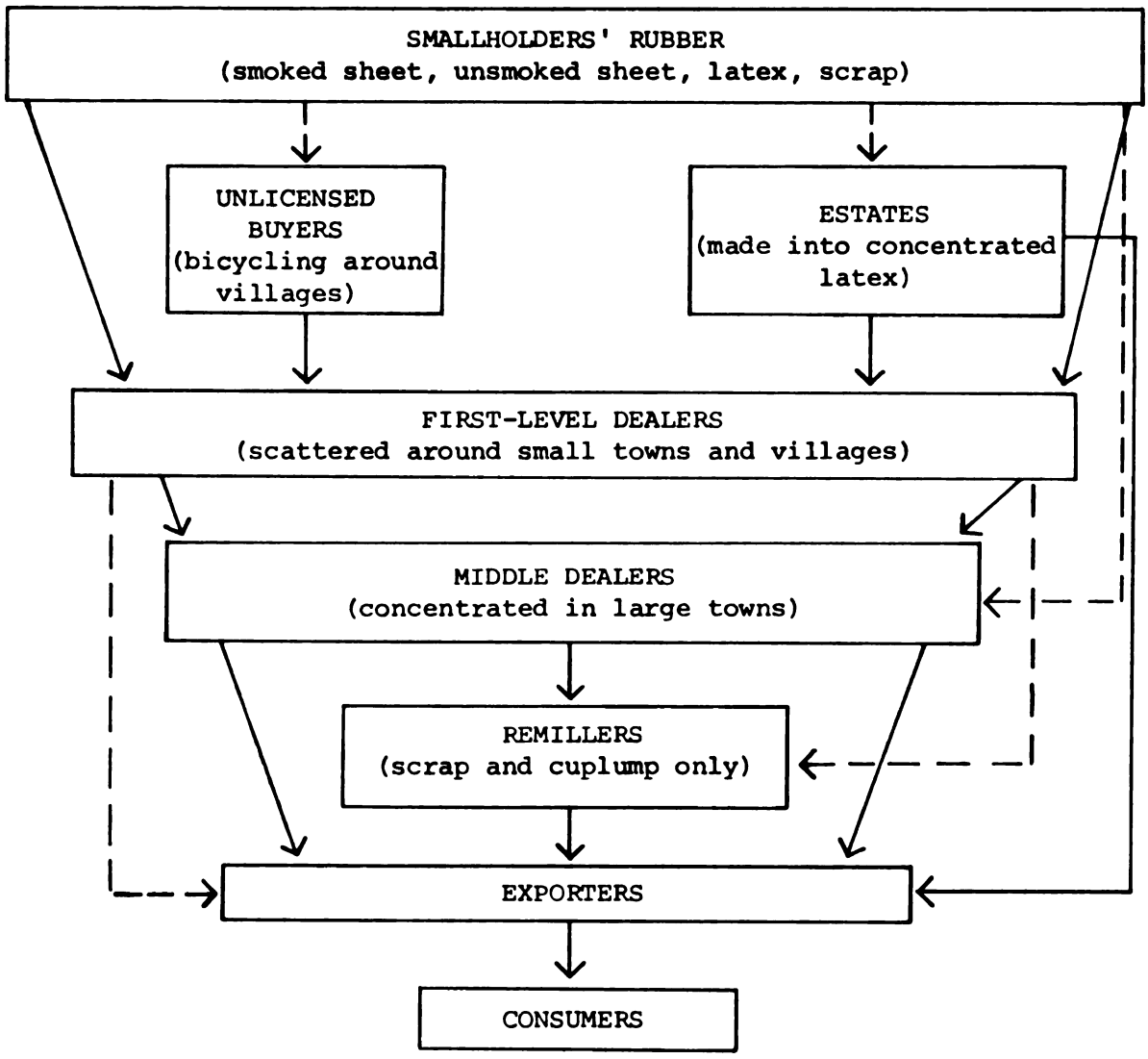
[3]This part of the discussion is drawn heavily from S. C. Lim, "A Study of the Marketing of Smallholders' Rubber at the First Trade Level in Selangor," Economics and Planning Division Report, No. 4, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (September, 1968).

[4]Ibid., p. 2.



Source: S. C. Lim, "A Study of the Marketing of Smallholders' Rubber at the First Trade Level in Selangor," Economics and Planning Division Report, No. 4, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (September, 1968), p. 13.

Figure 5.1.--Traditional Marketing Channel for Smallholder Rubber.

first level and middle dealers. These lower grades are manufactured into various grades of crepe rubber. The exporters form the last link in the marketing chain and their purchases mainly come from the middle dealers, re-millers, and estates. Their main function is to regrade the rubber sheets and pack them into 250 pound bales for export overseas.

As the rubber moves from the smallholdings to the final point of shipment, certain services are provided by the various agencies in the marketing channel. The cost of the services incurred, including the returns earned by the agencies at the different levels of the marketing channel, have been computed by Lim as the difference between the f.o.b. price, less export duty, research and replanting ceases, and the price received by smallholders. This difference represents the marketing margins involved.

For the ribbed smoked sheet (RSS), the average marketing margin based on December 1962 to April 1964 data, ranged from 2.3 cents/lb. (Malaysian) in the state of Negri Sembilan to 4.0 cents/lb. in Pahang. The weighted average margin for all states was 2.8 cents/lb. With respect to rubber initially sold by smallholders as unsmoked sheet (USS), the margin was found to vary from 8.3 cents/lb. in Kedah to 11.3 cents/lb. in Johore, with the weighted average for all states being 910 cents/lb.

Despite the big decline in rubber price since 1964, all available evidence indicates that the marketing margins have remained essentially unchanged.[5]

The analysis of the marketing margins indicates that the margins for the USS is high compared to those for the RSS. This can be attributed to the greater amount of services required by the USS before it can be exported, and to the greater degree of arbitrariness involved in grading the unsmoked rubber. Even within the RSS and USS, it was found that the margins tend to increase as the quality of the sheets decline.

The marketing channel for smallholders' lower grade rubber, i.e. scrap material consisting mainly of cuplumps and tree lace, is essentially the same as that for the RSS and USS. Lower grade rubber makes up about 20 per cent of total smallholding production and is sold to dealers in an unprocessed form, and usually in a dirty unsorted condition. The dirty condition is the result of storing under dirty conditions, and the failure to remove soil and other foreign materials from the scrap during and after collection. The common practice of sun-drying the scrap rubber results in severe degradation in its property and eventually leads to the lower grade of the processed rubber.

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[5] Ibid., p. 39.

A study of the marketing of smallholders' scrap rubber indicates that the average marketing margin (or the difference between the f.o.b. price, less export duty, research and replanting cesses, and the price received by smallholders) was 13.27 cents/lb.[6] This margin has been found to vary with the quality of the scrap rubber and the locations of sale. In remote areas, some unlicensed buyers were paying smallholders as much as 7.5 cents/lb. less than the licensed dealers in the towns.

Apart from the series of agencies involved in the movement of rubber from the smallholdings to the point of shipment and the resultant high marketing margins for the USS and scrap rubber, another unsatisfactory feature of the traditional marketing system is the method employed in moisture content determination and grading. Due to the absence of technical specifications on which grading can be based on, the grading method employed is very subjective. Grading is based on visual inspection of the sheets and tends to be arbitrary. This is more so in the grading of USS and scrap rubber.

In determining the moisture content of the USS, the most important factors considered are the thickness of the sheets, and the length of time after processing

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[6] S. T. Cheam, "A Study of the Marketing of Smallholders' Lower Grade Rubber," Economics and Planning Division Report, No. 8, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (July, 1971), p. 51.

when the sheets are sold with the deduction being higher, the thicker the sheets, and the shorter the time after processing at the time of sale. The subjective nature of the moisture content estimation and the resultant wide range of deductions made based on the thickness of sheets and the length of time after processing can be seen from the study by Lim presented in Table 5.1.[7] The table indicates that the average estimate of moisture content for thick sheets sold shortly after processing is 45 per cent by weight and decreases to 5 per cent for sheets sold two weeks after processing. For thin sheets the corresponding estimates are 37 and 2 per cent respectively. The standard deviation indicates that the estimates made by different dealers for both thick and thin sheets vary considerably even for sheets sold two weeks after processing. In fact, variability increases as the period after processing increases. Moreover, the dealers' decision as to whether a sheet is "thin" or "thick" has been found to be arbitrarily conceived.

In grading of smallholders' sheet rubber, the dealers put major emphasis on the visual appearance such as shades of color, the presence of bubbles, dirt, blisters, and minor mold growth, but ignore the vulcanizing

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[7]Lim, op. cit., pp. 60-61.

Table 5.1.--Malaysia: Average Dealers' Estimates of Moisture Content of Unsmoked Sheet Rubber and Variability of Estimates. (By Thickness of Sheets and Period after Processing.)

Period After Processing	Dealers	Thick Sheet		Thin Sheet	
		Moisture	Standard Deviation	Moisture	Standard Deviation
	No.	%		%	
Shortly after processing	101	45	8.1	37	7.0
24 hours " "	106	32	9.0	24	9.1
48 hours " "	102	23	9.0	16	7.2
3 days " "	97	15	6.6	10	5.1
One week " "	70	10	4.8	6	4.0
Two weeks " "	68	5	2.6	2	1.4

Source: S. C. Lim, "A Study of the Marketing of Smallholders' Rubber at the First Trade Level in Selangor," Economics and Planning Division Report, No. 4, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (September, 1968), Table 42, p. 61.

and other technical characteristics of the rubber.[8] The majority of the dealers determine the grades by merely glancing at the batch of sheet as a whole, while the rest scrutinize a few sheets at random and then apply the grading to the whole batch. The method of grading employed coupled with the arbitrary determination of moisture content are likely to work to the disadvantage of smallholders. It is difficult to ascertain whether the smallholders receive payments commensurate with the dry rubber content and the quality of their rubber. However, it is quite likely that the dealers would tend to overestimate the moisture content and underestimate sheet quality in order to safeguard themselves against mistakes that might occur in the assessment.[9]

In purchasing scrap rubber from smallholders, the dealers set only one basic price based on their opinion and expectations of the prevailing market situation for 2X thin brown crepe (2XTBC).[10] The price paid for the scrap is based on this price less deductions for moisture

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[8] P. W. Allen, "The Evolution of Market Grades," Rubber Developments, XVII, No. 4 (1964), 90-97.

[9] Lim, op. cit., p. 36.

[10] The great bulk of the smallholders' scrap rubber (about 80 per cent) is processed into 2XTBC for export. The other 20 per cent is processed into other grades, mainly 1XTBC and 3XTBC. This is the reason for using 2XTBC price as the basis for pricing scrap.

content. A major disadvantage of using only one basic price is that it acts as a disincentive for smallholders to produce high quality scrap as no price advantage is to be gained. However, it pays the smallholders to reduce the moisture content of the scrap as drier scrap will fetch a higher price. To achieve this, smallholders have been found to sun-dry their scrap though sun drying causes the scrap to oxidize and thus lowers the quality of the processed crepe.[11]

The Reorganized Processing and Marketing System for Smallholder Rubber

New Processing Methods

It was noted in Chapter II that the introduction of the Standard Malaysian Rubber (SMR) scheme has paved the way for the development of new processing methods which result in the production of block rubber in contrast to the conventional methods of processing rubber into sheets and crepe (see Figure 5.2). The main types of block rubbers produced and the methods of processing involved have already been discussed in Chapter I. Rubbers produced by the new processing methods have good and uniform physical properties. Uniformity in properties is achieved because the new processes lend themselves to centralization of processing facilities in large factories

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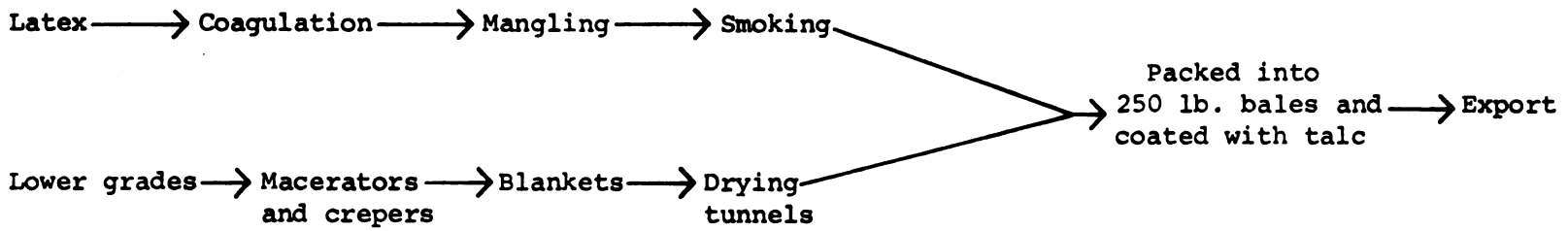
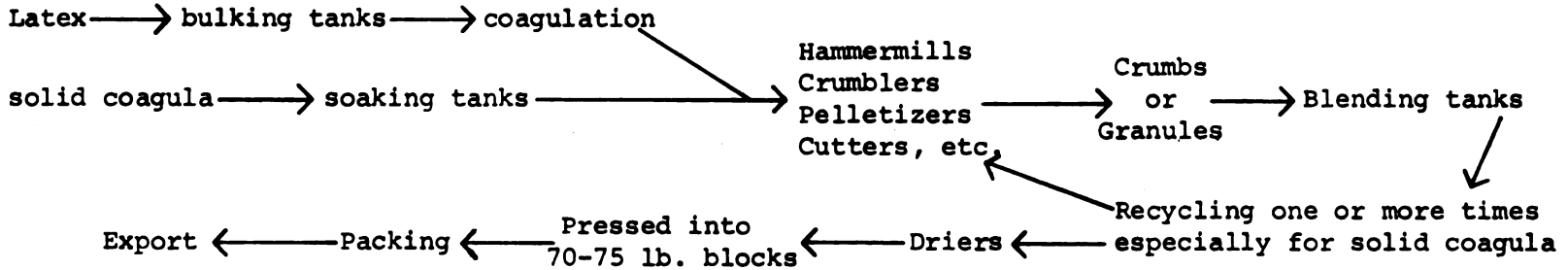
[11]Cheam, op. cit., pp. 20-21.

A. TRADITIONAL PROCESSING



B. NEW PROCESSING



Source: S. Nair, S. W. Sin, and T. H. Lee, "New Presentation Rubbers: SMR Market Reaction and Future Requirements," Planters' Bulletin, No. 110, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (1970), Figure 2, p. 204.

Figure 5.2.--Flow Chart for Traditional Processing of Rubber and New Processes.

where blending is improved due to the greater throughput. Moreover, these processes are versatile and lend themselves to production of rubbers with the properties desired by the consumers. For example, these processes require only slight modifications to produce constant viscosity rubbers, low viscosity rubbers and oil-extended rubbers.[12]

The above discussion indicates the technical superiority of the new processing methods over the traditional method. The latter method, as noted earlier, results in the production of generally inferior quality rubbers and require extensive pre-treatment before use in the consumers' factories. The latter methods also lack the versatility necessary to produce rubber to meet the consumers' requirement.

The development of the new process rubbers have revived consumers' interest in natural rubber. For

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[12]For a detailed and technical discussion of the new processing methods, see D. J. Graham, "New Presentation Processes and SMR Scheme," Planter's Bulletin, No. 99, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia; B. C. Sekhar, "Malaysian Natural Rubber: New Presentation Methods," Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia, 1967; "The Marketing of Block Natural Rubber Sold to Technical Specifications," Proceedings of Symposium organized by IRSG, London, 1969; J. E. Morris, "Heveacrumb Process," Journal of the RRIM, XXII, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia, 1969; and P. S. Chin, Y. B. Soh and N. M. Pillai, "Factors Influencing Consistency of SMR Production," Preprint No. 20, Rubber Research Institute of Malaya Planter's Conference, Kuala Lumpur, Malaysia, July, 1971.

example, the new process rubbers produced have all been sold and often at premium prices. Although the conventional forms of rubber (sheets and crepe) are also exported under the SMR scheme, the growth in these exports have been slow. In fact, exports declined slightly in 1969 and is expected to decline further in 1970 and 1971.[13]

With the availability of the new process rubbers, and their acceptance by consumers as reflected in the rapid increase in their exports, the conventional forms of rubber sold to visual specifications can be expected to phase out of the market for natural rubber. So far, the production of the new process rubbers are mainly confined to the estates and remillers, while the great bulk of smallholding output (which accounts for about one-half of total Malaysian output) is still processed into the conventional forms of rubber.

New Processing Methods and the Smallholders

With the superiority of the new processing methods, it is to the advantage of smallholders and to the Malaysian rubber industry if the smallholders' rubber is also processed by these new methods. However, for

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[13] S. Nair, S. W. Sin, and T. H. Lee, "New Presentation Rubbers: SMR Market Reaction and Future Requirements," Planters' Bulletin, No. 110, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (1970), p. 230.

several reasons, it is unlikely that the smallholders can adopt the new methods individually or even on a group basis such as the current group processing centers.

First, the new methods are relatively more complicated and require the use of specialized equipment, the cost of which would be prohibitive to the smallholders. Given the current available technology, it would not be economically feasible for smallholders to establish small scale plants as these plants are not likely to achieve the economies of size in processing in order to produce at competitive costs. Moreover, the production of high and consistent quality rubbers and the need to modify the processes to produce rubbers with the technical properties to meet the different consumers' requirements require technical expertise. The smallholders lack the necessary expertise, and thus, cannot be expected to undertake the new processes competently.

Second, the new rubbers produced must conform to certain technical specifications and packing requirements before they can be sold as Standard Malaysian Rubber (SMR), and conformity with these requirements is checked by the RRIM. In such a case, even if we assume that smallholders are able to adopt these new processes on an individual or a group processing center basis, the problem of quality control and of checking for conformity

with the SMR requirements and the specifications would be enormous considering the number and the scattered nature of the smallholdings.

Third, as has been noted earlier, the new processes lend themselves not only to the production of rubbers with the desired technical properties but also to the consistency of these properties. Since rubber is an industrial raw material, consistency in its technical properties is essential for high raw material prices. The manufacturer (consumer) after choosing the raw material with the desired technical properties for his particular application, requires that the raw material has consistency in these properties irrespective of the source of supply, period of purchase, and the forms in which it is purchased. Lack of consistency can result in rejects of finished or partly finished products thus incurring extra costs in reprocessing. As noted earlier, consistency can be achieved through the centralization of processing facilities in large factories where blending is improved because of the greater throughput. Moreover, centralization of processing facilities could also result in lower processing costs through the attainment of economies of size of large-scale processing. Adoption of the new processes by smallholders on an individual or a group basis is not likely to result in consistency in the technical qualities of the processed rubber

considering the small size of the holdings and the generally low output on these holdings.

Central Processing of Smallholder Rubber

Due to the large minimum plant size required for the new process rubbers with the current available technology, a central processing and marketing scheme for smallholder rubber is essential for smallholder participation in the SMR scheme. So far, central processing for smallholders has been introduced in Malaysia on a limited scale. The objectives of the central processing scheme are the improvement in the quality of the rubber produced by smallholders, and the increase in their income mainly through reductions in processing and marketing costs. In this section, and for the rest of this chapter, a description of the general features of the scheme and the organization responsible for implementing the scheme is attempted with the object of determining the benefits of the scheme to the smallholders and to the Malaysian rubber industry.

Figure 5.3 presents the stages involved in the central processing and marketing scheme. Each central factory is supplied by a network of collecting centers with each center being manned by a collecting agent. Each factory purchases rubber from smallholders within a radius of approximately twenty miles. Smallholders

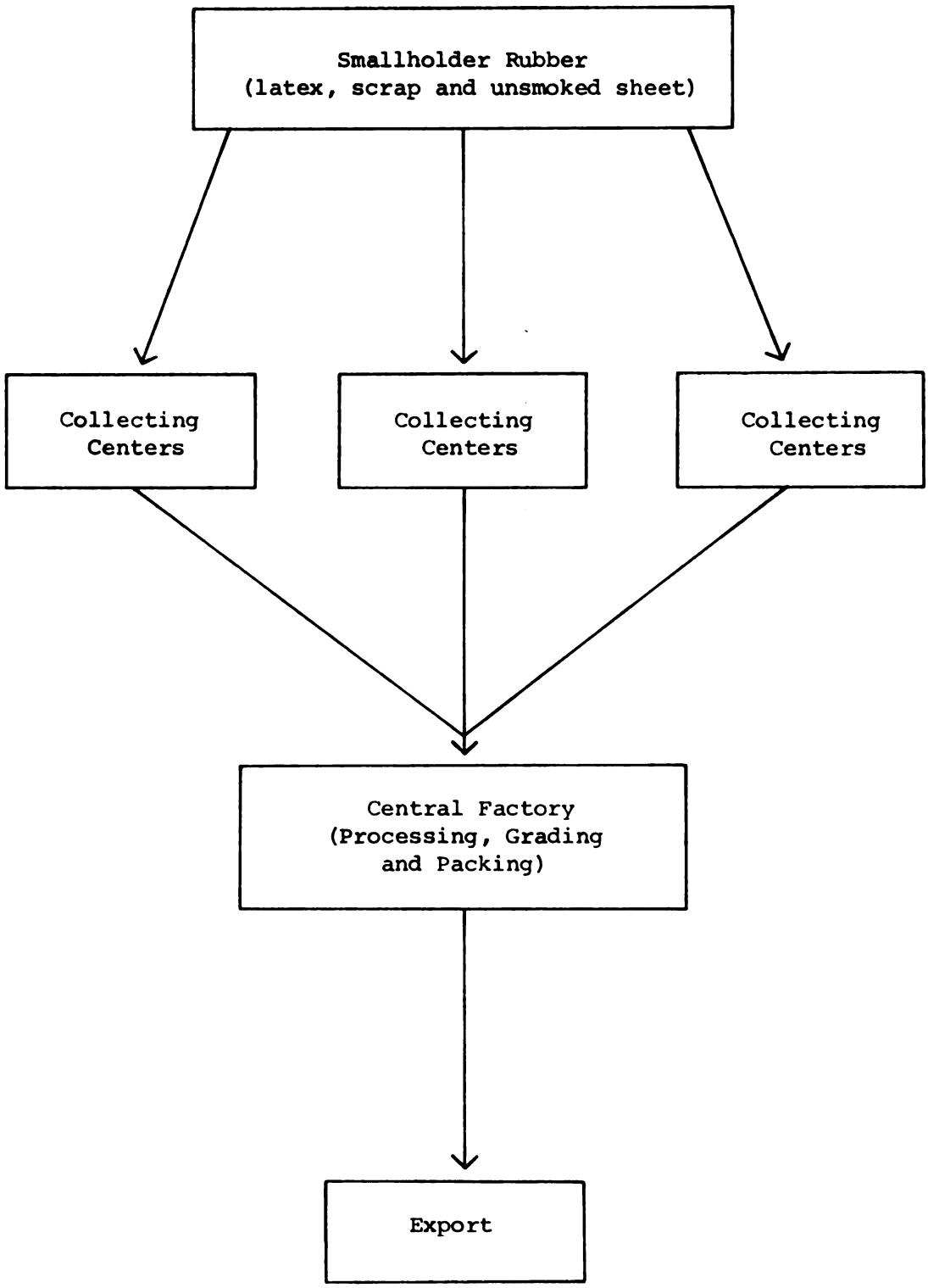

Figure 5.3.--Central Processing and Marketing of Smallholder Rubber.

bring their fresh latex and scrap rubber to the center closest to their holdings. At each center, the collecting agent determines the quantity of the latex received and makes payments to the suppliers. The latex received from the smallholders is bulked, and an anti-coagulant is added to prevent pre-coagulation. The latex and the scrap materials are then transported to the factory for processing, grading, packing, and for direct export to consumers.

The collecting agents are selected by the smallholders themselves and receive a commission of 1.5 cents/lb. of rubber purchased for their services. The price paid for smallholders' latex is based on the RSS 1 f.o.b. price on the previous day, less export duty, replanting and research cesses, the collecting agents' commission, and 6 cents/lb. deduction to cover processing and transportation costs. For scrap rubber, the price paid is based on the f.o.b. price of 2X thin brown crepe (2XTBC) less the above deductions. The 6 cents/lb. deduction compares with the current margin of 2.8 cents/lb. for the ribbed smoked sheet (RSS); 9.0 cents/lb. for the unsmoked sheet (USS), and 13.27 cents/lb. for scrap rubber as indicated earlier.

Malaysian Rubber Development Corporation (MRDC)

The implementation of the central processing and marketing scheme for smallholders is the responsibility

of the Malaysian Rubber Development Corporation, a public corporation formed in April, 1971. The history of MRDC dates back to 1965 when it was first started as a project under the Economic and Planning Division of the RRIM with the operation of one central factory. As activities expanded with the introduction of a second central factory, a new division, The Rubber Processing Unit, was created within the RRIM in 1968. As a result of rapid expansion of the unit, the Malaysian Rubber Fund Board took over the functions of Rubber Processing Unit with the formation of the Malaysian Rubber Development Sendirian Berhad in 1969, a non-profit company limited to making smallholders' crop into new process rubbers under the SMR scheme.

Since the objectives of the company have been the upgrading of smallholders' rubber quality and the increase in their income through higher prices paid for their output, the government became interested in the company. The government took over control of the company in 1971 and the name of the company was changed to Malaysian Rubber Development Corporation and in the same year MDRC became a public company. The corporation is vested with the responsibility of setting up factories; collection and processing of smallholders' rubber, and direct export of the processed rubber to the consumers. The corporation

is financed by the Federal government, Malayan Rubber Fund Board,and State governments.

Currently, five central processing factories are in operation under the MRDC.[14] Though these factories also purchase scrap rubber and unsmoked sheets (to be reprocessed into block rubbers), approximately 80 per cent of the purchases are latex. The corporation has plans to establish 25 more central factories during the 1971-75 period at the cost of approximately $35 million (Malaysian).[15] Each factory is expected to serve an average of 18,000 acres or approximately 4,000 smallholders and provide employment for 180 people (factory managers, field officers, clerical staff, laborers and collecting agents).[16]

The five existing factories were established at the cost of approximately $6 million (Malaysian) and currently produce 85 tons of processed rubber per day. Based on 25 operating days per month, the factories thus produce about 25,000 tons of rubber annually. This represents about 3.5 per cent of the total smallholding

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[14]The factories are located in Meru (Selangor), Rantau (Negri Sembilan), Grisek (Johore), Mentakap (Pahang) and Ulu Langat (Selangor).

[15]Malaysia, Second Malaysia Plan, 1971-75, Kuala Lumpur, Malaysia, 1971, p. 135.

[16]Private communication with MRDC.

production in 1971. Table 5.2 summarizes major operational features of the existing central factories. Examination of the estimated operating capacity indicates that the majority of the factories are operating either at full capacity or close to capacity. The relatively lower operating capacity of the Mentakap and Ulu Langat factories can be mainly attributed to the more recent establishment of these factories and to the lag involved in the extension efforts to get smallholders to shift to the new method of selling their output, and the lag in response of smallholders themselves. Smallholders are not likely to adopt the new selling method unless they are fully convinced of the gains to be derived by this adoption.

Upon arrival at the factory, the latex, sheets, and scrap rubber are processed into different SMR grades and packed into seventy-five pound bales for direct export to consumers. The latex and sheets are processed into SMR 5, and SMR 10, while the scrap materials are processed into SMR 20, and SMR 50 depending on the quality of the scrap. Marketing of the processed rubber is undertaken by the Marketing Division of the Corporation which is in direct contact with overseas manufacturers. As noted earlier, all the SMR produced are exported.

I attempted to obtain data on processing costs incurred by the five central factories, but my attempt failed as the MRDC was unwilling to divulge the

Table 5.2.--Central Processing Factories: Purchases, Smallholders Served, Employment and Operating Capacity for 1971.

	Factory Locations (Towns)						
	Meru	Rantau	Grisek	Mentakap	Ulu Langat	Total	Average
Number of collecting centers	43	47	55	36	29	210	42
Average monthly purchases (long tons)	222.5	463.3	681.2	287.1	262.8	1,916.9	383
Number of smallholders served	2,580	2,820	3,300	2,160	2,050	12,600	2,520
Smallholding acreage served	12,900	14,100	16,500	10,800	10,025	63,000	12,600
Number employed[a]	110	162	220	113	142	747	150
Capacity (tons/day)	10	15	30	15	15	85	17
Estimated operating capacity (per cent)[b]	90	100	90	80	70	--	86

Source: Malaysian Rubber Development Corporation, Information on Malaysian Rubber Development Corporation, Kuala Lumpur, Malaysia, 1971, and private communication with MRDC personnel.

[a]Includes factory managers, field officers, clerical staff, laborers, and collecting agents.

[b]Based on twenty-five operating days per month.

information for fear of being published and thus coming to the knowledge of synthetic rubber producers. However, some idea of the costs involved was obtained from a survey of six estate factories producing SMR in 1971 conducted by the Corporation. The factories have an average monthly output of 145 tons. The cost per pound was found to vary substantially between factories and range from 3.92 cents/lb. (Malaysian) to 6.49 cents/lb. Average cost was 4.84 cents/lb.[17] In contrast, under the traditional processing method, processing and smoking costs (excluding labor cost) average about 4.0 to 4.5 cents/lb.[18] However, comparison of costs under the new and traditional processing methods is quite meaningless as these methods result in different forms of processed rubber. Moreover, smallholders' rubber processed under the conventional method is generally of low quality with the bulk of the sheets (about 75 per cent) falling into grade 3 and 4.

Problems Experienced by MRDC

With the object of investigating the problems faced in the central processing and marketing of smallholders' rubber, I interviewed MRDC personnel and managers of two central factories. I found that the major

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[17] Private communication with MRDC.

[18] Barlow and Lim, op. cit., Tables 3 and 7, pp. 7 and 11.

problem currently faced by the Corporation is the high transportation cost involved in collecting latex from the collecting centers scattered in the villages. Transportation cost forms the major component of the overall processing costs. This is aggravated by the fact that the latex at each collecting center has to be collected daily to avoid coagulation and degradation of its properties before arrival at the factory.

The second major problem is that of obtaining adequate supplies of latex from smallholders to enable the factories to operate at near or full capacity. However, this problem is generally encountered in the first year of the factories' operation. As noted earlier, this can be mainly attributed to the lag in smallholders' response to shift from the traditional to the central processing and marketing system. To ensure an adequate supply of rubber to feed the central factories, the Corporation now purchases sheet and scrap rubber in addition to latex. In purchasing sheet and scrap rubber, each factory can extend its radius of purchase, as these forms of rubber are less bulky and can be transported over longer distances without any degradation in their properties as compared to latex. While latex is purchased from individual smallholders through the collecting centers, sheet and scrap rubber are also purchased from group processing

centers where the members of each center pool their output for bulk sale to the Corporation.

Third, some smallholders have been found to indulge in certain malpractices such as boiling or exposing their latex to sunlight before sale to increase the dry rubber content of the latex. These practices temporarily increase the viscosity and thus the dry rubber content of the latex but also leads to pre-coagulation. However, this is considered a minor problem as the collecting agents are able to detect the presence of these practices through experience and thus can make adjustments in the dry rubber content before making any payment to the smallholders concerned.

Finally, many smallholders prefer daily payments for their rubber. This presents a problem insofar as it involves more work on the part of the clerical staff responsible for disbursing these payments. To mitigate this problem, the smallholders are given the option of obtaining either cash or receipts at the time of sale,and the receipts can be redeemed for provisions at the local provision stores. The receipts can also be redeemed for cash at the collecting centers whenever the smallholders need cash.

Smallholders' Attitudes Toward Central Processing

The preceding discussion has indicated that the central processing and marketing scheme could provide an important means in strengthening the competitive position of natural rubber against synthetic rubber and in increasing the income of smallholders. However, the successful implementation of the scheme is very much dependent on the smallholders' willingness to sell their rubber to the central factories as opposed to selling to the dealers under the traditional processing and marketing system. Their willingness to participate is in turn a function of the benefits to be derived from the new processing and marketing system.

To ascertain the smallholders' views on central processing, a sample survey of 178 smallholders was carried out in October 1971 in two areas of the state of Selangor. In the first area, a central factory has been established and the smallholders are currently selling their latex and scrap to the factory. In the second area, the smallholders are currently selling sheet rubber and scrap to the local dealers under the traditional processing and marketing system. However, the Malaysian Rubber Development Corporation (MRDC) has proposed to set up a central factory in the area. Eighty-seven smallholders from three kampongs[19] constitute the sub-sample

[19]The Malaysian word for village.

in the first area while ninety-one smallholders from four kampongs constitute the second sub-sample.

The purpose of the survey in the first area was to ascertain the smallholders' views on the benefits they have achieved and the problems experienced by selling their rubber to the central factory.[20] In the second area where a central factory is expected to be established, the purpose was to ascertain their views on the benefits they expect to achieve and the problems they anticipate. Thus, results obtained from the survey of both areas would enable us to ascertain whether the benefits perceived by smallholders are commensurate with the benefits actually realized. Moreover, an understanding of the smallholders' views regarding the problems experienced and anticipated should help to ensure that these problems are alleviated or minimized as new central factories are established.

The result of the survey in the first area indicated that smallholders derive four benefits by selling their latex to the central factories. The benefits listed in order of their importance as viewed by the respondents are: (a) saving in processing costs and time; (b) higher prices received; (c) more accurate and satisfactory weighing and dry rubber content (d.r.c.)

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[20]The survey questionnaire is given in Appendix D.

determination by the collecting agents (that is, no "cheating" as was with the case of the traditional buyers); and (d) the collecting center is close to the rubber holding.

Table 5.3 lists the benefits and the number of responses to each benefit listed. It should be noted that the number of smallholders responding to the gains listed are greater than the number of smallholders interviewed (87). The reason for this discrepancy is that the question on the types of gains achieved by smallholders was open-ended and more than one response to this question was obtained from some respondents.

Table 5.3.--Smallholders' Benefits from Central Processing and Number of Smallholders Listing Each Benefit in Their Response.

Type of Benefit	Number of Smallholders Responding	Per cent of Sample
1. No processing costs and time required	81	93
2. Higher prices received	16	18
3. No "cheating" in d.r.c. determination and in weighing	16	18
4. Collecting center is close to the rubber holding	28	32

An interesting aspect of Table 5.3 is the low percentage of the respondents listing the higher prices received as one of the benefits of selling to the central factory. Three factors could be attributed to this low response. First, at the time of the survey, rubber prices were much lower than when they were selling to the traditional buyers five to six years ago. It was found during the survey that the majority of smallholders tend to compare the total revenue (or the amount received per sale) obtained from selling to the traditional buyers five to six years ago and that currently obtained by selling to the central factories, rather than comparing the price/lb. received from the central factory and that received if they had sold to the traditional dealers. Due to the decline in rubber prices, the smallholders' total revenue per sale is also likely to decline. As the smallholders view it, the decline in total revenue despite selling to the central factory indicates that they are not receiving higher prices by selling to the central factory.

Second, since the smallholders have been selling latex to the central factory for the last five years or so, they are not aware of the current prices paid by the traditional dealers which they could then compare with the prices paid by the central factory. Third, respondents currently selling latex to the central factory were previously selling mainly unsmoked sheet to the traditional

dealers. As such, they found it difficult to compare prices received from the two buyers on a latex or any other common basis.

As a result of the interaction of the above factors, the majority of the respondents have difficulty in realizing that the prices received from the central factory are higher than those received from the traditional dealers as will be indicated in the analysis in the following chapter.

With regard to the problems encountered in the central processing and marketing scheme, seventy-six (87 per cent) responded that they encountered no problems and were satisfied with the new channel of sale. The main problem which caused dissatisfaction among the remaining (13 per cent) respondents was with determination of the dry rubber content (d.r.c.) of the latex. These respondents felt that the matrolax[21] was inaccurate and tend to underestimate the d.r.c.

In the second area where a central factory is proposed to be established, the majority of the smallholders interviewed (71 per cent) indicated they would shift the sale of their rubber to the central factory if and when the factory and the collecting centers are established. A low percentage of the respondents (4 per cent) will not

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[21]The device used in determining the dry rubber content of latex.

sell to the factory while the remaining 25 per cent were uncertain.

For respondents who would not sell to the central factory, the reason given was the unsatisfactory method of determining the dry rubber content (d.r.c.) of the latex. In the case of respondents who were uncertain, 60 per cent expressed a wait-and-see attitude and would follow the action of other smallholders in the village, while 40 per cent cited their lack of knowledge about the central processing and marketing scheme as the reason for the uncertainty.

In the case of the respondents who expressed willingness to sell to the central factory, the benefits listed in order of their importance as viewed by the respondents are: (a) savings in processing costs and time (70 per cent); (b) higher price (55 per cent); (c) proximity of the collecting center to the rubber holdings (11 per cent); and (d) no "cheating" in weighing and d.r.c. determination by the collecting agent (5 per cent).[22]

The above respondents were also asked what problem, if any, they would anticipate when they sell their latex to the central factory instead of their current sale

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[22]Note that the total percentage of respondents expressing the four anticipated benefits is greater than 100. The reason for this discrepancy is that the question pertaining to the benefits was open-ended. As such, respondents gave more than one response to the question.

to the traditional dealers. The majority of the respondents (92 per cent) anticipated no problems. The other 8 per cent cited inaccuracy in weighing and underestimation of the d.r.c. of the latex as the problems anticipated.

Summary

The comparison between the traditional and the new processing and marketing systems for smallholders' rubber indicates the superiorities of the latter system. The new processing methods have been found to be versatile and can be utilized to process rubber with different technical properties to meet the consumers' requirements. The new process rubbers are graded according to technical specifications in contrast to the visual grading of the sheet rubber processed by the traditional method. Though it is essential for the Malaysian rubber industry and particularly for the smallholders to adopt these new processes in order to remain competitive in the elastomer market, there are several important reasons why these new processes will not be adopted by smallholders on an individual basis. However, the establishment of the central processing factories provides a means by which smallholders' output can be processed into the new rubbers and marketed as Standard Malaysian Rubber (SMR).

In order to ascertain the smallholders' views on central processing, a sample survey of 178 smallholders was carried out in October 1971 in two areas of the state of Selangor. In the first area, a central factory has been established and the smallholders are currently selling their rubber to the factory. In the second area, the smallholders are selling their rubber to the local dealers under the traditional processing and marketing system. On the basis of the survey, I am able to draw the following conclusions.

First, the sale of rubber to the central factories under the central processing and marketing scheme, has been, and is likely to be, well received by the smallholders. This conclusion is based on the fact that the majority of smallholders currently selling to the central factory experience no problem and are generally satisfied with the new channel of sale and also on the fact that the majority of smallholders in the proposed central factory area have indicated their willingness to sell to the factory and anticipate no problems in shifting to this channel of sale. Second, the benefits from central processing as perceived by smallholders are commensurate with the benefits actually realized. The similarity between the benefits anticipated by smallholders who expressed willingness to sell to the proposed factory and the benefits achieved by those currently selling to the

factory bears out this conclusion. Third, insofar as benefits from central processing are concerned, smallholders view the savings in processing costs and time as the most important single benefit.

Another interesting result of the survey needs to be mentioned. It has been widely believed that smallholders are reluctant to shift to the new channel of sale because of the availability of credit (both in kind and cash) from the traditional dealers. However, the result of the survey has not borne out the above belief. In both areas of the survey, non-availability of credit was not considered as one of the problems experienced or anticipated by the respondents.

CHAPTER VI

THE EFFECTS OF YIELD STIMULATION AND CENTRAL PROCESSING AND MARKETING ON SMALLHOLDERS' INCOME

In the preceding chapters, the effects of yield stimulation on world and Malaysian natural rubber output and prices have been analyzed followed by a discussion of the traditional and the reorganized Malaysian smallholder processing and marketing system. In this chapter, an attempt is made to estimate the effects of ethrel stimulation and central processing and marketing on the income of smallholders. More specifically, the objective of this chapter is to estimate and compare smallholders' income under the following alternatives:

I. Without yield stimulation and under the traditional processing and marketing system.

II. With the use of yield-stimulant but under the traditional processing and marketing system.

III. Without the use of yield-stimulant but under the central processing and marketing scheme.

IV. With the use of yield-stimulant and under the central processing and marketing scheme.

Gross rather than net income is used to compare smallholders' income under the alternatives because the variability in smallholder production costs makes it difficult to use net income figures. For example, production costs have been found to vary with the location, size of holding, yield per acre, types of processing equipment used, ethnic group of smallholders (whether Chinese or Malay smallholding) and whether the holding is operated by family labor or hired labor.[1]

In computing gross income, the prices used are those that are received by smallholders for their product rather than the quoted f.o.b. prices. The prices received by smallholders are arrived at by deducting from the f.o.b. prices, research and replanting cesses, export duty and the estimated marketing margins. A research cess of 1 cent/lb. is levied by the government on all rubber exported. This cess goes to the Malayan Rubber Fund Board to meet the costs of its rubber research activities. The replanting cess is levied at the rate of 4.5 cents/lb. of rubber exported . As its name implies, this cess is levied to help pay for the costs of the smallholder rubber

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[1]J. W. L. Bevan, "A Study of Yields, Labor Inputs and Incomes on Rubber Smallholdings in the Coastal Area of Selangor," Department of Agriculture, University of Malaya, Kuala Lumpur, Malaysia, 1962.

replanting scheme which has been in operation since 1955. An export duty is levied ad valorem with the rates ranging from 4 to 10 per cent depending on the prevailing rubber prices.[2] The marketing margin as noted earlier, is the difference between the f.o.b. prices, less research cess, replanting cess and export duty and, the prices received by the smallholders. The marketing margins computed by Lim[3] for smoked and unsmoked sheets and by Cheam[4] for scrap rubber will be used to arrive at prices received by the smallholders.

(i) Smallholder Income Projections Without Yield Stimulation and Under the Traditional Processing and Marketing System: 1975-80

To get a meaningful estimate of the smallholders' income, it is necessary to classify total production into its different forms as f.o.b. prices and prices received by smallholders vary with the forms of rubber produced and exported. Smallholding production can be classified

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[2]Rubber Research Institute of Malaya, Rates of Export Duty and Cesses, Kuala Lumpur, Malaysia, October, 1968.

[3]S. C. Lim, "A Study of the Marketing of Smallholders' Rubber at the First Trade Level in Selangor," Economics and Planning Division Report, No. 4, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (September, 1968).

[4]S. T. Cheam, "A Study of the Marketing of Smallholders' Lower Grade Rubber," Economics and Planning Division Report, No. 8, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (July, 1971).

into two forms; latex and scrap rubber. It has been found that the percentage of scrap to total production is affected by the tapping system employed, clones planted, year of tapping, and the time between tapping and collection.[5] Based on the experiments conducted by the Rubber Research Institute[6] and discussions with personnel of the Smallholders Advisory Service Division of the Institute, the overall average percentage scrap of smallholders' production is assumed to be 20 per cent, with the remaining 80 per cent being latex. It has been noted earlier (Chapter II) that approximately 30 per cent of the latex is processed by smallholders into ribbed smoked sheet (RSS), while the other 70 per cent is processed into unsmoked sheet (USS). The USS is smoked by the first level dealers before export.

The great bulk of the RSS (76 per cent) produced by smallholders are classified as grades two and three by the first level dealers at the time of sale while the great bulk of the USS (also 76 per cent) is finally exported as grades three and four.[7] For scrap rubber, more

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[5]For the effects of these factors on the percentage of scrap, see: Rubber Research Institute of Malaya, Planters' Bulletin, No. 101, Performance of Clones in Commercial Practice: Fifth Report, Kuala Lumpur, Malaysia (March, 1969), pp. 85-88.

[6]Ibid., p. 85.

[7]Lim, op. cit., p. 27.

than 80 per cent are processed into 2X thin brown crepe (2XTBC) for export.[8] Thus, in computing the prices received by smallholders selling RSS, the average f.o.b. prices for RSS 2 and 3 will be used as the basis. The average f.o.b. prices for RSS 3 and 4 and the f.o.b. price for 2XTBC will form the basis for computing prices received for USS and scrap respectively.

Smallholder Output and Prices: 1975-80

Output projection for the period 1975-80 without yield stimulation is shown in Table 6.1. The table also indicates the classification of smallholding production into ribbed smoked sheet, unsmoked sheet and scrap rubber. Price projections based on output without yield stimulation have been made in Chapter IV (Tables 4.3 and 4.4). The first set of price projections based on the assumption of the continuing decline in the share of natural rubber in the total elastomer consumption will be used in this section. Since in this section, I am estimating smallholders' income under the traditional processing and marketing system, it is more appropriate to use the first set of projections. The second set of projections was based on the assumption that the share of natural rubber in the total elastomer consumption will be maintained at

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[8] Cheam, op. cit., p. 40.

Table 6.1.--Projected Malaysian Smallholding Rubber Output Without Yield Stimulation, and Classification of Output into Ribbed Smoked Sheet (RSS), Unsmoked Sheet (USS) and Scrap for 1975-80[a] ('000 Long Tons)

Year	Projected Total Output	Classification of Total Projected Output		
		RSS	USS	Scrap
1975	934	224	523	187
1976	977	235	547	195
1977	1030	247	577	206
1978	1095	263	613	219
1979	1162	279	651	232
1980	1231	296	689	246

[a]Assumes that 80 per cent of the smallholding production is latex and 20 per cent is scrap. Thirty per cent of the latex is processed into ribbed smoked sheet (RSS), and the other 70 per cent is processed into unsmoked sheet (USS).

40 per cent throughout the projection period as a result of the increased production of the new process rubbers.

However, it should be noted that I have so far projected only RSS 1 prices. Since the average f.o.b. prices of RSS 2 and 3; RSS 3 and 4, and f.o.b. price of 2XTBC will be used in estimating prices received by smallholders for rubber sold as RSS, USS, and scrap respectively, it is then necessary to project the f.o.b. prices of RSS 2, 3 and 4 and f.o.b. prices of 2XTBC. Since the above prices are highly correlated with RSS 1 prices, these prices are determined in relation to RSS 1 prices by the following estimated equations for the period 1960-70.

1. $P_{RSS_2} = -0.4420 + \underset{(0.0103)}{0.9926} (P_{RSS_1})$ $\quad R^2 = 0.99$

2. $P_{RSS_3} = -0.7001 + \underset{(0.0218)}{0.9791} (P_{RSS_1})$ $\quad R^2 = 0.99$

3. $P_{RSS_4} = -1.0710 + \underset{(0.0145)}{0.9710} (P_{RSS_1})$ $\quad R^2 = 0.99$

4. $P_{2XTBC} = -1.5558 + \underset{(0.0669)}{0.9157} (P_{RSS_1})$ $\quad R^2 = 0.95$

where P_{RSS_1}, P_{RSS_2}, P_{RSS_3}, P_{RSS_4} and P_{2XTBC} are the f.o.b. prices of RSS_1, RSS_2, RSS_3, RSS_4 and 2XTBC respectively in Malaysian cents/lb. The figures in parentheses below each coefficient are the standard errors of the coefficients. The data used in estimating the above equations and their sources are given in Appendix C, Table 1.

Prices of RSS2, RSS3 and 2XTBC derived from the above equations together with the RSS1 prices and the average prices of RSS 2 and 3, and RSS3 and 4 are presented in Table 6.2. Given the classification of smallholding output into RSS, USS and scrap, and the average prices of RSS2 and 3; RSS3 and 4, and prices of 2XTBC, an estimate of smallholders' income is now attempted (Table 6.3).

Table 6.3 shows the various deductions made from the f.o.b. prices of the three forms of rubber, the prices actually received by smallholders as a result of the deductions, and the estimated smallholders' income. In reading the table, it should be noted that the marketing margin for scrap rubber is calculated in terms of the dry weight of rubber (100 per cent dry). In other words, the prices paid by dealers for the scrap rubber is converted to what would have been paid if the smallholders' scrap rubber had been 100 per cent dry. This procedure was followed by Cheam[9] on the ground that since f.o.b. prices refer to the dry weight of rubber, the marketing margin is also calculated in terms of the dry weight.

The above procedure leads to an underestimation of the marketing margin resulting in the overestimation of the prices received by smallholders shown in Table 6.3. However, since the objective in this chapter is to compare smallholders' income under different alternatives,

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[9]Cheam, op. cit., pp. 45-49.

Table 6.2.--Projected Malaysian Prices of Ribbed Smoked Sheet (RSS) 1, 2, 3 and 4; Average of RSS 2 and 3, and RSS 3 and 4 Prices, and Prices of 2X Thin Brown Crepe (2XTBC) Without Yield Stimulation: 1975-80.[a]
(Malaysian ¢/lb.)

Year	Prices of Different Grades of Rubber						
	RSS 1	RSS 2	RSS 3	RSS 4	Average of RSS 2 and 3 Prices	Average of RSS 3 and 4 Prices	2XTBC
1975	50.00	49.19	48.25	47.48	48.72	47.87	44.23
1976	49.11	48.30	47.38	46.61	47.84	47.00	43.41
1977	47.55	46.76	45.86	45.10	46.31	45.48	41.99
1978	45.72	44.94	44.06	43.32	44.50	43.69	40.31
1979	43.51	42.75	41.91	41.18	42.33	41.55	38.29
1980	41.52	40.77	39.95	39.24	40.36	39.60	36.46

[a]Calculations based on equations 1-4 on page 147.

Table 6.3.--Projected Malaysian Smallholding Rubber Output; f.o.b. Prices; Deductions from f.o.b. Prices; Prices Received by Smallholders, and Estimated Income Without Yield Stimulation and Under the Traditional Processing and Marketing System: 1975-80.

Form of Rubber	Year	Output ('000 Long Tons)	f.o.b. Prices[a] (¢/lb.)	Deductions from f.o.b. Prices (¢/lb.)				Prices Received by Smallholders (¢/lb.)	Estimated Smallholders' Income ($ Mil.)
				Export Duty	Replanting and Research Cesses	Marketing Margins	Total		
Ribbed Smoked Sheet (RSS)	1975	224	48.72	2.00	5.50	2.78	10.28	38.44	192.88
	1976	235	47.84	1.87	5.50	2.78	10.15	37.69	198.40
	1977	247	46.31	1.87	5.50	2.78	10.15	36.16	200.07
	1978	263	44.50	1.75	5.50	2.78	10.03	34.47	203.07
	1979	279	42.33	1.75	5.50	2.78	10.03	32.30	201.86
	1980	296	40.36	1.62	5.50	2.78	9.90	30.46	201.96
Unsmoked Sheet (USS)	1975	523	47.87	1.87	5.50	9.08	16.45	31.42	368.09
	1976	547	47.00	1.87	5.50	9.08	16.45	30.55	374.00
	1977	577	45.48	1.75	5.50	9.08	16.33	29.15	376.76
	1978	613	43.69	1.75	5.50	9.08	16.33	27.36	375.69
	1979	651	41.55	1.62	5.50	9.08	16.20	25.35	369.66
	1980	689	39.60	1.62	5.50	9.08	16.20	23.40	361.15
Scrap	1975	187	44.23	1.75	5.50	13.27	20.52	23.71	99.32
	1976	195	43.41	1.75	5.50	13.27	20.52	22.89	100.00
	1977	206	41.99	1.62	5.50	13.27	20.39	21.60	99.67
	1978	219	40.31	1.62	5.50	13.27	20.39	19.92	97.72
	1979	232	38.29	1.50	5.50	13.27	20.27	18.02	93.65
	1980	246	36.46	1.50	5.50	13.27	20.27	16.19	89.21

Sources: Rubber Research Institute of Malaya, Rates of Export Duty and Cesses, Kuala Lumpur, Malaysia, October, 1968; S. C. Lim, "A Study of the Marketing of Smallholders' Rubber at the First Trade Level in Selangor," Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (September, 1968), Table 24, p. 39; S. T. Cheam, "A Study of the Marketing of Smallholders' Lower Grade Rubber," Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (July, 1971), Table 26, p. 50.

[a]For ribbed smoked sheet (RSS), f.o.b. prices used are the average of RSS 2 and 3 prices. For unsmoked sheet and scrap rubber, average prices of RSS 3 and 4, and prices of 2XTBC (thin brown crepe) are used respectively.

the adoption of the above procedure, though it results in overestimating the prices received by smallholders, causes no problem so long as the same procedure is maintained in computing prices received and incomes under all alternatives.

In the case of unsmoked sheet (USS), the marketing margin is computed in terms of prices paid by dealers after deducting for the estimated moisture content and the prices are not converted to reflect the 100 per cent dry weight prices.[10] Such a procedure does not lead to an underestimation of the marketing margin and the overestimation of the prices received by smallholders. The smallholders' income based on the total production (that is, production of ribbed smoked sheet, unsmoked sheet, and scrap) is calculated from Table 6.3 and is shown in Table 6.4.

(ii) Smallholders' Income Projections With Yield Stimulation and Under the Traditional Processing and Marketing System: 1975-1980

Smallholding output with the application of the yield-stimulant ethrel has been projected in Chapter III. Two sets of output projections were made, the "low" projection and the "high" projection. For prices, two sets of projections were also made. The first set was based on the assumption of the continuing decline in the share of natural rubber in the total elastomer consumption. The

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[10] Lim, op. cit., p. 28.

Table 6.4.--Projected Malaysian Smallholders' Total Income from Rubber Without Yield Stimulation and Under the Traditional Processing and Marketing System: 1975-80.[a]

Year	Total Projected Income ($ Mil.)
1975	660.29
1976	672.40
1977	676.50
1978	676.48
1979	665.17
1980	652.32

Source: Calculated from data in Table 6.3.

[a]Includes income from ribbed smoked sheet (RSS), unsmoked sheet (USS), and scrap.

second set was based on the assumption that the share of natural rubber in the total elastomer consumption will be maintained at 40 per cent throughout the projection period (1975-80) as a result of the increased production of the new process rubbers. Since this section deals with the smallholder income under the traditional processing and marketing system, the first set of price projection will be used in computing income. Two levels of smallholder income will be estimated in this section based on the low and high output projections.

Smallholder Output and Prices

Projected output with yield stimulation (for the low and high projections) and the classification of the

total output into its different forms are shown in Table 6.5. The estimated proportions of each form of rubber in total production used in this table are similar to those used in Table 6.1.

However, the effect of yield stimulation on the percentage of scrap needs to be mentioned. Ethrel increases yield by prolonging the flow of latex after each tapping.[11] A prolonged flow period, however, is likely to lead to a higher percentage of late dripping of latex (that is, dripping after the latex in the receiving container has been collected), and this in turn leads to a higher percentage of scrap mainly in the form of cuplumps. The percentage of scrap has been found to increase to as much as 40 per cent as a result of late dripping of latex arising from ethrel stimulation.[12] The percentage of scrap can be reduced to the normal level if a second round of latex collection is undertaken to take advantage of the late dripping. In fact, the use of ethrel necessitates two rounds of latex collection instead of one as with the case of non-ethrel usage. In my analysis, I will thus assume

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[11] G. F. J. Moir, "A Radical Approach to Exploitation," Planters' Bulletin, No. 111, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (November, 1970), p. 342.

[12] T. Y. Pee, and P. D. Abraham, "Economic Analysis of R.R.I.M. Ethrel Trials," Preprint No. 3, R.R.I.M. Planters' Conference, Kuala Lumpur, Malaysia (1971), Table 1, p. 2.

Table 6.5.--Projected Malaysian Smallholding Rubber Output with Yield Stimulation, and Classification of Output into Ribbed Smoked Sheet (RSS), Unsmoked Sheet (USS), and Scrap for 1975-80.[a]
('000 Long Tons)

Year	Projected Total Output		Classification of Total Projected Output					
			RSS		USS		Scrap	
	Low[b]	High[c]	Low	High	Low	High	Low	High
1975	1018	1046	244	251	569	586	205	209
1976	1093	1122	262	269	612	629	219	224
1977	1184	1215	284	292	663	680	237	243
1978	1295	1328	311	319	725	743	259	266
1979	1416	1452	340	349	793	813	283	290
1980	1551	1591	372	382	869	891	310	318

[a]See footnote a in Table 6.1.

[b]Low projected output is based on the low level of adoption of the yield-stimulant by the Malaysian smallholders. See footnote b in Table 3.8.

[c]High projected output is based on the high level of adoption of the yield-stimulant by the Malaysian smallholders. See footnote c in Table 3.8.

that two rounds of latex collection are undertaken by the smallholders using ethrel and so the percentage of scrap will stay at the same level (20 per cent) as in the case of non-stimulation.

In calculating the prices received by smallholders for their output shown in Table 6.5, two levels of projected prices will be used as the basis. It can be recalled from Chapter IV (Table 4.4) that one level of prices is based on the low output projection while the other is based on the high output projection.

For reasons indicated in the preceding section, the average of RSS 2 and RSS 3 f.o.b. prices, the average of RSS 3 and RSS 4 f.o.b. prices, and f.o.b. prices of 2XTBC are used as the basis for calculating prices received by smallholders for their rubber sold as ribbed smoked sheet (RSS), unsmoked sheet (USS) and scrap respectively. Prices of RSS 2, 3, 4 and 2XTBC are derived from the projected f.o.b. RSS1 prices using equations 1, 2, 3 and 4 estimated in the preceding section. Table 6.6 shows the various RSS prices; average of RSS 2 and 3, and average of RSS 3 and 4 prices, and 2XTBC prices based on the low and high output projections.

Based on the classification of output into its different forms and on the projected f.o.b. prices of each form of rubber, the two levels of smallholders' income under the low and high output projections are estimated in

Table 6.6.--Projected Malaysian f.o.b. Prices of Ribbed Smoked Sheet (RSS) 1, 2, 3, and 4; Average Prices of RSS 2 and 3, and RSS 3 and 4, and Prices of 2X Thin Brown Crepe (2XTBC) With Yield Stimulation: 1975-80.[a] (Malaysian cents/lb.)

Year and Projection	Prices of Different Grades of Rubber						
	RSS 1	RSS 2	RSS 3	RSS 4	Average of RSS 2 and 3	Average of RSS 3 and 4	2XTBC
Low Output Projection[b]							
1975	48.26	47.46	46.55	45.79	47.01	46.17	42.64
1976	46.27	45.49	44.60	43.86	45.04	44.23	40.81
1977	43.48	42.72	41.87	41.15	42.30	41.61	38.26
1978	40.45	39.71	38.90	38.21	39.41	38.66	35.58
1979	38.55	37.82	37.04	36.36	37.53	36.80	33.84
1980	38.55	37.82	37.04	36.36	37.53	36.80	33.84
High Output Projection[c]							
1975	47.40	46.66	45.71	44.95	46.19	45.33	41.85
1976	45.04	44.26	43.40	42.66	43.83	43.03	39.69
1977	41.74	41.00	40.17	39.46	40.59	39.82	36.67
1978	39.02	38.30	37.61	36.96	38.00	37.32	34.37
1979	36.82	36.31	35.56	34.89	35.94	35.32	32.35
1980	36.82	36.31	35.56	43.89	35.94	35.32	32.35

[a]Calculations based on equations 1-4 on page 147.

[b]See footnote a in Table 6.5.

[c]See footnote b in Table 6.5.

Tables 6.7 and 6.8 respectively. The tables also indicate the various deductions from the f.o.b. prices and the resulting prices received by the smallholders. The smallholders' income based on total smallholding production (ribbed smoked sheet, unsmoked sheet and scrap) is shown in Table 6.9.

Before comparing the smallholders' income with and without the use of the yield-stimulant ethrel, it is necessary to deduct from the former income certain additional expenses expected to be incurred by smallholders using the stimulant. These additional expenses are the cost of the chemical (ethrel), and the cost of additional fertilizers required. It has been estimated that the current cost of the chemical is approximately $24.00 per acre per year.[13] However, ethrel is still in the early stages of commercial production. For the purpose of deducting the ethrel cost from the smallholders' income, a cost of $20.00 per acre throughout the projection period (1975-80) is assumed. This assumption is based on the likelihood that full-scale commercial production of ethrel would result in lowering the production costs and hence the price of the chemical.

In the case of fertilizers, additional costs would be incurred as a result of additional fertilization

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[13] Rubber Research Institute of Malaya, Planters' Bulletin, No. 111, Integration of New Stimulation Techniques with Exploitation Practice, Kuala Lumpur, Malaysia (November, 1970), p. 394.

Table 6.7.--Projected Malaysian Smallholding Rubber Output; f.o.b. Prices; Deductions from f.o.b. Prices; Prices Received by Smallholders; and Estimated Income With Yield Stimulation and Under the Traditional Processing and Marketing System: 1975-80 (Low Output Projection).[a]

Form of Rubber	Year	Output ('000 Long Tons)	f.o.b. Prices[b] (¢/lb.)	Deductions from f.o.b. Prices (¢/lb.)			Prices Received by Smallholders (¢/lb.)	Estimated Smallholders' Income ($ Mil)
				Export Duty and Cesses[c]	Marketing Margins	Total		
Ribbed Smoked Sheet (RSS)	1975	244	47.01	7.25	2.78	10.03	36.98	202.12
	1976	262	45.04	7.12	2.78	9.90	35.15	206.29
	1977	284	42.30	7.00	2.78	9.78	32.42	206.81
	1978	311	39.41	6.98	2.78	9.76	29.55	207.55
	1979	340	37.53	6.98	2.78	9.76	27.77	211.50
	1980	372	37.53	6.98	2.78	9.76	27.77	231.40
Unsmoked Sheet (USS)	1975	569	46.17	7.25	9.08	16.33	29.84	380.33
	1976	612	44.23	7.12	9.08	16.20	28.03	384.26
	1977	663	41.61	6.97	9.08	16.05	25.56	379.60
	1978	725	38.66	6.96	9.08	16.04	22.52	377.35
	1979	793	36.80	6.96	9.08	16.04	20.76	378.76
	1980	869	36.80	6.96	9.08	16.04	20.76	404.11
Scrap	1975	205	42.64	7.08	13.27	20.35	22.29	102.36
	1976	219	40.81	6.98	13.27	20.25	20.56	100.86
	1977	237	38.26	6.85	13.27	20.12	18.14	98.41
	1978	259	35.58	6.84	13.27	20.11	15.37	90.75
	1979	283	33.84	6.84	13.27	20.11	13.73	91.37
	1980	310	33.84	6.84	13.27	20.11	13.73	98.34

Sources: Rubber Research Institute of Malaya, Rates of Export Duty and Cesses, Kuala Lumpur, Malaysia, October, 1968; S. C. Lim, "A Study of the Marketing of Smallholders' Rubber at the First Trade Level in Selangor," Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (September, 1968), Table 24, p. 39; S. T. Cheam, "A Study of the Marketing of Smallholders' Lower Grade Rubber," Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (July, 1971), Table 26, p. 50.

[a] See footnote a in Table 6.5.

[b] For ribbed smoked sheet (RSS), f.o.b. prices used are the average of RSS 2 and 3 prices. For unsmoked sheet and scrap, average prices of RSS 3 and 4, and prices of 2X thin brown crepe are used respectively.

[c] Cesses include replanting cess and research cess.

Table 6.8.--Projected Malaysian Smallholding Rubber Output; f.o.b. Prices; Deductions from f.o.b. Prices; Prices Received by Smallholders, and Estimated Income With Yield Stimulation and Under the Traditional Processing and Marketing System: 1975-80 (High Output Projection).[a]

Form of Rubber	Year	Output ('000 Long Tons)	f.o.b. Prices[b] (¢/lb.)	Deductions from f.o.b. Prices (¢/lb.)			Prices Received by Smallholders (¢/lb.)	Estimated Smallholders' Income ($ Mil)
				Export Duty and Cesses[c]	Marketing Margins	Total		
Ribbed Smoked Sheet (RSS)	1975	251	46.19	7.25	2.78	10.03	36.16	203.31
	1976	269	43.83	7.12	2.78	9.90	33.93	204.45
	1977	292	40.59	6.95	2.78	9.73	30.86	201.85
	1978	319	38.00	6.93	2.78	9.71	28.29	204.78
	1979	349	35.94	6.93	2.78	9.71	26.23	207.64
	1980	382	35.94	6.93	2.78	9.71	26.23	227.03
Unsmoked Sheet (USS)	1975	586	45.33	7.25	9.08	16.33	29.00	380.67
	1976	629	43.03	7.09	9.08	16.17	26.86	381.05
	1977	680	39.82	6.92	9.08	16.00	23.82	367.90
	1978	743	37.32	6.90	9.08	15.98	21.34	359.60
	1979	813	35.32	6.90	9.08	15.98	19.25	355.29
	1980	891	35.32	6.90	9.08	15.98	19.25	388.49
Scrap	1975	209	41.85	7.06	13.27	20.33	21.52	100.75
	1976	224	39.69	6.96	13.27	20.23	19.46	99.51
	1977	243	36.67	6.81	13.27	20.08	16.59	95.05
	1978	266	34.37	6.78	13.27	20.05	14.32	89.29
	1979	290	32.35	6.78	13.27	20.05	12.30	83.28
	1980	318	32.35	6.78	13.27	20.05	12.30	91.72

Sources: Rubber Research Institute of Malaya, Rates of Export Duty and Cesses, Kuala Lumpur, Malaysia, 1968; S. C. Lim, "A Study of the Marketing of Smallholders' Rubber at the First Trade Level in Selangor," Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (September, 1968), Table 24, p. 39; S. T. Cheam, "A Study of the Marketing of Smallholders' Lower Grade Rubber," Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (July, 1971), Table 26, p. 50.

[a]See footnote b in Table 6.5.

[b]For ribbed smoked sheet (RSS), f.o.b. prices used are the average of RSS 2 and 3. For unsmoked sheet (USS) and scrap rubber, average prices of RSS 3 and 4, and prices of 2X thin brown crepe (2XTBC) are used respectively.

[c]Cesses include replanting cess and research cess.

Table 6.9.--Estimated Malaysian Smallholders' Total Income from Rubber With Yield Stimulation and Under the Traditional Processing and Marketing System: 1975-80.[a]

Year	Estimated Smallholders' Income ($ Mil)		Estimated Smallholders' Income ($ Mil) (Net of Ethrel and Additional Fertilizer Costs)	
	With Low Output Projection[b]	With High Output Projection[c]	With Low Output Projection	With High Output Projection
1975	684.81	684.73	676.41	673.54
1976	691.41	682.96	679.81	670.41
1977	694.82	666.80	672.42	650.26
1978	687.65	655.67	664.64	632.33
1979	680.63	642.21	669.19	623.21
1980	732.85	712.24	700.65	686.24

[a]Calculations based on data in Tables 6.7 and 6.8. Total income includes income from ribbed smoked sheet, unsmoked sheet and scrap.

[b]See footnote a in Table 6.5.

[c]See footnote b in Table 6.5.

required by the stimulated trees as it has been found that ethrel stimulation resulted in an increase in the nutritional requirements due to increased production of latex.[14] In order to sustain the response to stimulation, it is thus necessary to apply additional fertilizers to the stimulated trees. The cost of the additional fertilizers has been estimated at about $12.00 per acre.[15]

To make a meaningful comparison of smallholders' income with and without yield stimulation, the cost of ethrel and the additional fertilizers amounting to $32.00 per acre are deducted from the incomes based on yield stimulation. The incomes net of these costs are also presented in Table 6.9 in columns 3 and 4.

(iii) Smallholders' Income Projections Without Yield Stimulation and With Central Processing and Marketing: 1975-80

The central processing and marketing scheme has been discussed in Chapter V. In this section, an attempt is made to estimate the effect of the scheme on the income of smallholders. The procedure adopted here is to compare the estimated prices received by smallholders selling to the Malaysian Rubber Development Corporation (MRDC),

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[14] E. Pushparajah et al., "Nutritional Requirements of Hevea Braziliensis in Relation to Stimulation," Preprint No. 13, R.R.I.M. Planters' Conference, Kuala Lumpur, Malaysia, 1971, p. 3.

[15] Pee and Abraham, op. cit., p. 3.

and prices received from the traditional dealers. However, as noted earlier, while the dealers purchase ribbed smoked sheet (RSS), unsmoked sheet and scrap from smallholders, MRDC's purchases consist mainly of latex and scrap. In comparing the prices received by smallholders from the two buyers, it is necessary that the comparison be made on a common basis. In this case, the comparison is made on a latex basis. Thus, in computing smallholders' income under the central processing and marketing scheme, the savings on processing and smoking costs are included as additions to the prices received since non-incurrence of these costs partly constitute the gains to smallholders by selling to the central factories (MRDC).[16]

Smallholder Output and Prices

The output without yield stimulation was projected in Chapter III and the classification of the output into ribbed smoked sheet (RSS) unsmoked sheet (USS) and scrap was made in section (i) of this chapter (see Table 6.1). With regard to prices, it should be noted that the prices paid by MRDC for the smallholders' latex are based on f.o.b. prices of RSS 1 net of export duty, replanting and research cesses and less 7.5 cents/lb. deduction by MRDC for the collecting agents' commission, transportation and

[16]By selling latex to MRDC as opposed to selling processed rubber (RSS and USS), processing and smoking costs are no longer incurred by the smallholders.

processing costs. For scrap rubber, the price paid is based on the f.o.b. price of 2X thin brown crepe (2XTBC) less the above deductions.[17]

In calculating the expected gains and income of smallholders under the central processing and marketing scheme, both sets of price projections will be used as the basis. Recall that the first set of projections was made on the assumption that the share of natural rubber in the total elastomer consumption will continue to decline during the projection period, from 39 per cent in 1975 to 34 per cent in 1980. The second set of projections was based on the assumption that natural rubber is able to maintain its current share (40 per cent) of the total elastomer consumption during the same period as a result of the anticipated increase in the production of the new process rubbers.

Since, in this section I am interested in the smallholders' income based on the sale of their output to the central factories (where it is subsequently processed into the new process rubbers), the second set of projections is then the more relevant one to use in estimating the income. However, for the purpose of comparing the prices received by smallholders under the traditional and

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[17] It was noted earlier that approximately 80 per cent of the smallholders' scrap rubber is processed into 2XTBC. This is the reason for basing prices paid for smallholders' scrap on 2XTBC prices.

the new processing and marketing systems, the first set of price projection is used as the basis for calculation. Since the prices received by smallholders under the traditional processing and marketing system have been calculated on the basis of the first set of projection, the comparison is more meaningful if the same set of projected prices form the basis on which the prices received under new processing and marketing are derived.

Tables 6.10 and 6.11 show the projected smallholding output (without yield stimulation); f.o.b. prices; the various deductions from the f.o.b. prices; processing and smoking costs; prices received by smallholders, and the estimated smallholders' income for each form of the rubber produced based on the first (low) and second (high) set of price projections respectively. In the case of rubber produced as ribbed smoked sheet (RSS) and unsmoked sheet (USS), for reasons noted earlier, the f.o.b. prices of RSS 1 are used as the basis for calculating the prices received by smallholders. In the case of scrap rubber, the f.o.b. prices of 2X thin brown crepe (2XTBC) form the basis for deriving the smallholders' price. The RSS 1 prices used in the calculations are those projected in Chapter IV (see tables 4.4 and 4.6). The 2XTBC prices are derived from the RSS 1 prices using equation 4 in section (i). In comparing the smallholders' price and income under the traditional and the new processing and

Table 6.10.--Projected Malaysian Smallholding Rubber Output; f.o.b. Prices; Deductions from f.o.b. Prices, Prices Received by Smallholders, and Estimated Income Without Yield Stimulation and With Central Processing and Marketing: 1975-80 (With Low Price Projection).[a]

Form of Rubber	Year	Output ('000 Long Tons)	f.o.b. Prices[b] (¢/lb.)	Deductions from f.o.b. Prices (¢/lb.)			Processing and Smoking Costs[d] (¢/lb.)	Prices Received by Smallholders (¢/lb.)	Estimated Smallholders' Income ($ Mil)
				Export Duty and Cesses[c]	MRDC Deductions	Total			
Ribbed Smoked Sheet (RSS)	1975	224	50.00	7.50	7.50	15.00	4.20	39.20	196.70
	1976	235	49.11	7.37	7.50	14.87	4.20	38.44	202.35
	1977	247	47.55	7.25	7.50	14.75	4.20	37.00	204.71
	1978	263	45.72	7.25	7.50	14.75	4.20	35.17	207.78
	1979	279	43.51	7.12	7.50	14.62	4.20	33.19	208.05
	1980	296	41.52	7.12	7.50	14.62	4.20	31.20	209.53
Unsmoked Sheet (USS)	1975	523	50.00	7.50	7.50	15.00	1.70	36.70	429.95
	1976	547	49.11	7.37	7.50	14.87	1.70	35.94	440.37
	1977	577	47.55	7.25	7.50	14.75	1.70	34.50	445.91
	1978	613	45.72	7.25	7.50	14.75	1.70	32.67	454.73
	1979	651	43.51	7.12	7.50	14.62	1.70	30.59	447.53
	1980	689	41.52	7.12	7.50	14.62	1.70	28.80	446.93
Scrap	1975	187	44.23	7.25	7.50	14.75	--	29.48	123.49
	1976	195	43.41	7.12	7.50	14.62	--	28.79	126.40
	1977	206	41.99	7.00	7.50	14.50	--	26.49	123.52
	1978	219	40.31	7.00	7.50	14.50	--	25.81	127.68
	1979	232	38.29	6.95	7.50	14.45	--	24.10	127.54
	1980	246	36.46	6.90	7.50	14.40	--	22.16	125.71

[a]Assumes that the share of natural rubber in the total elastomer consumption will decline from 39 per cent in 1975 to 34 per cent in 1980.

[b]For ribbed smoked sheet (RSS) and unsmoked sheet, f.o.b. prices used are the RSS 1 prices, and for scrap rubber, f.o.b. prices of 2X thin brown crepe (2XTBC) are used.

[c]Replanting cess and research cess.

[d]For RSS, both processing and smoking of costs are included, and for USS, only the processing costs. No costs are involved in scrap rubber as smallholders do not process their scrap before sale.

Table 6.11.--Projected Malaysian Smallholding Rubber Output; f.o.b. Prices; Deductions from f.o.b. Prices; Prices Received by Smallholders, and Estimated Income Without Yield Stimulation and With Central Processing and Marketing: 1975-80 (With High Price Projection).[a]

Form of Rubber	Year	Output ('000 Long Tons)	f.o.b. Prices[b] (¢/lb.)	Deductions from f.o.b. Prices (¢/lb.)			Processing and Smoking Costs[d] (¢/lb.)	Prices Received by Smallholders (¢/lb.)	Estimated Smallholders' Income ($ Mil)
				Export Duty and Cesses[c]	MRDC Deductions	Total			
Ribbed Smoked Sheet (RSS)	1975	224	50.86	7.50	7.50	15.00	4.20	40.06	201.01
	1976	235	50.00	7.37	7.50	14.87	4.20	39.33	207.03
	1977	247	48.87	7.37	7.50	14.87	4.20	38.20	211.35
	1978	263	47.77	7.25	7.50	14.75	4.20	37.22	219.27
	1979	279	46.60	7.25	7.50	14.75	4.20	36.05	225.30
	1980	296	45.44	7.12	7.50	14.62	4.20	35.02	232.86
Unsmoked Sheet (USS)	1975	523	50.86	7.50	7.50	15.00	1.70	37.03	433.81
	1976	547	50.00	7.37	7.50	14.87	1.70	36.83	451.27
	1977	577	48.87	7.37	7.50	14.87	1.70	35.70	461.42
	1978	613	47.77	7.25	7.50	14.75	1.70	34.72	476.75
	1979	651	46.60	7.25	7.50	14.75	1.70	33.55	489.24
	1980	689	45.44	7.12	7.50	14.62	1.70	32.48	502.83
Scrap	1975	187	45.02	7.25	7.50	14.75	--	30.27	126.79
	1976	195	44.23	7.12	7.50	14.62	--	29.61	129.34
	1977	206	43.19	7.12	7.50	14.62	--	28.57	131.83
	1978	219	42.19	7.08	7.50	14.58	--	27.61	135.44
	1979	232	41.12	7.00	7.50	14.50	--	26.62	138.34
	1980	246	40.16	6.98	7.50	14.48	--	25.68	142.64

[a]Assumes that natural rubber maintains its share in the total elastomer consumption at 40 per cent throughout the projection period (1975-80).

[b]For ribbed smoked sheet (RSS) and unsmoked sheet (USS), f.o.b. prices of RSS are used, and for scrap, the f.o.b. prices of 2X thin brown crepe (2XTBC).

[c]Replanting and research cess.

[d]Processing and smoking costs for RSS and only processing costs for USS. No costs are involved in scrap rubber since smallholders do not process their scrap before sale.

marketing systems, the savings on the processing and smoking costs involved in the latter system should be added to the smallholders' price. For scrap rubber, no savings on processing or smoking costs are involved as in both processing and marketing systems, smallholders sell their scrap rubber in an unprocessed form.

As noted earlier, processing and smoking costs vary substantially among smallholders. The average cost figures of 1.7 cents/lb. for processing, and 2.5 cents/lb. for smoking, used in the Table 6.10 and 6.11 are based on discussions with the personnel of the Smallholders' Advisory Service and the Economics and Planning Divisions of the Rubber Research Institute of Malaya (RRIM), and on the results of a survey of 165 group processing centers by the Institute.[18]

Smallholders' total income (that is, income from ribbed smoked sheet, unsmoked sheet, and scrap) under the low and high price assumptions are derived from Tables 6.10 and 6.11 and are shown in Table 6.12.

(iv) Smallholder Income Projections With Yield Stimulation and With Central Processing and Marketing: 1975-80

In this section, an attempt is made to project smallholders' income with the use of the yield-stimulant

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[18] C. Barlow and S. C. Lim, "A Report on the Survey of Malay Group Processing Centers," Economic Report, No. 1, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (1965), Tables 3 and 7.

Table 6.12.--Projected Malaysian Smallholders' Total Income from Rubber Without Yield Stimulation and With Central Processing and Marketing: 1975-80[a] (With Low and High Price Projections)

Year	Estimated Smallholders' Income ($ Mil)	
	With Low Price Projection[b]	With High Price Projection[c]
1975	750.14	761.61
1976	769.12	787.64
1977	774.14	804.60
1978	790.19	831.46
1979	782.62	852.88
1980	783.17	868.33

[a]Calculations based on data from Tables 6.10 and 6.11. Total income includes income from ribbed smoked sheet (RSS), unsmoked sheet (USS) and scrap.

[b]See footnote a in Table 6.10.

[c]See footnote a in Table 6.11.

ethrel,and under the central processing and marketing scheme. In all, four income levels are projected based on the low and high output and price projections. The four income levels projected are those based on low output and price projections (Table 6.13); high output and low price projections (Table 6.14); low output and high price projections (Table 6.15); and finally, high output and high price projections (Table 6.16).

The output and the f.o.b. price data used in Tables 6.13 to 6.16 are those projected in Chapters III and IV (Tables 3.9, 4.4, and 4.6). For reasons discussed in the preceding section, the f.o.b. prices of ribbed smoked sheet (RSS) 1 form the basis from which prices received by smallholders for their latex (previously sold as RSS and USS) are derived. For scrap rubber, the f.o.b. prices of 2X thin brown crepe are used in deriving the smallholders' price. The 2XTBC prices are derived from the RSS 1 prices using equation 4 in section (i).

The four levels of smallholders' total income (income from ribbed smoked sheet, unsmoked sheet and scrap based on the low and high output and price projections) are then derived from Tables 6.13 to 6.16 and are presented in Table 6.17 (left half of the table). For reasons presented in section (ii), costs of the chemical ethrel and the additional fertilizers which are additional cash expenses incurred as a result of yield

Table 6.13.--Projected Malaysian Smallholding Rubber Output; f.o.b. Prices; Deductions from f.o.b. Prices; Prices Received by Smallholders, and Estimated Income With Yield Stimulation and With Central Processing and Marketing: 1975-80 (With Low Output[a] and Low Price[b] Projections).

Form of Rubber	Year	Output ('000 Long Tons)	f.o.b. Prices[c] (¢/lb.)	Deductions from f.o.b. Prices (¢/lb.)			Processing and Smoking Costs[e] (¢/lb.)	Prices Received by Smallholders (¢/lb.)	Estimated Smallholders' Income ($ Mil)
				Export Duty and Cesses[d]	MRDC Deductions	Total			
Ribbed Smoked Sheet (RSS)	1975	244	48.26	7.25	7.50	14.75	4.20	37.71	206.11
	1976	262	46.27	7.12	7.50	14.62	4.20	35.85	210.40
	1977	284	43.48	7.05	7.50	14.55	4.20	33.13	210.76
	1978	311	40.45	6.94	7.50	14.44	4.20	30.21	211.45
	1979	340	38.55	6.94	7.50	14.44	4.20	28.41	216.37
	1980	372	38.55	6.94	7.50	14.44	4.20	28.41	236.73
Unsmoked Sheet (USS)	1975	569	48.26	7.25	7.50	14.75	1.70	35.21	448.77
	1976	612	46.27	7.12	7.50	14.62	1.70	33.35	457.19
	1977	663	43.48	7.05	7.50	14.55	1.70	30.63	461.52
	1978	725	40.45	6.94	7.50	14.44	1.70	27.91	455.26
	1979	793	38.55	6.94	7.50	14.44	1.70	25.91	464.21
	1980	869	38.55	6.94	7.50	14.44	1.70	25.91	518.70
Scrap	1975	205	42.64	7.08	7.50	14.58	--	28.06	128.85
	1976	219	40.81	6.98	7.50	14.48	--	26.33	129.16
	1977	237	38.26	6.85	7.50	14.35	--	23.91	126.93
	1978	259	35.58	6.84	7.50	14.34	--	21.24	128.27
	1979	283	33.84	6.84	7.50	14.34	--	19.50	130.44
	1980	310	33.84	6.84	7.50	14.34	--	19.50	138.50

[a]See footnote a in Table 6.5. [b]See footnote a in Table 6.10.

[c]f.o.b. prices of RSS 1 for ribbed smoked sheet (RSS) and unsmoked sheet (USS), and f.o.b. prices of 2X thin brown crepe (2XTBC) for scrap.

[d]Replanting cess and research cess.

[e]Processing and smoking costs for RSS, and only processing costs for USS.

Table 6.14.--**Projected Malaysian Smallholding Rubber Output; f.o.b. Prices; Deductions from f.o.b. Prices; Prices Received by Smallholders, and Estimated Income With Yield Stimulation and With Central Processing and Marketing: 1975-80 (With High Output[a] and Low Price[b] Projections).**

Form of Rubber	Year	Output ('000 Long Tons)	f.o.b. Prices[c] (¢/lb.)	Deductions from f.o.b. Prices (¢/lb.)			Processing and Smoking Costs[e] (¢/lb.)	Prices Received by Smallholders (¢/lb.)	Estimated Smallholders' Income ($ Mil)
				Export Duty and Cesses[d]	MRDC Deductions	Total			
Ribbed Smoked Sheet (RSS)	1975	251	47.40	7.25	7.50	14.75	4.20	36.85	212.96
	1976	269	45.04	7.12	7.50	14.62	4.20	34.62	214.81
	1977	292	41.74	6.98	7.50	14.48	4.20	31.46	214.41
	1978	319	39.02	6.96	7.50	14.46	4.20	28.76	213.93
	1979	349	36.82	6.96	7.50	14.46	4.20	26.66	214.00
	1980	382	36.82	6.96	7.50	14.46	4.20	26.66	234.97
Unsmoked Sheet (USS)	1975	586	47.40	7.25	7.50	14.75	1.70	34.35	462.43
	1976	629	45.04	7.12	7.50	14.62	1.70	32.12	465.52
	1977	680	41.74	6.98	7.50	14.48	1.70	28.96	460.90
	1978	743	39.02	6.96	7.50	14.46	1.70	26.27	451.88
	1979	813	36.82	6.96	7.50	14.46	1.70	24.16	458.05
	1980	891	36.82	6.96	7.50	14.46	1.70	24.16	501.88
Scrap	1975	209	41.85	7.06	7.50	14.56	--	27.29	131.42
	1976	224	39.69	6.96	7.50	14.46	--	25.23	132.94
	1977	243	36.77	6.81	7.50	14.31	--	22.36	126.85
	1978	266	34.37	6.78	7.50	14.28	--	20.09	125.60
	1979	290	32.35	6.78	7.50	14.28	--	18.07	125.62
	1980	318	32.35	6.78	7.50	14.28	--	18.07	136.44

[a] See footnote b in Table 6.5.

[b] See footnote a in Table 6.10.

[c] f.o.b. prices of RSS 1 for ribbed smoked sheet (RSS) and unsmoked sheet (USS), and f.o.b. prices of 2X thin brown crepe (2XTBC) for scrap.

[d] Replanting cess and research cess.

[e] Processing and smoking costs for RSS, and only processing costs for USS.

Table 6.15.--Projected Malaysian Smallholding Rubber Output; f.o.b. Prices; Deductions from f.o.b. Prices; Prices Received by Smallholders, and Estimated Income With Yield Stimulation and With Central Processing and Marketing: 1975-80 (With Low Output[a] and High Price[b] Projections).

Form of Rubber	Year	Output ('000 Long Tons)	f.o.b. Prices[c] (¢/lb.)	Deductions from f.o.b. Prices (¢/lb.)			Processing and Smoking Costs[e] (¢/lb.)	Prices Received by Smallholders (¢/lb.)	Estimated Smallholders' Income ($ Mil)
				Export Duty and Cesses[d]	MRDC Deductions	Total			
Ribbed Smoked Sheet (RSS)	1975	244	49.05	7.37	7.50	14.87	4.20	38.38	209.77
	1976	262	47.06	7.25	7.50	14.75	4.20	36.51	214.27
	1977	284	45.04	7.12	7.50	14.62	4.20	34.62	220.25
	1978	311	42.84	7.06	7.50	14.56	4.20	32.68	227.66
	1979	340	40.70	6.94	7.50	14.44	4.20	30.76	234.27
	1980	372	39.15	6.94	7.50	14.44	4.20	29.15	242.90
Unsmoked Sheet (USS)	1975	569	49.05	7.37	7.50	14.87	1.70	35.88	457.31
	1976	612	47.06	7.25	7.50	14.75	1.70	34.01	466.24
	1977	663	45.04	7.12	7.50	14.62	1.70	32.12	477.02
	1978	725	42.84	7.06	7.50	14.56	1.70	29.98	486.88
	1979	793	40.70	6.94	7.50	14.44	1.70	28.16	500.21
	1980	869	39.15	6.94	7.50	14.44	1.70	26.65	518.75
Scrap	1975	205	43.37	7.12	7.50	14.62	--	28.75	132.02
	1976	219	41.55	6.90	7.50	14.40	--	27.15	133.19
	1977	237	39.80	6.90	7.50	14.40	--	25.40	135.37
	1978	259	37.68	6.85	7.50	14.35	--	23.43	136.93
	1979	283	35.72	6.84	7.50	14.34	--	21.48	136.16
	1980	310	34.30	6.84	7.50	14.34	--	20.06	140.00

[a]See footnote a in Table 6.5.

[b]See footnote a in Table 6.11.

[c]f.o.b. prices of RSS 1 for ribbed smoked sheet (RSS) and unsmoked sheet (USS), and f.o.b. prices of 2X thin brown crepe (2XTBC) for scrap.

[d]Replanting cess and research cess.

[e]Processing and smoking costs for RSS and only processing costs for USS.

Table 6.16.--Projected Malaysian Smallholding Rubber Output; f.o.b. Prices; Deductions from f.o.b. Prices; Prices Received by Smallholders, and Estimated Income With Yield Stimulation and With Central Processing and Marketing: 1975-80 (With High Output[a] and High Price[b] Projections).

Form of Rubber	Year	Output ('000 Long Tons)	f.o.b. Prices[c] (¢/lb.)	Deductions from f.o.b. Prices (¢/lb.)			Processing and Smoking Costs[e] (¢/lb.)	Prices Received by Smallholders (¢/lb.)	Estimated Smallholders' Income ($ Mil)
				Export Duty and Cesses[d]	MRDC Deductions	Total			
Ribbed Smoked Sheet (RSS)	1975	251	48.20	7.37	7.50	14.87	4.20	37.53	211.01
	1976	269	45.84	7.25	7.50	14.75	4.20	35.29	212.64
	1977	292	43.33	7.00	7.50	14.50	4.20	33.03	216.04
	1978	319	41.07	6.96	7.50	14.46	4.20	30.81	220.16
	1979	349	38.25	6.96	7.50	14.46	4.20	28.15	221.47
	1980	382	36.82	6.96	7.50	14.46	4.20	26.77	229.07
Unsmoked Sheet (USS)	1975	586	48.20	7.37	7.50	14.87	1.70	35.22	462.31
	1976	629	45.84	7.25	7.50	14.75	1.70	32.79	462.00
	1977	680	43.33	7.00	7.50	14.50	1.70	30.53	465.03
	1978	743	41.07	6.96	7.50	14.46	1.70	28.31	471.17
	1979	813	38.25	6.96	7.50	14.46	1.70	25.85	478.89
	1980	891	36.82	6.96	7.50	14.46	1.70	24.27	493.30
Scrap	1975	209	42.59	7.12	7.50	14.62	--	27.97	130.94
	1976	224	40.45	6.98	7.50	14.48	--	25.93	130.11
	1977	243	38.22	6.84	7.50	14.24	--	23.98	131.53
	1978	266	36.16	6.78	7.50	14.28	--	21.88	132.37
	1979	290	33.85	6.78	7.50	14.28	--	19.57	127.13
	1980	318	32.27	6.78	7.50	14.28	--	18.06	131.85

[a]See footnote b in Table 6.5.

[b]See footnote a in Table 6.11.

[c]f.o.b. prices of RSS 1 for ribbed smoked sheet (RSS) and unsmoked sheet (USS), and f.o.b. prices of 2X thin brown crepe (2XTBC) for scrap.

[d]Replanting cess and research cess.

[e]Processing and smoking costs for RSS, and only processing costs for USS.

Table 6.17.--Projected Malaysian Smallholders' Total Income from Rubber With Yield Stimulation and With Central Processing and Marketing (1975-80).[a]

Year	Estimated Smallholders' Income ($ Mil)				Estimated Smallholders' Income: Net of Ethrel and Additional Fertilizers Costs ($ Mil)			
	Low Price and Low Output[b]	Low Price and High Output	High Price and Low Output	High Price and High Output[c]	Low Price and Low Output	Low Price and High Output	High Price and Low Output	High Price and High Output
1975	783.73	806.82	799.10	804.26	775.33	795.63	790.70	793.07
1976	796.75	813.27	813.70	814.75	786.15	798.72	802.10	800.20
1977	798.90	802.16	832.63	812.60	783.50	794.62	817.23	794.06
1978	780.00	795.41	851.47	823.70	760.00	773.07	831.47	801.36
1979	811.02	797.67	870.64	827.49	786.58	768.60	845.20	798.42
1980	893.93	873.29	901.65	854.22	863.73	837.20	891.45	818.13

[a]Calculations based on data in Tables 6.13 to 6.16. Total income includes income from ribbed smoked sheet (RSS), unsmoked sheet (USS), and scrap.

[b]See footnote a in Tables 6.5 and 6.10.

[c]See footnote a in Table 6.11 and footnote b in Table 6.5.

stimulation are deducted from the smallholders' total income. The smallholders' incomes net of these costs are presented on the right half of Table 6.17.

Central Processing and Marketing, and Smallholder Prices

In this section, the gains (cents/lb.) by smallholders from selling their rubber to the central factories are estimated. The procedure adopted here is to compare the prices (cents/lb.) received by smallholders for the rubber sold as ribbed smoked sheet (RSS), unsmoked sheet (USS) and scrap under the traditional processing and marketing system and the prices received if they instead sell latex and scrap to the central factories under the central processing and marketing scheme. More specifically, the comparison is made between prices received by smallholders without yield stimulation and without central processing and marketing (taken here as the base price) and prices received without yield stimulation but with central processing and marketing (Table 6.18).

In the case of smallholders selling ribbed smoked sheet (RSS) under the traditional processing and marketing system, shifting their sale to the central factories could result in an increase of prices received by an average of 0.8 cents/lb. For the unsmoked sheet (USS) producers, the shift in sale is estimated to increase the average prices received by about 5.3 cents/lb. In the

Table 6.18.--Summary of Projected Prices Received by Malaysian Smallholders for Ribbed Smoked Sheet (RSS), Unsmoked Sheet (USS) and Scrap With and Without Yield Stimulation and Central Processing and Marketing: 1975-80.[a] (cents/lb.)

Year	Alternative Strategies								
	I	II		III		IV			
	Without Stimulation and Without Central Processing and Marketing	With Stimulation and Without Central Processing and Marketing		Without Stimulation and With Central Processing and Marketing		With Stimulation and Central Processing and Marketing			
	(Low Price Projection)[b]	Low Price and Output Projections	Low Price and High Output Projections	Low Price Projections	High Price Projections	Low Output and Low Price Projections	High Output and Low Price Projections	Low Output and High Price Projections	High Output and High Price Projections
RSS									
1975	38.44	36.98	36.16	39.20	40.06	37.71	36.85	38.28	37.53
1976	37.69	35.15	33.93	38.44	39.33	35.85	34.62	36.51	35.29
1977	36.16	32.42	30.86	37.00	38.20	33.13	31.46	34.62	33.03
1978	34.47	29.55	28.29	35.17	37.22	30.21	28.76	32.68	30.81
1979	32.30	27.77	26.23	33.19	36.05	28.41	26.66	30.76	28.15
1980	30.46	27.77	26.23	31.20	35.02	28.41	26.66	29.15	26.77
Average 1975-80	34.97	31.61	30.28	35.70	37.04	32.29	30.84	33.67	31.98
USS									
1975	31.42	29.84	29.00	36.70	37.03	35.21	34.35	35.88	35.22
1976	30.55	28.03	26.86	35.94	36.83	33.35	32.12	34.01	32.79
1977	29.15	25.56	23.82	34.50	35.70	30.63	28.96	32.12	30.53
1978	27.36	22.52	21.34	32.67	34.72	27.91	26.27	29.98	28.31
1979	25.35	20.76	19.25	30.59	33.55	25.91	24.16	28.16	25.85
1980	23.40	20.76	19.25	28.80	32.48	25.91	24.16	26.65	24.27
Average 1975-80	27.87	24.58	23.25	33.20	35.05	29.82	28.34	31.13	29.50
Scrap									
1975	23.71	22.29	21.52	29.48	30.27	28.06	27.29	28.75	27.97
1976	22.89	20.56	19.46	28.79	29.61	26.33	25.23	27.15	25.93
1977	21.60	18.14	16.59	26.49	28.57	23.91	22.36	25.40	23.98
1978	19.92	15.37	14.32	25.81	27.61	21.24	20.09	23.43	21.88
1979	18.02	13.73	12.30	24.10	26.62	19.50	18.07	21.48	19.57
1980	16.19	13.73	12.30	22.16	25.68	19.50	18.07	20.06	18.06
Average 1975-80	20.39	17.30	16.08	26.14	28.06	23.09	21.85	24.38	22.90

[a] Data in this table were originally given in Tables 6.3, 6.7, 6.8, 6.10, 6.11 and 6.13 to 6.16.

[b] References to low and high output and price projections are given in Tables 6.5 (footnotes a and b), 6.10 (footnote a), and 6.11 (footnote a).

case of scrap rubber, prices received is estimated to increase by 5.8 cents/lb. as a result of selling to the central factories.

The increase in smallholders' price for RSS and USS under the central processing and marketing scheme arises from a combination of three factors, namely the reduction in marketing margins, the higher f.o.b. prices[19] from which prices received are derived, and the savings on processing and smoking costs. However, in the case of scrap rubber, the increase arises only from reductions in the marketing margin as in both processing and marketing systems,smallholders' scrap rubber is sold in an unprocessed form, and the prices paid are based on the same f.o.b. prices, that is, f.o.b. prices of 2X thin brown crepe (2XTBC).

Comparison between the expected gains (in terms of prices received by smallholders) of RSS, USS, and scrap under the central processing and marketing scheme indicates that the smallholders currently producing RSS could expect to gain little by selling their rubber as latex to the central factories. The reason is that the marketing margin for RSS under the traditional processing and

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[19]Recall that for reasons discussed earlier, prices paid to smallholders for their RSS and USS under the traditional processing and marketing system are based on the average f.o.b. prices of RSS 2 and 3, and average f.o.b. prices of RSS 3 and 4. However, under the central processing and marketing scheme, the prices paid for the smallholders' latex are based on the f.o.b. prices of RSS 1.

marketing system (see Tables 6.7 and 6.8) is relatively low and little reduction in the margin can be expected by shifting the sale to the central factories. RSS producers could gain as much or more by upgrading the quality of the rubber to RSS 1 or RSS 2 and thus fetching higher prices. In the case of USS producers, the price gains are substantial resulting from reduction in the marketing margin (about 1.6 cents/lb.), savings on the cost of processing (about 1.7 cents/lb.), and the higher f.o.b. prices from which smallholders' prices are derived (about 2 cents/lb.).[20]

The highest potential gain from the central processing is achieved from the sale of scrap rubber. This gain is the difference between the 13.27 cents/lb. marketing margin under the traditional processing and marketing system, and the 7.50 cents/lb. deduction made by the central factory for processing, transportation costs, and the collecting agents' commission (see Tables 6.3 and 6.10).

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[20]The 1.6 cents/lb. reduction in the marketing margin is the difference between the 9.08 cents/lb. average margin for USS under the traditional processing and marketing system and the 7.5 cents/lb. deduction by the Malaysian Rubber Development Corporation (MRDC). Processing costs have been assumed at 1.7 cents/lb. The 2 cents/lb. higher f.o.b. prices is the average difference between RSS 1 prices and the average of RSS 3 and 4 prices (see Tables 6.2, 6.3 and 6.10).

Comparison of Smallholders' Projected Income With and Without Yield Stimulation and Central Processing and Marketing

A summary of the smallholders' projected income under four alternative strategies is presented in Table 6.19. In comparing smallholders' income under the different technological alternatives, the income without yield stimulation and under the traditional processing and marketing system (Alternative 1), is used as the base income. As can be seen from Table 6.19, this income is projected to be $660.29 million in 1975 and $652.32 million in 1980.

Based on the low output projection with yield stimulation, and under the traditional processing and marketing system (Alternative II), the income is projected to be $676.41 million in 1975 and $700.65 million in 1980. This represents an increase of about $16 million or 2.5 per cent, and $48 million or 7.5 per cent over the 1975 and 1980 base income respectively. With the high output projection, the income can be expected to increase to $673.54 million in 1975, and $686.24 million in 1980. This represents an increase of about $13 million or 2.0 per cent, and $34 million or 5.1 per cent over the 1975 and 1980 base income respectively.

In the case of the projected income without yield stimulation but with central processing and marketing (Alternative III), a substantial increase over the base

Table 6.19.--Summary of Malaysian Smallholders' Income Projections With and Without Yield Stimulation and Central Processing and Marketing: 1975-80.[a]
($ Million)

Year	Alternative Strategies								
	I Without Stimulation and Without Central Processing and Marketing (Low Price Projection)[b]	II With Stimulation and Without Central Processing and Marketing		III Without Stimulation and With Central Processing and Marketing		IV With Stimulation and Central Processing and Marketing			
		Low Output and Low Price Projection	High Output and Low Price Projection	Low Price Projection	High Price Projection	Low Output and Low Price Projection	High Output and Low Price Projection	Low Output and High Price Projection	High Output and High Price Projection
1975	660.29	676.41	673.54	750.14	761.61	775.33	795.63	790.70	793.07
1976	672.40	679.81	670.41	769.12	787.64	786.15	798.72	802.10	800.20
1977	676.50	672.42	650.26	774.14	804.60	783.50	794.62	817.23	794.06
1978	676.48	664.64	632.33	790.19	831.46	760.00	773.07	831.47	801.36
1979	665.17	669.19	623.21	782.62	852.88	786.58	768.60	845.20	798.42
1980	652.32	700.65	686.24	783.17	868.33	863.73	837.20	881.45	818.13

[a]Data in this table were originally given in Tables 6.4, 6.9, 6.12, and 6.17.

[b]References to low and high output and price projections are given in Tables 6.5 (footnotes a and b); 6.10 (footnote a), and 6.11 (footnote a).

income can be expected. Based on the low and high price projections, this income is estimated to range from $750.14-761.61 million in 1975 and $783.17-868.33 million in 1980. This is an increase of some $90-101 million or 13.6-15.3 per cent over the 1975 base income,and an increase of $131-216 million or 20.0-32.2 per cent over the 1980 base income. It must be emphasized here that this substantial increase in income is based on the assumption that all the smallholders shifted to the central processing and marketing. On the average, each smallholder that shifts to the central processing and marketing can expect to increase his income by the above estimated percentages.

It is interesting to note that the projected income under Alternative III is higher than the income with yield stimulation and under the traditional processing and marketing system. Thus, insofar as the smallholders are concerned, the analysis indicates that central processing and marketing has greater potential in increasing smallholders' income than yield stimulation.

The final comparison is now made between the base income (i.e. income without yield stimulation and central processing) and the income with yield stimulation and central processing and marketing (Alternative IV). From Table 6.19, it can be seen that four levels of income under this alternative have been projected based on the low and high output and price projections. As to be

expected, the level of income projected is highest for the low output and high price assumptions. Under this alternative, the income is estimated to range from $775.33-795.63 million in 1975, and from $818.13-881.45 million in 1980. Compared to the base income, this represents an increase of approximately $115-135 million or 17.0-20.0 per cent in 1975, and an increase of $166-229 million or 25.0-35.0 per cent in 1980. The magnitude of the increase depends on the output and price assumptions (low or high) used. Comparing the income under this alternative with the income without yield stimulation but with central processing and marketing, again indicates the potential of the central processing and marketing scheme as the major contributor to the increase in smallholders' income.

Summary

This chapter is an attempt to estimate the income of smallholders for the period 1975-80 under the four following alternatives:

1. Without yield stimulation and under the traditional processing and marketing system.
2. With yield stimulation but under the traditional processing and marketing system.
3. Without yield stimulation and under central processing and marketing system.

4. With yield stimulation and under central processing and marketing system.

Gross rather than net income is used to compare smallholders' income under the above alternatives, because the variability in smallholder production costs makes it difficult to use net income figures. In computing the income, the prices used are those received by the smallholders. These prices are arrived at by deducting from the f.o.b. prices, the research and replanting cesses, export duty, and the estimated marketing margins.

A comparison of the smallholders' income under the four alternatives indicates that both yield stimulation and central processing and marketing can be expected to increase smallholders' income during the period 1975-80. In comparing the income, the income under Alternative I is used as the base income. This income is projected to be $660.29 million in 1975 and $652.32 million in 1980. Under Alternative II, the income is estimated to increase by $13-16 million, or 2.0-2.5 per cent in 1975, and by $34-48 million, or 5.1-7.5 per cent in 1980. Under Alternative III, the income is estimated to increase by $90-101 million or 13.6-15.3 per cent in 1975, and by $131-216 million or 20.2-32.2 per cent in 1980. The higher increase in income under Alternative III, as compared to the increase under Alternative II, indicates that central processing and marketing has greater potential in

increasing smallholders' income than yield stimulation. The income under Alternative IV is estimated to be $115-135 million or 17.0-20.0 per cent higher than the base income in 1975, and $166-229 million, or 25.0-35.0 per cent higher in 1980. Comparing this increase in income with the increase under Alternative III again indicates the potential of central processing and marketing as the major contributor to the increase in smallholders' income.

An attempt is also made to estimate the gains (in cents/lb.) by smallholders under the central processing and marketing scheme by comparing the prices received for ribbed smoked sheet (RSS), unsmoked sheet (USS) and scrap under this system and those received under the traditional processing and marketing system. The result indicates that smallholders currently producing RSS could expect to gain little (about 0.8 cents/lb.) under the central processing and marketing scheme. These producers could gain as much or more by upgrading the quality of the sheets and thus fetching higher prices. For the USS producers, however, the price gains are substantial and average about 5.3 cents/lb. resulting from reduction in the marketing margin, savings on processing costs, and the higher f.o.b. prices from which the prices paid to the smallholders are based on. The highest potential gain from central processing and marketing is achieved from the

sale of scrap rubber. This gain is estimated to be about 5.8 cents/lb. and results from the reduction in the marketing margin under the new processing and marketing system.

CHAPTER VII

IMPLICATIONS OF YIELD STIMULATION AND CENTRAL PROCESSING AND MARKETING FOR THE MALAYSIAN NATURAL RUBBER INDUSTRY WITH SPECIAL EMPHASIS ON SMALLHOLDERS

The analysis of the potential effects of the new technologies in natural rubber production and processing raises a number of implications for the Malaysian natural rubber industry. In this chapter, the various implications arising from the above technologies are discussed.

Competitiveness of the Natural Rubber Industry

It was noted in Chapter IV that the natural-synthetic rubber competition occurs on both price and non-price basis. The adoption of the new production technology by Malaysian rubber producers, particularly the smallholders, and the processing of the output into the new process rubbers are likely to enable natural rubber to maintain or even enhance its price and non-price competitiveness in the elastomer market.

An important means of reducing production costs is through the increase in yield per unit area. Cost reductions have thus far been achieved mainly through replanting with high-yielding clones. The use of the yield-stimulant ethrel to increase yields has the potential of further reducing production costs, and thus enhancing the price-competitiveness of natural rubber against the synthetic.

Insofar as non-price competition is concerned, it was pointed out earlier that improvements in the technical properties of synthetic rubber have been rapid in view of the developments of the special purpose and the stereo-regular rubbers, as these rubbers have certain properties which are superior to those of natural rubber. It was also noted that the new processing methods for natural rubber, due to their versatility, can be made to produce block natural rubbers with technical properties required by the consumers, and that the rubbers produced require no pre-treatments before use in the consumers' factories. The production of the new process rubbers thus represents an improvement in the technical properties of natural rubber, and is likely to enhance its non-price competitiveness in the elastomer market.

The analysis of the impact of the central processing and marketing scheme on Malaysian smallholders' income has indicated that the scheme would substantially increase smallholders' income. However, equally important is the

fact that the scheme, by enabling smallholders' output to be processed into the new process rubbers, is likely to make a positive and significant contribution to the competitive position of natural rubber in the elastomer market. The contribution could be significant in view of the fact that Malaysian smallholders currently produce approximately 22 per cent of the world output of natural rubber.

Foreign Exchange Earnings

It has been noted earlier that Malaysian rubber exports represent the largest source of foreign exchange earnings. In 1970, the earnings from rubber accounted for about 40 per cent of the country's total foreign exchange earnings.[1] The adoption of the yield-stimulant ethrel by the Malaysian estates and smallholdings can be expected to substantially increase the foreign exchange earnings from rubber during the projection period (1975-80). Table 7.1 shows the estimated foreign exchange earnings with and without yield stimulation for the period 1975-80. The calculation of the earnings has been based on the low price projection made in Chapter IV.

Comparing the foreign exchange earnings with and without yield stimulation indicates that with yield stimulation, the earnings can be expected to increase from

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[1]Malaysia, Department of Statistics, Monthly Statistical Bulletin, Kuala Lumpur, Malaysia (December, 1971), Table 1.5, p. 149.

Table 7.1.--Projected Malaysian Foreign Exchange Earnings from Rubber With and Without Yield Stimulation: 1975-80.[a] ($ Mil.)

Year	Without Yield Stimulation			With Yield Stimulation		
	Smallholdings	Estates	Total	Smallholdings	Estates	Total
1975	992.28	797.91	1790.19	1062.27	854.22	1916.49
1976	1006.71	787.16	1793.87	1063.18	859.63	1922.81
1977	1013.79	762.80	1776.59	1063.23	843.53	1906.76
1978	1038.72	744.65	1783.37	1151.49	869.54	2021.03
1979	1062.40	723.18	1785.58	1351.53	923.55	2275.08
1980	1082.31	703.36	1785.67	1378.89	981.02	2359.91

[a]Calculations based on Tables 3.1, 3.5, and 3.9.

$1790.2 million to $1916.5 million in 1975, representing an increase of about $126 million or 7 per cent. By 1980, the earnings have been estimated to increase from $1785.7 million to $2359.9 million, or an increase of $574 million or 32 per cent.

Export Tax-Revenue

The increase in output resulting from yield stimulation would also significantly increase the export tax revenue from rubber. It can be seen in Table 7.2 that with the adoption of yield stimulation by the estates and smallholdings, the export tax revenue from rubber is estimated to increase from about $71.7 million to $75.5 million in 1975, and from $71.8 million to $93.9 million in 1980. This represents an increase of about $4 million or

Table 7.2.--Projected Malaysian Export Tax Revenue from Rubber With and Without Yield Stimulation: 1975-80. ($ Mil.)

Year	Without Yield Stimulation			With Yield Stimulation		
	Smallholdings	Estates	Total	Smallholdings	Estates	Total
1975	40.09	31.59	71.68	41.67	33.78	75.45
1976	39.82	31.14	70.96	41.04	32.56	73.60
1977	39.59	29.79	69.38	42.53	32.85	75.38
1978	41.84	30.00	71.84	45.77	34.60	80.37
1979	41.39	28.17	69.56	53.73	36.75	90.48
1980	43.51	28.27	71.78	54.82	39.04	93.86

Source: Rubber Research Institute of Malaya, Rates of Export Duty and Cesses, Kuala Lumpur, Malaysia, October, 1968, and Tables 3.1, 3.5, and 3.9.

5 per cent, and $22 million or 31 per cent in 1975 and 1980 respectively.

Apart from its positive effect on the export tax revenue, output increase through yield stimulation would also result in substantial increases in research and replanting cesses (Table 7.3). With yield stimulation, the research cess is estimated to increase from $37.7 million to $42.1 million in 1975, and from $45.5 million to 60.8 million in 1980. This represents an increase of about $4 million or 12 per cent, and an increase of about $15 million or 33 per cent for 1975 and 1980 respectively. The replanting cess is estimated to increase by about $8 million or 9 per cent in 1975, and by about $32 million or 26 per cent in 1980 as a result of the output increase through

Table 7.3.--Malaysia: Research and Replanting Cesses from Rubber With and Without Yield Stimulation: 1975-80.
($ Mil.)

Year	Without Yield Stimulation		With Yield Stimulation	
	Research Cess	Replanting Cess	Research Cess	Replanting Cess
1975	37.74	94.15	42.13	102.61
1976	40.00	98.48	44.93	110.17
1977	40.43	103.82	48.16	119.35
1978	42.11	110.38	52.08	130.54
1979	43.75	117.13	56.22	142.73
1980	45.50	124.08	60.77	156.34

Source: Rubber Research Institute of Malaya, Rates of Export Duty and Cesses, Kuala Lumpur, Malaysia, October, 1968, and Tables 3.1, 3.5, and 3.9.

ethrel stimulation.[2] An increase in research and replanting cesses means an increase in funds available for carrying out research activities in rubber and in replanting old trees with high yielding clones under the rubber replanting program.

Supply Elasticity and Price Fluctuations

It has been noted in Chapter III that the supply of natural rubber is price inelastic except in the long run.

[2]Increase in the replanting cess comes from the increase in smallholding output only. Increase in output of estates does not affect the cess as the cess levied at the time of export are returned to the estates. In other words, only the smallholders pay the replanting cess.

This supply inelasticity has been one of the factors contributing to fluctuations in natural rubber prices and to the declining share of natural rubber in the total elastomer consumption.[3]

Since the supply is inelastic, shifts in demand result in much larger variations in market prices than in the quantities supplied, thus resulting in wide fluctuations which have characterized natural rubber prices. These fluctuations in turn not only result in instability of the producers' income, but also in instability in foreign exchange earnings and export revenue. In the case of Malaysia where rubber is a major source of foreign exchange earnings and public revenue, instability in natural rubber prices causes severe economic strains and difficulties in development planning and implementation of development projects.

The inelasticity of natural rubber supply has also been a contributory factor in the inability of natural rubber to respond to the growth in world demand for elastomers. During the last two decades, total elastomer consumption has been increasing at an average annual rate of 7 per cent. However, natural rubber output has only been increasing at an annual average rate of 3 per cent. The

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[3]An analysis of the various factors contributing to the fluctuations in natural rubber prices is given in A. H. H. Tan, "Natural Rubber Problems and Techniques of Stabilization" (Master's prospectus, University of Malaya, 1962); and P. F. Adams, "Fluctuations in the Price of Natural Rubber," Kuala Lumpur, Malaysia, Ministry of Commerce and Industry, 1958.

gap was bridged by increases in the output of synthetic rubber. As synthetic rubber production increased to meet the increasing demand, its share in the total elastomer consumption increased steadily. For example, the share of synthetic rubber in the total elastomer consumption increased from 29 per cent in 1956 to 59 per cent in 1969.[4]

The use of ethrel in stimulating the yield of rubber trees is likely to enable production to be more responsive to changes in price and thus reduces the short run inelasticity of supply. For example, in the case of a price increase, producers can respond by increasing the frequency of ethrel application or by bringing younger acreage into stimulation. Increases in price might also induce new smallholdings to adopt the yield-stimulant. In the case of the decline in prices, producers can respond by reducing the acreage stimulated or discontinue the use of the stimulant. Thus yield stimulation, by reducing the inelasticity of supply is likely to have a stabilizing effect on natural rubber prices. Moreover, by reducing the inelasticity of supply, yield stimulation would increase the ability of natural rubber to respond to the future growth in world demand for elastomers.

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[4]International Rubber Study Group, Rubber Statistical Bulletin, London (October, 1971), Table 27, p. 28.

Policy Implications

Yield Stimulation

The adoption of the yield-stimulant ethrel has been shown to increase the Malaysian smallholders' income. However, it has also been shown that increases in output through yield stimulation would have a depressing effect on natural rubber prices, with prices being depressed more as the assumed levels of adoption of the yield-stimulant increases. The policy implication of yield stimulation for the Malaysian natural rubber industry is dependent on the response of other natural rubber producing countries to this new technology.

If yield stimulation is proven to have no long-term deleterious effects on the trees, and on the quality of the rubber produced, it is reasonable to assume that the new technology will be adopted by other natural rubber producers. Based on the potential response of other natural rubber producers to yield stimulation, two policy options for the Malaysian producers are recommended.

The first policy option calls for the adoption of the yield-stimulant by the Malaysian estates and smallholdings on a gradual basis in order to allow the market to adjust to the output increases. Any rush by estates and smallholdings into the adoption of the stimulant would result in quantum increases in output and in rapid decline in natural rubber prices. This policy option presupposes

an agreement by other natural rubber producers to the gradual adoption of the stimulant. However, if the failure of other international commodity agreements is any indication, then it is unlikely that the agreement between the natural rubber producing countries would achieve the desired objectives. In such a case, the only option open to the Malaysian producers is to accelerate the adoption of the stimulant.

Output increases through yield stimulation has the potential of reducing production costs and thus enhancing the price competitiveness of natural rubber against the synthetic. In view of the importance of yield stimulation in reducing production costs, the second policy option suggested above would enable the Malaysian natural rubber industry to maintain or possibly increase its competitive position not only against synthetic rubber but also against other natural rubber producers.

It was noted earlier that high output response to the yield-stimulant requires that the stimulant be applied to trees which are adequately fertilized. Furthermore, with yield stimulation, additional fertilization is required to make up for the additional nutrient losses resulting from the increased latex flow. However, the smallholdings are generally inadequately fertilized.[5] It is

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[5]The survey of smallholders conducted in October, 1971, indicated that 48 per cent of the respondents did not apply fertilizers to their mature rubber trees. The

therefore recommended that a fertilizer campaign be carried out to effect a more widespread application of fertilizers on smallholdings, and to impress smallholders on the necessity of adequate fertilization in order to obtain high and sustained response to yield stimulation.

Compared to the estates, the smallholders currently lag behind in production. Under the second option, the policy towards smallholders should therefore be directed at providing incentive to the smallholders to encourage them to adopt the new production technology in order to increase their production efficiency. Specifically, it is recommended that subsidies be given to smallholders adopting the yield-stimulant in the purchase of the stimulant (ethrel) and the additional fertilizers required. These subsidies can be recovered from the potential increase in export tax revenue which has been estimated to result from the increase in output through yield stimulation.

Central Processing and Marketing

This study indicates that central processing and marketing system for smallholder rubber has greater potential in increasing smallholder income than yield stimulation because of the higher prices received by smallholders under this improved marketing and processing system.

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main reason given for not applying is that they cannot afford to buy the fertilizers.

Since central processing and marketing would enable natural rubber to maintain or possibly increase its competitiveness against synthetic rubber, it is recommended that the central processing and marketing scheme be expanded to cover as many smallholders as possible.

In computing smallholder income under the central processing and marketing system, it was assumed that all smallholders shift to the new system. However, the rate at which the smallholders could shift to the new system would depend on the rate at which the central processing factories are established. It is unlikely that enough central factories could be established by the Malaysian Rubber Development Corporation (MRDC) by 1980 to serve all smallholder rubber output, as this requires an immense investment on the part of the public sector both in human and nonhuman resources. To expedite the expansion of the smallholder central processing and marketing system, two policy options are recommended.

The first option calls for increased participation of smallholders in central processing and marketing. This can be achieved by allowing smallholders to subscribe to the capital shares of MRDC. The shares need not be open for subscription by smallholders only, but it is recommended that preference in the subscription be given to them. Increased participation by smallholders in central processing and marketing of their rubber, by increasing

their sense of involvement, would likely increase their willingness to sell their product to the central factories. The second option open to MRDC is to encourage private entrepreneurs to establish and operate central processing factories to purchase and process smallholder rubber. The establishment of these factories by private entrepreneurs would complement those established by MRDC and would increase the degree of competition in the purchase of smallholder rubber.

Summary

The analysis of the potential effects of the new technologies in Malaysian natural rubber production and processing raises a number of implications for the Malaysian natural rubber industry apart from increasing smallholders' income. The possible reduction in production costs resulting from yield increase through stimulation, and the improvements in technical properties embedded in the new process rubbers could play a major role in maintaining or even enhancing both the price and non-price competitiveness of natural rubber against synthetic rubber.

The adoption of the new technologies in production and processing has been estimated to result in substantial increases in foreign exchange earnings, export tax revenue, and in replanting and research cesses during the projection period (1975-80). Foreign exchange earnings are estimated to increase by $126 million or 7 per cent in 1975, and by

$574 million or 32 per cent in 1980. Export tax revenue is estimated to increase by about $4 million, or 5 per cent in 1975, and by $22 million, or 31 per cent in 1980. The adoption of the new technologies can also be expected to increase research cess by $4 million or 12 per cent, and by $15 million or 33 per cent in 1975 and 1980 respectively. The corresponding increase in replanting cess is about $8 million or 9 per cent in 1975, and $32 million or 26 per cent in 1980.

The use of yield-stimulant ethrel is likely to increase the short run price responsiveness of natural rubber supply and reduce price instability. Moreover, by increasing the price responsiveness of natural rubber supply, yield stimulation would also increase the ability of natural rubber to respond to the future growth in world elastomer demand.

Insofar as the policy implication of yield stimulation is concerned, two policy options are recommended. The first option calls for the adoption of the yield-stimulant by Malaysian natural rubber producers on a gradual basis. This option presupposes an agreement by other natural rubber producers to the gradual adoption of the stimulant. However, if such an agreement cannot be achieved, it is recommended that the adoption of the stimulant by Malaysian producers be accelerated. Under the second option, it is suggested that incentives be given to

smallholders to encourage their adoption of the stimulant as they currently lag behind the estates in production.

With regard to the central processing and marketing scheme, it is recommended that the scheme be expanded to cover as many smallholders as possible. To expedite the expansion of the scheme, two policy options are recommended. The first option calls for increased participation of smallholders in central processing and marketing. This can be achieved by allowing smallholders to subscribe to the capital shares of the Malaysian Rubber Development Corporation (MRDC). The second option is to encourage private entrepreneurs to set up central processing factories to purchase and process smallholder rubber. The establishment of these factories by private entrepreneurs would complement those established by MRDC and would increase competition in the purchase of smallholder rubber.

CHAPTER VIII

SUMMARY AND RECOMMENDATIONS FOR FUTURE RESEARCH

Summary

Malaysia is the world's largest producer of natural rubber. The rubber industry comprising of estates and smallholdings plays an important role in the Malaysian economy. Apart from being the largest single crop by acreage, rubber provides the largest source of employment, and rubber exports represent the largest source of Malaysian foreign exchange earnings. Rubber has also been a major contributor to federal revenue, but over the last few years, its contribution has declined due to the decline in natural rubber prices, and the graduated export duty on the commodity.

Recently, major technological developments have been introduced in the Malaysian natural rubber industry. These developments include the introduction of the yield-stimulant ethrel, the Standard Malaysian Rubber (SMR) Scheme, and the new methods of processing natural rubber. The introduction of the yield-stimulant has the potential of substantially increasing the current yields of rubber trees. Under the SMR Scheme, Malaysian natural rubber is graded on technical

specifications in contrast to the conventional method where grading was based on visual appearance of the rubber. With the development of the new processing methods, natural rubber can now be produced in block form which can be easily handled in the consuming factories.

Smallholder rubber is marketed through a chain of agencies consisting of the local dealers, middle dealers, remillers, and exporters. Each agency in the marketing channel makes certain charges to cover the cost of its services and to make a profit. The greater part of smallholder rubber is of inferior quality due to the inadequate care taken during latex collection, processing, drying and storage. Apart from fetching lower prices, production of inferior quality rubber reduces natural rubber's competitiveness against synthetic rubber. The methods of grading smallholder rubber are unsatisfactory. The absence of a uniform standard based on technical specifications for grading has led to the subjective method of grading based on thickness, shades of color, presence of bubbles, and mold growth. Estimation of moisture content in the rubber is also arbitrary and is based on length of drying time and thickness of the rubber sheets.

For natural rubber to compete with synthetic rubber, it is imperative that the smallholders adopt the new technologies in production and processing. With the development of the new process rubbers, the conventional form of rubber

(sheet rubber) is likely to phase out of the international market. However, the smallholders cannot be expected to adopt the new technologies in processing and marketing individually as the new forms of rubber are processed and marketed along lines too specialized for them to perform competently on an individual basis.

A reorganization of the traditional processing and marketing system, insofar as it involves a reduction in the chain of agencies in the marketing channel, is likely to result in an increase in smallholder income. This increase in income could result from the reduction in marketing costs and the subsequent increase in the prices received by smallholders for their product. In the face of the declining natural rubber prices, the adoption of the yield-stimulant by smallholders could provide a means of maintaining or possibly increasing their income through output increase despite the more rapid decline in prices which is likely to result from the adoption.

The objectives of this study are to:

1. Analyze the potential impact of the yield-stimulant ethrel on the Malaysian and world natural rubber output and prices for the period 1975-80.

2. Investigate the changes in the Malaysian smallholder processing and marketing system, and compare estimates of Malaysian smallholder income under the following alternatives:

(a) Without yield stimulation and with the traditional processing and marketing system (Alternative I).

(b) With yield stimulation and the traditional processing and marketing system (Alternative II).

(c) Without yield stimulation and with reorganized processing and marketing system (Alternative III).

(d) With yield stimulation and reorganized processing and marketing system (Alternative IV).

3. Assess the implications of yield stimulation and reorganization of the smallholder processing and marketing system for competitiveness of the natural rubber industry; Malaysian foreign exchange earnings and export tax revenue from rubber, and natural rubber supply elasticity and price fluctuations.

4. Assess the implications of the study for government smallholder rubber policy.

To facilitate an understanding of the linkages between the various segments of the world rubber market, an economic model of the market is developed. However, due to the paucity of data and time, it is not possible to include all the variables in the model, and to quantify all the relationships between the variables in this study. The

inability to quantify all the relationships in the model, however, does not discredit the future usefulness of the model. It provides a framework for policy makers to trace the consequences of alternative policies to be pursued on rubber, particularly on the major segments of the rubber market such as costs, supply, demand, and prices. The model can also be useful for future researchers on the rubber industry as it provides a framework to absorb new and more complete data on the various aspects of the industry as they become available. The limitations of the model, however, suggest caution against drawing sweeping conclusions from the findings of this study.

Data for this study are mainly from secondary sources and were obtained through the publications of the various institutions connected with the rubber industry. Primary data were collected through a sample survey of 178 smallholders. The primary objective of the survey was to ascertain the views of smallholders on the potential adoption of the new production and processing technologies.

The analysis of the potential effect of yield stimulation indicates that substantial increases in Malaysian and world natural rubber output can be expected during the period 1975-80 as a result of the adoption of the stimulant by the natural rubber industry. With the use of the yield-stimulant, the Malaysian natural rubber output will be approximately 196,000 to 246,000 long tons, or about

12-15 per cent higher in 1975 than the output without the use of the stimulant, and in 1980, it will be approximately 682,000 to 722,000 long tons, or about 34 to 36 per cent higher depending on the assumed levels of adoption (low or high) of the yield-stimulant by the natural rubber industry. The corresponding increases for the world natural rubber output are 237,000 to 349,000 long tons, or about 6 to 9 per cent in 1975, and 924,000 to 1,206,000 long tons, or 21 to 27 per cent in 1980.

In analyzing the effect of the increases in output resulting from yield stimulation on natural rubber prices for the period 1975-80, two sets of price projections are attempted. The first projection is based on the assumption of the continuing decline in the share of natural rubber in the total elastomer consumption, with the share declining from 39 per cent in 1975 to 34 per cent in 1980. The second projection is based on the assumption that natural rubber will maintain its share of the total elastomer consumption at 40 per cent throughout the projection period (1975-80) as a result of the expected increase in the production of the new process rubbers under the Standard Malaysian Rubber (SMR) Scheme.

The first projection shows that, with yield stimulation, prices will decline from about 18.9 U.S. cents/lb. to 18.3 to 18.0 cents/lb. in 1975, and from 16.1 cents/lb. to 15.0 to 14.5 cents/lb. in 1980, depending on the assumed

adoption levels (low or high) of the yield-stimulant. As would be expected, the projected prices in the second set are higher than those of the first set. This projection shows that, with yield stimulation, prices are likely to decline from about 19.1 U.S. cents/lb. to 18.6 to 18.3 cents/lb. in 1975, and from 17.4 cents/lb. to 15.1 to 14.5 cents/lb. in 1980 again depending on the adoption levels of the stimulant by the natural rubber industry.

The comparison between the traditional and the new processing and marketing systems for smallholder rubber indicates the superiority of the latter system. The new processing methods have been found to be versatile and can be utilized to process rubber with technical properties to meet the consumers' requirements. The new methods also lend themselves to the production of natural rubbers with properties most of which are hitherto present only in synthetic rubbers. This is much to the advantage of the natural rubber industry in view of the strong competition between natural and synthetic rubbers. It is thus essential for the Malaysian rubber industry, particularly the smallholders to adopt these new processes in order to remain competitive in the elastomer market.

Due to the large minimum plant size required for the new process rubbers with the current available technology, a central processing and marketing system is essential for smallholder participation in the SMR Scheme. So

far, central processing and marketing for smallholders has only been introduced in Malaysia on a limited scale. The objectives of the scheme are the improvement in the quality of smallholder rubber, and the increase in their income mainly through reductions in processing and marketing costs. The implementation of the central processing and marketing scheme is the responsibility of the Malaysian Rubber Development Corporation (MRDC).

The central processing and marketing scheme involves the establishment of central processing factories which purchase and process smallholder rubber. Each central factory is supplied by a network of collecting centers with each center being manned by a collecting agent. Each factory purchases smallholder rubber within a radius of approximately 20 miles. Smallholders bring their latex and scrap rubber to the collecting center closest to their holdings. At each center, the collecting agent determines the quantity of the latex and scrap received and makes payments to the suppliers. The collecting agent receives a commission of 1.5 cents/lb. (Malaysian) for his services. The latex and scrap are transported to the central factory for processing, grading, packing, and for direct export to consumers.

Insofar as the smallholders are concerned, their willingness to shift the sale of their output to the central factories depends on the benefits to be achieved,

particularly in the form of higher prices. The higher prices could result from the reduction in marketing costs due to the reduction in the stages involved in the new processing and marketing system.

With regard to the smallholders' attitudes toward central processing and marketing, the results of the survey of smallholders currently selling to the central factory, and those expected to sell to a proposed central factory, point to the following conclusions. First, the sale of rubber to the central factories under the central processing and marketing scheme has been, and is likely to be, well received by the smallholders. This conclusion is based on the fact that the majority of smallholders currently selling to the central factories are generally satisfied with the new channel of sale. Furthermore, the majority of smallholders in the proposed factory area have expressed their willingness to sell to the factory and anticipate no problems in shifting to this new channel of sale. Second, the benefits from central processing and marketing as perceived by smallholders are commensurate with the benefits actually realized. The similarity between the benefits anticipated by smallholders who expressed willingness to sell to the proposed factory, and the benefits achieved by those currently selling to the central factory bears out this conclusion. Third, insofar as the benefits from central processing and marketing are

concerned, smallholders regard the savings in processing costs and time as the most important single benefit. Other benefits from central processing and marketing anticipated and realized by smallholders are the higher prices received; proximity of the collecting center to their rubber holdings, and no "cheating" in weighing, and in determining the dry rubber content (d.r.c.) of the latex by the collecting agent.

Smallholder incomes with and without yield stimulation and central processing and marketing are estimated for the period 1975-80. Gross rather than net incomes are estimated because the variability in smallholder production costs makes it difficult to use net income figures. In computing the income, the prices used are those received by the smallholders. These prices are arrived at by deducting research and replanting cesses, export duty, and the estimated marketing margins from the projected f.o.b. prices.

Comparing the smallholder income under the four alternatives (stated in Objective 2) indicates that both yield stimulation and central processing and marketing can be expected to increase smallholder income during the period 1975-80. In comparing the income under the four technological alternatives, the income without yield stimulation and under the traditional processing and marketing system (Alternative I) is used as the base income. This

income is projected to be about $660 million in 1975 and $652 million in 1980.

Based on the low output projection with stimulation and under the traditional processing and marketing system (Alternative II), the income is estimated to be approximately $676 million in 1975, and $700 million in 1980. This represents an increase of about $16 million or 2.5 per cent, and $48 million or 7.5 per cent over the 1975 and 1980 base income respectively. With the high output projection, the income can be expected to increase to about $673 million in 1975, and $686 million in 1980; an increase of some $13 million, or 2.0 per cent, and $34 million, or 5.0 per cent, over the 1975 and 1980 base income respectively.

In the case of the projected income without yield stimulation but with central processing and marketing (Alternative III), a substantial increase over the base income can be expected. Based on the low and high price projections, this income is estimated to be between $750 to 762 million in 1975, and between $783 to 868 million in 1980. This is an increase of some $90 to 101 million, or 13.6 to 15.3 per cent over the 1975 base income, and an increase of $131 to 216 million, or 20.0 to 32.2 per cent over the 1980 base income. (It must be emphasized here that this substantial increase in income is based on the assumption that all smallholders shift to central

processing and marketing.) The projected income under this alternative is higher than the income with yield stimulation and under the traditional processing and marketing system. Thus, insofar as the smallholders are concerned, the analysis indicates that central processing and marketing has greater potential in increasing smallholder income than yield stimulation.

Comparing the income with yield stimulation and with central processing and marketing (Alternative IV) with the base income indicates that, with yield stimulation and central processing and marketing, the income is estimated to increase by about $115 to 135 million, or by 17.0 to 20.0 per cent in 1975, and by $166 to 229 million, or by 25.0 to 35.0 per cent in 1980. The magnitude of the increase depends on the output and price assumptions (low or high) used.

An attempt is made to estimate the gains (in cents/lb.) by smallholders under the central processing and marketing scheme by comparing the prices received for ribbed smoked sheet (RSS), unsmoked sheet (USS), and scrap under this scheme, and the corresponding prices received under the traditional processing and marketing system. The comparison indicates that smallholders currently producing RSS could expect to gain little (about 0.8 cents/lb.) under the central processing and marketing scheme. These producers could gain as much or more by upgrading

the quality of the sheets, and thus fetch higher prices. For the USS producers however, the price gains could be substantial and average about 5.3 cents/lb. resulting from the reduction in marketing margin (about 1.6 cents/lb.), savings on processing costs (about 1.7 cents/lb.), and the higher f.o.b. prices from which the prices paid to smallholders are based on (about 2 cents/lb.). The highest potential gain from central processing and marketing scheme is achieved from the sale of scrap rubber. This gain is estimated to average about 5.8 cents/lb. and results from the reduction in the marketing margin under the scheme.

Apart from increasing smallholder income, yield stimulation and central processing and marketing has various implications for the Malaysian rubber industry. The possible reduction in production costs resulting from yield increases through yield stimulation, and the improvements in the technical properties embedded in the new process rubbers could play a major role in maintaining or even enhancing both the price and non-price competitiveness of natural rubber against synthetic rubber.

Output increases through yield stimulation has been estimated to substantially increase natural rubber's contribution to Malaysian foreign exchange earnings, export tax revenue, and research and replanting cesses. The use of the yield-stimulant ethrel is likely to increase the short run price responsiveness of natural rubber supply and

reduce price instability. The increase in price responsiveness of natural rubber supply would also increase the ability of natural rubber to respond to the future growth in the world elastomer demand.

Recommendations for Future Research

It was noted earlier (Chapter V) that a major problem currently faced by the Malaysian Rubber Development Corporation (MRDC) is the high transportation cost involved in collecting latex from the collection centers scattered in the village and transporting it to the central factory for processing. In fact, transportation cost currently forms the major component of processing cost.[1] It is recommended here that future research be focused on finding ways of reducing transportation cost. Specifically, two lines of research are recommended. First, the research should focus on analyzing the relationship between plant size and transportation and processing costs with the object of determining the size of plant with the minimum costs. Second, it is recommended that a locational analysis be undertaken to determine the optimum locations for the central processing factories; optimum with respect to transportation and processing costs.

The adoption of the yield-stimulant and the new processing methods by the Malaysian rubber producers has

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[1]Private communication with MRDC.

wide implications for employment in the Malaysian rubber industry. However, due to the data and time constraints in this study, it has not been possible to attempt any detailed analysis of the impact of the new production and processing technologies on employment. It is therefore recommended that research be undertaken in the future to analyze the employment impact of the new technologies. The research should focus on analyzing the changes in labor requirements of estates and smallholdings as a result of the adoption of the yield-stimulant. With regard to the central processing and marketing scheme, the establishment of the central processing factories and the collection centers have created a number of jobs in the form of factory managers, field officers, clerical staff, factory workers (laborers), and collecting agents. However, the scheme is also likely to displace the buyers of smallholder rubber under the traditional processing and marketing system. Future research should therefore focus on the number of jobs created and displaced by the scheme in order to determine whether the contribution of the scheme to employment is positive, neutral, or negative.

The adoption of the new technologies in production, processing, and marketing by the Malaysian estates and smallholdings is likely to affect the pattern of income distribution between estates and smallholdings and between the smallholders themselves. Since yield stimulation and

central processing and marketing are still in the early stage of adoption by the Malaysian natural rubber producers, this study has not included an analysis of the impact of the new technologies on income distribution due to the paucity of relevant data at the time this study was undertaken. It is recommended that future research be undertaken to analyze the changes in income distribution resulting from the adoption of the new technologies. The research should include an analysis of the changes in income distribution between the estate and smallholding sectors, and within the smallholding sector. In analyzing the changes in income distribution within the smallholding sector, it is suggested that emphasis be given to the changes in income distribution between smallholdings of different sizes, and between adopters and non-adopters of the new technologies. For the non-adopters, the research should include an analysis of the reasons for non-adoption with the object of identifying the bottlenecks and constraints faced by the smallholders resulting in the non-adoption of the new technologies.

BIBLIOGRAPHY

BIBLIOGRAPHY

Abraham, P. D. "Field Trials With Ethrel." Planters' Bulletin, No. 111, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (November, 1970).

_____. "Ethrel Trials on Smallholdings: Preliminary Results." Preprint No. 2. Rubber Research Institute of Malaya Planters' Conference, Kuala Lumpur, Malaysia, July, 1971.

_____; P'ng, T. C.; and Ng, E. K. "RRIM Ethrel Trials: Progress Report." Preprint No. 1. Rubber Research Institute of Malaya Planters' Conference, Kuala Lumpur, Malaysia, July, 1971.

Adams, P. F. "Fluctuations in the Price of Natural Rubber." Kuala Lumpur, Malaysia: Ministry of Commerce and Industry, 1958.

Allen, P. W. "The Evolution of Market Grades." Rubber Developments, XVII, No. 4, London, Natural Rubber Producers' Research Association, (1964).

Barlow, C., and Lim, S. C. "A Report on the Survey of Malay Group Processing Centers." Economic Report No. 1. Statistics Division, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia, 1965.

_____. "Natural Rubber and West Malaysia." Paper presented at the Singapore Meeting of the S.E. Asia Business Committee, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia, May, 1968.

Bauer, P. T. The Rubber Industry: A Study of Competition and Monopoly. Cambridge, Mass.: Harvard University Press, 1948.

Behrman, Jere R. "An Econometric Study of the World Rubber Market." Discussion Paper No. 85. Department of Economics, University of Pennsylvania, Philadelphia, July, 1968.

Bevan, J. W. L. "A Study of Yields, Labor Inputs and Incomes on Rubber Smallholdings in the Coastal Area of Selangor." Department of Agriculture, University of Malaya, Kuala Lumpur, Malaysia, 1962.

Biggs, H. G. "Report on the Marketing of Agricultural and Other Rural Produce in Malaysia." London, Department of Technical Cooperation, 1964.

Cheam, S. T. "A Study of the Marketing of Smallholders' Lower Grade Rubber." Economics and Planning Division Report No. 8. Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia, July, 1971.

Chin, P. S.; Soh, Y. B.; and Pillai, N. M. "Factors Influencing Consistency of SMR Production." Preprint No. 20. Rubber Research Institute of Malaya Planters' Conference, Kuala Lumpur, Malaysia, July, 1971.

Crosson, Pierre R. Economic Growth in Malaysia: Projections of Gross National Product and of Production, Consumption, and Net Imports of Agricultural Commodities. Planning Methods Series No. 2. Jerusalem: National Planning Association, Center for Development Planning, 1966.

Dayal, R. "Econometric Model of the World Rubber Market," Commodities Division, UNCTAD, Geneva, May, 1970. (Mimeographed draft.)

Graham, D. J. "New Presentation Processes and the SMR Scheme." Planters' Bulletin, No. 99, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (1968).

Greenwood, J. M. F. "Rubber Smallholdings in the Federation of Malaya." Paper presented to the International Geographical Conference, Kuala Lumpur, Malaysia, 1962.

Hague, Irfan Ul. "Efficiency in Resource Allocation: The Case of Natural Rubber." Economics Department, IBRD, July, 1971.

International Rubber Study Group. The Marketing of Block Natural Rubber Sold to Technical Specifications. London, 1969.

_____. Rubber Statistical Bulletin. London (various issues).

Knorr, K. E. World Rubber and Its Regulations. Stanford, Calif.: Stanford University Press, 1948.

Lim, S. C. "A Study of the Marketing of Smallholders' Rubber at the First Trade Level in Selangor." Economics and Planning Division Report, No. 4. Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia, September, 1968.

Malaysia. Department of Agriculture. Annual Report, 1969. Kuala Lumpur, Malaysia, 1969.

_____. Department of Statistics. Federation of Malaya Report on Employment, Unemployment, and Underemployment. Kuala Lumpur, Malaysia, 1962.

_____. Department of Statistics. Monthly Statistical Bulletin. Kuala Lumpur, Malaysia (various issues).

_____. Department of Statistics. Rubber Statistics Handbook. Kuala Lumpur, Malaysia (various issues).

_____. Second Malaysian Plan: 1971-1975. Kuala Lumpur, Malaysia: Government Printer, 1971.

Moir, G. F. J. "A Radical Approach to Exploitation." Planters' Bulletin, No. 111, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (November, 1970).

Morris, J. E. "Heveacrumb Process." Journal of the Rubber Research Institute of Malaya, XXII, No. 46, Kuala Lumpur, Malaysia (1969).

Nair, S.; Sin, S. W.; and Lee, T. H. "New Presentation Rubbers: SMR Market Reaction and Future Requirements." Planters' Bulletin, No. 110, Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia (September, 1970).

Natural Rubber Bureau. Natural Rubber News. Washington, D.C., March, 1972.

Natural Rubber Producers' Research Association. Technical Information Sheet No. 2. Technically Classified Rubber. London, 1965.

Ooi, Jin-Bee. Land People and Economy in Malaya. London: Longmans, 1963.

Pee, T. Y., and Abraham, P. D. "Economic Analysis of RRIM Ethrel Trials." Preprint No. 3. Rubber Research Institute of Malaya Planters' Conference, Kuala Lumpur, Malaysia, July, 1971.

Pushparajah, E. et al. "Nutritional Requirements of Hevea Brazilliensis in Relation to Stimulation." Preprint No. 13. Rubber Research Institute of Malaya Planters' Conference, Kuala Lumpur, Malaysia, July, 1971.

Ridley, H. N. The Story of the Rubber Industry. London: L. Reeve Press, 1913.

Rubber Research Institute of Malaya. Integration of New Stimulation Techniques with Exploitation Practice. RRIM Planters' Bulletin, No. 111, Kuala Lumpur, Malaysia (November, 1970).

_____. Kertas Sharahan Kursus Latehan Getah. Kuala Lumpur, Malaysia (n.d.).

_____. Performance of Clones in Commercial Practice: Fifth Report. RRIM Planters' Bulletin, No. 101, Kuala Lumpur, Malaysia (March, 1969).

_____. Rates of Export Duty and Cesses. Kuala Lumpur, Malaysia, October, 1968.

_____. SMR Bulletins, Nos. 3-8, Kuala Lumpur, Malaysia, (1970).

_____. Standard Malaysian Rubbers, Specifications and Sampling Procedures. RRIM Planters' Bulletin, No. 78, Kuala Lumpur, Malaysia (May, 1965).

Salim, Agoes. "The Market for Small Farm Rubber in Malaya." Unpublished Ph.D. dissertation, Department of Agricultural Economics, University of Wisconsin, 1967.

Sekhar, B. C. "Malaysian Natural Rubber: New Presentation Methods." Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia, April, 1967.

Tan, Augustin H. H. "Natural Rubber Problems and Techniques of Stabilization." Master's Prospectus, University of Malaya, Kuala Lumpur, Malaysia, 1962.

Thomas, P. O. "Malaysian Natural Rubber in the Seventies: A Forecast of Production Trends." Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia, July, 1970.

"t Hooft Welvaars, M. J. "Profitability of New Investments in Rubber Plantings in Malaysia." UNCTAD Document TD/B/C.1/SYN.52, Geneva, 1971.

United Nations Conference on Trade and Development. Review of Problems and Policies for Specific Commodities Facing Competition from Synthetics and Substitutes. UNCTAD Document TD/B/C.1/SYN.56, Geneva, May, 1971.

Voon, P. K. "Chinese Rubber Smallholding Industry in Selangor." Unpublished Master's thesis, University of Malaya, Kuala Lumpur, Malaysia, April, 1967.

Wharton, Clifton R., Jr. "Malayan Rubber Supply Conditions." Reprint No. 3. Agricultural Development Council, New York, November, 1964.

APPENDICES

APPENDIX A

DATA USED IN THE ANALYSIS OF NATURAL RUBBER PRICES: 1955-70

APPENDIX A

Table A.1.--Data Used in the Analysis of Natural Rubber Prices: 1955-70.

Year	Variables[a]									
	$P_{NR(NY)_t}$	$P_{NR(M)_t}$	O_{NR_t}	C_{NR_t}	C_{SR_t}	C_{TR_t}	$(C_{NR}/C_{TR})_{t-1}$	TCR_t	$(TCR/O_{NR})_t$	R_{spt}
1955	39.21	34.91	1917	1890	1009	2899	70.63	67	3.49	0
1956	34.23	29.59	1892	1877	1081	2958	65.19	63	3.33	0
1957	31.21	27.14	1905	1900	1204	3104	64.23	59	3.10	0
1958	28.12	24.53	1942	2012	1189	3201	62.85	55	2.83	0
1959	36.59	31.06	2042	2117	1516	3633	55.38	52	2.55	13
1960	38.14	33.05	1990	2065	1730	3795	58.27	42	2.11	159
1961	29.51	25.55	2095	2127	1821	3948	54.41	35	1.67	30
1962	28.62	23.91	2130	2220	2094	4314	53.87	34	1.60	67
1963	26.24	22.15	2067	2232	2283	4515	51.46	42	2.03	85
1964	25.32	20.84	2235	2260	2635	4895	49.43	36	1.61	103
1965	25.75	21.41	2342	2382	2758	5140	46.17	38	1.62	121
1966	23.66	19.99	2400	2552	3248	5700	46.34	40	1.67	159
1967	19.93	16.54	2452	2462	3220	5682	44.77	54	2.20	101
1968	19.92	16.24	2604	2793	3742	6535	43.33	112	4.30	74
1969	26.22	21.35	2820	2850	4191	7041	42.74	166	5.89	38
1970	21.04	17.25	2933	2914	4331	7245	40.48	250	8.52	32

Sources: International Rubber Study Group, Rubber Statistical Bulletin, London (various monthly issues); Malaysia, Department of Statistics, Rubber Statistics Handbook, Kuala Lumpur, Malaysia (various annual issues); Natural Rubber Bureau, Natural Rubber News, Washington, D.C. (various monthly issues); and P. O. Thomas, "Malaysian Natural Rubber in the Seventies: A Forecast of Production Trends," Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia, July, 1970.

[a]Variable Definitions:

$P_{NR(NY)_t}$ = Price of ribbed smoked sheet 1 (RSS 1) in New York in U.S. cents/lb.

$P_{NR(M)_t}$ = Price of ribbed smoked sheet 1 (RSS 1) in Malaysia in U.S. cents/lb.

O_{NR_t} = World natural rubber output in '000 long tons.

C_{NR_t} = World natural rubber consumption (including estimated imports into the centrally planned economies) in '000 long tons.

C_{SR_t} = World synthetic rubber consumption (excluding consumption in the centrally planned economies) in '000 long tons.

C_{TR_t} = Total elastomer consumption (excluding synthetic rubber consumption in the centrally planned economies) in '000 long tons.

$(C_{NR}/C_{TR})_{t-1}$ = The previous year's ratio of natural rubber to total elastomer consumption in percentage points.

TCR_t = Output of Technically Classified Rubber (including Standard Malaysian Rubber from 1965 onwards) in '000 long tons.

$(TCR/O_{NR})_t$ = Ratio of Technically Classified Rubber to total natural rubber output in percentage points.

R_{spt} = Net releases of natural rubber stockpiles in '000 long tons.

APPENDIX B

VALUES OF VARIABLES USED IN PROJECTING WORLD NATURAL RUBBER PRICES: 1975-80

APPENDIX B

Table B.1.--Values of Variables Used in Projecting World Natural Rubber Prices: 1975-80.

Year	Projected Natural Rubber Output ('000 Long Tons)			Projected Natural Rubber Consumption[c] ('000 Long Tons)	Projected Synthetic Rubber Consumption[d] ('000 Long Tons)	Projected Total Elastomer Consumption ('000 Long Tons)	$(C_{NR}/C_{TR})_{-1}^{e}$ (per cent)	Natural Rubber Stockpile Release ('000 Long Tons)
	Without Yield Stimulation	With Yield Stimulation						
		Low[a]	High[b]					
1975	3740	3977	4089	3727	5876	9,603	39.0	50
1976	3866	4238	4398	3867	6336	10,203	38.8	50
1977	4002	4501	4734	4008	6834	10,842	37.9	50
1978	4144	4793	5060	4158	7361	11,519	37.0	50
1979	4295	5086	5390	4300	7938	12,238	34.9	50
1980	4449	5373	5655	4450	8594	13,044	33.8	50

Sources: Table 3.12; and I. U. Hague, "Efficiency in Resource Allocation: The Case of Natural Rubber," Economics Department, IBRD, May, 1971, Table 1, p. 4.

[a,b]Levels of adoption of the yield-stimulant. [c]Includes estimated net imports into the centrally planned economies.

[d]Excludes consumption in centrally planned economies.

[e]Previous year's ratio of the share of natural rubber in the total elastomer consumption.

APPENDIX C

PRICES OF RSS (RIBBED SMOKED SHEET) 1, 2, 3, AND 4, AND 2XTBC (2X THIN BROWN CREPE): 1960-70

APPENDIX C

Table C.1.--Prices of RSS (Ribbed Smoked Sheet) 1, 2, 3, and 4, and 2XTBC (2X Thin Brown Crepe): 1960-70. (in Malaysian cents/lb.)

Year	Prices (¢/lb.)				
	RSS.1	RSS.2	RSS.3	RSS.4	2XTBC
1960	108.08	106.69	104.92	103.10	98.00
1961	83.54	82.84	81.81	80.71	75.12
1962	78.20	77.42	75.83	74.57	70.74
1963	72.42	71.85	70.56	69.30	65.81
1964	68.14	67.91	67.18	66.09	61.75
1965	70.02	69.56	68.57	67.10	53.99
1966	65.38	64.71	63.88	62.19	61.57
1967	54.08	52.79	51.43	50.28	46.26
1968	53.12	52.03	51.30	50.48	47.28
1969	69.82	69.26	68.56	67.70	62.86
1970	56.42	55.09	54.12	53.35	53.04

Sources: Malaysia, Department of Statistics, Monthly Statistical Bulletin, Kuala Lumpur, Malaysia (December, 1971), Table 7.12, p. 58; and private communication with the Malaysian Rubber Exchange in Kuala Lumpur, Malaysia in June, 1972.

APPENDIX D

SMALLHOLDER RUBBER SURVEY QUESTIONNAIRE

APPENDIX D

SMALLHOLDER RUBBER SURVEY QUESTIONNAIRE

Questionnaire A

(For Smallholders Currently Selling Rubber to the Central Factory)

Reference No:

Kampong (Village):

House No:

Name of Interviewer:

Name of Respondent:

1. How many acres of rubber do you own?
   (a) Immature rubber_____acres.
   (b) Mature rubber_____acres.

2. How much of the above acreage do you operate?
   (a) Immature rubber _____acres.
   (b) Mature rubber _____acres.

3. How many days in a month do you tap the trees during
   (a) Wintering season? _____days.
   (b) Regular season? _____days.

4. How many months in a year do you tap? _____months.

5. What is the yield per tapping during
   (a) Wintering season? _____katis/lbs.
   (b) Regular season? _____katis/lbs.

6. Did you apply fertilizers to the mature trees in 1970?
   (1) Yes_____
   (2) No_____

7. If the answer to 6(b) is "yes"
   (a) What kind of fertilizer did you use?
   (b) What was the quantity used per acre? _____katis/lbs./bags

8. If the answer to 6(b) is "no."
   (a) Why didn't you use fertilizers in 1970?
   Please indicate the reasons.

   _____
   _____
   _____

   (b) When did you last fertilize the trees? _____years ago.

9. Do you have other sources of income (besides income from rubber)?
   (1) Yes_____
   (2) No_____

10. If the answer to (9) is "yes."
   (a) What are your other sources of income?
      1. Fruits_____
      2. Livestock_____
      3. Odd jobs_____
      4. Other (specify)_____

   (b) What was your approximate income from other sources in 1970? $_____

11. What was your monthly average income from rubber in 1970?
   $_____

12. How long have you been selling your rubber to the collecting center (or central factory)? _____months/years

   Questions 13-17 are designed to gather information pertaining to the period before the smallholders started selling their rubber to the central factory.

13. What types of rubber were you producing? Please specify the types produced and percentages of each type.
   (1) Latex _____%
   (2) Unsmoked sheet _____%
   (3) Ribbed smoked sheet _____%
   (4) Other (specify)
   _____ _____%
   _____ _____%

14. Did you get any credit from the buyer of your rubber?
   (1) Yes_____
   (2) No_____

15. If the answer to (14) is "yes."
    (a) On the average, how much credit did you take per month? (If part of the credit is in kind, give an estimated value to this "in-kind" credit) $_____

    (b) What was the credit used for?
        (1) Production
        (2) Consumption
        (3) Other (specify)_____

16. What kind of payment arrangement did you make with the buyer?
    (1) Paid at the time rubber was delivered to the buyer.
    (2) Other (specify)

        _____
        _____

17. Why did you decide to sell your rubber to the collecting center (that is, selling to the central factory through the collecting center)? Please list the reasons.

    _____
    _____
    _____
    _____

18. What type or types of rubber are you now selling to the collecting center? (If the respondent is selling more than one type of rubber, specify the percentage of each type).
    (1) Latex _____%
    (2) Unsmoked sheet _____%
    (3) Scrap _____%

19. When do you receive payment for your rubber from the collecting agent?
    (1) Paid at the time the rubber is delivered to the collecting center.
    (2) Other (specify)

    _____
    _____

20. Do you get any credit from the collecting agent or from the central factory?
    (1) Yes_____
    (2) No_____

21. If the answer to (20) is "yes."
    On the average, how much credit do you get per month? (If part of the credit is in kind, give an estimated value to this "in kind" credit).
    $_____

22. If the answer to (20) is "no."
What is your source of credit now?
(1) None
(2) Other (specify)

_____
_____

23. How much per kati/per lb. do you gain by selling to the collecting center instead of selling to the former buyer for
(a) Latex? _____¢/kati/lb.
(b) Unsmoked sheet? _____¢/kati/lb.
(c) Scrap? _____¢/kati/lb.

24. What other benefits, if any, do you get by selling to the collecting center instead of selling to the former buyer? Please specify the benefits.

_____
_____
_____
_____

25. What is the distance from your smallholding to the nearest collecting center?
_____ miles.

26. Are you satisfied with the current procedure set up by the central factory regarding the purchase of your rubber?
(1) Yes_____
(2) No_____

27. If the answer to (26) is "no,"
(a) Why are you dissatisfied?_____
_____
(b) What changes in the present procedure would you like to see made?

_____
_____
_____

28. Now that you no longer process your rubber, how do you utilize your extra time (that is, the time you normally spent in processing)?

_____
_____
_____

29. Have you heard about the yield-stimulant Ethrel?
    (1) Yes_____
    (2) No_____
    Note: If the answer to (29) is "no" STOP here.

30. If the answer to (29) is "yes."
    Will you apply Ethrel to your rubber trees?
    (1) Yes_____
    (2) No_____
    (3) Uncertain_____

31. If the answer to (30) is "yes,"
    When will you start applying the yield-stimulant?_____

32. If the answer to (30) is "no,"
    Why will you not apply the yield-stimulant to your rubber trees? Please list the reasons.
    _____
    _____
    _____

33. If the answer to (30) is "uncertain,"
    Why are you uncertain? Please specify reasons for the uncertainty?
    _____
    _____
    _____

Questionnaire B

(For Smallholders in the Area of a Proposed Central Factory)

Reference No.:

Kampong (Village):

House No:

Name of Interviewer:

Name of Respondent:

Note: Questions (1-11) are identical to those for Questionnaire A.

12. What type or types of rubber do you produce?
Please specify the types produced and the percentage of each type:
(1) Latex _____%
(2) Unsmoked Sheet _____%
(3) Ribbed Smoked Sheet _____%
(4) Other (specify) _____%

_____
_____

13. Where do you currently sell your rubber?
(1) Sell to estates
(2) Sell to dealer
(3) Other (specify)

_____
_____

14. What is the distance from your holding to the place of sale of your rubber? _____miles

15. How often do you sell your rubber?

_____

16. When do you receive payment for your rubber?
(1) Paid at the time the rubber is delivered to the buyer.
(2) Other (specify)

_____
_____

17. Do you get any credit from the buyer of your rubber?
(1) Yes _____
(2) No _____

18. If the answer to (17) is "yes":
    (a) On the average, how much credit do you take per month? (If part of the credit is in kind, give an estimated value of this "in kind" credit). $_____

    (b) What is the credit used for?
    (1) Production
    (2) Consumption
    (3) Other (specify)
    _____
    _____

19. If a central factory is set up in your area (and this factory will establish collecting centers which will purchase your rubber and then transport it to the factory for processing, will you sell your rubber to the factory?
    (1) Yes
    (2) No
    (3) Uncertain

    If the answer to (19) is "yes," proceed to questions (20-24)
    If the answer to (19) is "no" proceed to question (25)
    If the answer to (19) is "uncertain" proceed to question (26).

20. What benefits, if any, do you expect to achieve by selling to the collecting center (central factory)? Please specify the benefits expected.
    _____
    _____
    _____
    _____

21. What kind of payment arrangement do you prefer?
    (1) Paid at the time rubber is delivered to the collecting center.
    (2) Paid twice weekly
    (3) Paid weekly
    (4) Paid every two weeks
    (5) Other (specify)
    _____
    _____

22. Do you anticipate any problem when you sell your rubber to the collecting center instead of selling to the current buyer?
    (1) Yes
    (2) No

23. If the answer to (22) is "yes" what problem or problems do you anticipate?

_____
_____
_____
_____

24. When you sell your rubber to the collecting center what will you do

(a) with your processing equipment?

_____
_____
_____
_____

(b) with the time you normally spend in processing your rubber?

_____
_____
_____
_____

25. If the answer to (19) is "no," please indicate the reasons why you will not sell your rubber to the collecting center.

_____
_____
_____
_____

26. If the answer to (19) is "uncertain," please indicate the reasons for the uncertainty.

_____
_____
_____
_____

Note: Questions (27-31) are identical to questions (29-33) in Questinnnaire A.