SUPPLY RESPONSE AND COST OF PRODUCTION OF NATURAL RUBBER - AN ECONOMETRIC STUDY

THESIS SUBMITTED TO THE DEPARTMENT OF APPLIED ECONOMICS
COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY

BY

MAYA C. PILLAI,
RESEARCH SCHOLAR,
DEPARTMENT OF APPLIED ECONOMICS,
CUSAT, KOCHI.

REG NO: 1896

FOR THE AWARD OF THE DEGREE OF DOCTOR OF PHILOSOPHY
IN APPLIED ECONOMICS

UNDER THE GUIDANCE OF

DR.D. RAJASENAN,
DEAN, FACULTY OF SOCIAL SCIENCES AND
HEAD, DEPARTMENT OF APPLIED ECONOMICS,
CUSAT, KOCHI.

2003

DEPARTMENT OF APPLIED ECONOMICS

COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY

KOCHI - 682 022, KERALA, S. INDIA

Prof. (Dr.) D. RAJASENAN
Dean, Faculty of Social Sciences
Head of the Department

Phone : +91-484-556030
: +91-484-550943
Fax : +91-484-556030
+91-484-550943
E-mail: rajasenan@cusat.ac.in

CERTIFICATE

I certify that the work entitled **'Supply response and Cost of production of natural rubber– an econometric study'** is a bonafide research done by **Maya C. Pillai** for the award of the degree of Doctor of Philosophy in the Department of Applied Economics under my guidance and supervision.

Kochi-22

03-03-2003

DEPT. OF APPLIED ECONOMICS
COCHIN UNIVERSITY OF SCIENCE & TECHNOLOGY
COCHIN-682 022

(Dr. D Rajasenan)

LIST OF TABLES

LIST OF TABLES

LIST OF FIGURES

PAGES

CHAPTER-I

INTRODUCTION

Natural rubber has been used for various purposes over centuries. No one knows exactly when man first started using rubber. The earliest recorded mention of rubber in print was made in 1530 by PMd'Angliera as "gummi de opium". Earliest written references of rubber also include the writings of Spanish invaders of Aztec civilisation. Aztecs were reported to have made shoes, head gear, clothing and other water tight articles from latex. Various Aztec religious rites involving rubber were also described. Spanish writings also reveal a game at the court of Aztec emperor Montezuma II which involved using a rubber ball.

In 1735 the French excavator de la Condamine discovered natural rubber in South America. He referred to natural rubber by a French word " catouchouc" derived from the local Indians word meaning "weeping wood", The "Cataoutchouc" came from a tree called He've which grew in parts of both Peru and Brazil. The botanical name of commercial rubber "Hevea Brasiliensis" came from the two words He've and Brazil.

Discovery of solvents and the principles of compounding made the use of natural rubber wide spread in the subsequent years. In the late 1830s Charles Good Year made the crucial discovery of the vulcanization process which enabled the manufacture of elastic pliable and durable rubber products which were insoluble in common oils no longer sticky and unaffected by temperature. The final major invention of the nineteenth century was that of the pneumatic tyre in 1888 by John Boyd Dunlop. The first motor car to use pneumatic tyres took part in the Paris Bordcauk motor race of 1895.

All these factors led to the tremendous growth of natural rubber consumption. Due to the increased demand for rubber the need to supplement the production in its colonies was realised by the British as early as 1860. Sir Henry Wickam made several expeditions between 1866 and 1876. He succeeded in his expedition in the year 1876 and brought seeds capable of survival in the historic liner 'S.S. Amazonas'. Most of the rubber plants were sent to Srilanka wherefrom hevea plants were planted in the teak plantations of Nilambur in Kerala State in 1879.

The first commercial plantation of rubber, however, was started only by 1902 with the formation of Periyar Syndicate. Plantations were made on the banks of Periyar River and at Thattekad near Alwaye. Thus the foundation stone for rubber plantations were laid down by the British. Therefore rubber cultivation could be termed as a "colonial heritage".

Though it is a colonial inheritance, the development of rubber plantations is the result of careful planning and hardwork of Indians. United planters Association of South India [UPASI] evinced keen interest on various aspects which helped in the rapid development of commercial plantations by the early years. The "Malayala Manorama", a leading Malayalam Daily took up the crusade for natural rubber as early as 1905 giving assurance to the general public about the price stability and profitability of natural rubber. The first local joint stock company to plant rubber was floated in 1910 under the name of Malankara Rubber and Produce Company.

Historical evidence shows that globally institutional factors have been responsible for the growth of rubber cultivation. When it comes to active government intervention, both in the pre and post colonial era, India is not an exemption. The rubber (Production and Marketing) Act 1947 enacted by the Government of India was an important hall mark in the history of rubber production in India. It setup "The Indian Rubber Board" which became the "Rubber Board" by an amendment of the Act in 1954. It was mainly due to the efforts of the Rubber Board, that the total tappable area increased from 67181 hectares in 1955-56 to 569,000 hectares in 2000-01 India is now the fourth largest producer of natural rubber in the world having a share of 9.4 percent of the global output.

One interesting aspect in the rubber plantation development is that there is static geographical distribution of rubber area over the years. The Rubber belt comprising of the districts in Central Kerala was already formed in the colonial era and continued so even after independence. The area wise share of other states which was 5 percent in 1950-51 rose only to 16.4 percent by 2000-01. Thus for about 50 years Kerala has retained its dominant position in the rubber map of India.

Development of natural rubber cultivation has given a long awaited boost to the Indian Economy by setting up infrastructural facilities and by generating employment to the unemployed millions in Kerala. Rubber tree is considered as a "Kalpadhenu" as far as Kerala is concerned. It is said to yield milk, honey and oil. In

other words rubber tree yields latex rubber honey, rubber seed oil, biogas from rubber latex and also rubber wood. Above all it provides the principal raw material required for manufacturing over fifty thousand different products indispensable to modern life.

Section 1.1:-Why an analysis of rubber situation in India?

Natural rubber is a raw material of considerable commercial importance in the world. India is the fourth largest producer of natural rubber in the world. India also ranks first in the case of productivity. In India, the traditional rubber growing regions comprises of Kerala, Kanyakumari district of Tamil Nadu and Coorg district of Karnataka. Non traditional rubber growing areas include Tripura, Assam, Meghalaya, Missoram, Nagaland, Goa and Andaman and Nicobar Islands. Rubber industry is primarily predominated by small growers. Hence, rubber cultivation has a great significance in income and employment generation. Rubber Board is increasing its area of production every year and hence it is fast achieving significance area wise.

Being a small grower sector, rubber industry is sensitive to market price of rubber. From a return of Rs.18/- per Kg. in 1989 – 90, the rubber price sky rocketed to Rs. 65/- per Kg. in 1996. This high level of returns generated great expectations and zest among planters. But this period was short lived. Price started to fall down to Rs. 45 /- per Kg. and by 1997 end it was as low as Rs. 26 /- per Kg.. In India demand for natural rubber and rubber products is ever on the rise. Supply is always short of demand and import has been accepted as a necessity. But even as NR prices were falling, NR stocks were accumulating. This inconsistent situation arose due to the liberelisation policies and the general industrial recession prevalent in the early nineties, which hit automobile industry in a big way. International price was also not supportive due to general growth sluggishness and later on due to South East Asian crisis. Domestically, liberalization can be pointed out as the cause for the sharp downfall of rubber prices from a very high level. Import of second hand rubber tyres was allowed and import of raw materials for making polyurethane beds, a major competitive to rubber was also allowed. Import of synthetic rubber, the prime substitute of NR was made easier. Due to lack of funds, co-operative societies failed to keep adequate buffer stocks of rubber. NABARD grants were found inadequate by Rubber Marketing Federation. The protest and propaganda against low prices assumed greater momentum when taken up by major political parties.

In this context an analysis of the macro economic environment of NR is thought to be of highly significant. It will throw light on the causative factors of the rubber price crash since 1997. The dilemma prompted the growers to revise the bench mark prices in the cause of their agitation against low prices. The business lobby in India continued its statement that the prices are too high and carried on their speculative stock policy to keep prices arranged desirable to them.

Tariff Commission studied the cost of production of NR and had notified the maximum and minimum price of rubber in the year 1951. Central Government's price ceiling limits depended on the subsequent revisions and recommendations of the Tariff Board. Recently, the Cost Accounts Branch of the Ministry of Finance conducted a study of cost of production of NR and the results of this study which is kept highly confidential, the central government notified the revised indicative price of Rs. 34.05 /- per Kg. of RSS 4 grade rubber.

Now the relevant question is, what is the fair amount of return that a grower especially small grower should get to make him satisfied enough to remain in business?. The Rubber Board, Tariff Commission, Finance Ministry all have their own methodology of calculating this amount of fair return and all of them are confidential. Rubber Board is accused of inflating cost figures to get grants for its own survival. The grower is alleged of including unnecessary elements in the cost calculations and ballooning up the figure.

In reality supply response implies the violation of the traditional 'Ceteris paribus' assumption of assuming other influencing factors to be constant. In the case of supply, the non price factors are, the cost of input, technology, weather, socio-political conditions etc. Due to seven years gestation lag, past prices are equally important as present prices. When these supply shifters are allowed to interact, the growers react. Their reaction is reflected through the quantity offered for sale by them in the market. The grower response is manifested in two ways incorporating the time element. One is short run price output relationship and the other is long run planting price relationship. In the short run, the farmer adjusts output with the cyclicality of price when the price is high and is expected to rise further, farmer adopts the strategy of new planting, intensive tapping of existing trees and postponement of slaughtering process in a bid to maximize profits. Again, when the down trend starts, the farmer resorts to replanting and thus follows a policy of loss minimization. Since the

gestation lag is a necessary evil, the economic rationality of the growers makes him manipulate the timings of the lags to suite his end.

The grower's response to the current price situation was varied. Majority stayed on adopting short term supply reduction policies in the hope for the better turn of the cycle. Some people resorted to crop switching and inter cropping. A few people just quit by selling their plots. Decision to quit is always a difficult one in the case of NR as the high capital investment is required for the long run and the return involves seven year lag. In this context, it is highly relevant to explore, whether there is any empirical evidence of the behavioral response of the growers with respect to planting decisions in relation to price cyclicality. Supply response studies are of great importance for the success of Government programmes and policies launched with a view to mitigating poverty and upgrading the standard of living of the masses.

Improved technology in rubber cultivation has improved the potential for greater output and the prospects of sustained growth of the industry in the face of both fluctuating prices and increasing cost of inputs. It is therefore, highly significant to forecast the supply and demand for NR. Since majority of rubber suppliers are small holders and economically more backward than the rubber consumers,and therefore it is relevant to determine the potential so as to verify whether encouragement of productivity increase is a viable option or not.

Section 1.2:- Objectives of the Study

1. To estimate the short term and long term supply response of NR in India.
2. To analyse the macro economic environment of NR industry and the causative factors of the rubber price crash.
3. To determine the minimum cost of production of NR.
4. To forecast the potential production of NR in India.

Section 1.3:- Database and Methodology

Both primary and secondary data are used for the study. Secondary data are collected from various publications of the Rubber Board and International Rubber Study Group.

Supply response of NR in India is analysed using the Nerlovian Method and Fishers Model.

A SWOT Analysis of the macro economic environment of NR has also been worked out.

An all Kerala primary survey was conducted from November 1999 and April 2001. Random samples were chosen from North, Central and South Kerala based on their weightage in rubber production. Altogether 20 sample units were surveyed with a well formulated questionnaire. Sample units chosen from North Kerala are Horsdurg, Kasargod,Kanjangadu, Thalassery,Thaliparampa, Kozhikode, Manjeri, Sreekandapuram, Palakkad, Thrissur and from Central Kerala , Kothamangalam, Eranakulam, Muvattupuzha, Thodupuzha, Pala, Erattupetta, Kanjirapally, Kottayam, Changanacherry, Pathanamthitta and from South Kerala, Thiruvananthapuram and Nedumangad.

Supply and demand forecasts were made using time series method. Production forecasts were made using average yield profile method and also by using normal production method.

Section 1.4:- Review of Literature

Rubber Research Institute of Malaya (RRIM) in its Annual Report (1975) stated that tapping and collection cost continued to be the biggest item accounting for about 40 percent of the total matured area cost per kilogram of rubber production.

Unni and Jacob, (1969-70) found out that most of the small holders used ordinary planting materials. Inter planting of other crops was found to be crucial in determining the yield of Rubber. Majority of the small holders were found to practice the crude method of sun or kitchel smoking. Both manuring and plant protection measure were regularly done only in 37.7 percent of the total area surveyed. The survey revealed that the average yield per hectare in budded clonal and unselected area were 641, 565 and 388 kilogram respectively.

A Report, (1980) of study on the working of co-operative societies in Kerala dealing in Rubber stated that in the case of small holders it is possible only to process 80 percent of its produce which they collect as liquid latex and sell it at reasonable price. The 20 percent of their produce, which is in the form of scrap rubber whose composition and dry rubber content vary considerably depending upon certain factors.

They have to sell it to country dealers from whom it passes through a chain of middle men before it actually reaches the rubber consumers.

Market study on Natural Rubber,(1982) stated that out of the total cost of production of raw rubber maintenance and upkeep account for 26 percent, tapping and collection 39 percent, general charge 6 percent, development or amortisation cost 8 percent and processing packing and forwarding cost account for 21 percent and 56 percent of the total cost of labour comprises of plantation labour.

George and Joseph, (1973) analysed the feasibility of investment in Rubber and examined the present value of future returns. They worked out the internal rate of return on capital for rubber as 10 percent. The benefit cost ratio was also worked out using constant discount rate which was found to be 1.2 for rubber. The pay back period of rubber was estimated as 14 years.

Thomas, (1979) estimated the cost of production of small holdings relative to estates. He found that the cost of production per 100 kg of rubber in estates had increased by 332.96 percent between 1950-51 and 1974-75, whereas corresponding increase in holdings was only 236.56 percent. But the actual cost of production of holdings remained higher than that of estates during the whole period of analysis. The increase in the yield was also higher in the estates (155.91 percent than that of holdings 139.77 percent). price had increased during the period by 103.9 percent. He estimated the break down point of Rubber cultivation and found that estates are in a more advantageous position than the small holdings both in physical and in its value terms.

Response of production or supply to the changes in prices has been studied intensively during the post-planning period. The studies range from investigation into association between changes in prices and changes in area under specific crops to formulation and testing of dynamic models of the supply function. Early in 1954, the study of relationship between production and prices was in the form of crude observations. Though most of the authors have observed a positive association between prices and acreage, a few of them observed absence of any relationship between the two or even a negative relationship.

Parthasarathy (1959) and John (1965) observed negative relationship in the case of sugar-cane versus paddy. Both of them observed that the changes in acreage are not induced by changes in prices but by changes in profitability. Sugarcane being

far more profitable than paddy, the area under sugarcane increased even during the period when the prices of sugarcane were on the decline. These studies have given simple correlation or simple regression with two variables and their conclusion vary. Though, most of the authors have observed a positive association between prices and acreage, a few of them observed absence of any relationship between the two or even a negative relationship.

Of all the studies which have investigated into simple association between changes in prices and area under different crops, DharmNarain's study (1950) has a significance of its own. His study is extensive and systematic and investigates into the price-acreage relationship for various crops in different parts of the country. His analysis brings into clear focus the positive relationship between acreages of competing crops and relative prices with the use of a simple device of tabular analysis and geometric charts. He has indicated the relationship of output and area with weather changes and prices. He has a wider compass which covers important food crops like rice and wheat and non-food crops like cotton, jute groundnut and sugarcane. The study covers the period from 1900 to 1939. Between food crops and non-food crops the production of the former is influenced to a great extent by weather, and that of the latter by prices. An element of subsistence economy is believed to be responsible for this differential behaviour.

The earlier studies of investigation into simple association between changes in prices and area under specific crops emphasised the need to investigate more closely into the supply relationship.

Rajkrishna, (1963), adopted a Nerlovian type distributed lag model and postulated that a farmer plans to achieve a certain level of production but the actual level of production achieved may be different. He formulated the model as under

$$X_t = a + b P_{t-1} + c Y_{t-1} + g Z_{t-1} + h W_t + U_t$$

$$X_t - X_{t-1} = B (X_t - X_{t-1})$$

The reduced form of equation being

$$x_t = a_0 + b_2 P_{t-1} + b_3 P_{t-1} + b_4 Z_{t-1} + b_5 W_t + b_6 X_{t-1} + V_t$$

where $a_0 = aB$, $b_2 = bB$, $b_3 = CB$, $b_4 = gB$, $b_5 = hB$, $b_6 = 1 - B$ and $V_t = B u_t$

and X_t = Standard irrigated acreage

x_t = Standard irrigated acreage planned by farmers

x_t = Total irrigated acreage in all crops of the season

w_t =Annual rainfall

p_t = The relative price of the crop deflated by the prices of alternative crops.

y_t = The relative yield of the crop deflated by the yields of the alternative crops.

Rajkrishnas pioneering work in this field revealed that the farmers of the Punjab adjusted acreage under competing crops like wheat and cotton in the same manner as farmers in USA. In other words, economic forces operate both in the under developed and highly developed countries in a similar manner. This finding ruled out the need for explaining the behaviour of the so called subsistence farmer in the developing economies in terms of non-economic factors.

Following Rajkrishna's approach Sethi (1966), used a non-linear- supply function. He postulated that due to the operation of the Law of Diminishing Marginal Product, linear model cannot be considered realistic. He therefore, tried several non linear functions of which he found the following one to be the best.

$$1\text{-}Y_t/2t = \text{Exp} - [a_0 + a_t P_{t-1} + a_2 X_{1t} + a_3 X_{2t} \ldots\ldots\ldots\ldots + U_t]$$

Where x_1 X_2 etc are other relevant variables such as yield, rainfall, etc., and

Y = acreage of the relevant crop,

Z = acreage of the competitive crop,

P = relative price,

U = random term.

He found not only the fit to be better in terms of higher value of R^2, but also the magnitudes of price elasticities to be larger in case of non-linear function than those found on the basis of the linear function. Sethi shows further that if the linear function is used, the price elasticities would be different for different sub-periods or long periods. Sethi calls the studies on the lines of Rajkrishnas'crop substitution functions' (CSF), they are not in a way true supply functions (TSF). Changes in acreages are used as proxies for changes in production the underlying assumption being that the farmer can control the use of acreages but cannot plan for production in view of uncertainty of weather. This will be true in so far as land is a major input and other inputs are closely associated with the use of land.

In a recent study relating to paddy in Kerala State, Pillai (1969) has extended the analysis of supply response a little further in addition to area. He has taken into account productivity and production for observing the impact of movement of prices. He has taken both the current and the lagged prices and has found that all the three variables, namely, production, productivity and area, are responsive to price changes. However, there was no systematic change in the value of R^2 when current prices and lagged prices were used as independent variables.

Herdt (1964) has an important contribution relating to the supply responses. His study differs from that of others in that he has attempted to estimate the response of supply of aggregate agricultural output to changes in price of agricultural products. He has estimated, probably for the first time in the Indian context, the elasticity of the aggregate agricultural supply. His research relates to the Punjab region and covers two periods. 1) 1907-46 and 2) 1951-64. He has worked supply responses separately for 12 districts of the region. Along with the price he has considered other relevant variables such as weather, canal irrigation, new technology, etc, Weather has been represented by rainfall for different crucial months and technology by a trend variable. For the period 1907-46, the results show positive response of aggregate output to changes in prices (real) of agricultural products. During this period the contribution of weather- also has been found to be significant. For the latter period viz, 1951-64, the results are divided .Of the 12 districts studied, five shows negative aggregate supply elasticities and the remaining districts show positive elasticitics.

Literature on crop supply response concentrated mainly on the annual crops and perennial crop received little attention till the 60s. The essence of previous econometric, studies of perennial crops supply response models are mainly related to the issues and problems of investment in perennial crops. Various supply response models throw light on various shift variables identified and relationships explained by different researches in the field.

Bateman (1965) estimated the supply functions for- Ghanian cocoa, in 1965. His model related producers expectations about future demand and supply with actual new planting and replanting. He used Nerloves adaptive expectations scheme to transform the expected price into determinants of planting. Actual planting is then related to observed prices and actual output becomes a function of actual planting price and natural factor namely rain, humidity etc.

The Bate Man, (1965), Model.

$x_t = a_0 + a_1 P_t + a_2 C_t + U_t$

where X_t = number of acres planted in year t.

p_t = average expected future real producer price of cocoa

c_t = average expected future real producers price of the competing crop viz coffee.

$$p_t = \frac{\Sigma_{t-0}\ P^*_{t+1}}{[1 + r]^t\ /\ n+1}$$

$$C_t = \frac{\Sigma_{t-0}\ c^*_{t-1}}{[1 + r]^t\ /\ n+1}$$

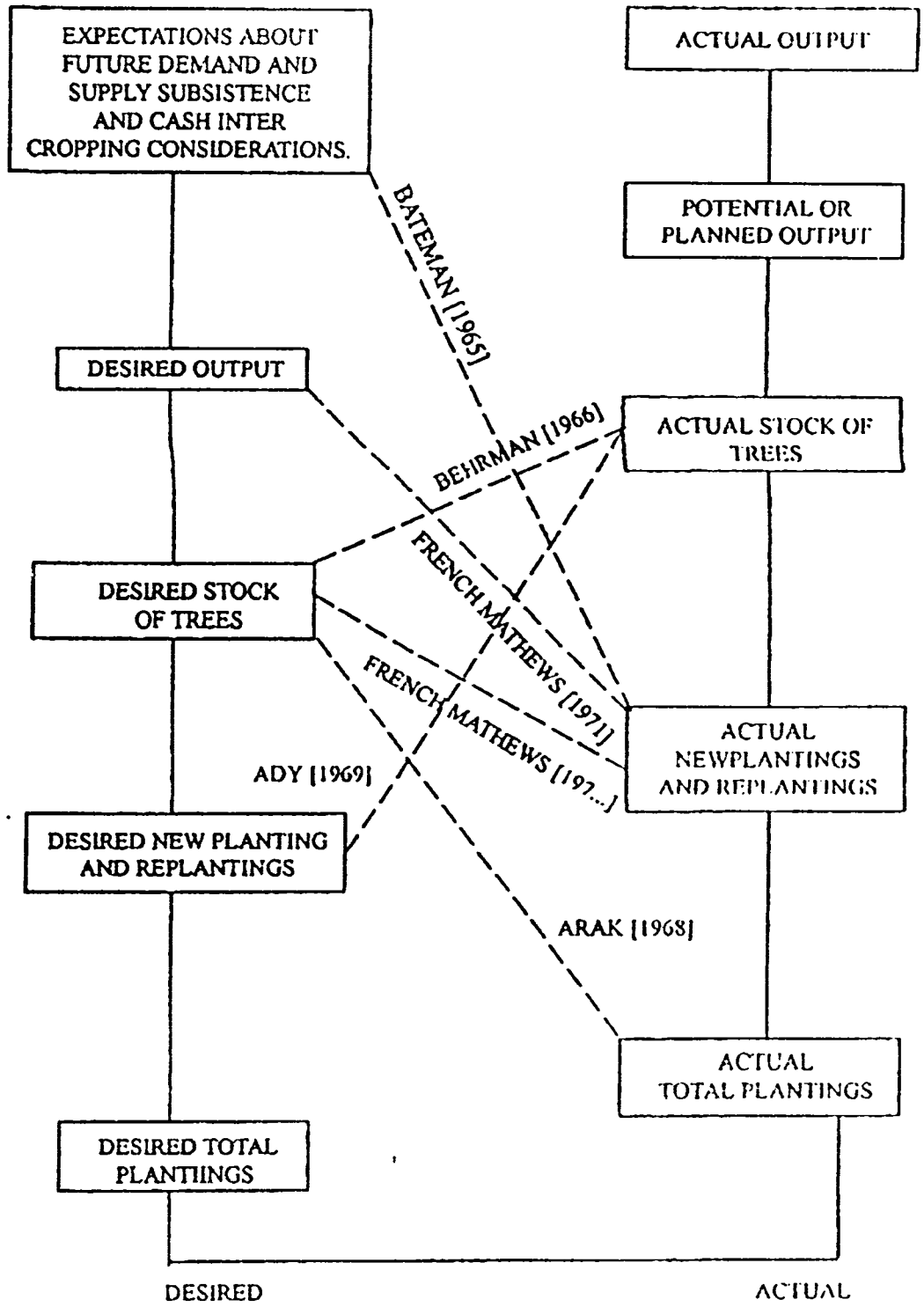
P^*_{t+1} = Expected real producers price of cocoa in year t + 1

C^*_{t+1} = Expected real producers price of coffee in year t

r = farmers subjective rate of discount.

n = life of the perennial crop.

Fig : 1.1 - Flow chart of major perennial crop supply studies



The estimating equation is attained

$X_t = a_0B + a_1 BP_t + a_2BC_t + [1 - B]Y_t - a V_t$

Where $V_t = v_t - [1 - B] V_{t-1}$.

Then

$$\frac{\Sigma_0 P^*_{t-1}}{[1+r]^i} - \frac{[1+B]\Sigma_0 P^*_{t-1}+I}{[1+i]} = [n+1]\ B P_t$$

After some algebraic manipulation we get

$$P^*_{t+n} = \frac{[1+r][n+1]BP_t + [1-B]P^*_{t-1} - (r+B_t)n\Sigma_0 P_t + n-1}{[1+r]\qquad[1+i]}$$

This is the price expectations formation equation implicit in Bateman's model.

J.R. Behrman' estimated the pricing response for cocoa in 1968. His model is based on a planting equation relating actual to the desired stock of trees. As the flow chart indicates this is complemented by an equation relating the desired stock of trees to the expected prices.

The Behrman,(1968), Model.

$$X_t = a_0 + a_{11}P^*_t + a_{12} C^*_t + U_{1t}$$

Where X_t * = desired acreage in cocoa in the year t

P^*_t = expected price of cocoa and coffee respectively in year t

$$X_t - X_{t-1} = a_{20} + 2[X^*_{t-1} - P_{t-1}] + U_{2t}$$

$$P^*_t - P^*_{t-1} = a_{30} + B[P^*_{t-1} - p_{t-1}] + U_3{}^*_{t-1}$$

$$C^*_t - C^*_{t-1} = a_{40} + Plc^*_{t-1} - C_{t-1} + U_{4t}$$

Estimating equation is

$$X_t = b_0 + b_1 x^*_{t-1} - b_2 X_{t-2} - b_3 P_{t-1} - b_4 C_{t-1} + V_0$$

where $a_0 = a_{10}\ B + a_{11}\ a_{30} + a_{12}\ a_{40}$

$b_1 = [2 - 2 + B]$

$b_2 = a_{11}\ \ 2B$

$b_3 = a_{12} \quad 2B$

$v_0 = 2V_0 + U_{2\,t-1} - [1+B] - U_{2\,t-1}$

$u_0 = U_{1t} - [1+B] \quad U_{t-1} + a_{11} U_{31} + a_{12} U_{4t}$

The Behrman model is expectation adjustment model and it was used to estimate supply response for annual crops and it is the most satisfactory of all models available.

Another economist named Ady,(1968),in his "supply function in Tropical Agriculture" formulated capital stock model based on the assumption that the existing or surviving stock of trees is an important determinant of further planting i.e. the actual tree stock influences desired new plantings. This basic relationship is complemented by equations relating actual to potential output and hence potential output to existing tree stock.

The Ady model:-

$X_t = a_0 + a_1 P^*_t \quad -a_2 A_{t-1}$..... (1) where,

P^*_t = expected price of Cocoa in year t

A_{t-1} = acreage under Cocoa in year t-1

X_t = difference between A_t and A_{t-1}

$P^*_t = P_{t-1} + B\,[W_{t-1} \quad P_{t-1}]$

$0 < B < 1$

Estimating equation is obtained as

$X = a_0 + a_1 [1- B] P_{t-1} + a_1 B w_{t-1} - a_2 A_{t-1} + U_t$

Arak,(1968),focused her interest on the determination of changes in the tree stock. It is basically a stock adjustment model, relating the actual new plantings to the desired stock of trees. The remaining equations in the model completing the adjusting mechanism are,

a) An equation relating the rate of new planting and replanting to the proportion of old to young trees and expectations about the labour cost due to near monopsonistic market for labour in the Sao Paulo coffee sector which she was studying.

b) An equation accounting for the cost of tree removals.

c) An equation accounting for tree abandonment.

Other important perennial crop supply response studies are as follows:

French and King,(1985), stated that for different age groups of trees the replanting response to price may be different. They also examined the rate of new planting of cling peach trees. With reference to market intervention programs, the elements of risk and uncertainty involved in the production of perennial crops are high. Uncertain market condition is not a favourable climate for prospective investors Market intervention programmes were aimed to ensure a guaranteed minimum price for the produce. It has been observed that the rate of new planting was higher when market intervention programmes were in effect compared with those after the termination of the programme.

Mani, (1982), conducted a study to find out the behaviour of natural rubber prices and the market structure. He divided the post 1969-70 phase into two sale periods is from 1969-70 to 1974-75 and from 1975-76 to 1978-79. In the first sale period, there was marked seasonality in prices, while the second period was characterised by wide fluctuations due to uncertainties in the market. He also formulated an econometric model of price behaviour and found that the monthly price movements are determined by variables like production consumption and manufacturers share in total stock. It was also found that domestic natural rubber prices were much higher than the natural rubber prices in other countries and the natural rubber prices were found to be lower than other raw material prices. Co-operative marketing was found to be unpopular among small holders. Estates were able to realise better price than small holders due to product differentiation.

Ipe and Prabhakaran,(1988), in a study of "Price response of a perennial crop"- A case of Indian natural rubber, found that the long run elasticities with respect to the expected price and the changes in the expected yield of rubber and coconut were 0.0855, 0.0297 respectively. The increasing prices and yield of rubber fall in the productivity of coconut due to pests and disease and the subsidy scheme for planting rubber might have accelerated on the planting of rubber in new area and substitution of coconut by rubber. Other factors which might have accelerated rubber cultivations are the differential slab rates and exemptions provided in the Agricultural Income tax Act in Kerala and the plantation labour act which did not apply to holdings below 10-17 hectares. The Agrarian relations Bill of Kerala which exempted rubber and other

plantation crops from the ceiling level might have resulted in the conversion of large areas into rubber.

Devi, (1981) studied the short run and long run supply responses to the price, in the case of Natural rubber in India covering the period of 1955 to 1980. The short run supply elasticity refers to harvesting decision, while the long run supply elasticity refers to planting decision as explained elsewhere. In the case of small holdings the short run elasticity is only 0.578which is positive and less than cone. This observation is in line with what we expect in the case of perennial crops. But the corresponding figure in the case of estates is -0.345 which is negative and very small. In the case of estates trade unions and other rigidities render it uneconomical to with draw any latent force to reduce production in response to a fall in price. Long run supply elasticities were estimated by taking both estates and holdings together. In the case of long run supply planting decisions, there is positive response to price only if prices as far back as seven years are taken into account; otherwise there is significant negative relationship between price and new planting activity.

Another article, (1988), found that the price elasticity of supply of rubber is less than unity. It means that though the producers are able to earn as much as they could, the supply could be expanded proportionately more than the rise in price. This study also reveals that backward and forward linkage effects of plantation sector with the rest of the economy is negligible.

Worth and Strong, (1984), studied the nature and magnitude of shift in the derived input demand and cost functions associated with different levels of rubber growing technologies. The paper analyses two different aspects of the problem .The study tried to answer questions such as whether past research has produced technology based towards one or more input factors and the effect of past technology advances on the unit cost of producing raw rubber. The methodology is based on the assumption that the basic underlying production process may be described by a Cobb-Douglas production function. The study is based on the data collected from the estate sector pertaining to three production years viz. 1964, 1970, and 1976. The conclusions of the study are:-

1. Technological developments which occurred in the past have played an important role in the Malaysian rubber industry in increasing productivity and reducing unit cost of production.

2. Past research has not been based in favour of one or more inputs.

3. The gains from research along the same lines as in the past appears to have been diminishing over time.

Chew, (1984), estimated the rate of technological changes in Chinese rubber small holdings in Peninsular Malaysia under the frame work of a production function. A Cobb Douglas production function was specified and fitted to two sets of cross section data collected in 1963-64 and 1978. The study concluded with the observations that the technological changes in Chinese rubber small holding is the capital augmenting type. The estimated rate of progress was about 1.2 percent per annum.

Hartely et.al., (1987), analysed the replanting responses of growers against price movements in the case of natural rubber in SriLanka. The replanting response was analysed by expressing its rate as a function of actual price of rubber, long term expected price of rubber and area eligible for replanting during each year. The empirical analysis led to the conclusion that replanting response with respect to long run expected normal price is significant and positive with elasticity + 1.7.

Trivedi, (1991), separately studied the factors governing new planting replanting decisions for the period 1966 to 1955. The analysis was based on the first order condition of revenue maximisation that present value of net marginal excepted revenue from additional investment equals the marginal cost of investment. The elasticity of new planting with respect to price is +1.60.

National Council of Applied Economic Research (NCAER),(1980), has conducted a study to evaluate the demand and supply of labour for ten years i.e. from 1980-81 1989- 90. The study asserts that the major factors affecting the consumption of rubber include production of all kinds of tyres and tubes and other rubber products like storage batteries conveyer and transmission belts, foot wears various types of hoses etc. Demand for these items in turn depend upon the production of all kinds of tyre and tube, fitted vehicles and other economic indications like net national product, indices of industrial and production, prohibitions of auto vehicles etc. Based on the above indications and using the regression analysis they worked out the demand for all kinds of rubber. They forecasted demand for natural rubber as 2,16,411 tonnes and 2,98,447 tonnes in 1984-85 and 1989-90 respectively.

They have projected the supply of rubber for the same period. Production of natural rubber is directly related to tappable area and yield per hectare in that year. They have also worked out the future levels of production of natural rubber by multiplying the values of tappable area with corresponding yield levels. The estimated production of natural rubber in 1989-90 is 2,16,225 tonnes.

CHAPTER-II

ANALYSIS OF NR SUPPLY RESPONSE

Section 2.1:- Supply response: Basic concept

Supply response shows the production of the crops which would be produced in response to different average expected prices keeping some influencing factors in production such as technology, weather input, prices, extent of risk etc. constant during a specific time period.

Mathematical expression of supply function may be given as,

$Q = f(P, R, T, W, O)$

Where,

Q = aggregate production

P = price of farm products

R = price of inputs

T = cost of technology

W = weather

O = other factors

These variables are called shift variables. In ordinary supply function the traditional 'Ceteris Paribus' assumption is allowed to prevail, the price in the current year is assumed to influence supply and influence of past prices are assumed to be constant. When these supply shifters are allowed to act, the growers react. The underlying aim of supply response studies is to find out how the farmers intend to react to movements in price. His response reflects planting and acreage decisions regarding a particular crop. Again supply response studies reveal how the farmers intend to reallocate his efforts between various crops in response to change in relative prices, Therefore, supply response studies are vital in making intelligent policy decisions in the agricultural field. It throws light on the farming psychology in the short run and also in the long run.

The question regarding growth of supply has two aspects, both equally important. the more widely known and understood aspect refers to the growth of agricultural products. This is a vast problem covering finding of resources for agriculture to grow and improving the institutional frame leading to a shift of the

supply function. The second and equally important aspect deals with the shape of the supply curve or response of the supply of agricultural products to changing levels of prices. These two factors are to some extent interrelated.

Section 2.2:- Various aspects of agricultural supply responses

Some of the characteristics of agricultural supply responses which are relevant in agriculture are:

1. **Aggregate Acreage Response:** As a result of a change in prices the increase the area under the crops provided additional land is available to them.
2. **Cropping Pattern Response:** In an economy where varieties of corps are grown and land is limited, response of one crop to changes in relative prices will be reflected more in terms of changes in relative acreages rather than changes in absolute area under the crop. Intercrop substitution might also lead to changes in the overall cropping pattern over the period. Other dimensions of substitutability take the form of substitution between the HYV and traditional varieties of the same crop. It automatically leads to the substitution between new inputs and old inputs especially between chemical fertilisers and organic manures. In the case of natural rubber, this type of substitution occurred in the form of replacement of old clones with the new improved variety viz RRII 105. The practice of a crop rotation might also lead to a systematic substitution of one crop for another in alternative years. But this type of response is possible only in the case of annual crops and is not found in the case of perennial crops like rubber.
3. **Cropping Intensity Response:** As a result of a rise in prices the farmers might utilise their land twice or thrice and thus raise their output through raising the cropping intensity without changing the net area sown. But the cropping intensity response to price changes may be conditional on the availability of sufficient irrigational facilities and credit facilities which may be considered to be the preconditions for the adoption of the multiple cropping system.

4. **Productivity Response:** If the possibility of increasing land inputs is difficult, the farmers might prefer yield raising intensive farming technique of production by using modern inputs like HYV seeds, chemical fertilisers and insecticides etc. rather than land using extensive farming technique.

5. **Behavioral response:** Supply response in its generalised sense of the term also includes behavioral responses of the farmer. By behavioral response in agriculture, we mean broad changes in the decision behaviors of farmers effecting agricultural supply in response to the price and other stimuli, e.g. behavioral response in relation to changes in climatic conditions, change in attitude towards the traditional method of cultivation, adoption of new agricultural practices etc.

Some of these various aspects of supply response could not be brought in the present study explicitly due to the paucity of relevant data, but to the extent possible they have been incorporated and utilised in formulating the regression model and in interpreting the empirical results based on them.

The importance of price response of supply is derived from the fact that a perverse relationship or absence of relationship between changes in prices and supply blunts the policy instruments for state action. Where forces of growth build up at a slower pace than the forces of demand the instrument of price to moderate farmers to act acquires overriding importance only if the instrument is effective.

From the point of devising remedial policies it is desirable to make a distinction between ex ante and ex post price responses. The farmers may be ex ante responsive but constraints, and shortages of various kinds may prevent them from being so. Another point is that one has to talk of different degrees of price responsiveness rather than just the two states - price responsiveness and price indifference. In this study, though it is only the ex post supply response that has been brought in the various equations and studies the distinction between the ex ante and ex post responses is kept in mind.

Section 2.3:- Selection of variables - Major considerations

Theoretical discussion and past empirical research regarding aggregate agricultural supply suggest that the following aspects should receive due consideration in the analysis of aggregate production a) Demand, Supply and price interactions b) Changes in both acreage and yield per acre the two components of production c) Uncertainty relating to prices d) Adjustments over time.

Demand, Supply and Price Interactions: In the empirical works relating to supply analysis, a single equation approach is often used. The usual argument against is that in general it gives biased estimates if the relation under study is a member of a

system of simultaneous relationships, The general condition for ordinary least squares regression to yield unbiased estimates is that disturbance term in a postulated relation should be uncorrelated with the explanatory variables. This condition is not violated even if the relation to be estimated is a member of a system of relationships when such a system is a recursive system. By recursive system, we mean a system that is composed of a sequence of causal relationships. For such a system the values of economic variables during a given period are determined by equations in terms of values already calculated, including the initial values of the system. It is logical to assume such a recursive system in case of agricultural industry because 1) biological cycles of crop production suggest that adjustments in supply in response to prices become perceptible only after a full production period and 2) agricultural industry competitive in nature the actions of one farmer or a small group of farmers have little influence over the price they receive for their products or the price they pay for the inputs. Decisions regarding supply in period 't' are made at the beginning of the period on the basis of prices in the past. Thus supply in period 't' depends on the prices in period t-1, t-2,...etc. While the price in period 't' is a function of exogenous supply in period t.

Acreage Vs production Elasticity: Supply response to price changes is indirectly examined through the acreage response to price. Planted area as dependent variable is generally taken as better decision variable by most researchers because area under the crop in most cases, under the direct control of the farmers but this is not the case with the actual production which is governed by the application of inputs and the biological processes involved. Unlike the factory processes the later are not fully under control.

However, land will be a reasonably good proxy for production so long as it is a major input and other inputs are closely complimentary to it. In a situation where it is not so and the use of non land inputs are influenced by changes in prices, use of non land inputs should be explicitly considered while determining supply response. Moreover, agro climatic condition may restrict allocation of land among different crops, but the allocation of other inputs like labour fertilizers, pesticides, irrigation etc. may not be subject to similar restriction. Besides, land is not a homogeneous input. If the non land inputs are in short supply, the farmer may decide to allocate better quality of land to a more profitable crop in order to increase production. Hence

even for an individual crop, acreage elasticity may be lower than production elasticity. Inadequacy of land as a proxy for production can be shown easily.

Let Q = Planned Output

A = Actual Planted Area

Y = Planned Output per unit of Area

P = Expected Price

If we define E_{QP} as the elasticity of planned production with respect to price P (relative to the price of competing crop or to the prices paid by the farmers), then we have $E_{QP} = E_{AP} + E_{YP}$ ie. Elasticity of planned output equals the sum of the elasticities of planted area and of planned yield per unit of area (assuming that the interaction between them will be negligible and hence can be ignored). The higher elasticity of yield, the higher will be the under estimation of E_{QP} by E_{AP}.

Inadequacy of the approximation of E_{QP} by E_{AP} is much more evident in the case of supply of aggregate farm production. Given the almost inelastic supply of total land under crops, it is likely that the response to price may come through variations in non land inputs. Hence, the component E_{YP} become more crucial in the context of response of aggregate production and hence we cannot afford to ignore it.

Uncertainty regarding Prices and lags in Adjustments of Supply: In the dynamic setting of supply response it is necessary to pay attention to the theories relating risks and uncertainties and also to adjustments over time and fixity of resources, if suspected. For most of the farm commodities, farmers have to commit inputs some time before the output is realized. Naturally they have to base their plan on the expected course of prices in future. It is difficult to observe subjective price expectations of individual farmers for a long period of time. Hence theoretical formulation of plausible process of average expectations of a group of farmers is necessary. Such theoretical constructs provide a link between farmer decisions at the micro level and their impact on supply at the macro level over time. One such postulation was originally formulated by Cagan (1956). Later on, it was used extensively in supply response studies by Nerlove (1987) and other authors.

Section 2.4:- The Nerlovian Supply Response Model.

Marc Nerlove (1956) has attempted to estimate the elasticity of supply for corn, cotton and wheat in the USA.

Nerloves model basically consists of three equations:

$$A^*_t = a + b_1 P^*_t + b_2 Z_t + U_t \quad \text{.....[1]}$$

$$P^*_t = P^*_{t-1} + b_3 [P_{t-1} - P^*_{t-1}]$$

$$\left.\right\} \quad 0 < b_3 < 1 \text{.....(2)}$$

$$\text{or } P^*_t = b_3 p_{t-1} + [1-b_3] P^*_{t-1}$$

$$A_t - A_{t-1} = b_4 [A^*_t - A_{t-1}]$$

$$\left.\right\} \quad 0 < b_4 < 1 \text{.....(3)}$$

$$\text{or } A_t = b_3 A^*_t + [1-b_4] A_{t-1}$$

Where,

A^*_t = Long-run desired acreage of the crop at time t

A_t = Actual acreage at time t

P_t = Actual price at time t

P_t = Expected normal price at time t

Z_t = Other exogenous factors affecting supply at time t.

u_t = A random residual

b_3 = Price expectation coefficient

b_4 = Acreage adjustment coefficient

Equation (2) presents the process of adaptive price expectation and indicates that the current expected price P^*_t falls some where in between last year actual price (P_{t-1}) and the last years expected price (P^*_{t-1}) depending upon the elasticity of expectation. If b_3 is zero the actual prices are totally divorced from expectation implying that there exists only one expected price for all time periods, while a unitary value implies a naive cobweb type model where expected prices are identical with previous years' actual price.

Acreage adjustment mechanism is presented in equation (3). The coefficient b_4 indicates how fast the farmers are adjusting to their expectations. A value of b_4 close to zero would mean that the farmers are very slowly adjusting to the changing prices, whereas the value of b_4 close to one would mean that the farmers are quickly adjusting to price changes. A meaningful interpretation thus requires that $0 < b_4 < 1$.

Allowing both adaptive price expectation (equation 2) and the area adjustment (equation 3) to operate in to the model, the reduced from equation thus obtained is called Nerlovian full adjustment model i.e.,

$$A_t = ab_3b_4 + b_1 b_3 b_4 P_{t-1} - b_2 b_4 Z_t - b_2 b_4 [1 - b_3] Z_{t-1}$$
$$+ [(1-b_3) + (1-b_4) A_{t-1} - [1-b_3] [1-b_4] A_{t-2} \qquad (4)$$
$$+ b_4 u - b_4 [1-b_3] u_{t-1}$$

If b_3 is assumed to be unity, the reduced form equation becomes simpler and known as the Nerlovian partial adjustment model i.e.

$$A_t = ab_4 + b_1 b_4 p_{t-1} + [1-b_4] A_{t-1} + b_2 b_4 Z_t + b_4 u_t \qquad (5)$$

Various estimation problems arise while estimating the Nerlovian full adjustment model. One such problem arises because of the presence of auto correlation in the error term which is clearly evident in the reduced form equation itself [equation 4]. This brings in the well known inconsistency in the OLS estimates. It renders the use of Durbin Watson d statistic invalid. Besides this many other problems are encountered when a model of Nerlovian type is used for annual crops and it has not worked well for perennial crops specially livestocks. However, Nerlove, Greinerand Carvelho (1987) have recently developed a new model for United States cattle industries based on the dynamic optimisation principle.

Section2.5:- Other types of distributed lags models and problems in their estimation

The problem arising in the case of estimation of a general type of distributed lag equation is that of estimating a sequence of infinite parameters of β is with finite set of observations. The usual restrictions imposed on such a sequence are 1)β's are of the same sign 2) they have a finite sum.

The direct least squares estimation of the general form is rather impossible because the number of parameters to be estimated is infinite. Further, the explanatory variables are intercorrelated as they are lagged variables belonging to the same time series. Hence serial correlations among them are likely to lead to large standard errors of the estimates of βs. However, in a practical situation approximation of a distributed lag model with an appropriate function is feasible i.e, one can retain as many lagged terms in x_t, as is desirable under the given sample size and thus ignore the additional lagged terms in x_t, when they cease to increase the explanatory power of the equation significantly.

Alternatively one can try simple one parameter schemes on a finite number of βs. The simplest form is given by a moving average with equal weight i.e.

$\beta i =$ $0 < i < N$

and $\beta i = 0$ for $i > N$

In this case one can construct moving averages of different lengths varying the value of N and choose the one which gives best fit to the data. One could also try moving averages with declining weights as follows. If N is the length of moving average then

$$W_I = \frac{N-I}{N[N+1]/2} \quad \text{for } 0 < i < N$$

$W_I = 0$ for $i > N$

Although, this method of moving averages is very simple and therefore useful, in practice algebraic and statistical treatment of such models become difficult. In fact, pre assignment of βs takes away the very purpose of enquiry into a possible shape of lag function and this is a more serious practical objection to procedure. Hence in order to get over this difficulty of estimation of infinite terms we can introduce some simplifying assumptions regarding the form of the lag e.g. geometrically declining lag with $b_i = \alpha\beta_{ii} = 0$ ..... α. In this case the problem gets greatly simplified as we have to estimate only two parameters α and β. However, it may be noted that this simplification has been achieved at the cost of imposing on the data specific lag structure. With the above restrictions on βs we have the following equation,

$y_t = \beta_0 x_t + \beta_i \; x_{t-1} + \ldots\ldots\ldots\ldots + u_t$

$$y_t = \alpha \sum_{i>10}^{\alpha} \beta_i x_{t-i} + u_t$$

$y_t = \alpha x_t + \beta y_{t-1} + u_t - \beta u_{t-1}$

$y_t = \alpha x_t + \beta y_{t-1} + V_t$

$V_t = u_t - \beta u_{t-1}$

The reduced form equation is very convenient because it involves only two explanatory variables. However its estimation by OLS method yields poor estimates in terms of statistical properties. The major sources of difficulty are existence of serial correlation in a composite disturbance form u_t and correlation between u_t and

Y_{t-1}. We cannot get away with just an arbitary assumption that V_t is independently distributed. In the time series analysis we are usually confronted with existence of positive serial correlation in the residual. It is known that presence of serial correlation is a more serious problem in distributed lag models than in a classical regression case where all the independent variables are exogeneous and non stochastic. In the latter case OLS method yields only inefficient estimates, while its application to the distributed lag model gives not only biased, but also inconsistent estimates. Moreover application of generalised least squares in the classical regression case improves efficiency of estimators considerably, but this does not hold if some of the regressors are lagged endogeneous as they are in the case of distributed lag models. In the case of positive serial correlation OLS method overestimates the value of β coefficient and hence estimated average lags are obviously biased upwards. Even the test for serial correlation provided by Durbin Watson statistic is inappropriate in the presence of lagged endogenous variables as the test statistic is itself biased in this situation.

One major illustration is Koyck's distributed lag function

$$w_i = [1-\lambda]\lambda_i$$

ie $\quad y = b\,[\,1-\lambda\,]\,[\,1+\lambda L+\lambda 2L_2+.....]\,x_t + u_t$

ie. $\quad [1-\lambda L]\,y_t = b\,[1-\lambda]x_t + [1-\lambda L]u_t$

$$y_t - \lambda y_{t-1} = b\,[1-\lambda]\,X_t + u_t - \lambda u_{t-1}$$

Where,

$$A\,[L] = 1-\lambda$$

$$T\,[L] = 1-\lambda L$$

One of the main advantages of Koycks distributed lag function is that this form is consistent with several expectations and partial adjustment models and offers a great simplification as it requires an estimation of only one additional parameter λ, however it involves restrictive assumption that the highest reaction or adjustment occurs in the beginning of the period and then it slows down. It is possible to get away partially with this restriction by introducing several separate early terms in the sequence W_i before starting geometric decline. We can write this modified form in the lag operator notation as follows.

$$W\,[L] \quad = W_0 + W_1L_1 + W_2L_2\,[1+\lambda L + \lambda_2 L_2.....$$

ie. $W\,[L] \quad = W_0 + W_1L_1 + W_2\,L_2 / [1-\lambda L]$

$$= W_0 + [1-\lambda L] + W_1 L\,[I-\lambda L] + W_2 L_2$$

$$= W_0 + [W_1 - \lambda W_0]\, L + [W_2 - \lambda W_1]\, L_2 \,/\, 1-\lambda L$$

$$= A\,[L] \;/\; T\,[L]$$

In this case the final reduced form distributed lag equation will be,

$$y_t - \lambda y_{t-1} = b\,[W_0 x_t + (W_1 - \lambda W_0)\, X_{t-1} + (W_2 - \lambda W_1)\, x_{t-2} + (u_t - \lambda u_{t-1}]$$

A way out is the use of Two Stage Least Squares (TSLS) method. TSLS is a two step estimation procedure. In the first step we regress y_t, on x_t, and then add x_{t-1}, X_{t-2} etc. as long as regression coefficients make sense. In the second step we regress y_t, on x_t, and y_{t-1}, [i.e. estimated y_{t-1}, which gives the highest R2 and significant estimates]. This solution was suggested by Griliches.

Stage 1: $y_t = b_1 X_t + b_2 X_{t-1} + b_3 X_{t-2}$.....

Stage2: $y_t = b_1 X_t + b_2 X_{nt}$ _

Now the Durbin Watson Statistic can be used and the estimates will be unbiased. But it has been found that in such a model, multicollinearity presents a problem using the independent variable and this way causes x_t, x_{t-1}..... etc. to be linearly related.

Gwyer uses Fishers method of compound variable to get round this difficulty of multicollinearity. Fisher suggested a method of constructing a compound variable which incorporates a lagged weighting system following a simple linear lag scheme.

$X_1 = [3x_t + 2x_{t-1} + x_{t-2}]$

$X_2 = [4x_t + 3x_{t-1} + 2X_{t-2} + X_{t-3}]$

$X_3 = [5x_t + 4x_{t-1} + 3X_{t-2} + 2\,x_{t-3} + X_{t-1}]$ and so on.

In the present study a declining weights specification is used. Under this specification the producers are assumed to form their expectations as to future prices on the basis of current prices and past prices with declining weights. This is particularly important in the case of rubber because rubber tree matures after five to seven years. A long run and short run response are implied since the effect of a given price in one period is assumed to be distributed over more than one period.

Examples of Fishers model are given below. In Fisher 1 we estimated,

(a) $PXW\,2 = 1/3\,[2P_t + P_{t-1}]$

(b) $PXW\,3 = 1/6\,[3P_t + 2P_{t-1} + Pt]$

(c) $PXW\,5 = 1/15\,[5P_t + 4P_{t-1} + 3P_{t-2} + 2P_{t-3} + P_{t-4}]$

(d) $PXW\,7 = 1/28\,[7P_t + 6P_{t-1} + 5P_{t-2} + 4P_{t-3} + 3P_{t-4} + 2P_{t-5} + P_{t-6}]$

Here the price variable was formed as a weighted sum of current and past few years prices with declining weights [N_t / T_{t-1}] [ie. newly planted area as a ratio of tappable / mature acreage] was regressed on this price variable in Fisher 11 the weighted sum of the logarithms of these prices was taken. Two equations were estimated with Plxw 3 and Plxw5.

The period of the analysis included in the present study is 1976-77 to 2002-2003. One point that was taken into consideration in selecting this period is that major technological changes were introduced in the rubber plantation industry in the country in the late sixties and its effect on yield was manifested from the late seventies because of the long gestation period involved. That is why the period 1976-77 to 2001-2002 have been taken as the period of analysis of the present study. Before examining the supply response of rubber as a perennial crop it is relevant to keep in mind certain peculiar characteristics of rubber as outlined below.

Investment in rubber plantation is similar to investment in a capital asset. This is because rubber tree yields a continuous stream of returns like any other capital asset. As decision making in the case of perennials becomes a problem in capital theory where the objective is to maximise the present value of the discounted future stream of net returns from the rubber investment. In order to understand the production behaviour in rubber industry it is necessary to demarcate the time horizon of the investment i.e. to distinguish between short run and long run. By Marshallian Cournot definition short run is a period in which productive capacity is fixed and supply variations are due to variations in the use of variable factors. Production decisions show variations in short run and long run.

In the very short run the decision to produce rubber depends on the decision to tap the tree or not. If the price is remunerative, then the output flow is controlled by increase of tapping and the use of chemical stimulants etc when the price is low in the short run, cultivators in land abundant countries may increase production to maintain their earnings from rubber. But if the price drop persists in the long run, the small holders would turn to alternative crop cultivation or seek alternative employment.

The ability to halt production instantaneously by not tapping and the inability to increase the output instantaneously beyond the trees potential output introduces an asymmetry into the short run production elasticity of natural rubber, as producers can

only respond to price rises only if the tapping rate is below the maximum feasible rate.

Section 2.6:- Short term response to price

An attempt is made to estimate the short term response to price in terms of the effect on output of price change. This does not involve lagged variables. The response of the farmers is to the current variables. Price is the major factor influencing the farming decision in quantity offered for sale in the market. In the short run quantity offered basically depends on the capacity utilisation as explained elsewhere in this chapter.

In the study two types of multiple regression were run for estimating the short term response of output of rubber to the price for the period 1976-77 to 2001-2002. The first one includes the trend variable and the second one excludes it.

Regression I

$[O/T]_t = 567.045 + 0.052\ p_t + 27.75\ t$

[1.67] [4.99]

$\bar{R}^2 = 0.8861$ F = 86.56 D.W = 0.274

Where,

$[O/T]_t$ = production of rubber as a percentage of tappable area or yield per hectare of tappable area in year t.

p_t = actual price of natural rubber in year t

t = trend variable

Both the price coefficient and trend variable are significant at 5 percent level of significance. The F ratio which shows the overall significance of the regression model is 86.56 which is significant at 1 percent level. The price elasticity is estimated to be 0.25.

Regression II

It is run to estimate the temporal effects on yield per ha.

$O_t = 582.14 + 35.81\ t$

[12.53]

$\bar{R}^2 = 0.877$ F = 156.96 D.W = 0.162

0t = production of rubber as a percentage of tappable area.

t = trend variable.

$\bar{R}^2$ and F ratio are highly significant it shows that short run production is greatly influenced by time variable.

Regression III

In this equation, production in metric tonnes was regressed on pt along with two more new variable ie. newly planted area and tappable area.

$O_t = -199883.63 + 20.69\ p_t - 2.04\ N_t + 1.80\ T_t$

[2.21] [-1.86] [11.14]

$\bar{R}^2 = 0.969$ F = 234.43 D.W = 0.409

O_t = production in metric tonnes in year t

p_t = actual price of all grades of rubber in yeart t

N_t = newly planted area in year t.

T_t = Tappable area in year t.

All the variables are significant at 0.05 level of significance. The price coefficients and the coefficent of T_t are positive revealing positive response of O_t to N_t and T_t

But the presence of the additional variable N_t and T_t leads to negativity of the intercept term. The negative sign of N_t shows that output in the short run is negatively related to the newly planted area. This is expected as tapping of these plants planted now can only be under taken after 5-7 years. The price elasticity in this case is 0.39.

Regression IV

This regression is run to estimate the short term supply response of holdings.

$O_{ht} = -16457.613 + 26.47\ p_t + 16676.99\ T_t$

[1.75] [6.16]

$\bar{R}^2 = 0.917$ F = 122.3573 D.W = 0.226

Though $\bar{R}^2$ is high price coefficient is relatively less significant. The price elasticity is 0.12. This means that output of holdings in the short run is relatively inelastic. The trend variable shows high significance.

Regression V

Dropping the trend variable supply response of holdings in the short

$OH = 8785.9376 + 107.51\ P_t$

[8.66]

$R^2 = 0.771$ F= 74.94 D.W = 0.721

When trend is eliminated intercept term became positive and price coefficient showed greater significance. The price elasticity in this case is 1.38.

Regression VI

$O_E = -50760.121 + 22.18\ p_t + 19429.74\ T_t$

[1.81] [8.83]

$\overline{R}^2 = 0.953$ F = 222.882 D.W = 0.371

Where

O_E = Output of estates

P_t = market price of rubber

t = Trend variable

Price elasticity = -0.28

In the case of estates when 0E is regressed on both p_t and T_t, time variable showed greater significance in the short run. The output of estates does not seem to be responsive to current price.

Regression VII

$O_E = -21349.79 + 116.61\ p_t$

[8.88]

$\overline{R}^2 = 0.779$ F = 78.91 D.W = 0.76

price elasticity = 0.40

Eliminating the time variable the price elasticity becomes positive and price coefficient becomes more significant. But R^2 is comparatively lower.

Section 2.7:- Long term response

For long term response we have chosen Bateman's model (1965)expressing gross investment as a function of price model. It is specified as,

$$X_t = a_0 + a_1 P_t + a_2 S_t + u_t \quad \text{.....} \quad [1]$$

Where $P_t = \sum_{i>10} P^*_{t-1} / n+1$

$$S_t = \sum_{i>10} S^*_{t+1} / n+1$$

X_t= the number of acres planted in year t

P^*_{t+1} = the expected real producer price in year t + 1 of the product being planted.

S^*_{t+1} = the expected real producer price in year t+ 1 of an alternative crop.

n = the expected age after which the trees planted in year t cease to bear

Price expectations are expected to be formed as follows:

$$P_t - P_{t-1} = b\,[p_t - p_{t-1}] \quad \ldots\ldots\ldots\ldots\ldots (1)$$

$$S_t - S_{t-1} = b[S_t - S_{t-1}] \quad \ldots\ldots\ldots\ldots\ldots (2)$$

Equations [1] and [2] are combined to estimate the price expectation to bring them in a form that can be estimated, which is,

$$bx_t = a_0 b + a_1 b P_t + a_2 b S_t + [1 - b] X_{t-1} + V_t$$

Where $V_t = U_t - [1 - b] U_{t-1}$

From this model we have dropped the explanatory variables S_{t-1}, and n i.e. the expected real producers price in year S_{t-1} of an alternative crop and the age composition of trees respectively. We have tried Fisherian and Nerlovian types of price expectations which involve lagged independent variables and in the case of Nerlovian model even lagged dependent variables.

The longrun elasticities in the Fisherian equations are derived by multiplying the price coefficients by their respective ratios of the means of price and total area [as a sum of newly planted and replanted area] as a ratio of tappable area [i.e. the mean of dependent variable] as seen in table2.1. The short run elasticities in these cases are got by multiplying the long-run elasticity by the respective weight [< 1 attached to the current price in the coefficient of the compounded price variables.

In the Nerlovian model the short-run elasticity is derived by multiplying the current price coefficient by the ratio of mean of P_t, and (N_t / P_{t-1}). The long run elasticity in this case is got by dividing the short run elasticity by b, the coefficient of expectation. In the Nerlovian case with the help of b we can find out how for back in time price influences.

Section 2.7 – 1:- Results of Declining Weights Specification

In the Fisherian equation (1) with the time variable included when the price variable is PW2 both the long run and short run elasticity estimates (-0.17,-0.07) The intercept terms(159.85) is positive and the price coefficient is significant 0.05 level of significance in the case of variables PW2 .For the price variable PW3 also both the

long run and short run elasticity estimates are negative (-0.22,-0.09).Price coefficient (-0.004) attains significance at 0.05 level. This is in confirmation with expectations as the price variable takes into consideration of a lag up to two years. When the price variable isPW5and PW7, elasticity estimates (0.07, 0.099) turned positive due to the increase in lags. Similarly in Fisher II the weighted sum of the logarithms of these prices was taken Two equations were estimated with PI x W 3 and Plx W5 short and longrun elasticities are positive. The long run and short run elasticity estimates for PlxW3 are2.90 and 0.55 respectively and the long run and short run elasticity estimates for PlxW5 are 5.10 and 0.55 respectively. Price coefficients of both equations(66.98,89.09) were significant at 0.05 level of significance.

Section 2.7 – 2:- Results of Unweighted Average Specification

Here Equal weight was accorded to current price and previous years' price and its arithmetic mean was taken. In the case of unweighted specification also the coefficient of the price variable(-0.006) attains significance at 0.05 level. $\overline{R}^2$ (0.385) and Durbin Watson statistic(0.160) are not satisfactory. The long run and short run elasticity estimates are (0.001,-0.003).

Section 2.7– 3:- Results of Specification with more lagged Values

A number of equations were estimated starting with regressing the sum of the newly planted area and replanted area (N_t / T_{t-1}) on P_t and P_{t-1} and so on till we included P_t, P_{t-1}, P_{t-2}, P_{t-3}, P_{t-4}, P_{t-5}, P_{t-6}, P_{t-7}. We found the coefficients of P_{t-4}, P_{t-5}, P_{t-6}, P_{t-7}, positive while the coefficients of P_{t-1}, P_{t-2}, P_{t-3} were negative. Choosing the estimated $(N_t / T_{t-1})_{t-1}$ from the equation where terms up to P_{t-7} were included as explanatory variables, we ran the Second stage of Least Squares regression (N_t / T_{t-1}) on P_t, and $(N_t / T_{t-1})_{t-1}$, i.e. the lagged endogenous variable to get our Two stage Least Squares Nerlovian estimates.

We estimated another set of Nerlovian Two Stage Least Squares regressions with six years lag using in the stage 1 terms up to P_{t-5} as explanatory variables. These two lags were chosen, because the rubber tree matures after 5-7 years.

In the six years lag equations the price coefficient is negative (-0.00977) and the coefficients of lagged dependent variable (0.90829) are positive. Though the price coefficient is not significant, the lagged dependent variable is significant at 0.05 level. The trend coefficient (-0.956) is negative. In the case of eight years lag

equations the trend coefficient (0.281) was found to be positive. A comparison of the eight years lag equations and six years lag equations would throw light on the long term decision. It was found that coefficient of elasticity increased from -0.06 to 0.02 in the case of short run and from -2.01to 0.01 when the number of lags were increased in the price variable. This leads to the conclusion that new planting positively responds to the past prices of rubber.

The results obtained from the Nerlovian model substantiates the findings. The lagged dependent variable is positive and significant at 0.05 level. Price coefficient was found to be positive. While the coefficient of elasticity is positive for the 8 years lag specification, it is found to be negative for the 6 years lag specification.

We may conclude that producers supply responds more to current price in the short run. The estates supply does not seem to be responsive to current price. The long run planting decision is influenced by past 8 years prices. The results also indicated that the time variable, do significantly influence the decision making on replanting or newplanting. It is felt that further exploration on the average response needs to be carried out taking into consideration of factors like Age composition, effects of alternative crop etc,. which is beyond the scope of the present study.

Table 2.1 REGRESSION RESULTS : - LONGRUN RESPONSE TO PRICE - THE PLANTING DECISION

DEPENDENT VARIABLE (N_t / T_{t-1}), PERIOD 1976 - 77 to 2000 – 01

EQUATION	INTERCEPT	FORM OF PRICE VARIABLE	PRICE COEFFICIENT	TIME	Nt-1/Tt-2	D . W	R 2	LONG RUN ELASTICITY	SHORT RUN ELASTICITY
Declining Weights Specification Fisher I (a)	142.89 [8.61]	PW2	0.111 [0.005]	—		0.161	0.321	0.18	0.08
(b)	159.85 [10.58]	PW2	- 0.21 [0.18]	2.83 [2.21]		0.172	0.319	- 0.17	- 0.07
Fisher I (a)	145.43 [7.99]	PW3	0.0132 * [0.005]	—		0.256	0.383	0.22	0.078
(b)	151.64 [11.68]	PW3	- 0.004 [0.031]	1.999 [2.69]		0.293	0.394	- 0.22	- 0.099
Fisher I (a)	138.97 [8.65]	PW5	0.151 * [0.005]	—		0.251	0.489	0.214	0.082
(b)	138.23 [15.31]	PW5	0.0166 [0.036]	- 2.15 [3.81]		0.287	0.478	0.199	0 07
Fisher I (a)	138.86 [8.32]	PW7	0.0151 * [0.006]	—		0.276	0.476	0.163	0.044
(b)	130.91 [16.93]	PW7	0.042 [0.057]	- 1.96 [3.99]		0.198	0.415	0.33	0.09
Fisher II (a)	- 5.12 [46.6]	PLW3	25.89 * [6.72]	—		0.286	0.545	1.46	1.66
(b)	- 260.91 [120.45]	PLW3	66.98 * [20.54]	- 4.12 *[1.88]		0.312	0.678	2.90	0.55
Fisher II (a)	- 10.03 [42.8]	PLW5	24.62 * [6.11]	—		0.189	0.489	1.80	0.43
(b)	- 480.69 [105 99]	PLW5	89.099 * [16.98]	- 6.9[1.98]		0.434	0.911	5.10	1.80
Un weighted Specification (a)	140.69 [8.89]	PUNWT	0.018 * [0.06]	—		0.158	0.398	0.002	0.0006
(b)	156.66 [13.11]	PUNWT	- 0.006 [0.321]	2.96[2.22]		0.160	0.386	0.001	- 0.003
NERLOVE 2SLS (a)	13.157546	8year lag	0.0022 [0.0099]	0.281	092870*(0.19)	0.867	0.811	0.21	0.03
(b)	17.516979	8 year lag	- 0.0009 [0.0044]	—	0.905250(029)	0.888	0.836	- 0 01	- 0.02
NERLOVE 2SLS (a)	23.331168	6 Year Lag	- 0.00977 [0.091]	-0.965(1.76)	0.90829*(0.29)	0.514	0.663	- 1.89	- 0.17
(b)	10.748765	6 Year Lag	- 0 0052	[0.0061]	0 978891*(0.25)	0.712	0.721	- 2.01	- 0.06

Note : Values given in the parenthesis are the respective standard errors *Significant at 5% level

CHAPTER-III

ANALYSING THE RUBBER CRISIS

Sec 3.1:-Government Sector

The definition of crisis in the rubber scenario is very difficult. To know whether there was any crisis and how it began is no simple thing because different sectors view it from different view points and hence no unanimous conclusion can be reached. For a better understanding of the situation it would be of help to examine the NR price scenario. The analysis mainly focuses on the time period between 1995-2000 or in other words the period of cyclical fluctuation from a peak price level to a trough level and its gradual recovery.

Chart 3.2 shows the average price level from 1985-86. In other words it covers a lagged fifteen year planting decision range and is therefore more relevant. One can see that between 1985-1990 the prices remained in the 16 to 20 range during early nineties. In the post liberation era the prices were contained with in the band of 20-25. The mid nineties showed a rise to the 35 level and from 1995 on wards it continued its upsurge to reach fantastically high levels like 57 to Rs 60 at a point of time. In the year 1997-98 saw the plummenting of prices to Rs 30 level. Sometimes fluctuating downwards to Rs. 25 after 1998 the down ward tendency was reaffirmed. Prices were again with in the 25 to 30 level. Wild fluctuations in prices are pointed out by growers as the causative factor of the crisis. Not enough returns in the lament of the small growers who say they are in a near suicidal situation, Whereas on the other hand manufactures and some policy makers raise their brows and ask "Is there a crisis?" Indian rubber situation shows that causative factor for the so called crisis come from various sources. It remains an unresolved debate even today.

Visions of vested interests are always myopic. Micro level relatively interdependent attributed causative factors are cited in figure 3.1.

a)**Liberalisation argument**

Leftist economist cites liberalisation as the main cause for rubber crisis through various papers and articles. To know how far the assertion is true we shall go through major routes of import.

Though rubber is an item in the restricted list, import is possible through the following channels.

1. **License against public notice:** - This facility is available only in deficit years. After periodical review of the availability and consumption requirements of rubber, the Rubber Board would recommend for import of rubber in the deficit year. In pre liberalisation times, such imports were through State Trading Corporation (STC). Now the rubber product manufacturers can directly import it after submitting an application to the Director General of foreign Trade (DGFT). Owing to Market glut, Government of India has banned import under this route after 1995-96.

2. **Special Import Licensing Scheme (SIL):-** Generally SIL is given to exporters having certificates as export houses, Trading houses, Star/superstar Trading houses. This license is transferable and subject to periodical duty revision. Importers using transferred license has to give certain percentage as premium. Because of these duties and premiums import through SIL is rare. After liberalisation the basic import duty of NR which was as high as 60 percent was slashed down to 25 percent in 1995 and further lowers to 20 percent in 1996. As a result importing rubber with the duty under SIL became an attractive option when there is considerable lowering of price relative to Indian price. Government of India has discontinued issuing license to import using SIL w.e.f April 2001.

3. **Advance Licensing Scheme**: - Except in 1993, this was the main channel for rubber import in the early 90's. Under this scheme, industrialists who are exporting their products are entitled to import raw materials to produce the exported good. Tyre exporters are allowed to import NR, SR, carbon black, nylon cord and other necessary chemicals.

The Advance Licensing scheme allows two routes for export related import of NR.

Fig : 3.1 - Circular flow of attributed macro economic interdependant causative factors

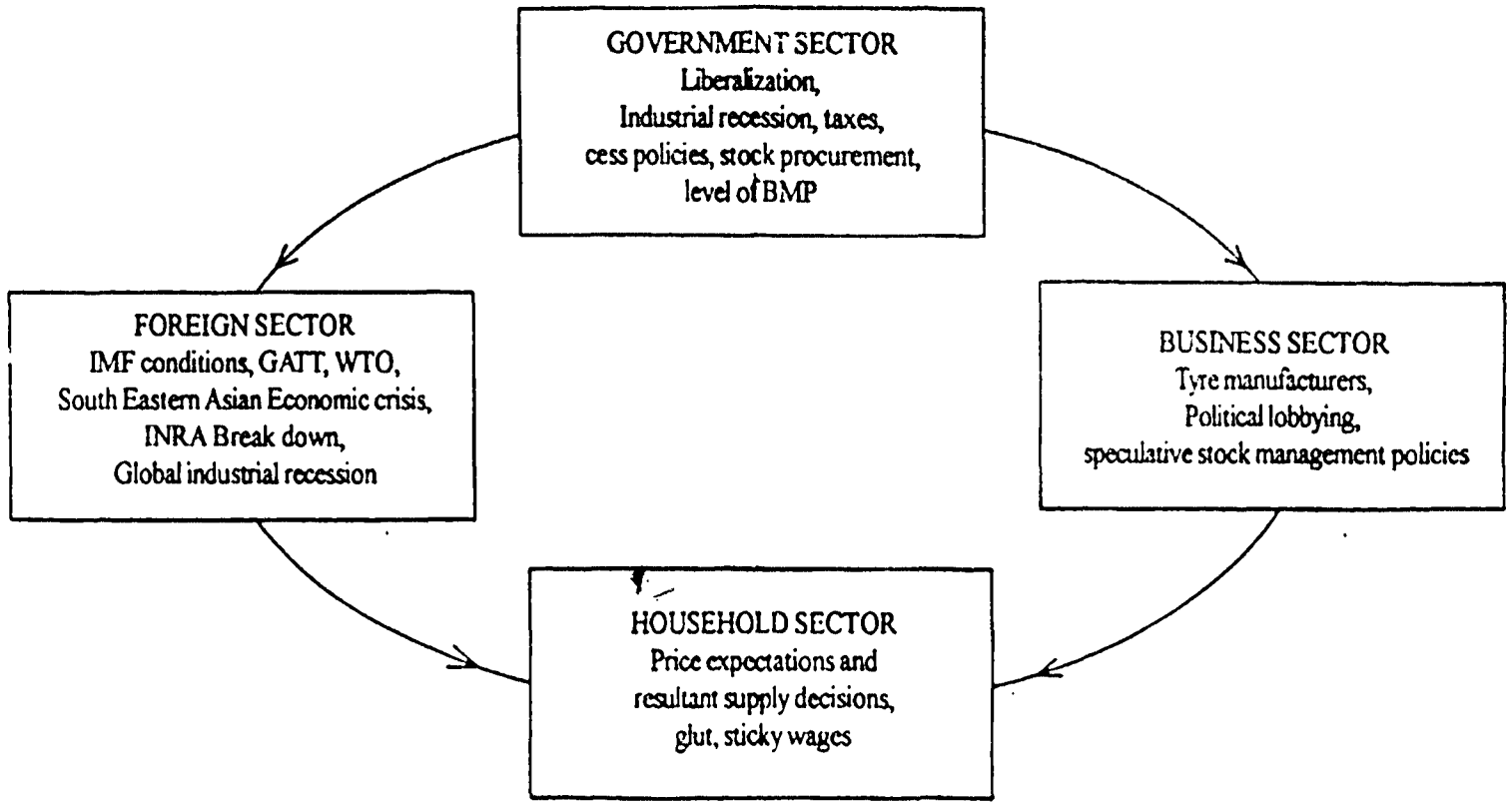
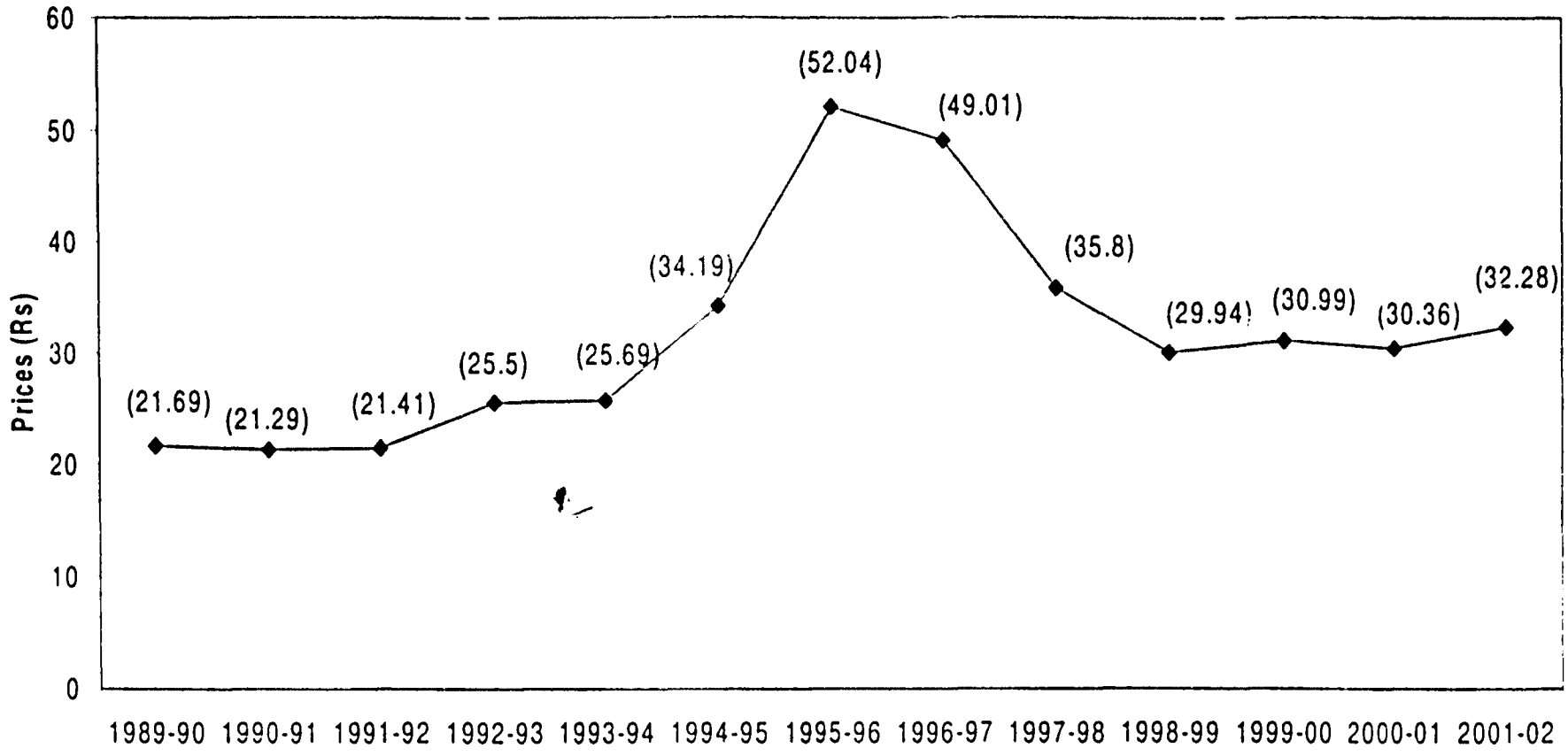
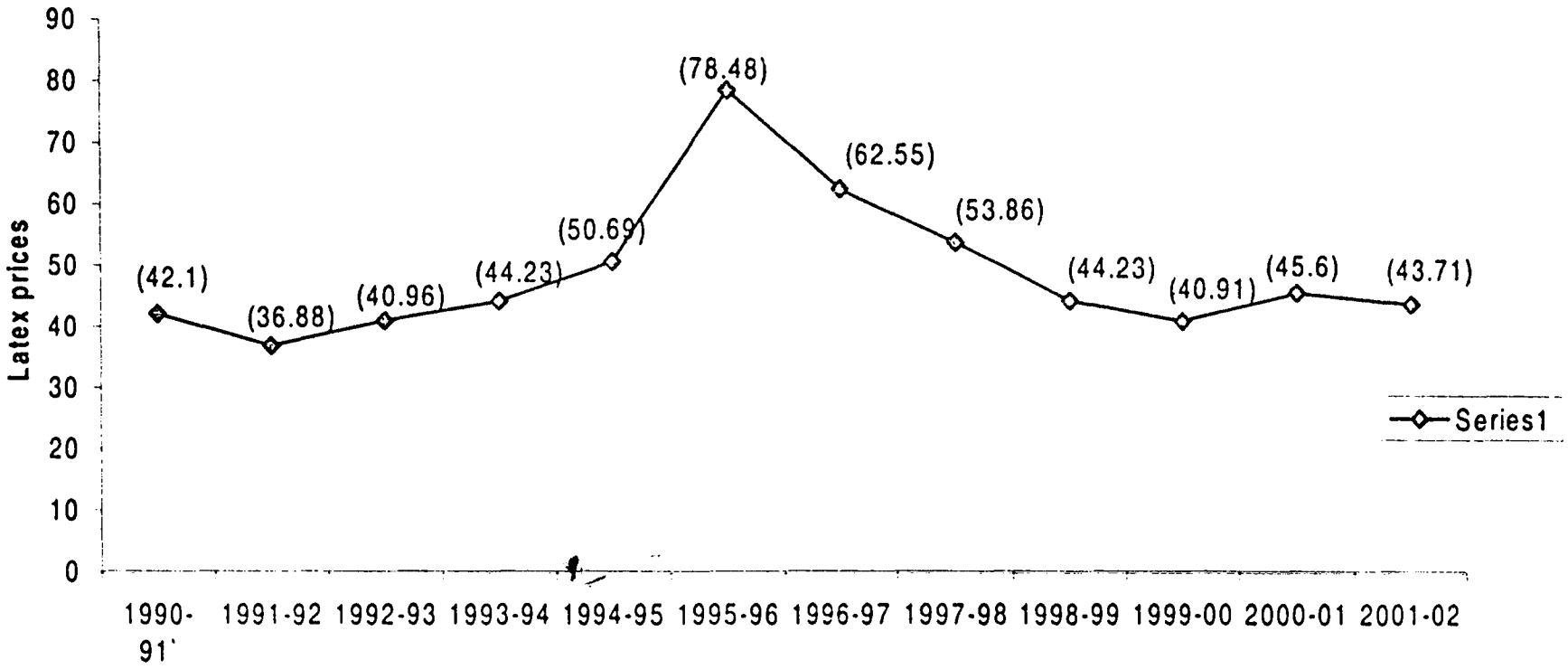


Fig 3.2- Indian rubber prices



Source- Indian Rubber Statistics

Fig 3.3 - Latex prices in India



Source- Indian Rubber Statistics

a) Duty Establishment Pass Book Scheme (DEPB) - Being in the Negative List, NR cannot be imported by using DEPB scheme introduced in the Exim policy for the period 1997 - 2002.

b) Value Based Advance Licensing (VBAL) - Under VBAL there was no restriction on the type of items that can be imported. Many misused this facility to import only NR. So in 1997, VBAL was reformed and Quantity Based Advance Licensing (QBAL) was introduced. Under QBAL, quotas were fixed for import items. There after if one item is not imported; it became impossible to import other items.

As a support measure, the Government of India imposed ban on the import of NR against advance license w.e.f. 20 February 1999. Owing to the pressure of industrialists exporters of rubber goods have been allowed to purchase NR from STC as an alternative arrangement. STC would supply at the international price from their locally procured stock .Since Advance license has a normal validity for 18 months after issue and can be extended twice for duration of six months each, import of NR continued even after the imposition on ban. However with the fixation and notification of minimum price, (which is based on import parity price for trading in natural rubber) procurement of NR through STC was stopped.

With effect from April 2001, Quantitative Restrictions [QRs] on import of natural rubber has been removed. Prior to that natural rubber was included in the negative list as a restricted item of import.

Sec 3.2:-The Long standing threat of synthetic Rubber

In the mode of production NR is labour intensive and SR is capital intensive. New tyre manufacturing technologies require materials with more consistent, predictable processing characteristics than NR, while retaining NR's good properties. Industrialists in India in a bid to topple MNCs, is copying their technologies. The use pattern of NR:SR in India is at present 79:21 whereas in advanced countries it is 60:40. There is a threat of substitution of NR on the grounds of technological upgradation unless some policies are formulated globally in favour environment protection.

Since SR production is oil based, a hike in oil prices shows a substitution effect and an income effect in relation to NR. When oil prices are up SR becomes dearer and NR is substituted for SR. But rise in oil prices raises general cost of production in the industry

and reduces incomes and slows down industrial growth which affects rubber consumption.

Liberalisation policies have favoured SR imports. Globally there is an emerging complementarity instead of compartmentalisation in SR production and consumption. There is a possibility of India and China emerging as great SR powers

Tab 3.1:- Production and Consumption of NR and SR

Year	P R O	DUCT	ION	[000] tones	C O N	SUMP	TION	[000] tones
	NR	SR	Total	Growth	NR	SR	Total	Growth
95-96	506.9	68.2	575.1	7.4	525.5	134.1	659.6	8.4
96-97	549.4	64.6	614.0	6.8	561.8	142.8	704.6	6.8
97-98	583.4	72.0	655.8	6.8	571.8	160.9	732.7	4.0
98-99	605.0	67.6	672.6	2.6	591.5	156.4	747.9	2.1
99-00	622.3	60.3	682.6	1.5	628.1	167.2	795.3	6.2
00-01	630.4	65.5	695.9	1.9	631.4	170.6	802.1	1.1
01-02	631.4	69.6	701.3	.73	638.2	174.5	812.7	1.3
02-03								

Source:-Indian Rubber Statistics,(2002)

In India production of SR showed a 5.6 percent decline between 1995-96 to 1996-97. Then between 96 to 98 it increased by 11 percent and then declined by 6 percent in 1998-99. This was due to decline in production of Styrene Butadiene Rubber (SBR) possibly on account of domestic capacity shortage and increased imports.

The consumption of SR increased by 6.5 percent between 1995-1997 and by 12.7 percent between 1996-1998. But it declined by 2.8 percent by 1998-99. In 1999-00 it has showed a rise of 11 percent. Though the relative pattern of NR: SR averaged during the period to 78:22 the threat of substitution in the future booms large in the minds of the growers.

Sec 3.3:- The Substitution Effect of Poly urethane

It is said that the price crash hit the latex market the worst. The main consumers of latex are foam bed manufactures. Figure 3.3 shows the trends in latex prices .

Price differential was 46.88 percent in 1989-90. It in the next year it almost doubled to 97.8 percent It stayed around seventies till an average till 94-95. After 1995 the range hovered between 40-50 percent. The substantial difference in the price of latex and sheet rubber had made many cultivators switch over to latex. The global threat of Aids meant

more business in gloves, condomn manufacturing etc. In Indian market the automobile seat Industry has completely captured Poly Urethane in the manufacturing technology. Big companies like Bajaj is now using only Poly Urethane for seat manufacturing. The manufactures of Poly Urethane are big multinational companies like Bayer, Union Carbide, Ohlin, Enicher shell, Rom Paulank, Arco etc.

Price differential of sheet rubber and latex ranged above 75 percent between 1989-1995. In 1995 it came down to the level of 40-50 percent. The substantial price differential and global aids scare and glove boom led to the switching over from sheet to latex. Switching back is extremely difficult as it necessitates search for finance, construction of rollers, smoke houses etc which brings an added cost of RS 3-4 in the total cost of production.

Ammoniated latex has minimal storage life, so stock procurement is ineffective. The working pattern of Amul and Milma had encouraged the Board to setup a collective processing marketing chain which is threatened by shutdown.

The sharp climb to Rs.78.48 is in tandem with the general rubber price rise in 1995 with import duty cuts, in prices were on a free fall after 1995.At present the price differential is Rs 11.43.

Sec 3.4:- Industrial recession

During 1991-92 and subsequently in 1992-93 Industrial production suffered a set back. During 1991-92 the general index of industrial production for the first time in recent years recorded zero rates. The relationship between rubber prices and industrial sluggishness is an established fact when one follows the views of many expert economists in the news papers and articles.

But an interesting contradiction in seen here. On an average the early 90's i.e. (1990-1995) the overall rate of industrial growth remains short of 5 percent but rubber prices showed progressive rise. During the same period. When industrial growth picked up after an adjustment phase between 95-97, rubber prices also rose very high but had its great crash in 97 when industrial growth rate was at a robust 12 percent. This result shows that the relationship is a spurious correlation.

Based on the experience of the seventies, during Indo Pak war and the formation of the OPEC,some analysts conclude that rubber prices and a country's GDP are unrelated.

But even then there was surplus production and this excess of which amounted to 26424 tonnes was exported due to the efforts of STC[1]. This excess of 26424 tonnes is about 20 percent of the annual production during that time phase. It is therefore equivalent to the present excess of 120000 tonnes.

Tab 3.2:-Industrial growth and growth in Rubber consumption in the post liberalisation Decade

Year	Industrial growth	NR consumption growth Rate
1990-91	8.2	1.86
1991-92	0.6	0.6
1992-93	2.3	16.03
1993-94	6.0	.73
1994-95	8.4	24.86
1995-96	12.8	34.30
1996-97	5.6	-6.18
1997-98	6.6	-36.89
1998-99	4.0	-19.57

Source- Rubber Feb 2000, IRS, CSO

In 1991 industrial growth rate fell from 8.2 percent to 0.6 percent. In 93 and 94 also the growth rate was sluggish and this period was temporary. Indian industry needed time to adjust to the changed circumstances. There was also the time required for reshuffling the technology in main production units. This recession was reflected in rubber consumption. Average rubber consumption in these 3 years was 6.6 percent from 1993-94 to 1995-96 the average industrial growth rate was 9.1 percent where as the average growth rate in rubber consumption was 8.3 percent. If we take the average from 1997-01 (the industrial growth rate was very low at 5.4% and the corresponding rubber consumption rate was proportionately low at 4.0 percent).

The table 3.2 reveals that the ultimate influence on prices in the post liberalisation era depends more on external influences from ROW [rest of the world]. Internal policy decisions are greatly offset by factors like opening of China gate and South East Asian Crisis 1996-97 can be seen as a year in which both internal and external forces were negative.

The main demand influencing factor of truck is in the goods transport sector. Good transport sector in turn depends on industrial agricultural growth rate for the transport of raw materials industries like petroleum, cement, steel chemicals and fertilizers, coal, paper, furniture, textiles etc depend road transport.

Commercial vehicles are needed for the transport of raw materials and machinery factories and also for the transport of final products from factories to end uses. Thus only under conditions of industrial prosperity will there be existence of conditions of demand for truck tyres.

1) Original equipment demand or continued increase in the production of trucks. This constitutes only 7% of the total production of truck bus tyres.

2) Replacement demand or continued increase in the movement of trucks. This constitutes 73% of the total production of truck, bus tyres.

Though the replacement demand is increasing with the years, the annual growth rate is seen to have a steep fall from the year 1996-97. This was mainly due to the sluggishness in goods transport which reduced the wear and tear of tyres.Also, retreading of tyres became wide spread instead of changing tyres frequently.

Power cut has also emerged as a major villain accentuating industrial recession. Kerala having hydro electrical power base, is always faced with the bottle neck of power shortage in summer months. At an all India level there was power shortage in 96-97. There were situations of 40 percent power cuts in North India states where the factory users of rubber are concentrated. Rising inflation led to lock outs arising from labor disputes. The cost of credit as a result of credit squeeze measures of the RBI is said to be affecting the industry hard. Most units are not prepared to go in for production with the borrowed money forcing them to pay over 20 percent interest per annum. [2]

Sec 3.5:- Unnecessary imports

Government is accused of submitting to industrial lobbying According to this view; the cause of rubber crisis is the continuous and totally unnecessary in flow of rubber and rubber products over and above import requirements.

Tab 3.3:-Production, Consumption, Import, Export and Price of NR

YEAR	PRODUCTION IN TONNES	CONSUMPTION IN TONNES	IMPORT IN TONNES	EXPORT IN TONNES	PRICE RS. PER 100 KG
1985-86	200465	237440	41431	-	
1986-87	219520	257305	45356	-	
1987-88	235197	287480	53685	-	
1988-89	259172	313830	59835	-	
1989-90	297300	341840	44445	-	
1990-91	329615	364310	49013	-	2129
1991-92	366745	380150	15070	5834	2141
1992-93	393490	414105	17884	5999	2550
1993-94	435160	450480	19940	186	2569
1994-95	471815	485850	8093	1961	3638
1995-96	506910	525465	51635	1130	5204
1996-97	549425	561765	19770	1598	4901
1997-98	583830	571820	32070	1415	3580
1998-99	605045	591545	29534	1840	2994
1999-00	622265	628110	20213	5989	3099
2000-01	630405	631475	8970	13356	3036
2001-02	631400	638210	49590	6995	2793
2002-03					
Total					

Source:- Indian Rubber Statistics (2002)

A 3 percent deficit is clearly not responsible for the Rs 14 downfall of price to Rs 36 from Rs 54 during 1996-98 period.

Between 1995-00 the total exports were 11973 tonnes. Based on this import requirement is calculated as 59865 tonnes; But statistics reveal an import of rubber during the past five years at 1.36 lakh tonnes or in other words, an unnecessary duty free import of 110,194 tonnes of rubber. This import was made at a time when the import duty required for tyre manufacturers is 60-65 percent and that of NR was 45 percent . Loss to the government as a result of this concession is estimated to be Rs 125 crore.

During 1994-95, rubber industrialists had demanded duty free import of one lakh tonnes to overcome production deficit by citing the industrial growth rate which was at a robust 6 percent. The Rubber Board had recommended the import of mere 20,000 tonnes of rubber and the Commerce Ministry had allowed 70,000 tonnes. This was reduced to 40,000 tonnes on account of wide spread protests from the growers. This 40,000 tonnes is included in the total import of 1.36 lakh tonnes.[3] Growers who subscribe to this theory

argue that if there were no imports, the excess stock would have been domestically consumed.

Of the total consumption more than 65 percent is used up for the manufacturing of tyres, tubes and retreads for motor vehicles and cycles of the total rubber consumed in the manufacture of truck tyres, 93 percent is accounted for by NR. [4]

Tab 3.4:- Import of Tyres [Quantity in no:s]

YEAR	CAR AND	TRUCK BUS	TRACTOR		CYCLE		MOTOR AND	CYCLES SCOOTERS
	TYRES	TUBES	TYRES	TUBES	TYRES	TUBES	TYRES	TUBES
90-91	6879	8	524	-	-	-	-	-
94-95	37721	39	1314	12	236800	295547	10847	-
95-96	12811	120	1906	89	276842	112890	24691	-
96-97	46781	40264	3452	6611	310301	72650	10469	-
97-98	165668	30894	2881	2013	161485	11164	31944	9956
98-99	265599	19436	8830	-	202256	115751	20126	8286

Source-"Monthly Statistics of Foreign Trade of India"[Annual] published by DGCI&S, Government of India

The Import of tyres have increased almost 25 fold between 1990-91 to 1998-99. Import of tubes of Car, truck/ bus increased from a mere number of 8 tubes to 19436 no's. Tractor tyres have registered nearly a 17fold increase. Tractor tube, cycle tyres and tubes, motor cycle/scooter tyres and tubes rose from zero level of imports to gigantic amounts as shown in the table. But it is argued that though absolute level of imports have risen in the past years, such high levels of consumption need not be taken as an indicator of domestic off take of NR [5]

If we take the import statistics, imports show the highest in 1998-99. Altogether 17211 truck/Bus tyres and 398673. Car tyres were imported to our country. Without considering the limiting factor of consumption requirements, the above figure would seem huge.

Tab 3.5:- NR Consumption Requirement

Types of tyres	Per tyre NR requirement (kgs)	Total imports 1990-01	NR requirement
Bus / truck tyre	25-29		
Small truck tyre	5-8		
Car tyre	1.6-2		
Total		918237	25818.32
Motor cycle tyre	0.9-1.4	1620228	223.60
Scooter tyre	0.6-0.7	110517	154.72
Cycle tyre	0.2	20387	324.05
TOTAL		2669369	26520.69

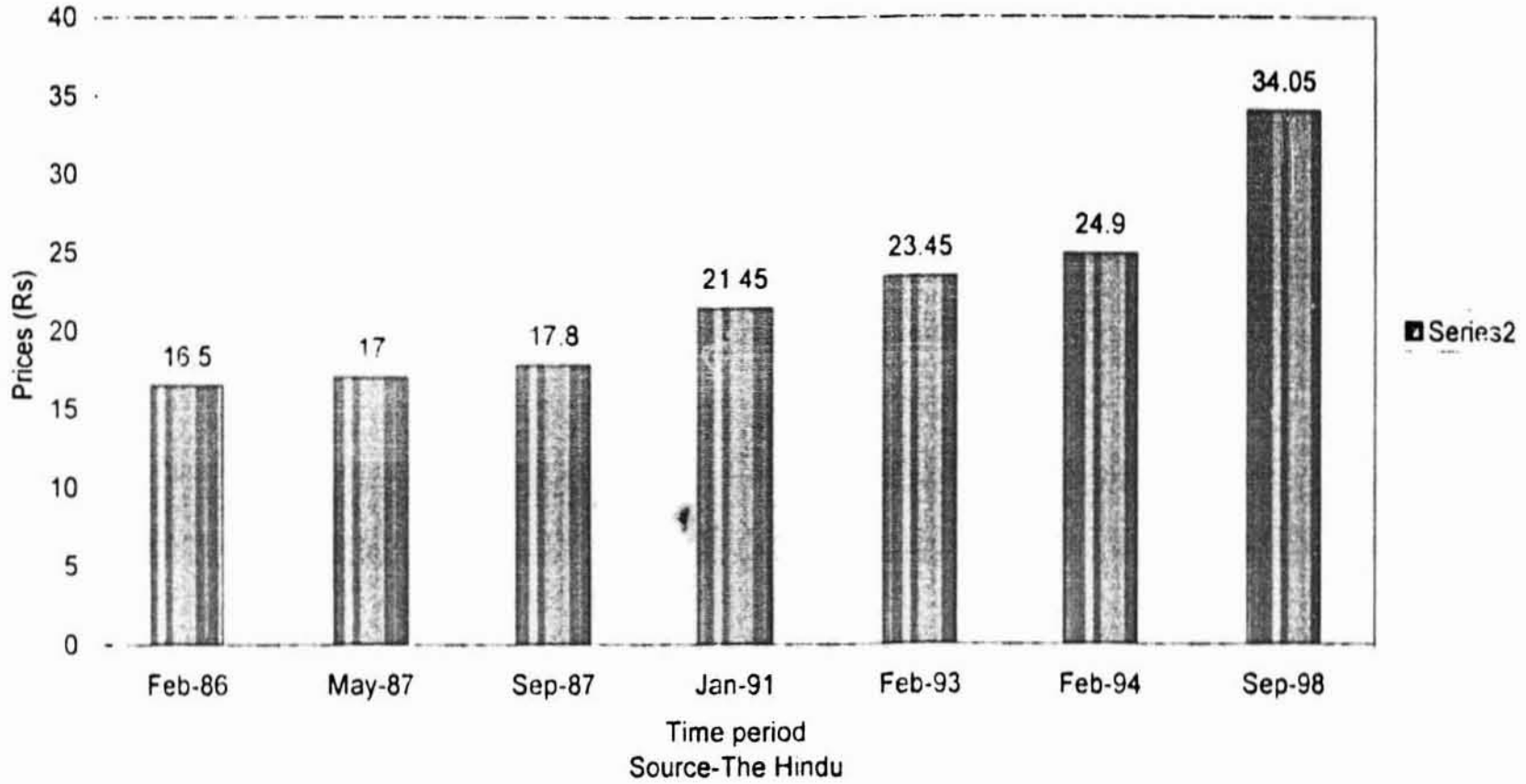
Source:-Worked out from IRS,Rubber,(Feb, 2000)
Using the formula
NR requirement = no: of tyres × Per tyre requirement/ 1000

In short, if there were no imports at all only 1,400 tonnes of NR would form as additional consumption. Even when we account for the additional domestic consumption of 2000 tonnes for the import of non tyre products, a mere total of 3400 tonnes emerges as additional consumption. The argument that an increase in domestic consumption @ 1400 tonnes could have avoided rubber crisis is found to be weak on the basis of consumption requirements. If we extend this logic to the five year period 1994-1999, we see that additional consumption requirement in the absence of imports is less than 15,000 tonnes. Clearly this is not adequate to remove the excess glut which was nearly 2 lakhs in 1998-99

Sec 3.6:-The Bench Mark prices

From 1986 onwards the Central government has been adopting a policy of fixing only Bench mark price of natural rubber. Cost Account Department of the Union Finance

Fig 3.4- Rubber Bench Mark Prices



Source-The Hindu

Ministry was entrusted with the task of revising the bench mark price at intervals taking into account the cost factors after conducting a thorough field study on variables such as increase in salary and wages and increase in other factors involved in the cultivation of rubber. Accordingly BMP was revised for rubber in the years 1987, 1988, 1991, 1993, 1994 and 1998. The floor price for rubber stood at Rs. 1,650 per quintal in 1986. Thereafter three revisions the floor price climbed to a level of Rs. 2,345 per quintal by 1993. The upper band of the price stood at Rs. 2395 per quintal while the lower band was Rs 2,295 per quintal. In February 1994 the bench mark price was revised to Rs. 2,490 per quintal. The upper and lower price is Rs. 2,540 and Rs. 2,440 per quintal respectively.

Commerce Minister V.B. Ramaiyyah's claim that the growers are getting a fair price. Since they are getting 4250/ quintal which is much above the 1994 fixation of bench mark price.

Tab 3.6:-Fair deal

Effeective From	Fair price	Upper band	Lowerband	Avg price
1986	1650	1700	1600	1661
1987	1700	1750	1650	1791
1988	1780	1830	1730	1815
1991	2145	2195	2095	2141
1993	2345	2395	2295	2569
1994	2490	2540	2440	3638
1996	3482	-	-	3375
1998	4248	-	-	3800

Source:-The Hindu, 23-9-1998.

The bench mark price is the guideline price and in theory the minimum price below which the rubber cannot be traded and not the minimum price which the grower should get. In actuality, however there is no mechanism to ensure that the rubber is traded only at a level matching or rising above the BMP. And the grower themselves are the culprit rather than the victims of such violations. Whenever they needed money, they would not mind under cutting the industry norms and disposing of their stocks for lower prices.

It was said that when the BMP of NR was fixed at Rs. 24.80/ kg in February 1994 average productivity per hectare was 1286 kgs. It went up to 1505 kgs in 1996-97 and has

achieved new heights in 1997-98. Considering the productivity increase, the cost of production has obviously come down nullifying justification for any upward revision of BMP.

In 1998, based on the estimates of the Finance Ministry study the fair price of NR would work out to be Rs. 42.48. The findings of the study of finance ministry are not in tandem with the level of BMP announced. This provided a base for the accusation that BMP level fixation is unrealistic.

Sec 3.7:-The accusation of State government's neglect

Kerala's political scene and rubber plantations have close relation. Many notable political leaders have emerged from the ancient Syrian Christian families of the estate sector. Political parties whether Left or Right are unanimous when it comes to the issue of rubber crisis. Each one competes with the other to take up the propaganda to the centre. Both UDF and LDF blame each other for bringing about a difficult situation for the grower. But the state government is accused of being inactive and irresponsive on the following grounds.

As per the State Economic survey (1998), the rubber production was over 5,40 000 tonnes .If we calculate at Rs.25 per Kg. the earnings for the state economy is Rs.1,355 crore . If the price in the early months of 1996 is considered state should get more than 3000 crore rupees. This is more than the earnings from all the cash crops from Kerala. The crisis had upset the economic base of 13 lakh Keralite families of which 9 lakh constitutes small growers. Such an attitude amounts to the total neglect of the growers who constitute more than 1/5th of state's population.

In 1997, state is said to have lost about Rs 100 crores by way of state income tax collection and about Rs 150 crores by way of sales tax collection. The major weapon to fight rubber crisis in the hands of the state government is its right to collect sales taxes. Rubber is included as the 110 nth item in the first schedule of the sales tax law. As per Kerala state sales tax law ,sales tax should be collected at sale point in some instances and at purchase point in some circumstances for cash crops like rubber, pepper, ginger, tax is collected at purchase point. The main intention here is to exclude the farmers from liability. Sales tax for rubber is charged @ 10 percent plus 1 percent surcharge. In effect the tax is 11 percent. It is laid down that the last purchase should give the 10 percent

sales tax for rubber bought inside the state. From 1994 onwards for rubber purchased form outside states has 10 percent sales tax for the first sale inside the state. This is not applicable to those who produce rubber products which are imported like tyres. In short it means that if domestic price and imported price are the same, imported goods have a 11 percent price advantage. So for tyre manufactures import was profitable.

It is said that the statistics about rubber production is collected by Rubber Board after considering the figures got from the check post, figures of the industrialists etc. It was pointed out that it is a known fact to every one that mass quantities of rubber is regularly going to North Indian states through the districts like Trivandrum and Kasargode. Rubber smuggling is not included in the statistics. Because of that generally quoted statistics of rubber production will be less than about 20,000 tonnes. But the root cause of import pressure from industrialists, is the unnecessarily high purchase tax rate. There should be a measure from the Kerala government to initiate steps for the unification of sales tax rate. In Tamil Nadu and Karnataka it is only 4 percent . Either their rates should be raised to 11 percent or our rate should be lowered.

Out of the total loss due to rubber procurement incurred by STC, 7 percent is accounted by purchase tax liability to the state government. State budgets during the price crash period were non supportive. Concessions, if given were insignificant and superficial in effect.

The export of centrifuged latex or cenex whose international price was higher than domestic price would have been a way out. Here again the state government is accused of standing in the way of small growers. From 1995 onwards latex is subject to state sales tax of 11 percent. To sell latex outside, central sales tax should be paid over state sales tax. But at the same time the 11 percent purchase tax does not apply to the big companies who process latex in their estates.

It is accused that short term public notices like SRO 601/97 and SRO 693/97 were able to serve little purpose as there was no perceptible market change as the time span of the orders covered only a maximum period of three months.

Another demand raised strongly was that the state government should bear the loss in the export of excess rubber at the international rate. Little progress was made in the export field as our export opportunities are not fully exploited.

State government accuse that while the centre insisted on the withdrawal to state sales tax, the cess for rubber (or excise duty in rubber) was increased by 50ps to 1.50/Kg on 1-9-98 to provide for the increased expenses for the working of the Rubber Board. It is also accused that the Board cites the impressive 20 percent growth in productivity to justify its non productive research activities while nothing has come to the field in effect since RRII 105 was developed in the 70's. Thus the ball of blame continued to be shifted from one court to another.

Sec 3.8:-The Stock Procurement

The State trading Corporation (STC)was the main agency for rubber import and export till liberalization.In April 1992, rubber was removed from the banned list but STC still retained its power over exports. The major accusation against STC was that it misused or neglected this power and was insincere in its attempts to procure and export rubber.

On 8-5-97 the then Commerce Minister R.B. Ramaiyyah ordered STC to procure 10,000 tonnes of rubber @ Rs. 42/Kg. In November 97 40ps subsidy per kg of procured rubber was announced. [6]

Procurement chain

District co-operative society → State Co-operative society→ RUBCO→ State Warehousing Corporation→RUBMARK→ STC

Rubmark a state run agency was to be given an advance of Rs. 2 crores 40 Lakhs on the decision of the State Ministerial order for the fund grant which put Rubmark in difficulty. In Sept. 97, sales tax cut of 11 percent for procurement agencies were announced giving a cost advantage of Rs. 4 over that of dealers.[7]

The fund granted to Rubmark was less than Rs100 crores and it had no independent means of finance. There was no support to Rubmarks effort through a centrally sponsored scheme. By the end of 1997 only about 4000 tonne rubber was there in the go downs of Rubmark and export performance was only 500 tonnes. In October 97, STC was directed to procure rubber @ 200 tonnes per day. If procurement had gone at that pace at least 20000 would have been procured. But STC procured only 10,000 tonnes by 97 end.[8]

RUBCO with an estimated capital of Rs 62.8 crores didn't reach its target and procured only 10,000 tonnes. In February 98 RUBCO extended its procurement and within less than two months it procured 10, 136 tonnes worth Rs29 crores.

On 11-2-98 State government high-level committee met and decided to procure 20,000 tonnes at Rs 2 more than market price plus the handling charge of 40ps per kg [9]. In March 98, the state government directed the procurement of additional 8,000 tonnes to RUBCO due to inability of KSWHC following a severe cash crunch.

By April 98, STC had 10,000 tonnes and Rubmark 7000 tonnes of NR. Rubmark has exported 690 tonnes at a loss and the state government is yet to give Rs 27 lakh for this deal to Rubmark. Another 2 crore rupees was due to Rubmark for procurement on behalf of STC. To raise the share capital of Rubmark an assistance of Rs. 15 crores was asked from the state Govt. and no promising decision has been made. As a result RUBCO had decided on the release of part of the procurement and it was said to create instability in the Government fixed BMP level. A sale of 2000 tonnes by RUBCO to industrialists resulted in lowering of North Indian demand in 1998. [10]

As a second phase of market intervention the Union Agricultural Minister announced that STC will procure 20,000 tonnes of rubber from June 98. RUBCO sale was made after this announcement. As price went below Rs. 34/Kg, STC restarted its buying operations. One cannot judge whether RUBCO's movement and STC operation has any direct association.[11]

It is accused that STC rejects about 10 percent of the load on the grounds of low quality. But STC is helpless in this case. The buyers are generally not happy with the STC rubber quality. Due to heavy rainfall, humidity and longer periods in go downs 60 percent of the stock has deteriorated. Kerala High Court allowed STC to sell in auction 7250 tonnes of damaged rubber in the open market @ Rs 20kg in August 1999 without inviting public tenders. Original procurement was @ Rs 40/Kg in 1997. Such a sale would entail a loss of Rs 14 crores to the Centre and the STC. [12]

Had the STC made purchases at the fixed prices of Rs 34/Kg and allowed the RUBCO and Rubmark to procure rubber at the ruling market price when it is low enough to accommodate their operational charges and tender small growers rubber to STC itself, it would have helped the market for RSS to remain at least Rs 1.50 below the

procurement price.This margin would have helped the agencies to meet their operational expenses.

Again, dealers and the procurement agencies are not prepared to deal with STC for fear of rejection and loss on account of wasted effort transport and loading. There are several delays and procedural formalities before the deal is clinched. Dealers are required to register with STC after giving bail deposit of Rs. 10,000. Payment to the dealers is made at the day's market price and that too in installments.

It is alleged that Rubmark was given only 56 minutes to clinch a deal. The order was cancelled by STC on the grounds of delay in Rubmark's response. It is also accused that STC directs a cooperative society from mid Travancore to download the stocks at go downs in northern areas, so that by the time load reaches their destination (after one or two days) the market prices would have fallen further. Since STC tenders at the prevailing market price, this means losses to the societies and profit to STC. [13]

A procurement of 20, 000 tonnes @ 100 tonnes per day all take 200 days. In that time the excess stock in the market would increase and affect prices.

In December 1999 Rubco and Rubmark announced that they would together procure 50,000 tonnes and independently procure 30,000 and 50,000 tonnes respectively. [14]@ ps50 above market price plus ps50 handling charge. But it is alleged that to make such a promise when State treasury in empty and Rubmark godown is glutted is done only create a panic rise prices so that it becomes easier for Rubmark to release of stocks.

The STC in November 1999 claimed to have suffered a loss of 56 crores out of which 8 crores is the purchase tax paid to the State. On 17-11-1999, government withdrew sales tax as a response. [15]

On 10-12-1999 Rubco exported 15000 tonnes of rubber from Cochin port of Singapore. This measure was seen as an emerging ray of hope. [16]The export of NR increased from 5989 tonnes during 1999-00 to 13,356tonnes during 2000-01. However it declined during 2001-02 to 6995 tonnes.

In the second phase of procurement, STC procured 19,831 tonnes during the period September 1998 to October 1999 and sold the entire quantity to exporters of rubber goods in lieu of import against Advance License. In order to prevent large scale import of NR using Advance License the Government of India imposed a ban on the

import of NR against Advance License w.e.f. 20th February 1999. As an alternative arrangement exporters of rubber goods have been allowed to purchase NR from STC at the international price. Since global rates are Rs 8-10/Kg lower than the domestic prices, STC would bear the difference and get it reimbursed from the government. STC would also after credit facility of all types of rubber up to 150 days at London Inter Bank offer Rate (LIBOR) plus 0.75 percent per annum. [17]

Despite these incentives, procurement continues to be sluggish. The industry is not keen to purchase rubber directly from the STC and seemed to be happy with the existing arrangement of reimbursement of the price differential between domestic and international markets on their domestic purchases against advance License. Since Advance License has a normal validity for 18 months after issue and can be extended twice for duration of six months each, import of NR continued after the imposition of ban. The third phase of procurement operation which started in March 2000, STC lifted a quantity of 20,000 and sold the entire quantity to advance license holders. The fourth phase had set the target for another 20,000 tonnes but the actual procurement was only5,260 tonnes. A part of the rubber purchased by STC in the first phase of procurement and the entire quantity purchased during the second third and fourth phases were sold to the advance license holders at international prices. During 2001-02, the government of India notified the statutory minimum prices for nr at Rs 32090/kgfor RSS4 and Rs 3079 for RSS 5 effective from 12th September 2001with the fixation of minimum price, which is based on import parity price for trading in natural rubber, procumbent through STC was stopped

Prevalence of relatively lower price in the inter national market made exports less attractive during 2001-02. In October 2001 the government of India approved a scheme for export promotion of NR by providing financial incentives to exporters of NR for quality improvement, certification, packaging and transportation. The Government of India has approved a proposal from the Rubber board for the export of 20.00 tonnes of NR by Kerala State Cooperative Rubber Marketing Federation with an outlay of Rs 1740 crores to be shared by the Government of India and the Government of Kerala.

Sec3.9:-Business Sector

The business sector in the case of rubber plantation industry consists of the group of industrial end users. The major off take is by the tyre industry.

The case against the tyre industry as cited by various plantation interests goes thus.

1. Tyre industry is in the form of collusive oligopoly against disorganised growers.
2. Sales of the tyre companies together more than double the sales of 13 lakhs rubber growers. Comparatively tyre companies are economic giants which naturally gives them funds for political and media influence.
3. Tyre companies have from time to time used their lobbying power on the govt to suit their needs.
4. The liberalisation is made to benefit the tyre companies and when entry of MNCS became a threat suitable protection was provided to them.
5. Industrial recession has not hit the tyre industries badly as the Association of Tyre Manufactures (ATMA) points out
6. In 1995 World supply exceeded demand there was excess stock. But prices were high proving an exception to the traditional demand theory. For some, cause for this was the growers expectations regarding future price rise as global demand has showed upward trend. As expectations rode high, the grower was willing to keep more stocks. It was accused that the tyre companies used their influence on the newspapers to create an artificial fear about down sliding prices thereby forcing the grower to release his stocks and glut the market. One newspaper in Kerala is owned by a tyre company and has emerged as the main media for grower interests. This saviour attitude of the paper is accused to be based on ulterior motives.

Industry Basics

There are about eight or nine major tyre companies in the tyre sector. These include J.K. Tyres, Vikrant which was taken over by JK in 1997, MRF, Ceat, Apollo, Modi, Birla, Good year others including TVS Srichakra and others.

There are 29 tyre companies and their installed capacity is 37 Million tonnes.The percentage of capacity utilisation is90percent.Taxes and duties paid by these companies are nearly 2700 crores and value of export is nearly 900 crores

There are 13 different categories of tyre in the country. These include Truck and bus tyres (HCV), Passenger car, Jeep, Light commercial vehicles (LCV), Tractor front, Tractor rear, Tractor Trailer cart tyres scooter, Motor cycles, moped, Industrial, off the road tyres (Aero tyres)

Of these truck and bus segment ranks top both in terms of weight age and value. The passenger car tyres come second followed by LCV, two wheelers and tractors.

It was the steady flow of demand from the replacement market that helped the tyre producers stay afloat even during the declining trend in the commercial vehicles segment in 1997-98 and 1998-99. [18]

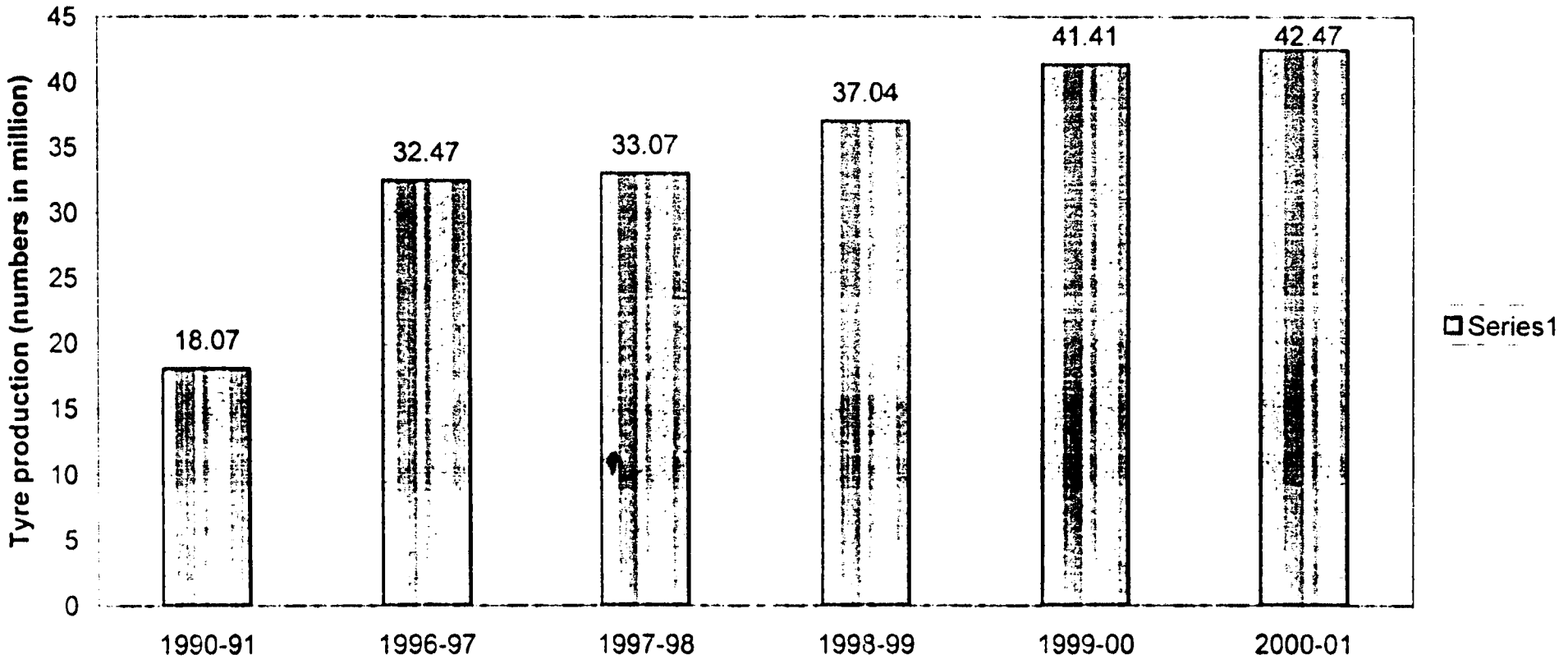
India exports tyres to 51 countries and they even enjoy a premium status in the United States market. The market share of US in India's exports is almost 30 percent, Asian countries account for 29 percent followed by the Middle East at 20 percent. The rest is accounted by Pakistan and African countries .World tyre market requirement is posted at 1,600 million units with Indian exports forming 0.13 percent of this.

.During the last decade tyre exports have grown at an annual compounded rate of 27 percent .The export performance over the last couple of years was affected on account of the economic crisis in the South East Asia and mounting competition from China. India primarily exports cross ply tyres, which is no longer produced by global majors. However, the South East Asian economic crisis led to considerable capacities in these regions going idle. The producers in the countries were forced to concentrate on exports for survival. This in turn affected the export prospects of Indian producers.

But it is the revival of the South East Asian economies that resulted in an improvement in exports from India. The tyre exports between April- Sept. 1999 posted a 12 percent growth compared to the 10 percent decline in the year ended March 1999. The truck and bus tyres exports posted a 13 percent rise during this period.

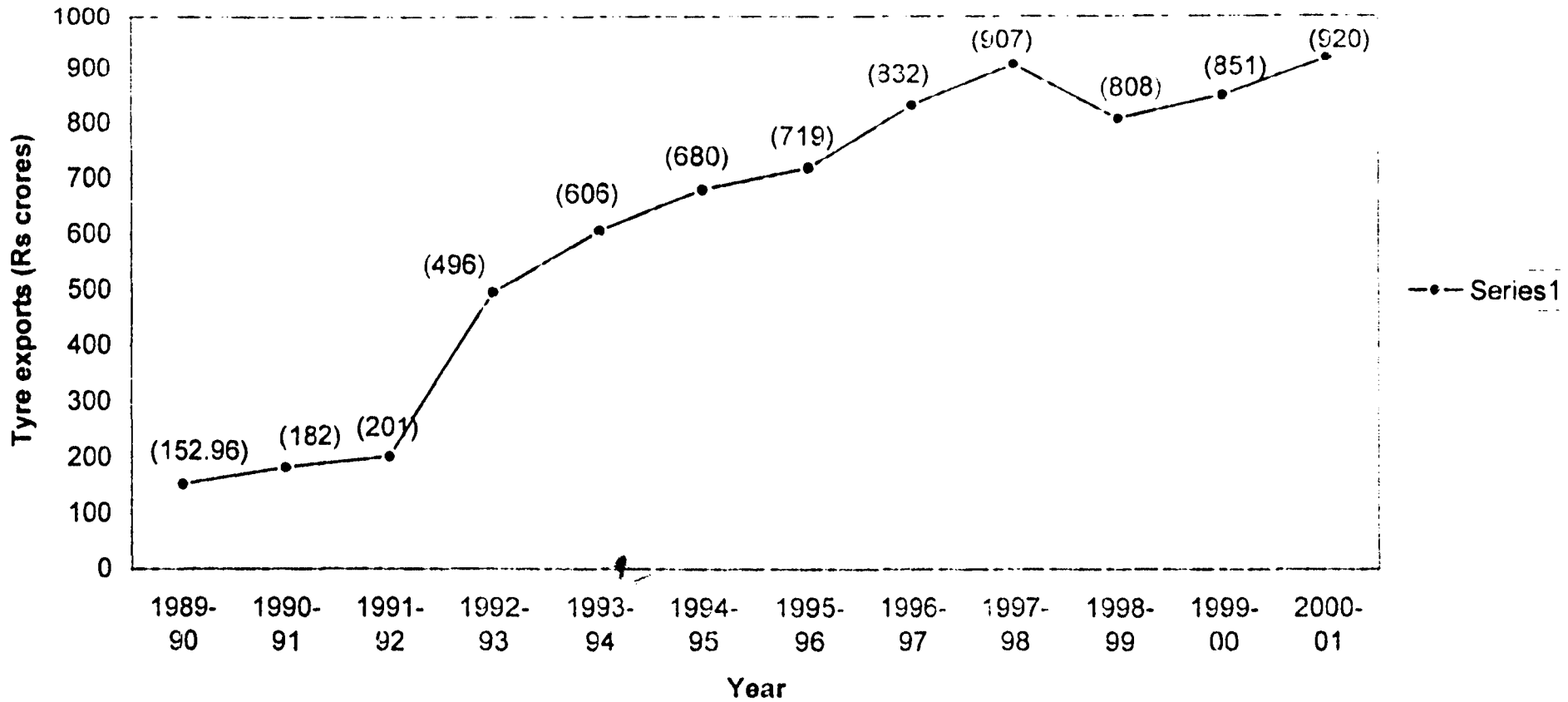
There are also fears of China upsetting the Indian apple cart in the fiercely competitive international market for truck tyres. At present China's presence in International market is much larger than ours viz Rs. 1, 800 crores worth of tyres.

Fig-3.5 Tyre production in India



Source- Automotive Tyre Manufacturers Association.New Delhi

Fig-3.6 Skid row of tyre exports



Source-CAPEXIL,Kolkata and Council for Leather Exports ,Chennai

We are able to sustain due to the quality of our tyres. But quality comes at a premium. Indian tyres sell in the US market at about Rs.5 more than the Chinese tyres. What's more, Chinese tyres are improving in quality constantly. Secret of low priced Chinese tyres is not known as no reliable statistics were available from China. It is estimated that not less than 100 tyre manufacturing units exists in Peoples Republic.[19]

Between 1997-2001, the growth rate of tyre industry was 7 percent on an average. This was due to increase in production in the two wheeler segment . Production of Heavy Commercial Vehicles registered a 10 percent slump in 1998. Production of Light Commercial Vehicles was relatively less affected. Its production fell only about 1.5 to 2 percent. Major causative factors for the fall in production were 1) imports of car radial s from South Korea to the extent of 11percentt of international demand 2)lock out at one of Apollo tyres plants due to labour manager strains[20]

A history of Lobbying

It is said that clever strategic policies of the tyre lobby is decades old by citing the example of an incident in the sixties. By the end of 1966 the rubber price was Rs. 3.50. At that time govt influence on the tyre prices were comparatively less. All of a sudden rubber prices leap frogged to Rs. 7.50. This was the result of the stock policies of the tyre lobby who in their turn raised tyre prices by 60 percent .[21]

After five or six months they cited the cause of shortage and started pressurising for NR imports. Within no time they were able to reduce NR prices back to the old level of Rs. 3.50. But no change what so ever was made in the price of tyres. Industrialists are accused of continuing this policies even now.

In the early days Dunlop used to buy rubber for all industrialists. Due to grower agitation for fair price in 1968, minimum price was raised to 5 rupees by the government. STC was directed to procure 10,000 tonne as a response to growers demand. Such procurement policies were found harmful to their interests by the industrial lobby. They refused to buy the rubber procured by the STC. The reason they gave for this was STC procured rubber is of bad quality belonging to grades RSS 1 and 2 grades which causes damage to their machines. They claimed that they usually buy only high quality grades. Following this, an examination of the earlier bills of the industrialists showed that they

had always bought grades RSS 4 and 5. When the guilt was proved, tyre monopolies were forced to buy STC's rubber.

For the first time in this decade stock of dealers crossed 40,000 mark by 94-95 year end. It was in early 95-96 that the industrialists raised hue and cry that they do not have enough rubber for even two weeks stock. On the basis of applications to the government 40000 tonnes was imported. This was in addition to import under Advance licenses. This lobbying pressure overcame the rubber Board recommendations of import of 20,000 tonnes. In 95-96 there was a historic excess stock of 32000 tonnes. (In 1995, the total imports was 59000 tonnes).[22]

International price differential is usually cited as the cause for imports. The industrialists have to pay a no of taxes on the rubber bought from India at market rate. 11 percent purchase tax, 4 percent CST with CST (c) forum, 10 percent with out CSI (C) forum, cess of Rs. 1.50. If market price is Rs 50 the industrialists in India have to pay Rs 59 by way of taxes. Apart from this there is transportation charges to the factory, Insurance, loading and down loading charges etc. This will raise the price to Rs.62

Under duty free imports there is no taxes or cess. But there is cost on insurance and freight (CIF) plus loading and down loading charges and transport charges from port to factory. If we add the expenses under these heads to the market price of Rs 50 the total would amount to Rs. 53.50-54.50. It means that when Indian and international prices are in parity, duty free import under Advance licenses would yield a profit of Rs. 6.50-7.50/kg.

Sec 3.10:-The International rate Puzzle

According to the growers the international rates are used as a smokes screen to favour the industrialists. They say that rubber is made available indigenously international rates. But tyre is not available at international price. International rates seem to be applicable only to rubber producer. Those who quote international price level and argue for international price parity are conveniently forgetting the international rates of subsidy which is almost 90 percent in major rubber producing countries like Malaysia and Indonesia.

The Union Government has imposed restrictions on the import of used tyres even if the material is available at throw away prices, the duty imposed price should not be less than $25 for car tyre and $175 for truck tyre. At the current exchange rate of Rs. 42.40 dollar, a used car tyre would cost Rs. 1,060. Freight and insurance would come to about 6 percent of the price making the landed cost of Rs. 1,124 per tyre. Charges on unloading at the entry port, retreading etc are some of the additional cost. All these would put the cost of an imported used tyre at Rs. 1,500 per unit. At the same time brand new radial car tyre would be available in the country around this price. Now the question raised here is will anybody be interested in buying worn-out old tyre? [23]

The Rubber Board chairman K.J Mathews has stated "That generally Indian prices are higher than international prices". Indian rubber prices in March 1999 were Rs24.25 /kg and Kuala Lumpur price were 28.26. If 11 percent purchase taxes were added to this Indian prices would beRs 26.92. Cost on freight, insurance, brokerage, port clearance charge, loading charge at the port etc together add 8 percent to the landed cost of imported rubber. Inclusion of this makes the price of imported rubber 30.51 making the current argument of Industrialists that imports are more profitable now, meaningless. The 8 percent additional cost factor is cited as an obstacle for export of rubber to China but conveniently forgotten in the case of import of rubber. This clearly reveals the buyers intention to hammer the local market.

Grower activists say that the Chairman's statement rubber growers have always got a price Rs 5-10 . above international prices can only be termed as a daydream. As per the IRSG statistics, not once in the past decade the 5 rupee difference above international level was broken.

It is alleged that international rates applies only to NR and not SR. Only NR price is forming as an obstacle in the path of achieving international competitiveness the almost double prices of SR domestically is ignored by industrialists to suit their ends.

SR fetches double the international prices. Over this there is 18 percent excise duty and 2 percent surcharge. SR imports are 80,000 per year and consumption is almost double this figure.

Sec 3.11:- Stock management

1.Non observation of stock norms

Rubber Board prescribes stock norms to the industry and has powers to take strong actions, if it is not kept. Previously tyre, consumers in North India needed time for transport. that was how stock formula originated .Today, truck loads can reach any corner of India with in 8 days. As a result the time period for stock formula was reduced to two weeks. Some times companies adopt speculative strategies and do not even keep two weeks stocks.

2. Quoting prices; Joint buying strategy

The policies for price crash is made under the frame work of collusive oligopoly. Every week tyre company representatives would meet in Ernakulam and come to an understanding about the quantity and the price at which rubber is to be bought. If prices were to pushed down, all the companies would together quote low prices. In order to avoid the accusation of cartel behavior they would decide small variations, upward or down wards, beforehand and quote the same.

3. Joint invisibility

They would cite general industrial problems and disappear from the market for one or two weeks. Then the growers would be forced to clear their stocks at a lower price. The accusation finds a statistical base when we look at the company wise share in production, MRF and CEAT together account for about 40% of the market. If these two companies stay away from market for just one day there would be a glut of 260 tonnes in search of a buyer. Once the prices have lowered to the company targets they would buy rubber and reap profit. While NR prices are declining continuously tyre prices are ever on the rise. Great loss of the growers has become a gold pot to the industrialists. [24]

4. Artificial rise to fillip stocks

If the industrialists find that their stocks are limited single entry itself would raise general prices. So they hold their existing stocks and start joint buying till prices increase by 2 or 3 rupees. Then they would adopt joint invisibility policy till prices fall to the profitable level of inventory procurement.

5. Managing the timing of policy announcement

Lobbying interests are always keep to make the govt announce their intention to import just before the most productive seasons. In Sep-Jan when the market is flush with supply, import threat would suit their ends by lowering prices. If and when they fail to influence the government to make favourable policy decisions their next aim is the people at the operational level viz officers. Bribery and corruption would work towards the non implementation of policies against business interests. Policies like imports was banned on 1999 Jan 25th. At first there was a price rise of Rs 3/kg but it later declined.

Imports ban was announced at a time when there was least buying pressure even in domestic market. Better grades were available in plenty in the internal market at that time. Even the channelised demand failed to raise prices due to excess stock. Tyre-crumb industrialists say that prices have fallen despite import ban and so ban should be altogether done away with.

6. Managing STC and Procurement

Another weapon is refusal to take the procured rubber like in the 1960's. They cite reasons like low grades, coolie problems, etc. It has become a custom to visit STC go downs unpack the stock and reject them. About 7250 tonnes procured by STC were rejected thus. A good deal of official time of the Rubber Board and STC was wasted on negotiations with the business sector. Since stocks can't be kept for long as there is the threat of degradation, STC was in a vulnerable position. Then STC agreed to tender rubber from the new stock. It was even agreed to transport rubber from STC go downs to the factory yard. The buying price for the factories was fixed on par with international market rates. STC agreed to ignore the importing expenses. A further incentive was the loan of at international rates (at 6.5 percent) for five months. Thus a situation was created whereby it became more profitable to buy from the domestic market than importing the same from international market. Thus the power given by a few thousand tonnes of import is used to get the 6 lakhs tonne of domestic rubber at throw away prices. Even then there wasn't much off take. Finally under the threat of ban of import licence, they bought a mere 3000 tonnes. [25]

To make delays and make procurement ineffective, the officials are influenced. There are instances when prices below market rate is quoted when procurement was

going on at the market rate. Market rates itself are various, namely Kottayam price, Kochi price Rubber Board price, Dealer price different papers publish various prices. Through media influence, higher price is directed to be given in papers and rubber is bought at lower prices. Then rubber is sold to the procurement agencies at a certain prefixed higher percentage. (the officials can reap the margin profit). Grader is bribed and bad quality rubber is given to the procurement agencies under the label of first grade rubber.

If by any chance procurement is showing signs of propping up prices, then the rubber won't reach STC godowns. Officials would be manipulated, delivery notes would be taken to the godowns and certified "rejected" on the basis of low standards. Thus no one will be blamed that way.

Sec 3.12 Looking through the eyes of the tyre manufactures

The tyre industry is highly raw material and capital intensive, cash hungry business characterized by relatively low profit margins. The operating profit margins both for Indian producers and global majors hovers around the 10 percent mark. Also the need to provide credit and maintain a minimum level of inventory of both the raw materials and finished products results in a significant outlay of funds towards working capital. Raw material costs account for close to 46 percent of the total turn over, the principal raw material being NR, SR, carbon black and tyre cords. NR constitutes about 24 percent of the total input cost. Abundant production and carry forward stock has helped the softening of NR input prices. Nearly 60 percent of the other inputs viz SR, carbon black nylon cord are petro based. The recent upward spiral in crude oil prices to the present level of around $23 per barrel is likely to push up these input prices.

The prices of carbon black account for 12 percent of the total cost, SR+nylon cord together account for 26 percent of the total cost. Import tariffs for these key imports attract a duty of close to 40 percent which is the same as the import duty on finished products. Added to this an antidumping duty has been recommended on the imports of SBR and nylon cord which would result in the rise in their price too. All this would compound the problems of domestic tyre majors. There has been a 2-3.5 percent hike in tyre prices in 1999-2000. While this would negate the present hike in input costs, crude oil prices are continuing a firm trend. [26]

Tyres are put under OGL after liberalisation. Tyres attract an import tariff of 40 percent while imports from Korea enjoy a concession of about 10 percent by virtue of the Bangkok Agreement. Imports from South Korea are picking up gradually and if the present duty structure were to prevail, the domestic producers would find it difficult to sustain their profit margins which are already wafer thin. With the full enactment of WTO provisions, and resultant slash in duties on line with global trends the domestic major would have to face import onslaught though at present import of tyres have not assumed alarming proportions. [27]

Radial Vs cross ply

Based on the technology, automotive tyres can be broadly classified into the traditional cross ply tyres and the technically superior radial tyres. In the absence of modern model of car, Indian manufactures were making cross ply tyres in the pre liberalization period. Radials constitute about 50 percent of the total market for passenger car tyres. However the usage of radials is negligible in other segments. [28]

Globally the cross ply tyre is a fading concept characterized by relatively low value addition. In the export market cross ply tyres have been Indians forte. Radial tyre production involves highly technology intensive process. As a result the price of a radial tyre is about 30 percent more than the cross ply. But they have greater strength and quality.

After liberalisation, cars having world standard like Ford, Opel Astra, Ceilo etc entered Indian market. Realising the growing importance and preference for radial tyres domestic majors are gearing up to exploit the opportunity. Many have started already on an experimental basis. Before they were able to secure their footing tyre imports were liberalised. Indian manufactures have to compete with tyres from foreign countries where raw materials like rubber, carbon black electricity are comparatively cheaper.

The entry of MNCs is yet another threat, Until a couple of years ago, global tyre majors, except for the US based Good Year tyre had negligible presence in the Indian market. Post liberalisation zest in the automobile sector attracted many MNC to Indian market. Competitive dynamites will change with the entry of global majors. While Bridge Stone has commissioned its production facilities, Continental is set to graduate from the status of a mere technology provider to an equity partner. The other global player-Michelin is mulling the possibility of setting up a plant in Karnataka. So also Kumho, which is toying with the idea of setting up a plant in Tamil Nadu.

MNC tyre technology is most modern. It is not easy for Indian tyre manufacturers to compete with them. Foreign tyres are longer lasting so replacement demands would decline in the future. Since MNCs export Indian made tyres to other countries they can import rubber duty free under Advance licence facility. MNCs also have lakhs of acres of rubber plantations in countries like Africa. They can utilise the cheap labour in these countries and reap benefits of comparative cost advantage. These MNCs can afford to be

independent of NR supply which will puncture Indian prices to a flat. Out look shows tough competition for Indian manufacturers. Shutting down of many Indian companies is on the cards in the absence of cost reduction and quality up gradation. These companies were Big fishes in the Indian river swallowing up grower interests. At the point when the river opened up to meet the sea, it looks as though MNC whales will swallow them up.

Moreover MNCs use more SR relative to NR. Competition forces Indian companies to mimic the foreign technology. If foreign brands of tyres establish themselves in the Indian market, the rubber growers would lose what demand share they had in the automobile sector. On top of this comes the permission to import second hand tyres. Second hand tyre imports would result in good tyre imports in effect through bribery. WTO cannot insist on the import of waste products to any country as opined by MRF sources. It was also stated that in 1950's, Indian rubber production was only 20,000 tonnes. Of that 25 percent was imported at that time. Now the production has increased to 6 lakh tonnes and import has decreased to 3.5 percent . It is the increase in domestic demand that led to production increase and high prices import of tyres would reduce domestic off take and would accelerate rubber price decline.

Out of second hand tyres reclaimed rubber was made after retreading .In effect foreign tyres would invade the retread market. It was on this consideration that industrialists stayed away from the market reducing their stocks. Though tyre companies succeeded in their agitation in fixing a minimum price for second hand tyres the danger is not completely wiped off. Protectionism goes out of date with WTO regulations. In view of such factors, it may be contended that as the tyre companies have to be competitive to face a global market where the guiding rule is " survival of the fittest". They may be justified in their action as a Big fish to growers. Competition is the key word in the global village and it applies to growers also as the operational environment and its conditions show no favouritism to anyone.

Sec 3.13:- Foreign Sector

The operational environment in the foreign sector related to natural rubber include IMF conditions, GATT, WTO, SAARC, Non commodity agreements, South East Asian crisis, Breakup of INRO etc, To analyse their interactive influence, a focus on each of these is necessary.

Sec 3.14 IMF conditions:-

The debate among economists on the role that a government can usefully play by manipulating market forces had been going on at least since Adam Smith divined the working of an " invisible hand" in the market. In more recent years the leading opponents of government interference have been the group of monetarists who have closely followed Milton Friedmans "laissez faire" economic philosophy and also some international organisations notably the IMF and the World Bank. On the other hand a large number of Neo Keynesians concerned with development problems have tended to emphasis the positive role of the state and advocated the same through UNCTAD and through regional commissions of the UN.

Also, Erstwhile Soviet Union, Eastern Europe, India etc have developed what can be called "plan weariness" and Economic reform is the key phrase. So when there was a severe cash crunch in the wake of the Gulf war 1991 India resorted to IMF loans subject to conditionality of " laissez faire". The license Raj has been done away with and thrust was given to the creation of a more competitive environment for improving the systems productivity and efficiency. Planning assumed an indicate role. New economic policies were formulated in all key sectors.

Sec 3.15:-Globalisation and GATT

General Agreement of Tariff and Trade (GATT) as we know, is an institutional decision making body on international Trade set up in 1948 to promote free trade by reducing trade barriers and discrimination, increase competition and efficiency and thus assist the growth and development of all member countries.

The 8th round or the Urgency round of the GATT (1991) touched on new areas such as Agricultural subsidies, Trade Related Intellectual Property Rights (TRIPS); Trade

Related Investment Measures (TRIMS) and General Agreement in Trade in services (GATS) etc.

It has brought into focus on the " Most Favoured Nation" MFN clause to discourage bilateral trading .The principle of MFN implies that tariff preferences given by a country to another must be extended to all others with which it has trade relations.

Market access is ensured by abolishing non tariff barriers as well as by reducing tariffs, It requires the countries to cut tariffs on industrial goods and farm goods by about 37 percent and to reduce domestic support viz export and import subsidies .As a part of the package of liberalisation and on the recommendations of the Chelliah committee India has promised to reduce basic duty by 30 percent over a period of six years and is to cover raw materials, intermediates and capital goods. However this does not include agricultural products, POL, fertilisers etc.[29]

Since India's share in world trade is less than 3.25 percent and percapita income is less than $1,000, she is exempt from the prohibition of export duties.

Agreement on Agricultural subsidies

The Dunkel act postulates that ""Domestic Support programme" (subsidies) for farm products should not exceed 5 percent of the value of agricultural produce. Besides 10 percent product specific subsidies, subsidies on fertilisers, irrigation, power, seeds etc should also not exceed 10 percent .

Special and differential treatment alias Green Box treatment is given to developing countries like India which needs to reduce subsidies for values greater than 10 percent only over a period of ten years. But it is laid down that all countries have to provide access opportunities to import at least 4 percent of their total consumption except for those primary commodities which are considered as staple in the diet of a developing country. For non staple commodities including rubber, access opportunities would have to be increased annually over six years. Developing countries are required to reduce general tariff rates by 24 percent over six years. Other measures like Multi fibre Agreement is concerned with the lowering of tariff on textiles. TRIPS is concerned with intellectual property rights and patent protection for new inventions. GATT provides protection to plant Breeders under which new range of seeds, bio fertilizers, bio pesticides and successive generations of the protected variety will be under patent

protection. This means that, for sowing the next crop the farmer cannot use farm saved seeds of protected variety automatically .He has to obtain the approval of the Breeder who are generally Giant MNCs or pay compensation for the use of the seeds .It is obvious from this that there a threat and opportunity for research in Rubber. [30]

TRIPS has relevance in the rubber scenario in view of "national treatment clause" under which foreign investor shall be given the same right in the area of and magnitude of investment .Quantitative restrictions on imports and exports will be abolished. Performance obligations like usage of local materials and equipment, technology transfer etc. will be eliminated. It is through this gateway that MNC grants in tyre industry is going to come in. Exceptions are allowed to countries having BOP difficulties.

On the whole Indian agriculture- a non commercial activity- should not attract GATT rule which are relevant for commercial production and trading activities. Since India is not a significant agricultural exporter, the controversy among the big countries does not really affect us. Since developing country is generally faced with BOP problems, it can easily avoid tariffication. The Aggregate measure of support (AMS) which is designed to calculate the extent of protection the country enjoys, is negative in the case of Indian agriculture which means that the domestic price of most commodities is less than their international price and therefore would not require the removal of subsidies. As per the calculations by the Commerce Ministry, the non product specific AMS works out to be 2.9 % which is obviously less than 10 percent [31] . For most product specific AMS, the support is negative except for rubber and oilseeds which have positive AMS. It might require the reduction in the protection in the long run. The long run can be very long on the grounds of BOP difficulties. In the case of rubber planting subsidy increased from Rs.8,000 to Rs.18,000 in 1997 in order to meet the increased cost of production. (So the argument of the leftists that liberalisation and GATT sowed the seeds of rubber price crash has little ground). However these hiked rates were lowered by 1/3rd in March 2000 from RS18,000 to RS12000.

As the duty on latex foams is unbound under GATT, the Government of India raised its basic customs duty from 35 percent to70 percent w.e.f 1st March 2002.

Sec 3.16:- World Trade Organisation

The successful conclusion of the Uruguay Round of the GATT paved way for its successor, a new world trade organization in 1995. Globalisation and liberalistion are the key words in achievement of the WTO.

To enable India to take advantage of trade liberalisation, some WTO provisions need to be taken up for further negotiations. Priority should be given to agriculture and textiles. Before the formation of the WTO, though GATT applied to trade in agriculture, there were various exceptions to the use of non tariff measures and subsidies. India has hopes for boosting agriculture exports under WTO. For the realisation of such hopes government should take measures like,

1) Reaping comparative cost advantage of land and labour through technology up gradation , land reforms, optimal use of fertilisers and irrigation.
2) The government should look into the price formation of several agro products. Due to high price realisation from exports, cultivation of such products may replace those not much in demand abroad and may even distort food production.
3) There is an imperative need for better understanding of the politics and economics of trading Blocks in agriculture. For instance, an increased understanding of the Common Agricultural Policy (CAP) will go a long way in increasing agricultural exports to Europe. In the Textile case, Developed countries like the US and the EU are not willing to do away with MFA on the pretext that imports from their low cost counter parts may cause "Market Disruption" to their domestic industries and have resorted to stern anti dumping action.
4) India has made a beginning in Export Oriented Units (EOUs) in agriculture. Further foreign collaboration would ensure quality of EEC which virtually created milk and butter lakes through enormous subsidies, professionalism and ready acceptability abroad.
5) Research on AMS must be made so that of protection in Indian agriculture can be quantified. This would create data base which would be useful for India in trade negotiations and in the settlement of disputes.

6) Since agriculture is a state subject, role of state governments becomes important. State can create conducive conditions for farm projects with foreign collaborations.

India marginally improved its world trade during 1996.

Indian imports which were around 20 percent of GDP during 1994 and 1995 was down to almost 12 percent of the GDP. But this was due to the South East Asian Crisis. The anticipated benefits from this largest ever multilateral trade Agreement are so enormous that no developing country can remain out of it. There are several steps required to be taken by member countries within the stipulated period of ten years (1995-2005) called transition period. India too has lots of unfinished jobs like amendment of patent laws; acceleration of tariff dismantling, liberalisation of financial services etc.

When WTO comes into existence it would be unrealistic to agitate for protectionist policies like procurement, announcement of support prices etc. Market distortions are likely to be wiped out and only the most efficient units can stay on. Market price will rule whether it is for rubber or for tyres. Existence would depend on the utilisation of or the discovery of areas of comparative cost advantage as the weapon of Antidumping measures cannot be used at all times and in all cases.The main problem in the case of NR is that it is included under industrial rawmaterial and other important plantation crops like tea, coffee, cardamom,and pepper which have been categorised as agricultural commodities and coming under agreement of agriculture(AoA)..In India the bound ratefor tea is 150 percent , coffee and pepper is 100 percent,and that of solid forms of NR is as low as 25 percent. Hence the country cannot raise the import duty unless the bound rate is fixed at a higher rate.The Governmnt of India in its initial negotiating proposals for agriculture submitted to the WTO, had stressed the need for rationalization of the product coverage of the agreement.

Sec 3.17:- South East Asian Economic Crisis

The Asian crisis began on 2 July 1997, when the Thai government allowed its currency, the baht, to fall freely after a large scale shifts of funds out of the domestic financial markets. As a results the baht fell sharply by -20 percent .. This has resulted in further competitive devaluations by Asian currencies. By the end of August 1998 the currencies compared with June 97 were Singapore dollar - 19 percent , Yen -21 percent , Won -32 percent , Baht - 38 percent , Peso -38 percent , Ringgit -40 percent and Rupiah - 79 percent [32].

Asian Currencies relative to the US Dollar.

The crisis started because the fast economic growth in Thailand and other countries in this region attracted floods of inward foreign investment, which pushed up land and asset prices. Helped by poorly regulated financial systems and spurred on by the decline in global interest rates, private capital surged into these countries and percolated through their domestic banks from the early 1990s. At the beginning of 1997, investors pursued a quest for higher yielding alternatives to their own currencies, eg, the Malaysian ringgit rose sharply in January. In Thailand, lending increased sharply with many loans politically connected and an investment banks from the West rushed in. That encouraged the companies to borrow, often in unhedged foreign currencies and through short term lending. There were some increases in infrastructure projects, but most investment went into housing and other unproductive projects.

The trigger for the crisis was the export slow down in 1996. Most South East Asian currencies were pegged, to the US dollar, which had appreciated against the Yen in recent years. This caused the exporting sectors of these countries to become increasingly less competitive .Asian export growth slumped to 2.5 percent in 1996, compared with 9.5 percent previously in the 1990's. Slower export growth threatened the inflow of foreign capital badly needed to sustain current account deficits. This led to market concerns about exchange rates, bringing pressures on them and leading to their eventual collapse. [33]

After an average increase of more than 4 percent per year during 1994-97 the total world elastomer (NR&SR) consumption is estimated to have risen by only 0.7 percent from 16.52 mill tonnes in 1997 to 16.64 million tonnes in 1998. [34]

The slow down cause by the Asian crisis which began in July 97 affected rubber consumption towards the end of that year and throughout 1998. Despite the lowest growth rate since a decline of - 4.1 percent in 1993, consumption has nevertheless broken the record for the fourth consecutive year.

World total elastomer consumption did not decline because of quite high growth rates in the European Union (EU) and North America where the Asian crisis had little effect on elastomer consumption. In UK there was only a slight decline in economic growth due to strong Pound. Japan was worst hit because trade wise Japan depends on Asian countries more than Asian countries depend on Japan. The year long crisis in Asia has put pressure on the seven-year slump in the Japanese economy. Japanese accounts for 17 percent exports from South East Asian countries combined together and 40 percent of Japans exports go to these countries' Japan is also the largest provider of Foreign Direct Investment in these region .So in a way its a vicious circle.

But while Asia/Pacific may have shown increasing dominance in rubber consumption, North America and Western Europe are still dominant in terms of rubber "absorption" ie consumption of rubber end products. This is important in terms of global rubber off take and increases the significance of the vehicle industries in the industialized countries. In the USA, the general trends of marginal increases in vehicle registration and production have continued .

World NR consumption from 1997 to 1998 grew almost 2 percent while SR consumption only marginally. SR share of world consumption fell from 60.7 percent in 1997 to 60.3 percent the lowest level in 32 years since the 56.9 percent recorded in 1963 when the SR share was rising rapidly. The result is not surprising in the wake of price competitiveness of NR.

World NR output is estimated to have increased for the fifth year in 1998. From 6.41 million tonnes in 1997 to 6.41 million tonnes NR production increased by 2.5 percent , slightly more than NR consumption and as a result NR stocks have continued to decline but at a slower rate than the latter part of 1997.

Despite falling international prices, NR production in Indonesia and Thailand increased quite sharply because of higher revenues in terms of domestic currencies.

Those countries whose currencies were still over valued have been facing intense pressure to devalue in the South Asian crisis era eg Indian Rupee, Chinese Renminbi, Russian Rouble Canadian Dollar, Mexican Peso the South African Rand and Pakistani Rupee. Some countries like India and Russia have raised interest rates to defend their currencies. In India we were able to contain rupee depreciation with in 8 percent .[35]

Between June 1997 to March 1998, variations in rubber prices in terms of American Dollar, Malaysian Ringgit, Indian Rupee were-44 percent, +3 percent, -28 percent respectively.

The Columbo based Srilankan Rubber Traders Association analyses that it will be a great loss to Srilanka if they lower price by even about 30 percent , since they wont be able to meet the cost of production. In dollar terms even if we lower price by 44 percent in Malaysian currency we get 3 percent more than before raising Malaysian price competency. In Srilanka, domestic consumption is only 35 percent . So Srilanka is forced to lower its price.

In Malaysia domestic consumption is only 33 percent and in Thailand and Indonesia it is only 8 and 9 percent respectively. The rest is exported causing a rubber flood at competitive prices internationally. India is the worst hit because of its strong manufacturing group production is never enough in most years. The Asian crisis reduced export prospects; increased the propensity to import at a time when the waves of Asian recession was accelerating the domestic recession.

In Indonesia, the government has adopted rubber cultivation as means of settling unemployment population. Government allots the land for cultivation and provides credit for entire planting and maintenance operations at concessional rates with longer repayment periods. Domestic use of rubber is only 10 percent of production. Labour wages are low since most growers are themselves tappers. So the currency crisis has become a blessing for rubber growers.

Sec3.18:- Break up of the International Natural Rubber Organisation (INRO)

The INRO was set up in 1980 under the auspices of the United Nations Conference on Trade and Development (UNCTAD) to stabilise world rubber prices. It was formed on

the basis of INRA; the International Rubber Agreement which was a price agreement for price stabilisation.

As its web page puts it, INRO main purpose has been to stabilise world rubber prices by buying when the prices drop sharply and selling when prices surge. Each member country has a different number of votes, depending on the size of their exports or imports. Contributors to the organization are based on the number of votes each member carries.

There are seven pre-specified price levels .There is a floor and ceiling and between them is a reference price. The area below the reference price is divided into three bands by two other price levels, a lower intervention price or a "May buy" price and the lower trigger action price or "Must buy" price, calculated respectively at 15 percent and 20 percent below the reference price. Similarly the area above the reference price is divided into three bands by the upper intervention price or "May sell" price and the upper trigger action price or the "Must sell" price calculated respectively at 15 percent and 20 percent above the reference price.

These price levels are denominated in INRO DMIP, or the Daily Market Indicator Price which is the weighted average of the fob prices of RSS1, RSS 3 and TSR 20 in Kuala Lumpur, Singapore, London and NewYork expressed in Malaysian/ Singapore cents/kg and is published daily by INRO.

The stabilisation mechanism consists of an international buffer stock with a maximum capacity of 5.5 lakh tonnes, a normal level stock of 4 lakh tonnes and a contingency of 1.5 lakh tonnes [36].The idea is to maintain prices with in a predetermined range by purchasing at depressed prices and selling at higher levels.

In 1995 February there was a revision of reference prices. Under the UN-brokered International National Rubber Agreement III, effective from February 97, there was only a 4 percent increase from the previous reference prices . Reference price was raised from 206.68 Malaysian/Singapore (M/S) cents to 214.95 M/S cents. May sell level was fixed at 247M/S cents . May buy level was determined at 258 M/S cents .May buy level was determined at 183 m/s cents and must buy level at 172 M/S cents.

In short , maximum fluctuation of rubber prices will be in between 258 M/S cent - 172 M/S cents under the INRO scheme of things.

But the international agreement didn't come to save rubber when prices stooped in the wake of South East Asian Crisis. If we assume that one Ringgit was worth Rs 15 before its devaluation the reference price of 214.95 M/S cent can be translated into about 32 Rupees .if India were an INRO member the fair price in India would've been Rs 32. After devaluation the value of one Ringgit fell to Rs 10. Then value of reference price of Rs 214.95 M/S cent dwindled to about Rs. 21.5. But market prices didn't fall to that level.

The buffer stock at the end of the year 1998, is estimated to be in the region of 80,000 tonnes. The failure of INRO to take up significant tonnage with the DMIP in the May buy zone and to intervene to defend the price when the must buy level was breached was unprecedented in the history of INRA'S. It was ascribed to a lack of funds resulting from member governments not meeting the call-up for funds within the allotted 60 day period.

Trapped in severe economic crisis Malaysia devalued its currency. In effect it also lowered the value of international natural rubber agreement. When the Agreement was formulated, had the reference price been fixed in terms of dollar or yen, South East Asian Crisis would not have affected the fruitfulness of INRO. It is said that the reference price was fixed in Malaysian Ringgit at the insistence of Malaysia. At that time Malaysia could not have foreseen the Economic crisis. But the end result was that, despite considerable price decline in dollar terms most of the times the DMIP was within the neutral zone.

Now that Ringgit is fixed to the US Dollar, the movement in the DMIP is partly influenced by the value of the US dollar. The INRO DMIP measured M/S cents and US dollar started to move together in 1998, after diverging sharply in the second half of 1997.

Although Thailand was the first to state that it would leave INRO, only Malaysia took positive action and announced its with drawal at the October 98 Council. While the two biggest producers flooding markets, there was precious little the INRO could do by way of fire fighting . In August 1999 Srilanka also decided to withdraw with this decision, INRO is left with only Indonesia, Ivory coast and Nigeria as producing members. Effectively only Indonesia, being the second largest producer, can make any impact on the global world scene. The presence of the other two is negligible .But INRO

is unlikely to exist without Thailand which supplies about 40% of INRO's contributions from rubber producers.

In the light of the withdrawal of three exporting countries INRO's acting executive Director Mr. Gerard Loyen announced the decision to prematurely terminate the INRA 1995 w. e. f. October 13, 1999. Original termination was scheduled at early 2001. Its extention or replacement by a fourth agreement looks increasingly unlikely. The concerned countries were of the view "After all, if there is another organisation with the same structure, same agenda, the same members, What's so new about it?[37]

INRO's decided to complete the sale of its 1,26,314 tonnes rubber stocks @ 34,000 tonnes per quarter by the end of June 2001, INRO was to be dissolved when liquidation of the rubber stocks was completed INRO will transfer all the existing studies and projects to another international rubber organization, International Rubber Study Group (IRSG).

The year 2001 saw the creation of the International Tripartriate Rubber Organisation(ITRO) when Thailand, Indonesia and Malaysia joined together for stabilizing the global price of NR in July 2001. The long term aim of ITRO is to reduce rubber out put by 4 percent and export by10 percent starting from January 2002.

Sec 3.19:- ANRPC as a saviour? Possibility of OPEC model cartel

The Association of Natural Rubber producing countries (ANRPC) ,set up in 1970, is an inter governmental organisation. The objectives of the ANRPC are (1) to bring about co-ordination in the production and facilitate cooperation in marketing of NR to promote technical cooperation among members.[2]To bring about remunerative and stable price for NR . ANRPC member countries account for over 86 percent of the world supply of NR.

During the price crisis ANRPC suggested the formation of a price cartel in the model of OPEC for natural rubber. But the major bottleneck here is that it is not possible to control production in the lines of OPEC which is an organized body of few. Rubber cultivation is mainly dominated by small holders and for some it is the main source of living. Many rubber producing countries are poor developing countries. As such they cant reduce production for a long term rise in production. As Keynes puts it "In the long term

we may all be dead." Even for the medium term, reduction is not possible by the price vulnerable small grower.

Measures like utpadan hartal were under taken by some small growers as a protest against price crash. But production cut were for only a few days and helped little to serve the cause.

ANRPC meetings showed lean attendance with member countries enthusiasm brought down by the South East Asian crisis and lean production. In the wake of INRO break up, Malaysia is urging support for a producer run price stabilization scheme through ANRPC. This would involve a withholding scheme to limit production, a marketing system to keep supply below demand and a private sector- led consortium to stock pile rubber in periods of over supply.

On 1st March 2002 a rubber consortium based in Thailand was formed for price stabilization in the model of OPEC was formed.

Sec 3.20:- Emergence of new demand sources

Relaxation of some of iron rules of China had led to the increase in Chinese demand. Some economists attribute the opening up of China gate, as the main reason for the sudden rise in world prices in the mid nineties. During 1980-95, the price rise was of a sustained type.

When prices rose, there was excess capacity utilisation in Malaysia and Thailand resulting in glut. This coupled with South East Asian crisis caused the rubber price crisis.

But future demand prospects are high. Globally the US is the first consumer followed by the EU China and Japan. Globalisation means interdependent fortunes. That is the reason why the US is spending crores in South East Asia to remove their recession. The recovery of South East Asian Tigers and Japan is not an optimistic hope but an optimistic possibility. Already they are half way on the path.

The emergence of economic union has created a contending force to the US which had been enjoying the role as the sole super power in the wake of Soviet Disintegration. Both are top NR consumers. In 1993 India concluded a new cooperation agreement with EU on the pattern of what is known as "third generation agreement "which will increase Indo-EU trade. There is also the possibility that the government might take up

Prof.Jagdesh Bhagwathis suggestion that India should strive to get associate member status with EU and enter into a trilateral agreement. All there may have far reaching implications in the rubber demand scenario.

Sec 3.21:- South Asian Association of Regional Cooperation [SAARC]

The world economic scene shows a preference towards free trade at the same time there is protectionism through regional blocks. Some economists attribute the increase in world trade in the past years to WTO but to the growing strength of regional trading blocks and improved trade relations among the developing countries.

Sixth summit of the SAARC set up a high level committee on economic cooperation to look into Srilanka's proposal forming a South Asia Preferential Trade Area by 1997. Thus the momentum for eventual setting up of South Asian Economic Community was set.

Srilanka is a major producer, and exporter of rubber and Pakisthan and Nepal being rubber importers, the setting up of a free trade area has great significance on rubber. On Dec.28, 1998 as a part of the future integration; India and Srilanka entered into bilateral free trade Agreement. The agreement provides for three year and 10 year phase out of all tariffs by India and Lanka respectively. The negative lists and zero customs duty lists were to be finalised with in 60 days. It was said that rubber and tea were at first put under concessional duty list. But India withdraw its offer later on bowing to immense pressure from domestic producers and put these items under the negative list.. It is notable that the threat of competition from a major producer and exporter of rubber arose at a time when rubber prices were only staging a marginal recovery. From August 1998 onwards NR can be imported duty free from SAARC countries.

Sec 3.22:- House Hold Sector

In the traditional macro economic theory, when postulating the circular flow of income and expenditure, the household sector is defined as the owner of all the factors of production viz land, labour and capital. This sector receives income by selling the services of these factors to the business sector and spends it by buying the output of product of the business sector. In the rubber scenario our attention is focussed on

different members of household like a grower, tapper and dealer. In same cases these three roles lose their demarcative significance. Often we find a grower who is himself a tapper. Just as often as we find a grower who is also a dealer. But when there is no interactive roles, these three members of the rubber household sector act as adversaries, each intent on striking a better deal for themselves than the other.

Analysis of existing operational and causative factors with reference to household is very much important for understanding the real problems in the rubber arena. Household, as we knew is the main cause for consumption and economic activity at the micro level which pave the way for macro level economy dynamics. So the crisis causing factors arising from the household sector rate equally with the global causative factors.

Sec 3.23:- Paucity of Labour-The White Collar Effect

Kerala has many economic peculiarities. As against the situation of trade off between agriculture and industry seen in the stages of development in many other countries and states, in Kerala the trade off is between agriculture and service sector. It does not mean that there is no trade off at all but that the trade off is marginal comparatively. Lewis theory exists in a diluted form. The increased absorption of people from the farm sector has created labour shortage. A class of people discriminated previously on the base of caste as lowly labourers, now have reservation in the government sector, thus reducing the availability of blue collar workers.

Thus a great number of people are absorbed away from agricultural sector by white collar jobs and those who are unabsorbed by the industrial and service sector prefer to stay unemployed and absorbed by the fascinating hope for white collar job.

The end result of the absorption whether real or imagined is acute scarcity of labour which inevitably raises the bargaining power of the existing blue collar workers. The industrial wage rate and cost of living become reference points in their bargain.

All these factors have led to the rise in tapper wages from 15 ps/tree in 1990-91 to 30 ps/tree.

Estate Vs Small holders:- The infight

Small growers are Big in number only. When it comes to bargaining power estates are real Big. The small grower do not enjoy the advantage of efficient organisation like the estates. Estates have their own smoke houses and as a result they can store their produce to take advantage of the high prices. For the poor farmers building a smoke house worth almost Rs 25000 just to smoke 4 or 5 sheets is unimaginable and highly impractical. Without proper facilities for smoking there is the danger that his produce may rot. Some farmers cannot indulge in speculation since income from rubber is his main source of livelihood. On the other hand large estate holders have other sources or revenue so they can hoard their produce and speculate to get higher income. Such policies make estates the dominant sector who is the price maker and small growers the price taker. Growers have to follow the lead even at a loss.

Shortage of tappers is the a major problem faced by grower and estates alike. Available tappers are monopolised by the large estates attracting them away from small holders with even higher pay. This forces the small grower to pay similar amount to get a tapper, the tapper usually comes late, only after the tapping in estates is over. Early morning tapping which yields best is reserved for estates. Late tapping reduces yield and life span of the tree. Hence again quality of bargaining strength defeats its quantity.

Small holders smallness is a bane in one more aspect that it makes cartelised behaviour impossible. ANRPC suggestion of OPEC model cartel fails on the grounds of small scattered ness. During the price crash, many suggestions were made for "Utpadan Hartal" or production strike. But the decentralised characteristic of decision making units made it impossible to implement strong and uniform policy decision. Among small holders almost 98 percent belong to the group of 2 hectares and below. In such a case the growers relative poverty is their weakness. Some growers have to earn their daily bread through rubber sales.

If there had been better cooperation among small growers or estates or among the small grower themselves the crisis in prices could have been avoided or managed in a better fashion. It was suggested that a reduction of 30 tapping days by all the growers or that just ten days of non production could lift the grower out of the rut. Such suggestions were not taken up. There was some form of protest in Pathanamthitta District where

about a compaign of felling about 100 trees in each plot was started. Needless to say it remained as a model of protest.

Sec3.24:-Rubber dealer villain or Victim?

Rubber dealer is often seen as a villain by small growers. 90 percent of the growers produce is being marketed through private trade channels like licensed dealers. Since this channel is monopolising their trade scene, they say that exploitation is possible by deliberately downgrading the quality of their produces as rubber grading is taken place in the form of visual grading. Grower also say that dealers finance the growers in times of difficulty against the assurance that the growers will sell their rubber in future at the terms specified by them. By helping the growers to tide over difficulties the dealers try to create a psychological bondage leading to moral exploitation of the growers.

When rubber prices crashed, farmers sold rubber in a panic without keeping any stock to the dealers. In the hope of future price rise the dealers bought all these panic sales and they were forced to release their stocks at throwaway prices. Stock keeping for more than six months will lower the grade of rubber. 10-15 percent of the 10,000 licensed dealers is said to have terminated their transactions.

The hike in sales tax to 11 percent early 1998 led the dealers to more difficulties. If tax is not paid, the tax department would not give delivery note to the companies and without it companies won't transact. The increased tax liability for tyre companies is estimated to be Rs. 1000 per one load. On an average, daily 10-15 loads are transacted in Kochi. Companies are prepared to pay the excess tax for current transactions but not for earlier deals. If tax is levied for earlier deals some companies would have to remit crores of Rupees on this account.

When the cess was levied there was a doubt whether it should be levied from the dealers. As a result there was Supreme Court Ruling that it should be levied only from end users or Rubber manufactures. Since such a ruling was likely to be contended by the tyre manufacturers, the Supreme Court has specified the liability of the tyre manufactures. Such favourable decisions are necessary for solving the problems of rubber dealers though it took almost two decades to decide over the issue of the cess inclusion. Government should come forward to solve dealers problems.

In the post price crash period, in a small scale dealer who invests a capital of about 3 lakhs rupees to enter the rubber dealing scene, can get only about Rs2000 if he does business in the straight forward way . So they are vulnerable to the promises of brokers who act as a link between the dealer and big manufacturing companies. The broker cleverly sinks the stock tendered by the dealer in a black deal. He sometimes delays payments and reaps interest benefits. [38]

Sec 3.25:- The Income effect of Rubber price crash

Rubber is a source of income for about 13 lakh household in Kerala. Of this nine lakh is accounted by small growers alone.

It was said that there was a general spurt in effective demand when rubber prices were high. This led to increased industrial activity especially in the rubber belt ie central Kerala in Towns like Kottayam and Kanjirappally, it was a common sight to see a rush in dress and jewellery shops. Markets were packed and buzzing with activity. Price crash changed the situation and it is said that car finance companies were the first to realise the change in winds. They suddenly discovered that it was not so easy to make a living. Prior to the crash three out of every 10 Maruties were sold were in the rubber belt. Maruti had even sent sales promotion officers to Meenachil Taluk to take a list of growers who doesn't own cars. After the crash many sold these cars. Some cars were dumped in their sheds because these isn't enough money for petrol[39]. A part of the increased income caused by rubber boom was invested in the education of children outside the state in the form of capitation fees given to secure a medical/engineering or a nursing seat. Education out side state also increased movement of people and transport. The relation ship between rubber prices and general economic activity is direct and immediate.

The dilemma of an out of state nursing school is reported. The institution named "Khat prabha" is in Belgam in Karnataka state. This school had got establishment and prosperity solely out of the purses of the Kerala rubber growers who sent their daughters to join their course in view of the rising demand and salary of nurses in countries like the USA and the Gulf.

Worse still is the plight of people who were myopic about the sudden hike and frantically resorted to loans from banks and other financial institutions to buy the plot at a

time when land prices were high for new planting. Their hopes for better future returns crashed simultaneously with rubber price crash. Now they face not only low returns but high input prices as well.

But there exists an other side of the coin. It is reported that "We Tamilians can exist without Keralalites but you Keralites cannot exist even a day without Tamilians. A single days hartal in the track transport sector would double rice and vegetable prices and drain a keralites pocket."[40] Vegetables worth 600 crores are daily brought to Kerala from other states. For rice we are dependent on Andhra and for wheat, on Punjab. Some economists are of the view that rubber cultivation has led to the highly skewed agricultural growth in Kerala. It enjoyed the highest rate of subsidy and was treated as an "elite" among agricultural crops. General cost of living rose as a result of hike in the price of goods most necessary for subsistence. Land prices were up due to high rubber prices. Some writers even accuse that the profitable factor in rubber cultivation went only to increase conspicuous consumption. According to them, the main factor behind the agitation for highest prices is that growers have got used to their luxurious life style and laments that they can't continue as before. They accuse further that many growers have alternative employment provisions and is not as worse off as they pretend. A majority has inherited the land or bought it years back at cheaper rates. A grower's main problem when prices fall, is high wages since plant protection measures can be postponed for rubber without much harm in the long run unlike some annual crops. Though, it is true that increase in rubber growers income shows multiplier effects, it is still lesser compared to the multiplier effect which would have been achieved by general increase in real incomes owing to low cost of living.

Sec 3.26:- Social implications of rubber price crash

Among rubber grower's, literacy is very high, family members are often employed in alternative occupations (often out of Kerala). The support from religious institutions and fraternities is strong. Another interesting aspect pointed out was that there is an increased leaning towards religion as the crisis intensified. It is a common sight to hear priests taking up the cause of the growers. Hence the heavy rise in suicides witnessed in Tamil Nadu in the wake of the coffee price crash was averted here.[41]

Sec: 3.27:- SWOT Analysis

Strengths

1. Geographical suitability which makes rubber cultivation highly suitable.

2. Indian industrial climate is showing signs of revival. A good crop period and the resultant income effect is expected to increase goods movement leading to increase in original and replacement equipment demand.

3. Government of India has banned import under license against public notice after 1995-96. Import under Special Import License (SIL) is discontinued from April 2001. Also Li Advance Licensing scheme was banned from February 20,1999. This shows that state role is effective even after liberalisation.

4. Long gestation lag and initial high investment which ensures commitment from growers.

5. New innovations in tapping which would double the productivity of existing trees viz; inclined upward tapping developed by Scientists.

6. India exports tyres to 51 countries and they even enjoy a premium status in US market. The market share of US in Indian exports is almost 30 percent. Though tyre export growth fell by 10 percent in 1998, it is fast picking up.

7. Revival of South East Asian economies since globalisation means interdependent fortunes countries like the US is taking keen interest in investing for South East Asian revival.

8. Under GATT developing countries like India enjoy "Green Box Treatment" under which India need to reduce subsidies for values greater than 10 percent only over a period of 10 years. Since India's share in the world trade is less than 3.25 percent and per capita income is less than $1000, she is exempt from the prohibition of export duties. [42] Bop difficulties can be cited to prolong the time span for tariffication.

9. High level of cooperation and grower awareness in the wake of crisis which led to industrial venture in some areas.

10. Since India is a "Developing Country", rise in demand for tyres and other end products a sure certainty.

11. High level of literacy and alternative employment among small growers enabling them to bear short term price fluctuations.

12. Strong religious, institutional and political support. Rubber votes being a deciding factor for both parties and hence their causes are actively taken.

13. Rising population trend would add an extra dose of purchasing power each year.

Weaknesses

1. Smallness of 95 percent of growers reduces economies of production. Small holders do not enjoy the advantage of efficient organisation like estates. In the absence of smoke houses, go dov/ns etc they cannot hoard and speculate to get higher incomes. Estates thus become the price maker and the growers the price taker.

2. Absence of a strong and transparent supply chain from grower to dealer and to the producer

3. Linkages between rubber related small industries are weak.

4. Lack of cooperation among estates and small holders make it impossible to adopt production control measures in the wake of price crisis, along the lines of OPEC model cartel. Since small growers are vulnerable to price fluctuation, they cannot afford to adopt measures like production cut or stock keeping.

5. Since rubber is a perennial crop, capital investment is for long term and it becomes impossible to form rational expectations about future. They can respond with respect to cropping pattern, cropping intensity and productivity. But they are unable to change acreage in the short run, since it would take another 6-7 years and the then price situation is obviously impossible to predict.

6. It is said that rubber cultivation has led to a highly skewed agricultural growth in Kerala. It enjoyed the highest rate of subsidy. As cultivation of subsistence crops were neglected, general cost of living rose. Income proceeds from rubber were frittered away in conspicuous consumption with no productive reinvestment in rubber related industries. Though increase in rubber incomes had shown multiplier effects ,it is lesser when compared to the multiplier effects which would have been achieved by general increase in real incomes owing to low cost of living.

7. In countries like Indonesia and Malaysia, rubber cultivation is considered as a means for removing unemployment. So it enjoys 90-95 percent state subsidy. Both India and these countries face equal level of international prices, but different levels of domestic

support. As against India, in these countries devaluation would work towards increasing exports as domestic consumption is less than 20 percent.

8. State Trading Corporation (STC) proved to be a "weak player" in the procurement scene. There were delays in ministerial order for fund granted for procurement. Fund granted was also inadequate. There was no support to Rubmarks efforts through a centrally sponsored scheme. Lack of coordination and cooperation between STC and the procurement agencies viz Rubco and Rubmark. Procurement was for a time span of 100 days in the first phase and 200 days in the second phase. By that time period excess stock accumulated and accentuated the glut. As far as latex was concerned, no procurement was done since ammoniated latex has minimal storage life. State sales tax of 11 percent stood in the way of STC procurement till it was withdrawn in 17-11-1999. STC lost Rs 8 crores in this account[43]. Delay and procedural formalities with STC, fear of rejection of stocks on the basis of quality, delayed payments etc. created frequent frictions between STC procurement agencies, rubber dealers.

9. There is no price support procurement mechanism to ensure that the BMP is maintained at the fixed level. A lot of calculations and government efforts goes into the fixation of BMP. Whenever they are short of money, the growers themselves would ignore BMP level and sell at levels below it. BMP being partially protectionist in effects. It cannot be relied upon particularly in the WTO era.

10. Breaking up of INRO as a price stabilising agency made international prices weak. As the intervention price was pegged in terms of Malaysian currency, its devaluation resulted in the pegging of intervention price level below the "Must Buy" level. Though, it was later linked to the US dollar, there was lack of cooperation among member countries resulting in fund shortage and breakup of price stabilisation scheme.

11. Since domestic demand had always been sufficient to absorb the excess production until recently, there wasn't any necessity to expand basic infrastructural facilities for export. We are unable to offer a steady supply for longer periods. Quality of our products is not known internationally. We cannot offer forward market rates in the absence of a well developed forward market system. This makes exporting away of surplus production difficult.

Opportunities

1. Crop Substitution is impossible in the present agricultural situation of Kerala as all crops are suffering badly. There is no crop viable enough to substitute rubber. The other option is sale of land. But land prices show a proportionate relationship with rubber prices. Due to the growing disinterest among Gulf based NRI to invest in the real estate sector, registered land deals have come down. So opportunity for rubber cultivation is still alive in Kerala.

2. Green box provision in WTO will boost agricultural exports.

3. GATT provides protection to plant breeders under which new range of seeds, bio-fertilisers, bio- pesticides and successive generations of plant variety are protected. This provides an opportunity for further research in rubber.

4. To reap the benefits of trade liberalisation under WTO, government should take measures like.

a. Technology upgradation, land reforms, optimal use of fertilisers and irrigation.

b. Analysis of price formulation of agro products and taking steps to avoid distortion in food production.

c. Maintaining Export Oriented units in agriculture with further foreign collaboration.

d. Research on Aggregate Measure of Support (AMS) to quantity protection in Indian agriculture.

e. Formation of Trading Blocs and Common Agricultural Policy among developing countries.

d. Conducting state agricultural projects with foreign collaboration.

5. Central government is taking measures to expand export opportunities in rubber. Rubber Board has set up Export Cells for technological specification and information. A rubber park is proposed to be set up in Kirapuram in Perumbavoor. This would set up additional small scale rubber related industries with better linkage.

6. Rising demand for rubber wood

7. Road rubberisation is emerging as a new source of demand supported by state governments.

8. Rubber honey is emerging as a new source of additional income to growers.

9. It was the emergence of new demand sources like opening up of China gate, which had led to the sporadic rise in prices in 1996. Again, the emergence of Economic Union as a contending force against the US will increase competition in the rubber market since both the EU and the US are top NR consumers which might lead to future rise in prices

10. There is a possibility of signing up of a "third generation agreement" between India and EU which will increase Indo-EU trade and prop up rubber prices.

Threats

1. Though imports through Advance Licensing Scheme were banned since February 1999, imports continued. Since Advance License has a normal validity for 18 months after issue and can be extended twice for duration of six months each, imposition of ban didn't help much.

2. Liberalisation policies have favoured SR imports. Growth in SR production and consumption is showing steady increase since 1995-96. Since SR is petro based fall in oil prices can favour SR at any time. Indian industries are copying SR based foreign technologies to achieve price competitiveness.

3. Under TRIPS, the national treatment clause gives the foreign investor the same right in area and magnitude of investment. MNCs have entered the domestic scene and set up tyre plants. They have the advance licensing facility for making export related imports, while utilising cheap domestic labour. There is a threat of import of NR from African countries where labour is cheaper. TRIPS stipulate no qualitative restrictions on imports and exports and performance obligations like usage of local raw materials and equipments, technology transfer etc.

4. There is also the threat of import of second hand tyres. Lobbyism has succeeded in suppressing this threat for the present. Import of SR and its raw materials are protected by levying anti-dumping duty. But import of NR does not enjoy the same protection.

5. Lowering of import duty on Poly Urethane from 75 percent to 20 percent lowered the price advantage in latex production by 50 percent . This has prevented reaping the benefits of global aids scare and glove boom.

6. Since Kerala's electricity is hydro based frequent power cuts upset industrial climate.

7. Domestic demand is insufficient for glut removal though it is always on the rise. If we take the per tyre requirements, of the total quantity of all kinds of tyres imported, less

than 15,000 tonnes would form additional consumption requirement in the absence of imports.

8. Business lobbying has always been a threat to stable rubber prices. Whenever rubber prices rises, industrialists raise tyre prices more than proportionately. Within months they would agitate for imports and bring down rubber prices while tyre prices would remain at the raised level. Tyre companies like MRF & CEAT which have about 40 percent share in rubber market cite various reasons and jointly appear or disappear from the market to manage prices. Bribery and corruption is used to formulate favourable policies at the government level. If they fail at this, they influence officers to prevent the implementation of such policies. They reject STC's stocks citing low quality as a reason and influence STC officials to make procurement ineffective. Media is influenced to create false panic and lower prices. Due to development of transportational facilities time period of business inventory is reduced two weeks. Business lobbying resulted in imports for in excess of import requirements and is said to heve resulted in the loss of revenue of Rs 125 crores.

9. Retreading of tyres have become popular reducing replacement demand for tyres.

10. China's presence in the tyre export market is much larger than ours. India sustains due to quality which makes its exports costlier. Secret of low priced chinese tyres is not known.

11. Bangkok agreement provides 10% duty concession for tyre imports from Korea which makes sustaining of domestic profit margins difficult.

12. Psychological bondage towards white collar jobs has led to voluntary unemployment even though better paid blue collar jobs are available. This has resulted in artificial labour shortage and rise in labour wages. Trade Unionism prevents proportionate downward movements in rubber prices and rubber wages thereby reducing price competitiveness.

13. From August 1998 rubber can be imported duty free from SAARC countries.

14. Newer HYV could be evolved with sowing patents in other countries and they would avail protection under Plant Breeders Rights.

15. Kerala growers might favour a multicrop model of agriculture if the prices continue to fall.

16. Possible shifting of cultivation to North Eastern region due to rising labour costs as evident from increased interest taken by the Rubber Board in extension and development to North Eastern areas.

Road Rubberisation-SWOT Analysis

The patent for rubberised tar was taken by a scientist named Cantonberg as early as in 1898,but it caused delay in the continuance for further research efforts. In 1947 wide spread rubberisation was done in Rufesior in Geneva. Following this roads were rubberised on an experimental basis in European countries, major cities in the US, Malaysia Australia and Newzealand It was found that rubberised tar increased the life span of the roads .

Strengths

A lot of experimental research has been conducted in the field. Major advantages may be summed up as follows.

1. Mixing of latex with tar changes the "thermo plastic" nature of tar to "Thermo elastic". The mixing is done at a temperature not less than 140 ^{0}C and for at least half an hour. This procedure increases its strength in atmosphere temperature resulting an increase in road life span by about 60 percent .[44]
2. Thermo elastic property raises the adhesive capacity of metal to tar in high temperature. Rubberised tar melts at 20 percent higher temperature than ordinary tar. The adhesive capacity of metal, sand etc. is also increased.[45]
3. It absorbs comparatively smaller amount of moisture.
4. It increases the grip of vehicle tyres and ensures safety by reducing accident possibilities through skidding. It also increases the life span of vehicle tyres by reducing wear and tear.
5. Since the life span is extended, the time to reach critical reference value is also extended i.e. the state when roads are destroyed as a result of loss of viscosity of tar due to wear and tear. Raising the critical reference value means cost saving in Road transport sector.
6. According to NATPAC, the average speed of vehicles in our national highways is less than 60 kilometers whereas in developed countries it is above 150 km on an

average. This is mainly attributable to the low quality of Indian roads. Rubberisation raises the quality of roads and removes traffic jams thereby ensuring better speed, better movement of goods and overall increase in productivity.

7. Rubberisation sustains the shape and beautiful finish of new roads.
8. Rubberised tar is made in refineries so it ensures better product quality

Weakness

The major weakness is the cost hike. It is estimated that the required two percent mixture of latex with rubber increases the cost by 12 to 15 percent [46]. But in the method of mixture which requires 4 percent of latex the increase in cost is only percent. Another cost estimate shows an increase of about 20 percent .[47]

Opportunities

1. Because of the fluctuations in the price of rubber and ordinary tar, the cost may not be same all the time. If when price of rubber falls, the demand for rubberisation can prevent further price fall. Bitumen needed for road repairs is only 30-35 percent of the original costs for rubberisation. [48]
2. Since rubberised roads absorb less moisture it is extremely suitable for rain fed states like Kerala. Due to rapid urbanisation there is wide\spread traffic blocks in Kerala. So an acute need for better transport system is already present in the home state .On April 21st 1999, Central surface Transport ministry has ordered the use of rubberised bitumen in the repair of 10 percent of roads. [49]
3. Global economic development trend is towards ecological sustainability. Since rubberised tar is heated and mixed in the refineries, there is less pollution during road construction making it environment friendly.
4. A research report found out that tar emulsions marketed by Ticky tar industries Bombay and Hindusthan Petroleum co-operation etc. is a better substitute for ordinary tar in road rubberisation. Since latex is an anionic emulsion it mixes at the required time with tar which is a cataonic emulsion. If the ph value of latex is kept lower by using preservatives like formaldehyde. The major opportunity presented by the funding is,

1. Previously it was technically impossible to include more than 4 percent latex in rubberisation. Now using this process it is possible to mix up to 20 percent of latex in rubberisation with a higher degree and durability.[50]
2. Ordinary rubberisation uses kerosene and causes atmospheric pollution when it evaporates while tarring. Rubberised tar emulsions coins do not require heating prior to tarring and sets in atmospheric temperature. So it saves fuel and creates a better working atmosphere to labourers
3. Crusade of Tamil Nadu Highway Research Station (HRS) to popularise road rubberisation could one day lead to the rubberisation of about 28 lakh kilometers of Indian roads. In Kerala state the government has already launched on a time phased rubberisation programme.[51]

Threats

1. The major threat to the rubber producing sector is that the prescribed off take is only 2 percent per kg of tar[52]. So unless rubberisation is undertaken on a large scale and conducted rapidly there cannot much propping up of demand.

Tab3.7:- Road length in Kerala

	Length(km)	Total average area(sq m)	Estimated rubber requirement(tonnes)
Total Road Length	145215	575051.4	33,472
National Highways	1011	4003.56	233
PWD Roads	22,273	88201.88	5133
Panchayath Roads	1,09,058	327174	25,137
Municipality Corporation Roads	8627	34162.92	1988
Miscellaneous	4246	16814.16	978

Data source on Road length - NATPAC.

Table 3.8 shows that total road length in Kerala is 145215 kms .The average breadth of roads in Kerala is 3.96 metres. For village roads it is 3 metres .Based on this the total

average area of each type of road is worked out. Given that tar requirement per metre is 2.91 kg we can workout the per kilometre requirement as 11523.6 kg. Rubber requirement at 2% of tar requirement works out to be 230.5 kg .On this basis the total rubber requirement worked out to be only about 34,000 tones as shown in the table. When the market glut is estimated to be around 2,00,000 tonnes ,this is a meagre figure. A one time shipment of 15,000 tonnes by RUBCO to Singapore failed to cause sustained price rise. So it is unrealistic to expect that the off take in various phases of 34,000 tonnes can save rubber growers from price crisis. The political assurance has thus been economically disproved.

2. Excepting a few research institutes there is inactivity in the case of rubberisation research on the part of the rest of the institutes.
3. State governments are either not aware or inactive with regard to rubberisation.
4. It is the vested interests of some contractors who want to stay on in their business that roads repair become frequent. These interests would do all they can to prevent adoption of rubberisation.
5. Major tyre companies would act against rubberisation and consequent rise in rubber prices.
6. Delhi PWD department is using 12 percent mixture of TBM super, a synthetic substitute in the place of 2 percent rubber latex. Studies conducted by HRS show that mixing of TBM super lowers road quality. Mixing is done on road sides and therefore environmentally hazardous. TBM super is made by chemical treatment of powdered old tyres and costs about Rs30,000 per tonne. The foreign agencies offer of attractive commission for imports is the inducement for the use of TBM super.

Sec 3.28:-Rubber Related Industries SWOT

Strengths

1. Strong governmental and institutional support. A Centre-State government joint venture initiated by Rubber Board and Kerala Industrial Infrastructure Development Corporation (KINFRA) has laid the foundations of a "Rubber park" in Airapuram in Ernakulam district on October 7th 1997.

2. Strong employment potential since enterprises like rubber band industry, balloon industry etc requires less technical skill and is more labour intensive. The estimated employment potential is about 4 lakh.
3. Kerala ranks first in the terms of manufacturing units and second in terms of consumption .Off take in other states is showing an increasing trend.
4. Techno economic survey undertaken by Rubber Board.

Weaknesses

1. Lack of diversification in rubber products.
2. Absence of Entrepreneurship Development Programme (EDP) resulting in lack of confident and risk taking entrepreneurs,
3. Absence of a Quality Control Board issuing quality certificates.
4. Stepchild treatment given by financial Institutions to Kerala's entrepreneurs.

Opportunities

1. Aids scare is increasing the demand for latex all over the world. There is scope for further development along Malaysian model.
2. In Russia, Doctors recommend the use of rubber based balloons to cure baldness. Though such balloons can be made out of silicon rubber it raises cost of production by at least 10 fold.
3. Balloons have conquered a fashionable place in all the religious and family festivities. Their demand has a positive relation with rise in population and urbanisation. 84 percent of the balloon units are concentrated in Maharashtra and Gujrat. One balloon unit consumes an average 300 metre latex. If the existing 130 units has 300 working days they would consumes 117 lakh. Liters of latex on one year. But the no. of balloon units in Kerala is only 32. In view of the easy availability of raw material in the home state, it can be said that balloon industry has a good future in Kerala.
4. Tamil Nadu Industrial Development Corporation (TIDCO) has set up a Rs 50 crore rubber industrial complex in Kanyakumari District with integrated small and medium units.

G8499

5. Coir Board has developed rubberised coir carpets with better flexibility and durability.
6. India exports and imports rubber bands simultaneously. The trend is towards decline in imports of rubber bands from countries like Japan Germany and UK. and increases in exports of rubber bands. The export income was Rs. 71 crores in 1980-81. Out of an export of 1.9 meter tonne. It increased to an export of 67.60 tonnes of export in 1995-96 earning an income of worth 7192 crores.
7. Indian chappals are becoming increasingly popular in the international market owing to their superior quality and durability. There is huge export potential in this sector, especially in the Gulf where the openly major competition is China. Rubco has entered the chappal producing scene in 1998, it is producing light weight slippers with technical collaboration from Malaysian company called High tech setters.
8. Rubco has also laid foundations for a treat rubber factory and an automobile tyre factory.

Threats

1. Fluctuations in rubber prices causes fluctuations in price realisation of industrial units.
2. Absence of unified marketing chain leads to exploitation from middlemen.
3. Reduction in demand in certain rubber related industries viz rubber band industry faces low demand due to substitution by polythene bags, cello tape, stapler pins etc.
4. Highly literate Keralities are also highly environment conscious. It is a wide spread belief that rubber based industries are a threat to the ecosystem.
5. High labour costs in Kerala compared to other states raises the variable costs of the factory. Strong bargaining power of the labourers in Kerala often leads to strikes and lock outs even in tiny units.
6. Lack of adequate power supply and procedural delay in getting electrical connection to factories forces entrepreneur to choose those products whose products requires minimal amount of electricity.
7. Lack of encouragement given by of industry related officers at the government level forcing the entrepreneurs to shut down and exit in some cases.

8. High population density in Kerala creates scarcity of land for large scale industries.

Opportunity

Plantation Corporation has bagged latex export orders from countries like Mexico Sweden and Russia. Export loss if any is guaranteed by the government. Export will be made attractive with new improved modes of packing. Plantation Corporation has also undertaken the establishment of a glove factory which on completion is estimated to earn an export income of 6 1/2 crores of foreign exchange per year. A nine crore project for construction of conveyor belt factory with export orientation is also under consideration.

Sec3.29:- Rubber wood-SWOT

Strengths

1. Developing countries are faced with 16.8 deci lakhs of forest destroyal. Destroyal of forests is taking place at a faster tempo than forest conservation[53]. This is thought to create serious ecological unbalances world wide. At present the idea of replacing lost rain forests with artificial forests viz commercial tree plantations is acquiring great relevance.

   Full utilisation of rubber wood amounts to forest conservation of about 9 lakh hectares globally. In India the equivalent figure is about 20,000 hectares every year[54].

2. Perennial nature of rubber cultivation induces commitments from growers. shift in rubber cultivation favouring small growers which are comparatively hard up induces further commitment towards the exploitation of commercial possibilities of rubber wood.

3. Free availability of eco friendly technologies based on impregnating wood with borax-boric acid treatment in vaccum pressure impregnation chambers and seasoning in conventional kilns or the hitch computerised vaccum drying.

4. Existence of 61 rubber processing units. 17 units in Furniture and furniture parts, 13 units in door and window frame, paneling products, 11 units in floor tiles, brush handle, table top, black board etc. 9 units 545 materials (rectangular panels) and 11 units in toy making, ice cream spoon, guitar photo frame, household articles etc. All the 61 units together have a total processing capacity of more than 61,000 cube

metres. About 40 of these 61 units functions in Kerala and most of them were established in the early nineties.

Weaknesses

1. Rubber Board survey points out the case of low value addition. A major chunk export of rubber wood is mostly in the form of surface four side planned (S4S) materials. This shows that value addition is taking place in destination countries like Japan, EU and the Gulf. It is stated that there is a possibility of domestic value addition of about 1500 percent. But at present only about 296 percent of value addition is made. This is reflected in the low export income of less than 10 crores from rubber wood exports[55].
2. The commercial exploitation pattern of rubber woods reveal that almost 58 percent is used for packing case manufacture. The next largest consumer is plywood manufacturing industry consuming about 28 percent . Match box manufacturing and other uses claim 3 percent each of consumer share. The 61 units producing products with commercial importance gets only 12 percent of the total production.
3. Unscientific tapping, insufficient panel protection especially in small holdings results in the loss of 50 percent of the wood during processing. Unscientific cultivation also results in low girth of trees and reduces the rubber wood productive capacity of modern holdings.

Opportunities

1. The export of rubber wood products in 1995 was worth 2840 crores. Under conditions of proper research effort, and governmental support, new processing units with modern technical know how can be set up in India, leading to production of export quality rubber products which would enable India to capture a major share of global demand.
2. Domestic demand potential is even stronger. The growing stock of rubber wood in India was estimated at 43 million cubic metres which was a significant resource in a timber deficit country such as India with an increasing requirement of about 70

million cubic metres of timber by 2000. The National Commission of Agriculture is reported to have put the rising imports at Rs. 4,000 crores annually.

3. The wood products from tropical rain forests are expected to be progressively banned by 2002 by several European countries. Recently many importers in Europe require Ecolabelling and the world wild life fund and SGC had already set in motion these certification programmes for sustainable managed plantations.
4. There is a better future for Indian rubber wood industry as rubber production in Malaysia and Thailand is declining due to scarcity of tappers as they shifted to oil palm industry in the wake of price fall. In Indonesia rubber plantation is not scientifically and systematically looked after.
5. According to Indian Rubber Wood Task Force (IRWTF), rubber wood has a potential to corner a big share of over $35 billion American furniture market.
6. Kerala State Road Transport Corporation (KSRTC) has initiated steps for manufacturing bus body out of rubber wood; thereby creating a new hitherto untapped demand for rubber wood.
7. World wide rubber market is worth$1.5 billion but Indian export is only $ 3 million. Rubber at present meets only 2 percent of the timber needs.

Threats

1. Signing up of WTO has led to the possibility of massive imports of rubber woods and rubber wood products at international rates if cheaper.
2. Direct positive relation ship between rubber prices and rubber wood prices has lowered the replanting tempo. As a result the wood availability is reduced. This may in turn be a cause for imports.
3. Lower price realisation by growers due to middlemen. The market price of one rubber wood is Rs 800 but the grower gets only 55 percent of this i.e. Rs450. From this down loading charges (higher if the holding for slaughter tapping) will be deducted if the middle men has under taken the holding for slaughter tapping the price realisation of the grower is even lower. All this coupled with low rubber prices may lead to shift towards multi crop farming.

4. Unhealthy competition among existing units as they are producing identical products leads to destroying of small units by large units.
5. Existing units are facing financial difficulties. This makes adoption of new expensive technical know how viz small dimensions timber technology impossible.

Sec3.30:-Rubber futures market in India SWOT analysis

Futures trading are widely prevalent internationally. There are 4 major organised NR markets viz Kuala Lampur, Singapore, London, New York and other market including Tokyo, Kobe, Paris, Hat Yai, Jakarta and Columbo.

In India on the basis of forward contracts Act 1952, a forward market commission was set up in 1956. Forward markets were established for pepper, oil seed, coffee, cotton, potato, turmeric and others. The possibility of establishing a futures market for NR is now under consideration.

Futures are contracts for the purchase or sale of a fixed quantity and grade of commodities for delivery some time in the future on an organised exchange as against physical trading in exchange for cash. Futures market allows the growers to hedge in the market. Hedging is covering of the risk i.e. of not getting estimated income at the time of investment. It is the transfer of price to other market participant viz speculators will to bear those risks.

Strengths

1. Futures market has a high tech information centre which provides statistics on goods availability, demand stock transport facilities, imports exports, value of foreign exchange interest rates etc. Existing statistics are often incorrect and leads to inaccurate decision making by producers and consumers.
2. It brings greater visibility and liquidity in monopsonic markets faced by rubber. It increases price elasticity of rubber. In direct trading, price is determined on the basis of direct negotiations, adjusting a reference price to changes in quality, processing location etc. Direct trade is often bilateral and secret which means that rubber is increasingly bypassing open market. Producers are not always fully aware of market

conditions and they lose out as they have little bargaining strength. Futures market with high tech information increases grower's awareness and bargaining power.

3. Since production is scattered, consumers face high discovery costs and high transportation costs. The futures price equals the statistical expectations of the spot price which will prevail at the maturity of the contract. Since information is an important stabilising device, efficient futures are stabilising. Futures trading causes rational expectations about stocks, cost of production, just in time raw material supply. Better production planning is possible for producers as quality goods supply are ensured at a prefixed time period at a prefixed rate. Thus it stabilises production process since price discovery is an important factor for the planning production, distribution and processing of commodities. As knowledge provides efficiency and extra insurance, production is stimulated and as profitability increases consumers may be prepared to absorb goods at a higher price.

3 Futures trading help the dealers also in decision making which increases their efficiency and leads to better profit sharing along with growers and consumers. Dealers lost interest income on account of inventory stocks and stock keeping also leads to risk on account of price fluctuations. Warehousing facility in the futures market leads to culmination of risk bearing by the dealers. They also facilitate stock holding because the forward premium which is the price of storage acts as a guide to inventory control and may be interpreted as a return on hedge stock. It can thus reduce inventory holding and inventory costs. It also reduces other wasteful expenses on coolie charges, expense on bribery etc. Dealers can also speculate in the futures market at a low risk level due to close contract with the merchants.

4. A future market with a good warehousing facility would induce financial institutions to give loans at low rates of interests on the basis of rubber stock. At present loans against stock are not easily available for the grower. If at all it is got, it is available at high rates of interests and involves procedural delays since in the absence of a futures market, it takes time to exchange goods, determine their price, grading and selling etc.

5. Futures market will standardises unit. (as 100 kg, 500 kg, 1000kg units) to facilitate transaction and also determine quality grades. This will help to stabilise growers

income. Also regional markets would become more efficient as standardization reduces inter market differences.

Weaknesses

1. Futures contracts must be in conformity with conditions in the underlying physical market to limit the possibilities of price distortion.
2. Though futures trading reduce price variability it also requires sufficient price volatility for its efficient functioning. If there is low volatility in the physical market there is little need for hedging as the cost of hedging would outweigh it benefits in terms of risk reduces excess short term volatility in the prices of a futures contract can also make hedging transaction more difficult to execute and more expensive.
3. Futures trading require well developed financial legal and communication system in which India is a long way behind. Financial facilities are needed for payment of margins and contract settlement to futures merchants. In the absence of strict legal enforcement, price distortive activities of speculators cannot be checked.
4. Futures market must be liquid both the transaction volume and the number of buyers and sellers should be large enough to ensure maximum liquidity. It would not work under oligopsonic market structure as a high degree of vertical integration. Globally natural rubber production is dominated by a few countries and consumption is also similarly dominated. Globalisation of course ensures more liquidity. But under conditions of globalisation, two steps need to be taken.

   1. Contracts must be linked to various centers.

   2. There should be centralised markets in one or two locations trading globally on a world contract on a 24 hour basis and clearing centrally. Such a setup is at best a slow possibility in our country. In India at the legal and practical level; till recently the ideal of futures market has been viewed with suspicion.
5. Suggestions of Khusro Committee ( ) on futures contract Regulation Act has not been enforced so far. There is a need to improve the communicative facilities of existing commodity exchanges; fix capital adequacy norms, globalise the markets, strengthen the vigilance, arbitration committees as pointed out by the Kabra Committee(1956)

which was also formulated to suggest recommendations to make forwards contracts act 1952 more efficient.

6. There is need to diversify the financial instruments of trade as in foreign countries viz Commodity Bonds, Commodity loans range forward contracts etc. Existing transaction is narrowed to Non Transferable Special Delivery contracts (NTSD) and Transferable Special Delivery Contracts (TSD)

Opportunities

1. Overall increase in volume of trade as profit possibilities of the grower dealer and the consumer is ensured.

2. Efficient futures market can be a way out of the rubber crisis.

3.Global trend towards free market without government control is irreversible. The producers are now facing less stable prices and need good reliable reference prices for their physical trade deals.

4.Futures prices are determined by spot prices. Futures prices can be in turn determined by physical prices by becoming official reference prices of the market. It may be used as future indicators and physical prices would adjust to it slowly. Thus it brings stability in the system.

5.Competitive price discovery is possible in futures market. Price determination in futures market is close to market competition since it reflects the views of a large number of buyers and sellers on the supply and demand situations on the physical as well as futures market.

6.Private commercial stock holdings by speculators have a stabilising effect. They will narrow the range between upper and lower ceiling limits of the INRO buffer stock. Free market operation is the most effective means to bring down excess volatility as speculators would buy in times of surplus thus pushing the prices up and sell in times of shortage depressing the price.

7.Speculative stock holdings can substitute INRO buffer stock. INRO operated on past information in contrast to futures market. It also interferes with laissez fair system. Coexistence between INRO and futures markets implies that the capital requirement

of buffer stocks is reduced, it being the major bottle neck causing failure in INRO's operation.

Threats

1. Major threat is speculation. Speculation based on inaccurate expectations leads to the some type of trading at the same time. Since transactions involve commodity stocks rather than financial instruments, panic buying or selling when prices are below the floor or above the ceiling will result in exaggeration of price swing.
2. There should be balance between trade related buyers and non trade related speculators. Speculation should form only a small proportion of the overall volume of trade. Otherwise there is a serious threat of price distortion and malpractice.
3. Globalisation has resulted in the increase in the volume of speculative funds moving in the international system. It has thus increased the potential for destabilizing movement of speculative funds into or out of the futures markets.
4. On the face of such destabilising movements capital requirement of buffet stock in the fashion of INRO could be larger.
5. Increasing importance of world rubber demand in Asia/Pacific region and the saturation in consumption in North America and Western Europe has accentuated the trend of destabilising movements.
6. Increasing trend towards bilateral trade agreement and price controls will prove a threat to the efficient functioning of futures market.

Sec3.31:-Rubber plantation development in the North Eastern Area- A special focus

Traditional rubber growing areas comprises the South west coast of India viz Kerala, Kanyakumari District of TamilNadu. The laterite soil conditions and the prevalence of both the South West and North East monsoons make this track ideal for rubber cultivation. But further development possibilities are limited as far as area is concerned in the traditional area. However productivity improvement is actively

campaigned by the Rubber Board through replanting of old and low yielding areas and better agro management of mature plantations.

Non traditional areas so far identified as almost fully or marginally suitable for rubber cultivation are hinter lands of coastal Karnataka, Goa, Konkan region of Maharashtra, hinterlands of coastal Andhra Pradesh and Orissa, certain areas in the Northern parts of West Bengal, Assam, lower reaches of hills of Meghalaya, Mizoram, Manipur, Nagaland and Arunachal pradesh and Andaman& Nicobar islands.

North Eastern region comprising of Tripura, Assam, Meghalaya, Mizoram, Manipur and Nagaland, Arunachal pradesh stands out among non traditional areas in that the agro climatic conditions prevalent is unique. A near tropical climate and monsoons are experienced there. Early plantations in these regions were under taken in the 1960's in Tripura & Assam and encouraged by its successors, commercial scale plantations were raised by Government Forest and Soil Conservation Departments. Later on, extensive cultivation was under taken by Public Sector Corporation in Assam and Tripura. In Manipur, Mizoram and Arunachal Pradesh State Forest and Soil Conservation Departments took the lead in rubber cultivation.

The traditional cultivation practice the tribals in the NE region in jhum cultivation. A type of shifting cultivation following slash and burn method. Jhum cultivation is causing serious soil erosion and other ecological problems and therefore the interest of state forest soil conservation departments towards rubber cultivation as a means of weaving the tribals away from jhum.

The welfare Department of the Tripura government considered rubber as one of the ideal crops to rehabilitate the nomadic tribals. It is notable that the same reason was the behind the development of rubber in Indonesia.

Increase in area in North Eastern States

Prior to 1975, cultivation in North Eastern areas was almost non existent. From a mere 0.03 percent the area increased now averages around 7 percent Area of small holdings which was only 0.01 percent in 1975-76 rose up to 6.1 percent in 1998-99. Estates area during this period shot up from 0.96 percent to 19.1 percent. There is the likely chance of small holdings overtaking the estates in magnitude, a repetition of Kerala

trend. The total production at the end of 1998-99 in North Eastern Regions in 12183 tonnes though only 2 percent of the total is a sure indicator for future growth.

Rubber Board had initiated a project for Accelerated Development of Rubber Plantation from 1984-85 to 1989-90 Development infrastructure composed of Boards offices, Nuclear Rubber Estate Training Centre (NRETC), District Development Centre (DDC) and Tappers Training Schools (TTS) of adequate scales was also established under the project.

In addition to this Rubber Board provides comparatively concessional assistance in non traditional areas. Rollers are supplied free of cost to voluntary organisations. There are special schemes for irrigation or rubber, and fencing of rubber plantations in non traditional areas.Tripura which accounts for 52 percent of the total planted area of North Eastern region. The development cost in NE region 15-20 percent less than what it would be in the traditional areas. As a result, there has been considerable expansion in area as shown in table3.11.

Tab 3.8:-Percentage increase in area in North Eastern States.

Year	1975-76	1980-81	1985-86	1990-91	1995-96	1999-00p
Holdings	0.01%	0.07%	0.8%	4.4%	4.8%	6.1%
Estates	0.96%	6.2%	12.9%	21%	22.82%	19.1%
Total	0.3%	1.6%	3.05%	7.1%	7.4%	7.6%

Area- include Tripura, Assam, Meghalaya, Nagaland, Mizoram, Manipur, Arunachal pradesh

Source:-Compiled from IRS

Majority of the small growers are illiterate and financially handicapped. The labour cost share in rubber cultivation is around 66 percent . Lower size holdings generally depend as family labour. This makes cultivation in North Eastern regions economic. Better awareness programmes will lead to scientific agro management practices and will increase yield. If at all tappers are hired their wages when compared to that of Kerala wages are low.

There is the threat of Estate holders buying land in NE region by way of following the principle of not putting all the eggs in one basket. They may reap the cost advantages

and realise better profits. In the era of globalisation efficiency being the key word will be welfare aspect of labour conditions or inflation doesn't count much in policy making. Governmental agencies will also be forced to follow the general trend.

In the future a great chunk of rubber cultivation may shift to NE region shifting of cultivation might regain competitive conditions in the traditional areas. But what is the critical level which restores competitiveness and what are its far reaching implications on traditional areas cannot be predicted. Agitations against price fall surely have justifications on the basis of growers and tappers welfare. But in the WTO era only market conditions and considerations rule roost and all the rest is ruled out.

Foot notes

1. Rubber Page - 3 February 2000
2. Business line dated 8th March 97
3. Malayala Manorama dated 8-5-97
4. Deepika 27-11-1997
5. Chandrika dated 11-12-1998
6. Business line dated 31-7-1999
7. Chandrika dated 9-5-1997
8. Deepika dated 9-9-1997
9. Mathrubhmi dated 28-8-1998
10. ATMA press release on 10-11-1998 in Business line
11. Deepika dated 12-6-1998
12. Malayala Manorama dated 12-10-1999
13. Deepika dated 22-5-1998 article by Bony Kuriakose.
14. Deepika dated 9-12-1998
15. Deepika dated 16-11-1999
16. Business line dated 10-12-1999
17. Business line dated 31-7-1999
18. ibid
19. Business Line dated 13-8-1999
20. ibid
21. Desabhimani dated 9-5-1997

22. Deepika dated 7-4-1999

Deepika dated 7-4- 1997

23. Rubber september 1999

24. Malayala Manorama 6-8-1997

25. Deepika dated 7-4-1999 - article by Adv. Jose Anithotta.

26. Business line 26-8-1999

27. ibid

28. ibid

29. GATT 1994 Uruguay round of multinational trade negotiations. April 1994 Geneca - GATT

30. ibid

31. Financial express 12-3-1998

32. International Rubber Digest – International Rubber Study Group (IRSG) January 1999.

33. ibid

34. Rubber Statistical Bulletin - IRSG March 2000

35. Rubber March 1998

36. International Rubber Digest - IRSG May 2000

37. Business Line dated 21-12-1999

38. Mangalam dated 10-8-1998

39. Kerala Koumudi dated 5-6-1998

40. Deepika 18-7-1999

41. Financial Express Aug. 24 1999

42. Business Line 28-11-1998

43. Desabhimani dated 4-5 1999

44. Report Submitted to the Transport Ministry by Dr. Soodh and Dr. Jain of central Road Research Institute December 1999.

45. Report of Tamil Nadu High Way Reserch Institute - February 2000

46. Report of National Rubber Production Research Association - 1971

47. Report of Tamil Nadu High way Research Institute - February 2000

48. ibid

49. Business Line dated 21-4-1999

50. Research Report by Dr. Rani Joseph and Jashy Mathew, Dept. of Polymer Science Cochin University (1999)

51. ibid

52. NATPAC (2000)

53. Business Line 12-3-1999 - Estimates of Food and Agricultural Organisation

54. Business Line 12-3-1999 Estimates of International Trade Centre.

55. Statistice of Malaysian Timber Board 1999

CHAPTER-IV

ANALYSIS ON COST OF CULTIVATION OF NATURAL RUBBER

To analyse the cost of cultivation of NR, identification of the various stages of cultivation of NR is necessary. It enables pin pointing of major cultural practices and expenses on them as well as areas where cost minimisation is possible.

Sec 4.1:- Land Preparation

Rubber plantations in India are mostly situated on sloping and undulating lands. As a result soil conservation measures are necessary. The availability of flat lands suitable for rubber plantation is limited where agricultural operations are comparatively easy. In south India, June July is the best season for new planting or replanting. So land preparation operations must be completed before season.

1. Clearing and felling

Since rubber requires good sunlight all other trees must be removed .But some trees may be retained in the borders especially South West border to protect the plants from sun scorch and strong wind. As far as possible, small plants and trees should be removed using manual labour. Where there is strong growth there are lightly burned. But excessive clearing and burning may cause loss of humus in the soil and expose the land to increased damage from erosion before a ground cover is established. In case of replanting, trees may be slaughter tapped felled and land cleared.

2. Lining

In flat or slightly undulating areas square or rectangular planting is adopted. In the case of rectangular planting the lines are taken east west to get maximum sun light. Contour lining is done or undulating and hilly lands by marking out the planting points in level lines across the slopes.

3. Terracing

Contour terraces must be made with a breadth of 5 feet or 1 ½ meter with a bent to the inner side so as to retain the water flowing from above. Small blocks of sand are made to prevent water from flowing the sides of the contour terrace.

4. Drainage

Proper drainage is essential especially on low lying lands. Otherwise the weeds would set as result of accumulated rainwater. If there are drainage channels available naturally only clearing is to be done. Otherwise a new planter must bear the expenses of cutting a new drainage according to layout of the land.

5. Silt pits and Edakkayalas

Silt pits and edakkayalas help in conserving the soil. As per the slope of the land, construction of contour bunds with stone boulders eddakkayalas is made. The stone bunds check the surface runoff and at the same time allow water to filter through the bunds. Though this operation is expensive it is economic in the long run, if the stones from the plot itself is used for making edakkayala soil would improve as a result of stone removal.

Silt pits of 1m x ½ x 1/3m of (L x B x Density) would retain the rainwater in the raining season. As a result moisture content in the bottom soil level would be more during summer.

6. Fencing, Kayyala, Roads and Footpaths

Protection should be made against the encroachment of men and animals capital expenditure is to be made on the development of land viz: fencing, kayalas approach roads and footpaths for the movement of men and materials etc.

7. Pitting and Refilling

Pitting is essential to provide favourable conditions for the easily establishment and growth of plant. The size of the pits depends upon the type of planting material used and the nature of the soil .For example, the standard pits recommended are of 90x90x90 cm or 75x75x75cm sizes. But alterations from this standard size may be made when stumped budding or germinated seeds are planted. Stumped buddings would need a larger and deeper pit white germinated seeds or basket plants need comparatively smaller pits. Geographical soil position affects the cost of pitting. If the soil is hard and rocky a deeper and wider has to be made. For economy is better types of soil, pits are

often dug wider at the top and tapering to the bottom or the depth reduced to about 60cm with a central alavango hole 15cm or more in depth for the top root.

Felling should be completed sometime before planting to give the soil sufficient time to settle. Sufficient surface soil has to be collected for filling the pits after removing all stones and roots. When manure is to be applied it should be thoroughly mixed in the top 20cm of the soil in the pit.

8-Planting

Planting should be carried out during favourable weather conditions with seedling stump with seedling stump for with budded stump of high yielding clones. Poly bag plants are the most commonly used variety.

After planting, the plants should be inspected at regular intervals of about 10 days and only one vigorous sheet should be allowed to grow. The planting density recommended by the Rubber Board is 420 to 445 plants per hector (170 to 180 per acre) in the case of budding or plants proposed to be field budded and 445 to 520 plant points per hectare (180 to 210 plants per acre) in the case of seedlings. High initial stand is recommended for providing for casualties during the immaturity period and for selective thinning out. As the initial planting density is high, no general vacancy filling may be attempted unless warranted by very special circumstances. During the period of immaturity and initial years of tapping, selective thinning out should be carried out and by the 10th year of planting (third year of tapping) the stand per hectare may be brought to 310 (125 per acre) for both budding as well as seedling.

9-Wind Belt and Fire Belt

Young rubber plants are susceptible to wind and fire damages. To prevent this wind Belt and fire Belt have to be established during the first year itself. They have to be maintained during the life time .Fire belt is made by clearing small shrubs and wastes at 5-7 meter breadth surrounding the plot.

10-Manuring

The rubber plants have been found to respond well to systematic manuring necessary to provide adequate nourishment to the plant. Manurial requirements of rubber plant vary considerably during the three important stages of growth namely nursery, immature and mature stages. In view of the fact that the majority of our rubber growing soils belong to the laterite and lateritic types which exhibit only little variations in the inherent fertility status, the following generalised manurial recommendations are shown in table 4.1, based on the fertiliser experiments conducted by the Rubber Research Institute of India.

Tab 4.1Manurial recommendation

	South Kerala	NPK 10:10:4:1.5	North Kerala	NPK 12:12:6
Immaturity period	Dose per plant	Dose per plant	Dose per plant	Dose per plant
1st year	225	100	190	85
2nd year	900	400	760	340
3rd year	1100	500	960	430
4th year	900	400	760	340
	N P K 10 ×	10 × 10	N P K 12×	12 × 12
	Dose per plant	Dose per ha	Dose per plant	Dose per ha
5th to tapping stage	450gm	300kg	375gm	250kg
No cover crops and mulching	600gm	400kg	600gm	400kg
Tapping trees	900gm	300kg	750gm	250kg

Source : Rubber and cultivation (2001) , Rubber Board.

At the time of planting incorporation of 12 kg of compost or well rotted cattle manure and 175 g of rock phosphate in every pit at the time of filling to provide good soil condition .

Up to 4 years after planting, application of 10:10:4:1.5 NPK mg or 12:12:6 NPK mixture is per recommended. In Kanyakumari district of TamilNadu, Trissur, Palakkad, Malappuram, Kozhikode, Wynad, Kannur and Kasargod districts of Kerala, Karnataka, Goa and Maharashtra regions, the available magnesium status of soil is high and application of 12:12:6 NPK mixture is recommended. In the third fourth year NPK mixture containing rock phosphate recommended. In all the other regions 10:10:4:1.5 NPK mg mixture may be applied.

The fertiliser requirements of rubber during the remaining period of immaturity ie from the fifth year to tapping stage, depend to a great extent on the cultivation practices, such as mulching the plant bases during the initial years and the establishment and maintenance of leguminous ground covers in the area. Cover cropping increases the nitrogen content of the soil. That is why differential fertiliser applications are recommended.

It was found that 99 percent of the growers surveyed used NPK10 ×10×10 for tapping trees .NPK 12 ×12× 12 was mainly used from the 5th year to tapping stage .

For tapping trees application one dose once a year in April/ May or two split equal doses in April -May and Sep- Oct. Application twice a year is found to be more effective.

Because of economic considerations no fertiliser applications are recommended for mature trees which are expected to be replanted with in a period of three years.

10-1-Economic advantage of making own fertiliser mixture

NPK mg 10:10:4:1.5 can be made by mixing 22kg of urea, 50 kg mussurie phose, 7 kg Muriate of Potash, 4 kg of Magnesite. Since magnesite is not easily available,magnesium sulphate can be used instead @ 2 ½ kg magnesuim sulphate for 1kg

magnesite. Also magnesium sulphate once mixed with urea dissolves easily so cannot be stored for long. Application should be done on the day it is mixed.

For making NPK mg in the ratio 10:10:4:1.5 only 83 kg of fertilisers are required. Fertilisers are usually sold in 100 kg packets. The remaining 17 kg is filler usually and, saw dust, china clay etc are used as fillers. This would cause great difference in costs.

There is economic advantage in making own fertilizer mixture. For making NPK 10×10×10 which is commonly used on tapping trees, urea(22kg,Rs.111.32), Rockphos(50kg,Rs.125), Muriate of Potash(17kg, Rs.79.39). The market price(2003) of this mixture is Rs.460. The cost saved by the grower who makes own mixture is Rs.144.19.

11:-Weeding

A minimum 4-5 rounds of weeding becomes necessary in a year. For one round of weeding about 8-10 workers are required. In the first year, there should be 4 rounds of overall weeding in the inter rows and planting strips. In the second year there should be 9 rounds and in the third and fourth year 6 rounds are required. In the 5^{th} and subsequent years only 2 rounds are required as the rubber plants grow and canopy spreads to prevent quick regeneration of weeds.

For weeding herbicides may be used .Pre emergent herbicides prevent emergence of weeds for about 6-10 weeks after planting. Klass, Princep and Lasso are the major pre emergent herbicides. For Lasso dose per hectare is 5 liters and water requirement is 600 liters.

Post emergent Herbicides are root and shoot destroying like glycel, Fernoxon etc and root and leaf destroying like Gramoxon. For Glycel 2liters per hectares together with 400 liters of water @ 2-3 rounds at a gap of 3 months are required. Glycel is the generally used herbicide. As it is more expensive, sprayer used for spraying copper sulphate may be used. Usually one day spraying is enough and the sprayer rent is Rs. 250/day.

Controlled Droplet Applications (CDA) is a comparatively is a sophisticated type of sprayer which reduces the water requirement to 20 litres/acre. It also reduces spray volume to 15-30 litres per hectares there by reducing labour costs.

The sample survey reveals that generally manual weeding is practiced. Herbicides are used mostly in the immature period.

12:-Protection against Sun Scorch

From second year onwards till the canopy spreads, white washing is done from collar up wards on the brown bark to protect the bark from sun scorch. The basis for this practise is the principle that white surface does not absorb heat and light. Lime is the commonest and cheapest material available for while coating. Once the canopy closes, only the border plants need be white washed. Provision of Bamboo tree guards affording shade and mulching the plant bases with dry organic matter for young plants will be helpful in reducing sun scorch.

13:-Spraying and Dusting

For spraying, oil based copper fungicide mistifier type sprayers are necessary. Micro sprayers command 3-4 hectare one day and is used to spray oil based copper oxy chloride. The effective coverage of ordinary sprayers is only 0.4-0.5 ha/day. Thus the coverage of Micron sprayers is 8 times more effective. For young plants knap sack sprayer and a hand rotary duster is used. For mature plants, rocker sprayers and micron sprayers are used. Micron sprayers are priced beyond the reach of the small growers. Rubber Board is supplying Rubber Producers societies and cooperatives with sprayers and dusters at subsidised rate. The burden on the grower is greatly reduced as he can rent these tools from the societies or cooperative Societies. These societies/cooperatives will also give technical assistance to the growers in using the equipments.

Bordeaux mixture 1 percent can be made by dissolving 50kg copper sulphate in 50 liters of water in a vessel. In mature trees one round of spraying requires about 3000 to 5000 liters per hectare of bordeaux mixture. For spraying 3000 liter, 30 kg of copper

sulphate @ Rs. 30.5/kg and 30 kg of lime @ Rs.3.6/kg is required. It requires 21 labourers @ Rs. 150 per day. The total cost would be Rs.4175.

Micro spraying can be done in two rounds with 17 to 22 liters of the mixture of copper oxychloride spray and oil at the proportion of 1:6. For immature trees a single round worth 17 to 25 liters should be sufficient. There should be a gap of 10-15 days b/w successive rounds of spraying.

Cost of Micron spraying for 40 liters of spray oil is Rs.770 after a subsidy of 19percent. 8 kg of copper oxy chloride with 56 percent concentration costs Rs.30-40 The cost of spray material alone would be Rs.1274. The labour charges @ 4 men for one day would be Rs. 900[Rs.150/day] and the total costs would be Rs.2174. If five growers share the rent of the sprayers and cooperate in the labour of spraying, the cost would be reduced to minimum.

For dusting 3 to 4 rounds of sulpur dust at the rate of 11 to 14 kg per round at weekly or fortnightly intervals may be given..

14:-Mulching

Mulching improves the soil fertility by retaining moisture and also helps in the control of weeds. It is understood from a recently conducted experiment that the water weed salvina sp (African payal) spreading as a menace in the waterways of Kerala, when used as a mulch material in seedling nursery @ 5kgm2 as sun dried material during November gives either equal or better quality seedlings when compared to conventional leaf mulch.

15:-Rainguarding

If tapping is not done during raining season the total tapping days would be only 100 days. An additional 35-40 tapping days could be obtained every year by rain guarding the trees. Rain guarding is recommended only in areas where the yield is 675 kg/ ha/ annum or more and 25 more tapping days are lost annually by rain. Rain guarding costs Rs.2 ½ per tree so a cost of rain guarding per hectare would be around Rs.800.So if

yield is less than 675 kg rain guarding would not be possible. Tapping under ½ S d/3 system is economical only when rain guarding is done.

Four types of rain guard viz polythene skirt, "Tapping shade," "Guardian rain guard," "Tapping shield" are recommended and popularised. For rain guarding one tree, four people are required. Such people are selected and trained by the producer societies.

Tapping shades are expensive and during strong winds it cannot protect the bark from the rain and often the cups are filled with water. When tapping channel reaches the lower level of the tree it is not possible to fix tapping shades.

Tapping shades cost vary between Rs.5.18-7.26. For Polythene sheets the cost range is between Rs.3.60-5.02. On an average 20 percent of the first year's shades and 30 percent of the 2nd year's shades had to be replaced. Sample survey reveals that 50 percent of the growers used initial years' material in the second year by changing the fixing side of the sheet. In the case of polythene sheets 66 percent is replaced in the first year. Tapping sheets are more popular as it is comparatively less expensive.

16:-Tapping

Tapping is a process of "controlled wounding" during which thin shavings of bark are removed. Budded plants are regarded as tappable when they attain girth of 50 cm at a height of 125 cm from the bud union. It will be generally economic to begin tapping when 70 percent of the trees in the selected area attain the standard girth. It takes as average of seven years to reach this state. The tapping cut of the budded trees should have a slop of about 30'' to the horizontal.

Hevea latex in the latex vessels of the tapped trees contain 30-40 percent rubber in the form of particles.

Response to different tapping system varies from clone to clone, in general budded trees are to be tapped on half spiral alternate daily [1/2 S d/2] system and seedlings on half spiral third daily [1/2 S d/3] system. It is recommended to adopt d/3 tapping frequency in case a high incidence of panel dryness is encountered.

For high yielding varieties like RRII 105 d/3 frequency can be adopted. Although the yield per hectare may be a bit less [about 20 percent] during the initial period, the difference between d/2 and d/3 system will be narrowed in course of time and there will be an ultimate saving in the cost under d/3 system and increase in net profit, as the latex got under d/3 system has comparatively more rubber content and it also reduces the risk of tapping panel dryness. A comparative study by the Board has revealed that yield from the block where tapping is over by 7 O'clock is 15 % more than the block where tapping is over by 11 O' clock.

Expense on tapping knives is a capital investment. "Michie Golledge" knife and Jebong knife are the commonly used knives in our country for tapping. The tapping task is defined as the number of trees tapped on a day by one tapper. In India it is about 300 trees compared to 400 to 500 trees is other countries.

In addition to the knives, tapping requires tapping light, glass pieces, cups, buckets etc. Previously coconut shells were used as cups. Now a days plastic and rubber cups are widely used since it has increased capacity to store latex and has smooth surfaces which prevents coagulation in the cups and also makes cleaning easier. There is also the expense on coir or plastic threads used to fix these cups on the tree yield stimulation is recommended for trees which are at least 17-18 years old. The application of yield stimulants like ethephon results in the maximum yield for the first year. Successive applications in later years lead to declining yields. After 5 or 6 years stimulation becomes unprofitable. In the case of slaughter tapping a system of multiple band application is in vogue.

17:-Processing the Latex

Of the total rubber production 80 percent is collected from the holdings as latex. The remaining 20 percent of the total crop collected is in various coagulated forms. The latex which gets dried up on the tapping panel (tree lace) and collection cups (shell scrap) also form part of the crop and are collected by the tapper in basket just prior to tapping. The latex split and/or overflowed on the ground (earth scrap) when gets dried up is also

collected as scrap once in a month or so. Tree lace, shell scarp and earth scarp tree together called field coagulum rubbers.

Fresh latex cannot be kept for more than 5 hours without coagulation. Under certain climatic condition latex gets coagulated before processing. This is called pre coagulation which prevent proper processing of rubber.

An anticoagulant is a chemical added to latex to prevent pre coagulation. Generally used anticoagulants are ammonia, sodium sulphite and formalin. If the plot is near the grower's house no anti coagulant is required.

Sodium Sulphite is used to make sheets and Pale Latex crepe (PLC). When formalin is used as pre coagulation agent, the latex is not suitable only for making sheet rubber. Ammonia is most recommended when the latex is processed as preserved latex or latex concentrates.

18:-Making Sheets

For making sheets dilution is done @1:2 or 1:1 depending on the latex concentration to reduce the Dry Rubber Content [DRC] in rubber latex by 12 .5 to 15 percent. Dilution removes impurities, prevents mould formation softness to the milk coagulum and also makes sheeting and drying easier. Diluted latex is left undisturbed for 10-15 mts for sedimentation and then transferred to pans. Each clean and dry pan is filled with 4 liters of latex for making half kg sheets. Fresh latex from a tree of peak age has a rubber content of only about 30-40 percent. The remaining 60 percent is accounted by water protein, resin, ash and sugar. Colour of the sheets is a major determinent in the grading of the sheets. So sodium bisulphate is used to remove the black spots. The major coagulants used in the manufacturing of sheets are formic acid, Acetic acid and catalyst AC. Acid requirement varies for sheeting on the same day and for sheeting on the next day. Next day sheeting requires less acid and is more economic.

Formalin is most widely used coagulant for rubber. With 1kg formic acid 413 half kg sheets can be made from same day sheeting and 551 half kg sheets can be made form next day sheeting. Acetic acid requirements for sheeting are double that of formic acid requirements and catalyst A C is recommended only for same day sheeting.

The price of formic acid was Rs.35.3/kg in 1992. It rose with rubber prices in 1995 to Rs. 48.5. In 1996 it fell to Rs.30.5 and in the year 1996-97, it again rose to Rs.45.8.

After coagulation the coagulum is removed from the trays and thoroughly washed in running water. They are sheeted either in a sheeting battery or smooth rollers. Mould growth on sheet rubber can be prevented by treating the freshly machined sheet in a dilute solution of Para Nitro Phenol (PNP).

19:-Smoking

The sheets after two or three hours of dripping in shade, are put in the smoke house where the temperature is maintained between 40'' and 60''C.

Four days of smoking is generally sufficient under normal conditions but during the rainy season 5-6 days are required for the satisfactory drying of sheets.

If the number of sheets got every day is limited, then they can be sun dried or kitchen dried. But they won't have the quality and colour of smoke house dried sheets.

20-Grading of rubber

The grading of rubber by taking a sample to the laboratory is highly expensive and therefore impractical .250 gm rubber from each sheet has to be taken for examination. So visual grading system is widely adopted. Sample books have 6 sheets of each grade viz RSS 1,2,3,4 and 5 and grading is done by comparison with the sample book. Ungraded or lowest quality sheets are called Lot rubber.

Proper quality ensurement is extremely important on the grounds of maximum profit realisation. Difference in price realisation of high and low grades about Rs.3-4 per kg.

Building of smoke house is a capital investment by the small grower. Under a scheme intended for improving the quality of small holder rubber sheets, the Board is providing technical and financial assistance for construction of smoke houses of 85 kg capacity. Plans and instructions for construction and operation are supplied free. The financial assistance granted in Rs.3,000 per unit or 50 percent of its cost of construction which ever is less.

The expenses relating to the operation and maintenance of smoke house also form part of processing expenses. These include workers wages, fuel cost, repairs and maintenance. In case the grower has no smoking facility the hire charges paid by him towards smoking is taken as processing cost.

The Board is providing an assistance subject to a maximum of Rs.one1akh for constructing 650 kg capacity smoke houses by RPS.

A limited subsidy of Rs.1,000 per set of rollers per grower is given for rollers of the following specifications.

a) Cost trees rollers of size 610 mm x 127/125 mm or 610 mm x 114/110 mm
b) Mild steel rubbers of size 610 mm x 122/120 mm or 610 mm x 107/105 mm

Sec 4.2:- Fringe Benefits

Cover cropping, inter cropping, rubber honey and rubber wood are the fringe benefits of rubber cultivation.

4.2-1:- Cover Cropping

Cover crops are established and maintained in rubber plantation for the purpose of preventing soil erosion prevalent in the rubber tract of South India, improving and maintaining soil structure by lowering soil temperature and fertility by fixing nitrogen content. Pueraria, Mucuna, centrosema are the major leguminous creepers used in rubber holdings.

Seed requirement is @ 5.5 kg per hectare of Centrosema and the seed rate of Mucuna is 3-4.5kg per hectare. In the case of Pueraria the seed rate is about 3-4.5 kg per hectare.

About 4 kg of pueraria seeds per hectare are required for cover crop establishment. The cost of seeds is Rs.80. The expenses on fertilisers, wages of the labour would total up to Rs.400. On the whole there is an expense of about Rs 500. This may look like a heavy burden at first glance.

But studies of the Rubber Research Institute show that the yields in a holding in the first three years with cover crops in 446 kg higher than without cover cropping. In the holdings where tapping has begun it was found that fertiliser requirements with cover

crops were low. Where as 20kg of nitrogen or 43.5 kg. Urea was required to a certain yield, the same can be got by the application of 80kg Nitrogen or 174 kg of Urea under cover cropping.

Besides the amount saved in fertiliser application there is additional profit from the sale of cover crop seeds. In a holding with luxuriant cover crop 30-40kg seeds/year can be got in the first four five years. Rubber Board gives Rs.20/kg for cover crop seeds. Deducting the expenses on the establishment there can be a net profit of Rs.10. The profit per hectare would thus be Rs.300-400.

4.2-2: Inter Cropping

Inter cropping is possible only up to three years from the year of rubber plantation. Intercropping speeds up the girth increment of rubber tree as additional organic manure is incorporated into the soil. Banana is found to be most preferred intercrop. Banana is found to be most preferred intercrop. Ginger plantation requires excessive ploughing and is said to cause soil erosion. Prices of ginger show wild fluctuation. Tapioca cultivation requires less investment and is highly profitable. But it also requires excessive ploughing and loss of humus of the soil. Tapioca gives extra shade and retards the growth of rubber plants. It also causes increase in pests.

Since Ayurveda is gathering ground, now a days medicinal plants like turmeric, kacholam etc can be profitably cultivated.

As Kerala depends on other states for vegetables, cultivation of yam, ladies finger, lettuce, beans etc together with banana cultivation is profitable. The canopy of banana does not restrict rubber plantation. It controls pests and since ploughing is done only at the base, it prevents soil erosion to a great extent. After harvesting the remaining leaves and shoot can be used for mulching . The sale of seeds also gives an income(@ Rs 5).

Pineapple

May June is the season for planting pineapple. The Major varieties are Kew and Maurities. Suckers having 500-1000 gm weight are planted after taking trenches at convenient length 90cm width and 15 cm depth. Organic matter requirement is 25 mt/Ha

and chemical fertilizer requirement is at N.P: K. 320: 160: 320 Kg/Ha. Irrigation is done 5-6 times during the crop reason .Weeds can be controlled either manually or using weedicides. Flowering is induced by using hormone.

Cost of cultivation of 2000 pineapple plants as an inter crop with spacing of 70 x 30 cm in an approximate cropped area of 0.5 ha is given in table no 4.2 .

Major land preparation expenses are expenses on digging, weed removal, clod breaking, leveling, taking trenches, pits, Tractor hire charges and labour changes.

Banana

Major varieties of Banana are Nendran, Table varieties, culinary varieties planting season is the rain fed April - May month and irrigation is done on May and September. Planting material viz sword sucker are planted after taking pits of 50 x 50 x 50cm. Usual spacing adapted is 2 x 2m/2.13 x 2.13/ 2.40/ 2.40 x 1.80.

Organic manure requirement is 10kg/plant. Chemical fertilizer requirement for Nendran is 190:115:300 gm/plant. During summer irrigation is done once in 3 days.

For planting 1250 suckers with a Spacing of ,2 x 2m and with a pit size of 50 x 50 x 50 cm the cost statement is given in table no.4.2.

Ginger

Both dry and green ginger are grown in Kerala. Treated rhizome @ 1500kg/Ha is required. Land is digged /Ploughed and beds of 1m wide and 25cm height are made with 40 cm spacing between the beds. Organic manurial requirement is 30MT/ha and NPK requirement is 75:50:50kg./Ha/Yr Mulching is very necessary 1st time @ 15MT and 2nd @ 7.5mt/Ha

At the seed rate of 750kg for 0.5 hectares , the Spacing adopted is 20 x 25 cm .Land preparation involves digging , clods breaking , weeding, taking beds etc

Besides Intercropping, Fringe benefits can be derived from bye product viz Rubber seed and scrap product viz Rubber wood.

Tab 4.2:-Cost of inter cropping

COST	PINEAPPLE		BANANA		GINGER	
	Unit/Qty/@	Cost[RS]	Unit/Qty/@	Cost[RS]	Unit/Qty/@	Cost [RS]
Suckers	20,000@25p	5000	@Rs.5	6250	750kg@Rs.50/kg	37500
Land preparation	Men-50 Women-35		@Rs.5	6250	Men-2 Women-30	Rs.3700
Planting	Men-10 Women-5	1450	Men-10 Women-5	1450	Men-5 Women-10	1250
Manure& Fertilizers		3150				
Organic manure	12.5mt @250/mt		12.5mt @500/mt	6250	15mt	3750
Application	Men-5 Women-5	2000	Men-10 Women-5	1250	10Men	1100
Urea	340kg	1360	150kg	600	80kg	
Rock phos	400kg	1000	250kg	650	125kg	

Tab 4.2:-Cost of inter cropping (Cont.)

COST	PINEAPPLE		BANANA		GINGER	
Muriate of Potash	300kg	1800	200kg	1200	45kg	
Application	Men-15 Women-5	2000	Men-10 Women-5	1450	Men-15 Women-10	2350 1000
Weeding/ Mulching/ Earthing up					2times 7.5mt&3.5mt	2810
Providing Stakes			12500			
Plant protection		1500	3000			1000
Harvesting and cutting						1000
Irrigation		1500		1000@		1000
Transportation			4150	500		400
TOTAL		20760		26850		56860

Source: Sample Survey

Tab 4.3 Returns from Intercropping

	Pineapple	Banana	Ginger
Stand/acre	20000 Nos	1250 Nos	750 Kg
Price/kg	Rs. 10	Rs.14	Rs.20
Cost of suckers	5000	6250	3750
1st years return	1,500,00	1,750,00	15000
Total income from Intercropping	4,500,00	5,250,00	45000
Total income/hectare	1,800,00	2,100,00	18000
Total income/plant	Rs, 7.5	Rs, 140	Rs. 4
Total cost of intercropping	62010	80550	1,705,80
Net returns	3,879,90	4,444,50	-1,255,80
B/C Ratio	7.26	6.52	0.26

Source: Results of estimation

Tables 4.2 and 4.3 show the costs and benefits of intercropping. The benefit cost ratio of ginger is very low. B/C ratio of pineapple and banana signals viability.

4.2 -3 Rubber wood

At the time of slaughtering, the girth of well maintained rubber tree will be 50-70 inches. If 445 trees are planted per hectare, then by the time of felling there would be about 290-310stands in the plot. That means one hectare commands 7000 cubic feet of rubber wood. One cubic meter or about 35 cubic feet rubber wood would have a weight of about 560-650 kg .Of 45 decilakh cubic feet, 60 percent is base trunk and 40 percent is small branches and dry sticks. Dry sticks and branches are used as fuel wood. Of the base

trunk about 15.5 decilakh cubic feet is used for making packing case, 3 decilakh cubic feet is used for making match boxes and one decilakh cubic feet is used for other purposes.

The yield from smallholdings is 150 m3 per hectare and from estates is 180 m3 per hectare. A holding of size 0.5 hectare having 300 trees which are thirty years old will fetch Rs. 45000 at the current rate.

Another fringe benefit is the income from the sale of rubber seed. One hectare yields 150 kg of rubber seed. Rubber seeds are used to make rubber seed oil which is priced at Rs. 18/kg.Oilcake fetches about Rs.8/kg.

4.2-4:- Rubber Honey

Rubber development experts foresee unlimited possibilities for growers in the era of what is termed as "sweet revolution" Bee Boxes of local bees kept in ordinary surroundings yields only 9 kg honey per box per year. This much yield realisation is possible in boxes kept in rubber plantations with in one and a half months. On an average one box yields 20 kg honey per year and 250 - 350 gm beeswax. It is possible to sell two colonies in a year; Honey yields Rs 60 /Kg, Beeswax Rs. 90 - 120/ kg. and Bees colony costs Rs.300 each.

A 20 kg yield is got when Indian bees (Apis cerana indica) is kept. Italian bees (Apis mellifera) are better yielding. During Feb-March season honey can be extracted once in four days. Each time the yield is 10-15 kg. amounting to 35-60 kg a year. About 72 percent of our rubber trees are at tapping stage and is therefore suitable for bee keeping. Rubber tree flowers during Dec-March season. In one hectare land having 400 trees, about 25 boxes can be kept. If we take an average 20 boxes, Indian honey bee yields (20 x 20) 400 kg. honey a year and Italian honey bee yields (30 x 20) 600 kg. honey per year. At Rs 60/kg, the price realisation per year is 24000 and 36000 respectively.

Table 4.4:- Cost of Bee Keeping

ne unit	one unit [no:]	Rate in Rs	Indian Bees	Italian Bees
BeeBoxes	4	600/2500	2400	10,000
Bee cage	16	100/250	1600	4000
Extracter	1	800/2500	800	2500
Smoker	1	100	100	100
Knife	1	25	25	25
Queen cage	1	5	5	5
Queen gate	1	10	10	10
Queen expeller	1	50/25	50	250
Net	1	25	25	25
Mask	1	25	25	25
Sugar	-	16 kgs	128	1600
C.F sheet	-	25	-	1280
Total			5168	19820

Source:Rubber (September 2001),Rubber Board

Table 4.4 clearly shows that cost of keeping Italian bees is higher than that of Indian bees. But this cost difference is outweighed by yield difference.

Growers under the area category 0.20 - 0.5 acres are eligible for rubber board subsidy which is Rs.1000 for one unit of Indian bees and Rs. 4500 for one unit of Italian bees. If we consider Rs.40 depreciation / box and cost of giving sugar solution @ Rs10 / Box (500 - 800 gm/ week) .Net income per box is Rs. 70 (total yield 20kg × Rs 60 - Rs. 50).

Till 1991, rubber honey constituted 40 percent of Indian honey production (2750 tonnes) Later on due to a persistent viral disease the output was reduced to 550 tonnes. Now 75 percent of Indian bees are free from this viral disease. Rubber honey has tremendous export potential .Per capita honey consumption is on the rise both domestically and internationally.

4.3:- Sample Survey Results on Actual Protection Methods Adopted

An all Kerala primary survey was conducted from November 1999 and April ll. Random samples were chosen from North, Central and South Kerala based on their ghtage in rubber production. Rubber growing tract of Kerala and Kanyakumari dist. Tamilnadu is shown in fig.4.1.Altogether 20 sample units were surveyed with a well mulated questionnaire. Sample units chosen from North Kerala are Horsdurg, sargod,Kanjangadu, Thalassery,Thaliparampa, Kozhikode, Manjeri, Sreekandapuram, akkad, Thrissur and from Central Kerala , Kothamangalam, Eranakulam, vattupuzha, Thodupuzha, Pala, Erattupetta, Kanjirapally, Kottayam, Changanacherry, hanamthitta and from South Kerala, Thiruvananthapuram and Nedumangad.

Natural rubber requires heavy investment compared to other crops. About 60 cent of the cost is shared by the labour component. Almost 90 percent of the surveyed is had no immaturity costs in which labour cost share is very high. The remaining 10 cent is found to follow the recommended cultivation norms of the Rubber Board.

Rubber Board estimates of labour requirements was found to be higher for the rs of immaturity period. Though the no: of surveyed immature sample units are few, results are in tandem with the general practise, since the sample is a representative t. Also, cultivation practises are more or less similar area wise especially in the case immaturity period wherein growers are keen to follow the Board instructions plicitly.

	PARTICULARS	FIRST YEAR		SECOND YEAR		THIRD YEAR		FOURTH YEAR		FIFTH YEAR		SIXTH YEAR	
		Units in no./kgs	Cost Rs.	Units in No./kgs	Cost Rs.	Units in No./kgs	Cost Rs.	Units in No./kgs	Cost Rs.	Units in No./kgs	Cost Rs.	Units in No./kgs	Cost Rs.
1	Poly bag plants	450	6750	5 no.s	75	5 no.s	75						
2	Mulch materials in bundles	450	900										
3	Fertilizer												
A	At the time of planting 175gm of MF/ plant	75	187	1kg	Rs.3	1kg	Rs.3						
B	Farmyard manure 12kg/plant	5400	1800										
C	Pre monsoon and post monsoon10:10:1.5 equivalent 12:12:12	225kg	810	450kg	1620	550kg	1980	450kg	1620	88kg	396	88kg	396
4	Plant protction material(for abnormal leaf fall)												
A	Spray oil	36litre											
B	Copper fungicide or 1:1 Bordeaux mixture(copper sulphate+lime)	6kg/ 20kg 20kg	99	20kg 20kg	1200	20kg 20kg	1200	20kg 20kg	1200	20kg 20kg	1200	20kg 20kg	1200
5	Dusting for powdery milders Sulphur dust+clay powder	20:8K	225	20:8K	225	20:8K	225	20:8K	225	20:8K	225	20:8K	225
6	Cover crops												
A	Seed	4kg	160										
B	Fertilizer	150kg MRP	375										
7	Panel protection Bark recovery compound Bordeaux paste 1:1 for pink disease	2.7kg-2/2kg	55	2/2kg	55	3/3kg	55	3/3kg	55	3/3kg	55	3/3kg	55
8	Other plant protection china clay/Quick lime		99		99		155	18kg	155	18kg	155	18kg	155
9	Wind protection stick			450no.s	675	115no.s	175						
10	Tools&implements	Lumpsum	140	Lumpsum	140	Lumpsum	140	Lumpsum	140	Lumpsum	140	Lumpsum	140
	TOTAL		11600		4092		4008		3395		2176		2036

Tab:4-6 Estimated labour requirements for 450 poly bagged plants for new planting

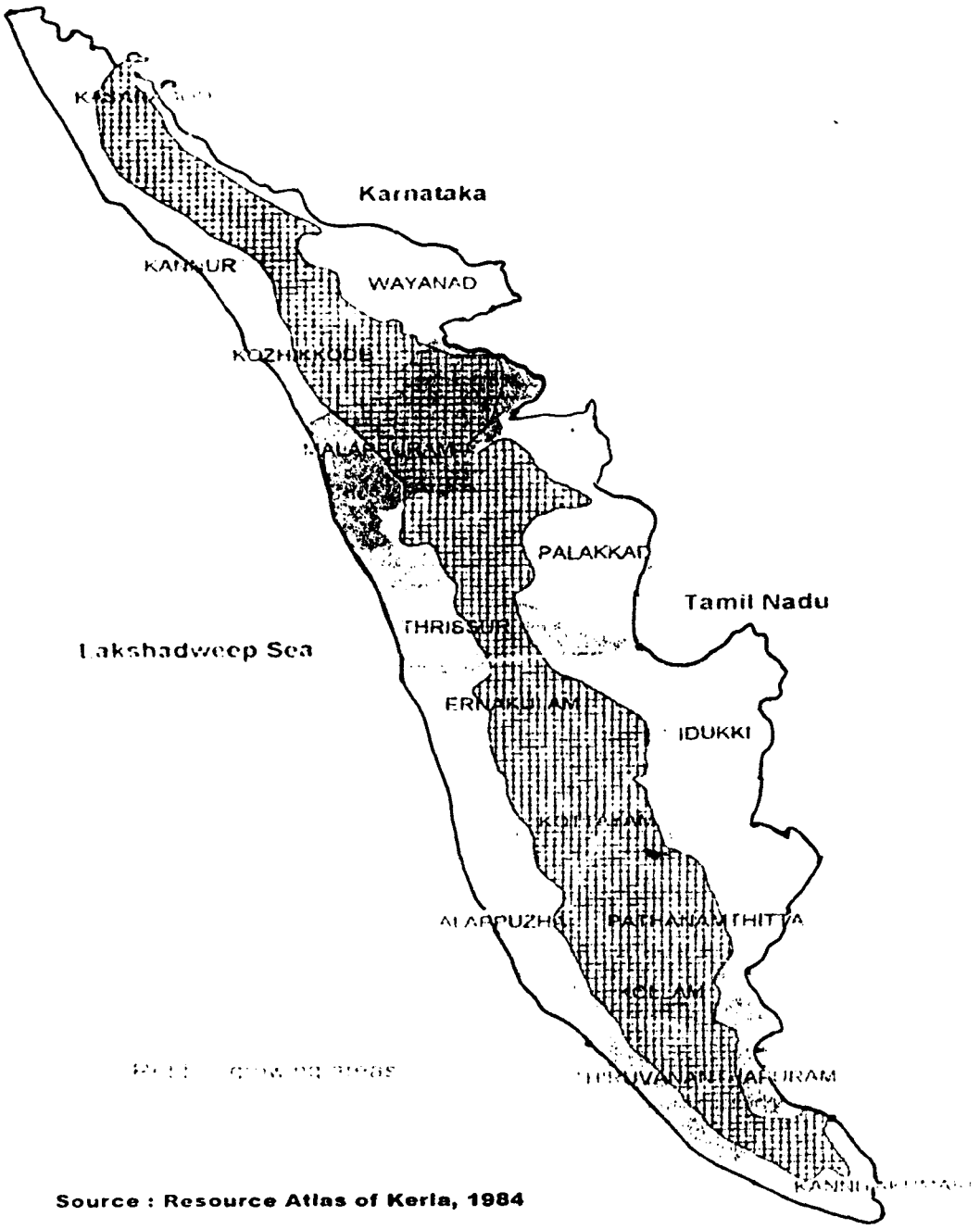
	PARTICULARS	FIRST YEAR		SECOND YEAR		THIRD YEAR		FOURTH YEAR		FIFTH YEAR		SIXTH YEAR	
		MEN	WOMEN	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN
1	Felling &Clearing	8											
2	Terracing,Lining&pitting	40+5											
3	Filling,Planting&Vacancy filling	20+16		2		2							
4	Pruning&Thinning out	5		3		2							
5	Weeding&Mulching (5 rounds)	4	90		70		50		40		40		30
6	Fertilizer application (2 rounds)	12	8	4	8	4	8	4	8				
7	Plant protection spraying	5		10		3		2		2		2	
8	Other measures/dusting	5		5		5		5		5		5	
9	Cover crop establishment	6	7	6	2								
10	Fencing/Kayala/Foot path	15		1		2		2		2		2	
11	Drainage&Misc.work	7		1		1		1		1		1	
12	Wind&Fire belts	5		1		1		1		1		1	
13	Watchman	3		3		3		3		8		3	
	TOTAL	156	105	36	80	23	58	18	48	14	40	14	30

TAB 4.7 Estimated labour cost for 450 poly bagged plants for new planting

PARTICULARS	FIRST YEAR		SECOND YEAR		THIRD YEAR		FOURTH YEAR		FIFTH YEAR		SIXTH YEAR	
	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN	MEN	WOMEN
1 Felling&Clearing	960											
2 Terracing,Lining&Pitting	5400											
3 Filling,Planting&Vacancy fill	4320		240		240							
4 Pruning&Thinning out	600		360		240							
5 Weeding&Mulching(5 rounds	480	7200		5600		4000		3200		3200		2400
6 Fertilizer application(2 rounc	1440	640	480	640	480	640	480	640				
7 Plant protection spraying	750		1500		450		300		300		300	
8 Other measures dusting	600		600		600		600		600		600	
9 Cover crop establishment	720	560	720	160								
10 Fencing/Kayala/Foot path	1800		120		240		240		240		240	
11 Drainage&Misc.work	840		120		120		120		120		120	
12 Wind&Fire belts	600		120		120		120		120		120	
13 Watchman	360		360		360		360		360		360	
TOTAL	18870(69.2)	8400(30.8)	4620(41.9)	6400(58.1)	2850(38.1)	4640(61.9)	2220(36.6)	3840(63.4)	1740(35.2)	3200(64.8)	1740(42.01)	2400(57.97)
TOTAL COSTS	27270		11020		7490		6060		4960		4140	

Men:@ 120/@ 150 for spraying
Women:@ 80

Fig : 4.1 - Rubber growing areas



Source : Resource Atlas of Kerla, 1984

Table 4.8 **Planting cost estimate for the year 2002 per hectare**

YEAR	LABOUR COST[RS]	MATERIAL COST [RS]	TOTAL [RS]
Ist YEAR	27270	11600	38870
IInd YEAR	11020	4092	15112
IIIrd YEAR	7490	4008	11498
IVth YEAR	6060	3395	9455
Vth YEAR	4940	2176	7116
VIth YEAR	4140	2036	6176
TOTAL	60920	27307	88227

Source :- Sample Survey

Variation in wage rates across different geographical regions was also found. Shortage of labourers both male and female was acutely felt in all the geographic regions. Northern and Southern Kerala were identified as low wage regions. This should be due to the influence of the availability of immigrant labourers from the neighbouring Tamil Nadu state at a cheaper rate. Central Kerala showed comparatively higher wage rates. The area form an industrial belt of the state and therefore high wage rates reflect the opportunity cost component in the industrial and construction sector. Compared to estate where wages are uniform and is fixed based on a tripartite agreement between the employee, employee and the government, the wages prevailing in the small holding sector are heterogeneous and is fixed on the basis is of supply and demand. As a result high level of wage rate prevails in the small holding sector.

Most of the cultivation works were carried out on a daily wage system. Same wage rate prevailed for all the works associated with rubber in same areas pitting and refilling was undertaken on a contract basis. Wage rates for pitting depended on the type of soil. Greater effort is required for pitting hard rocky areas. Higher pitting wage means higher refilling wage as while refilling is done stones are to be removed from the soil.

Gender inequality in wage rates was observed. Female wage rate comes to only 66 percent of the male rate (Rs. 80.3 as against Rs. 120.1 for male on an average). This is

justified on the ground that the type of works undertaken by women involves less physical exertion than that of men. Female work participation rate during immaturity period was 58 percent. 94 percent of the female labourers are employed for weeding and mulching.

Work participation of family labour is negligent in the immaturity period. During maturity period also, less than 5 percent were engaged in tapping and other plant protection measures. This is in tandem with the sample survey results of the Rubber Board which reveal the sole income dependency of sample units as only 40.5 percent. Out of this 95 percent don't engage in cultivation activities. It was found that in practise watchmen were not kept by small holders for supervision. Supervision is under taken by family liability. Perhaps the cost of supervision is included in Board estimates to incorporate the opportunity costs of family labour.

It was found that protection measures like construction of wind belt and fire belt was net practised widely. Manurial recommendations of the Rubber Board for immaturity period were strictly followed by the growers. During tapping stage, however discriminatory fertilizer application was practised on the basis of price realisation. 90 percent of the surveyed units made their own fertilizer mixture. Only those who are members of the co-operative society or those who live in remotest areas bought fertilizers at market price. However for estimating material costs market price of fertilizers was made use of.

Though chemical weeding is more profitable than manual weeding when considering the labour cost component, it was found that majority practised manual weeding. This could be on account of ignorance or due to slow rate of change of habitual cultivation practises.

Micron spraying is more cost efficient. Spraying costs are 48 percent less than that of Bordeaux spraying. This is due to the fact that labour cost component under micron spraying is only 42 percent whereas under Bordeaux spraying it is 75 percent. Here again, a slow change of habit was found.

Mulching is a widely prevalent cultivational practise. Mulching using African Payal is also found to be widely practised.

Sec 4.4:- Methodology suggested for arriving at cost of production of NR as per MOU between ICWAI and Rubber Board w.r.t. to small holding sector

Over heads and other terms of expenses imputed or other use

1. **Rent on land:** - The present lease rent fixed by the state government Rs.1300 per ha/ per annum is taken as the opportunity cost for self cultivated land.

2. **Amortization of Development cost:** - Current development cost of the Rubber Board is deflated to 1985 year @ 5 percent per annum. This is because majority of the plants relates to 1980 - 1985 vintage. Since the small holders normally do not keep proper accounts it is not possible to get reliable data on the actual development cost incurred by the growers.

The development cost after deflation works out to be Rs. 45,000/- for 1985 planting spread over for six years i.e. till 1990. After giving a weight age of 12 percent (Compound interest for the year wise investment from 1985) the amount works out to Rs. 75,000/- This is amortized and the share of this cost for a yielding period of 25 years will work out Rs 3000/- per annum per hectare.

3. **Interest on loans during the yielding period.**

4. **Interest on working capital @ 12** percent

5. **Adjustment of loss on scrap:** - Normally 20 percent of the yield is lost as scrap. The loss would amount to 20 percent of the difference between the price of ungraded rubbed and scrap of 100 percent DRC.

6. **Grade difference:** - Loss on account of grading i.e. the difference between the price of upgraded rubber and the price of the required grade rubber is added to the cost.

7. **Managerial expenses:** - Hanumantha Rao Committee has recommended a rate of 10 percent of the total cost of maintenance and processing which has been accepted by the government.

8. **Return on Capital Risk:** - The entrepreneur is taking high risk in the plantation industry like disease, wind, droughts etc. The modern high yielding done RRII 105 is susceptible to degeneration. So a high post tax return @ investment is highly essential to induce the growers to remain in the industry.

Tab : 4.9 - All Kerala sample sur

AREAS	Changanacherry	Pathanamthitta	Nadumangad	Tvm	Thalassery	Taliparambu	Kanj. Hsdr. Ksgd	Manjeri	Sreekandapuram	Kozhikode
Immature area in ha	0.00	2.83	1.84	1.39	1.04	0.79	0.00	0.00	0.00	0.88
mature area in ha	10.69	12.22	11.23	6.87	2.78	2.82	4.24	4.77	3.65	12.26
No. of trees tapped	5565.00	5445.00	2310.00	1780.00	1410.00	1450.00	1420.00	17.95	1880.00	6215.00
Production in Kg										
Sheet	23390.00	16151.00	6597.00	8356.00	6185.00	4500.00	4460.00	6403.00	6853.00	24748.00
Scrap	3607.00	2285.00	880.00	976.00	780.00	300.00	470.00	820.00	800.00	2921.00
Total	26997.00	18436.00	7477.00	9342.00	6965.00	4300.00	4830.00	7223.00	7653.00	27689.00
Price			0.00							
Sheet	30.00	25.75	29.20	29.20	31.33	29.00	33.33	31.33	30.00	30.20
Scrap	18.00	15.50	17.80	17.00	18.66	18.00	17.66	17.00	17.00	18.10
WAGES										
Maintenance & up keep	16575.00	17980.00	97.15	3900.00	8570.00	5455.00	5610.00	6120.00	7290.00	26016.70
Rain Guarding		8625.00	0.00	0.00	0.00	0.00	0.00	0.00	600.00	8560.00
Tapping & Collection	198287.00	228540.00	80400.00	63915.00	56930.00	61200.00	51120.00	66915.00	76920.00	258000.00
Processing, Sheeting & packing	11020.00	2100.00	5500.00	2100.00	850.00	500.00	3000.00	0.00	0.00	0.00
Transports & Marketing	3790.00	3950.00	2360.00	1500.00	1100.00	550.00	1950.00	4580.00	2670.00	4750.00
Total	226772.00	261195.00	97975.00	71415.00	67450.00	67708.00	62680.00	77895.00	87480.00	297326.70
MATERIALS										
Maintenance & up keep	35270.00	25870.00	18837.00	9240.00	8600.00	6270.00	8940.00	7881.00	13660.00	24092.50
Rain Guarding	0.00	15290.00	0.00	0.00	450.00	1250.00	0.00	0.00	980.00	12180.00
Tapping & Collection	3366.00	1610.00	3528.00	3525.00	600.00	1075.00	2200.00	1150.00	0.00	2630.00
Processing sheeting & Picking	8445.00	8766.00	4500.00	3072.00	2210.00	5000.00	1680.00	2660.00	2820.00	10704.50
Total	47081.00	51536.00	26865.00	15837.00		13595.00	12820.00	11891.00	17460.00	49607.00
Overheads	6523.00	4344.00	5600.00	3085.00	875.00	1730.00	2250.00	1800.00	1605.00	6699.00
Depreciation	4700.00	5510.00	1500.00	1380.00	450.00	0.00	2350.00	0.00	1800.00	5540.00
Total cost of production	285976.00	312731.00	131940.00	91717.00		243765.00	80100.00	91186.00	73785.00	359172.00
Cost of production NR / ha	51.39	57.43	57.12	51.53	0.00	56.95	56.41	50.80	57.63	57.79
Output / tree	4.85	3.39	3.24	5.25	4094.00	3.90	3.47	4.02	4.7	4.45
Production / ha										
Sheet / ha	22.83	1321.69	587.44	1217.76	2224.00	1539.13	1051.89	1342.36	1877.53	2018.60
Scrap / ha	3.52	186.99	78.36	142.07	280.58	15[illegible]52	110.85	171.91	219.18	238.25
Total production / ha	26.35	1508.67	665.81	1359.83	2505.00	1696.65	1162.74	1514.26	2096.71	2256.85
% of scrap to total production	13.36	12.39	1177.00	10.45	11.20	9.28	9.53	11.35	10.19	10.56
Sales in Rs.										
Sheet	6174960.00	3327106.00	963162.00	1221436.00	581390.00	3818540.00	445000.00		411180.00	7473896.00
Scrap	461696.00	283340.00	78320.00	82960.00	43680.00	224750.00	24910.00	41820.00	27200.00	529701.00
Total Sales in Rs.	6636656.00	3610446.00	1041482.00	1304396.00	625070.00	4041290.00	470910.00		438380.00	8002597.00
Gross margin	6350680.00	3297715.00	909542.00	1212679.00	625070.00	37975252.00	390810.00		330035.00	7643424.30
Total cost of production										
Particulars										
Equivalent Production										
Sheet 100 %	23390.00	16151.00	6597.00	8366.00	6185.00	15145.00	4480.00	6403.00	6853.00	24748.00
Scrap 80 %	2885.60	1828.00	704.00	780.80	624.00	1240.00	676.00	656.00	640.00	2336.8
Total	26275.60	17979.00	7301.00	9146.80	6809.00	15385.00	1136.00	7069.00	7493.00	27084.8
Total cost of production										
Upto latex stage	251498.00	297915.00	112480.00	80580.00	75150.00	219270.00	68870.00	82066.00	99450.00	331479.2
Cost / kg upto latex stage	9.57	16.57	15.41	3.81	11.40	13.38	14.24	11.63	13.27	12.24
Total cost - sheet (latex stage)	223878.36	267624.74	101634.10	73701.43	68263.00	202675.87	63515.00	74439.52	90955.67	302880.13
Total cost - scrap (latex stage)	27619.64	30290.26	10845.90	6878.57	6887.00	16594.00	5354.66	7626.48	8494.33	28599.9
Total cost of production - sheet	274753.00	312731.00	124840.00	87252.00	79310.00	81300.00	73500.00	89386.00	104940.00	346933.7
Cost / kg	11.75	19.36	18.92	10.43	12.82	18.07	16.93	13.96	15.31	14.02

...vey result (Mature Area)

Palghat	Ernakulam	Kothamangalam	Trichur	Thodupuzha	Muvattupuzha	Erattupetta	Kanjirapally	Kottayam	Pala	Total	Average
2.05	3.07	0.93	0.00	0.6	0.54	0.6	0.73	3.29	1.44	21.99	10995.00
14.20	18.63	4.03	6.73	3.06	4.51	9.08	11.83	8.44	13.27	165.31	62655.00
6730.00	6292.00	2150.00	3520.00	1358.00	2110.00	3926.00	5800.00	3420.00	5680.00	70056.00	3502.8
27458.00	35545.00	5550.00	14820.00	6326.00	11491.00	13774.00	23236.00	16270.00	22275.00	284398.00	142199
3120.00	4170.00	1150.00	1120.00	560.00	2035.00	1693.00	3200.00	1967.00	2721.5	35675.50	1783.775
30578.00	39715.00	6700.00	15940.00	8986.00	13526.00	15467.00	26436.00	18237.00	24996.5	320073.50	16003.38
31.80	30.66	31.5	36.5	32.00	30.00	29.6	30.06	29.2	31.6	612.26	30.613
18.60	17.66	17.75	21.5	17.5	17.6	19.1	18.45	19.06	18.00	359.95	17.9975
485585.00	19290.00	3845.00	5194.00	3136.00	7015.00	10820.00	14045.00	14030.00	14253.00	248454.70	12422.24
19210.00	2440.00	3750.00	1050.00	800.00	0.00	5350.00	4200.00	2150.00	3930.00	65885.00	3293.25
296305.00	25147.00	88170.00	135800.00	45425.00	85413.00	152063.00	255047.5	113722.00	233093.00	2544317.50	127215.9
0.00	89.63	0.00	0.00	0.00	1000.00	500.00	1490.00	5880.00	3900.00	45808.00	2343.4
3150.00	3040.00	880.00	1500.00	410.00	900.00	2820.00	5320.00	3820.00	2900.00	51825.00	2591.25
389250.00	286856.00	96645.00	143544.00	50771.00	94338.00	171353.00	251002.5	139602.00	253086.00	3184170.20	159208.5
32700.00	30295.00	7522.00	10224.00	6044.00	11465.00	12440.00	17098.00	15070.00	22667.00	324185.50	16209.28
23530.00	7760.00	2600.00	6500.00	1200.00	810.00	10100.00	7700.00	2040.00	14300.00	106650.00	5334.5
2180.00	3966.00	510.00	200.00	320.00	2517.00	200.00	2450.00	11.50	2580.00	35756.00	1787.8
10520.00	13410.00	1585.00	3985.00	1550.00	2330.00	7120.00	6865.00	9735.00	8778.00	116015.50	5800.775
58930.00	55430.00	12197.00	20909.00	9414.00	17122.00	29860.00	32943.00	27995.00	48325.00	569617.00	28480.85
6520.00	9022.00	2200.00	4300.00	2915.00	3486.00	3300.00	5510.00	4540.00	4295.00	80479.00	4023.95
8770.00	12015.00	930.00	2050.00	750.00	610.00	4080.00	7740.00	5050.00	3000.00	68225.00	3411.25
53470.00	363362.00	111972.00	170803.00	63750.00	115536.00	208593.00	297195.5	177187.00	31876.00	3664156.50	183205.3
67.38	57.75	52.08	244.15	46.94	54.76	53.13	53.07	51.81	56.11	1234.23	61711.5.00
4.54	6.31	3.12	24.16	5.14	6.41	3.94	4.72	5.33	4.4	4198.71	209935.00
1958.49	1907.94	1377.17	2202.08	2067.32	2547.89	1516.96	1964.16	1927.73	1678.5	32351.56	1617.578
222.54	223.83	285.38	166.42	215.69	451.22	186.45	270.5	233.06	206.08	4049.39	202.4695
2181.03	2131.78	1662.53	2368.5	2283.01	2999.11	1703.41	2234.66	2160.78	1883.69	36401.37	1820.869
1020.00	10.5	17.16	7.03	9.45	15.05	10.95	12.1	10.79	10.89	1234.00	61.7
731644.00	16350700	599300.00	2163720.00	809728.00	1723850.00	4077104.00	10479436.00	7126260.00	10558350.00	87737444.00	4386872
88320.00	1105060.00	81650.00	96320.00	46200.00	179080.00	323363.00	586400.00	562562.00	734805.00	6393127.00	319656.4
311964.00	17455750.00	780950.00	2260040.00	855928.00	1902730.00	4400467.00	11365836.00	7888822.00	11293155.00	94130571.00	4706529
358494.00	17092396.00	663978.00	2089237.00	792178.00	1787194.00	4191874.00	11068640.5	7511635.00	10974449.00	90145073.80	450.7254
27458.00	35545.00	5550.00	14820.00	9326.00	11491.00	13774.00	23236.00	16270.00	22275.00	298043.00	14902.15
2496.00	3336.00	920.00	896.00	528.00	1628.00	1354.00	2560.00	1573.00	2177.00	29539.20	1476.96
9964.00	38881.00	6470.00	15716.00	6854.00	13119.00	15128.4	25796.00	17843.6	24452.2	324583.40	16229.17
24510.00	216897.00	1063.97	158968.00	57925.00	107225.00	190973.00	271440.5	148162.00	296833.00	3697088.70	184854.2
14.17	8.15	16.44	10.12	8.45	8.17	12.62	10.52	8.3	12.1	235.56	11.778
89136.53	289707.2	91267.91	149904.9	53462.73	93918.93	173875.8	244502.69	136095.82	269492.3	3359932.56	167996.6
5733.47	27189.85	15129.09	9063.08	4462.27	13306.00	17097.24	26937.81	13066.18	25343.68	337516.41	16875.82
68180.00	342315.00	108842.00	154453.00	60185.00	111460.00	201213.00	285115.00	167597.00	311411.00	3767716.70	188385.8
15.96	9.63	19.61	11.1	9.51	9.7	14.61	12.27	10.3	13.98	278.24	13.912

On the basis of cost estimate amortization of the development cost is lower.

Table no 4.10:- Amortization of the development cost

Total development cost	**Labour cost + Material cost** **= 60920 + 27307** **= 88227**
Adding 5% to incorporate inflation	**4500**
Total expenses incurred	**92727**
Total income during immaturity period from Intercropping [income on an average of three crops]	**1,65,000**
Less interest, tax, supervision	**70500**
Total income received	**95500**
Amortization	**95500-92727=2773** **rounded to 2700**

Source: Sample survey

As given in table4.8, Total amortization is adjusted for inflation and total income from inter cropping is included and interest, tax, supervision is excluded to arrive at total net income.

In the cost calculations, this amount of 2700 is added every year to the cost. This is the normal accounting procedure of the initial capital investment as accepted by NABARD for giving loans to the growers. The development cost is amortized in plantation companies based on the actual expenditure as the current cost accounting principles have not been accepted in auditing and taxation purpose. However in estimating plantation projects, determination of scale of finance and for management decisions etc current development cost can be usefully employed.

Sec 4.5:- Results of the sample survey for mature yielding areas.

The survey covered on an average to a total mature area of 1653 ha with about 70056 tappable trees. As shown in table 4.10, average all Kerala level of production was found to be 16003.68. Sheet production was 88 percent of total production. On an average 12 percent of total production was lost as scrap. There is a 20 percent lose of income from sale of scrap when compared to the sale of sheet.

On an average the all Kerala price level for the sample period was recorded at Rs 30 for sheet and Rs.18 for scrap. Average yearly output per tree was found to be about. 210kgs.

All Kerala Average total cost of production is found to be Rs. 183205.3. Wage costs had an 87 percent share is the total cost of production. Tapper wages alone had a 69 percent share in the total cost of production and a 79 percent share in total wage costs.

Overheads and depreciation had a share in the gross cost figure while the remaining is accounted for by materials cost. Per hectare average cost of production of NR per hectare is recorded as Rs. 61.7115 recorded to Rs. 62.

Per hectare average total production is 1820.069 per hectare sheet production are 1617.578 and per hectare scrap production is 202.4695. Average percentage of scrap of total production is 61.7.

Average total sales are Rs. 4706529. Average total sales of sheet alone in 93 percent of this gross figure. Average gross margin at the all Kerala level is 4507254.

Average equivalent total production is 16229.17 tonnes. Average total cost of production up to latex stage is 184854.4 cost per kg up to latex stage is about Rs.12. Average total cost of production of sheet is Rs.188385.8. Taking into consideration the equivalent production cost/ kg works out to be 13.912 rounded to Rs.14. This is the basic per kg cost of production.

Basic cost of production of sheet is adjusted by adding the land rent; amortization of deflated development cost Interest on loan, interest on working capital Adjustment of loss on scrap, grade difference, managerial expenses and return as capital risk to arrive at actual cost of production .Actual average cost of production worked out to be Rs.360688.82 .On a per kg basic it works out to Rs.22 i.e., Rs.12 below BMP level.

This cost figure is worked and without taking into account opportunity cost explicitly. Interest rate is considered as the opportunity cost for finance. Opportunity cost of land is not taken into consideration as it is a highly complicated and widely debated issue.

In the first place opportunity cost or cost of next best alternative does not exist in the case of rubber. In the agricultural field no other crop yields better than rubber even when rubber prices are crashing. Annual crops are subject to violent seasonal fluctuations. Kerala's overall economic climate is slowly rooting out paddy and coconut cultivation.

Paddy

In Kerala the production meets only half of consumption requirements. Land reforms enforced in 1970-Government subsidies, climatic changes etc; favoured rubber cultivation. When grow more food campaign was propagated forest cleared lands were used for rubber cultivation.

On an average the cost of cultivation is Rs.5500-6000/acre yield is 10-12 quintals. The return from this production Rs.5000-6000/acre. This is hardly sufficient to meet interest on capital expenditure lease on land. Usually 1/3rd of the market price is the levy to the government. There is no adequate Bench mark price or market intervention. Mechanisation though is expensive has become a necessity due to white collar effect. The no. of labourers between ages 35 to 40 has reduced considerably. Water projects have become useless in effect e.g. Pamba canal and Kallada canal. Above all unpredictable climate has become a bane to paddy cultivation in Kerala.

Coconut

On a global basis the share of India in coconut production is 25-30 percent. Kerala ranks first in coconut production but its share has reduce from 60 percent in 1980s to about 42 percent in 1990s.Coconut commands about 40 percent of the agricultural land in Kerala and gives employment to about 70lakhs of the population. Coconut cultivation accounts for 37 percent of the total revenue from agriculture in Kerala. Not getting fair price for coconut and the low price of the coconut oil is the main problem of coconut growers. Prices are unpredictable and show wild fluctuations. There is no marketing

mechanism to ensure fair price. Institutions like Kerafed which work on a cooperative basis were unable to help coconut growers. In southern districts, heavy wind fall reduces productivity. Diseased trees can only be felled and felling costs about Rs.200-250/tree. In northern districts unscientific cultivation and lack of irrigation lessens productivity.

Oil production from coconut is less than 20 percent whereas oil production form oil seeds like peanuts, Soya bean, sunflower, sesame etc. are over 90 percent. Coconut oil production faces tough competition from these other oils whose production is based in North Indian and other states. There is also heavy lobbying pressure. Coconut based industries are not diversified.

Therefore no other crop has been officially identified as a substitute so far and data are not available for comparison. Thus we see that the aspects of rubber scenario outlined in the SWOT analysis are quantitatively verified in the present chapter

The characteristic industrial sluggishness of Kerala, though showing signs of improvement in various corners does not have enough force to drive people from agriculture to industry in the Lewis fashion to raise prices and costs in the agricultural sector.

Rubber Board sample survey reveals that only 40 percent of the growers depend solely on rubber as a main source of income.

As per Boards questionnaire for sample survey, a grower is solely dependent on rubber as main source of income when his income from rubber is greater that the other entire alternative source of income. This means that even the 40 percent does not stand for a true estimate of the sole dependents on rubber for income among 9.5 lakh small growers. So rubber cultivation itself has become a next best alternative for a tertiary sector dominated state like Kerala. When majority is engaged in alternative occupations rubber cultivation requiring only supervision once the plant reaches maturity is the most viable alternative.

Land was converted into rubber plantations to come under the exemption enjoyed by rubber plantation under the land ceiling Act. Most of the plantation was purchased years back and data on the land prices is not available for calculating its imputed value. In Kerala the concept of mortgage land is outdated as all such lands have been given to

the users. Leased land (after 10-12 years) is also given out. So for rubber opportunity cost concept on such lands are irrelevant. So there remains only owned and inherited land.

In the cost of production study under Ministry of Agriculture imputed value of land is not taken. This is because continuation of the use of land for the same crop is considered itself as an indicator that there is no next best alternative use.

In the wake of global price competitiveness, the adjusted basic average cost is an efficient one. But the condition is that Bench Mark level of Rs 34/kg is above the calculated level and so stands for a "fair" return for the growers. Or in other words what the grower is justified to get so that he remains in the cultivation of rubber. The peak level attained in mid 1997 can be explained away as seasonal fluctuation's or in other words wind fall gains. It may recur depending on the post WTO global changes. But to use the peak prices as a base for price calculations amounts subscribing to "ratchet effect" phenomenon of Duesenberry.

Sec 4.6:- Methodology for cost calculation as given in the memorandum to Minister of finance w.r.t. to floor price by United Farmers Front.

The cost of production is arrived at by calculating the cost of three consecutive stages in the life of a rubber tree which spans about 25 years.

1. **Expenditure up to planting in Part I**
2. **Expenses for 7 years prior to yield Part II**
3. **Expense after start of yielding part III**

Part I

Expenditure up to planting = Expenses on Nursery and preparation of land + Pitting + Refilling + price of budded seedlings + Transportation + koolie charges for planting.

Less subsidy provided by the Rubber Board plus interest @ 12 percent per annum for the next 7 years in up to start of yielding.

Part II

1. Yearly maintenance cost for 7 year period = Expenses on fertilisers and Manuring, plant protection + Labour charge for application + management charge @ Rs 200/p.m

2. Net Expenses = Yearly maintenance cost - Rubber Board subsidy for each year

3. Cost = Net expenses + 12 percent interest of net expenses.

4. Lease rent is taken as the opportunity cost of land. A minimum amount of Rs. 5,000 per year is considered for each of the 7 years.

Total opportunity cost = opportunity cost for i th year + 12 percent compounded interest for opportunity cost for ith year (i = 1, 2.....7)

Part III

Yearly expenses of yielding period = Tapping charge + plant protection + labour charges for application + fertlizer& manuring + expense on shade cup powder + Acid, smoke house expenses + Management charge.

Total cost of production = 12 percent interest of the first and second part costs + yearly recurring expense of IIIrd stage.

Board estimated maximum total production per ha per annum = 16000/ha

On a per acre basis = 640 kg

Less 1/4 th of the production as land rent payable to the land lord or the opportunity cost = 160 kg

Net production = 480kg

$$\therefore \text{Cost per kg of rubber} = \frac{\text{Total cost of production}}{\text{Net production}}$$

About 40 percent might be recovered by slaughter tapping and sale of timber but it is not considered.

The methodology is adopted after making a few variations. Stage one includes cost items of Nursery and preparation of land Pitting, Refilling, Price of seedlings, Transportation and Koolie charges for planting without labour cost and material cost

classification. Results of the sample survey having item wise cost share is slightly less and is more accurate.

Price of seedlings has come down from Rs.22 in1997 to Rs.10-15 on an average at present. Subsidy per plant has been slashed from Rs.6 in1997 to Rs.5 as a part of progressive subsidy reduction programme in the WTO period.

In the second stage cost of production in the immaturity period is a concrete figure of Rs.3940 less the Board interest subsidy. Board has stopped the grant of interest subsidy since 1998 so there is no need for adjusting yearly immaturity costs. Again, yearly immaturity cost shows a pattern of progressive reduction and is not a constant figure in practice. In the calculation of yearly maintenance cost, fertiliser, manuring, plant protection, application charge and management charge are considered. In actuality there is additional costs incurred on weeding fencing maintenance etc which is not considered in the original calculation

Sec 4.7:- Cost of production per hectare of natural rubber-second method

First stage

Cost of production = Rs 10458.8

Less subsidy [5 ×180+1000] = Rs 1900

Total = Rs 8558

Plus interest @ 12 percent per annum for the next 7 years

up to the start of yielding = Rs 10361

Total = Rs 18919

Second Stage

Yearly maintenance cost

With no subsidy deduction = Rs 28849.12

Plus @ 12 percent interest per annum = Rs 34927.11

Total = Rs 63776.23

A minimum Rs5000 per year net of all expenses was taken as oppurtunity cost of the land is leased out. @ 12 percent interest, total for 7 years

Total of opportunity cost with interest =Rs 51068.49

Cost of tree up to yielding stage = Rs 23121.076 + Rs 63776. 23 + Rs 51068.49

TOTAL = Rs 137964.279

@ 12 percent interest rate of cost = Rs 16555.774

Third stage cost

Yearly maintenance cost of tapping stage = Rs. 14420

Total cost of production = Rs.14420 + Rs.16555.74

= 30975.74

Net Production = 480 kg

Cost per kg. of NR = Rs.30775.74

480 kg

= Rs.64.53

Though same variations are made in the estimation the cost/kg is works out to be greater than the cost worked out by united farmers front viz. Rs. 63.99.

If we deduct 40 percent from the cost of production as cost recovery from rubber wood. Then cost per kg workout to be,

cost per kg = 18465.44 = Rs. 38.5

480

If we consider the argument that lease rent itself is a sufficient component to account for opportunity cost and ignore separate opportunity cost calculations the interest of the total cost of production would be 12 percent Interest of Rs. 63776.23

i.e., Rs.14420 + Rs.7653.15 = Rs.22073.15

Cost/kg = Rs. 50.44

Adjusted to rubber wood

price realisation = 8829.26 = Rs.18

48

The concept of normal price is fixed on the theory that the investor should get a return which is enough to cover the cost of production and yield a normal level of profit such that he is not tempted to shut down. There is a normal level of exit and entry. The price level of Rs.18 worked out by the ICWAI methodology can be classified as a normal

price under a perfectly competitive situation. Theoretical price levels are not enough for boosting the growth of any industry. Sample survey results based on this methodology (Rs.26) can be considered as the range above shutdown point

Peaks and troughs in price level are common phenomena whether it is an agricultural or industrial good. It is the result of wind fall gains or losses. But having attained a high level once there is a psychological fixity to that level. The price level between Rs.55-60 can be classified as a peak price level. Using peak prices as a base for price calculations amounts subscribing to "Ratchet effect" of Duesenberry.

The midway level worked out using the second methodology is Rs.38.5 and is higher than the BMP level. At present it is unattainable since international price hovers around Rs.32 We may conclude that the question of how fair is the fair price is a matter of growers view point. Opting for the economically feasible level is the best option for growers Though a major share of rubber returns leaked out as conspicuous consumption, changes in Business scene and attitude will definitely bring forth positive reinvestment of the surplus. As it is most suited for Kerala's peculiar industrial climate and as there are no viable alternative, rubber cultivation should be shown green flag. For this the grower should at least get the BMP level in the present situation or else exit would be the most viable alternative.

Foot note of table 4.10

% of scrap to Total production = Scrap / ha Total production/ ha

Total cost of production = Cost of sheet up to latex stage + (processing sheeting, packing, transport and marketing costs under wages and material heads)

Cost up to latex stage = Total of maintenance and upkeep + Rain guarding + Tapping collection costs under wage and material heads.

Cost of scrap up to latex stage = % of scrap in output × cost up to latex stage

Cost of sheet up to latex stage = % of sheet and output × cost up to latex stage.

CHAPTER - 5

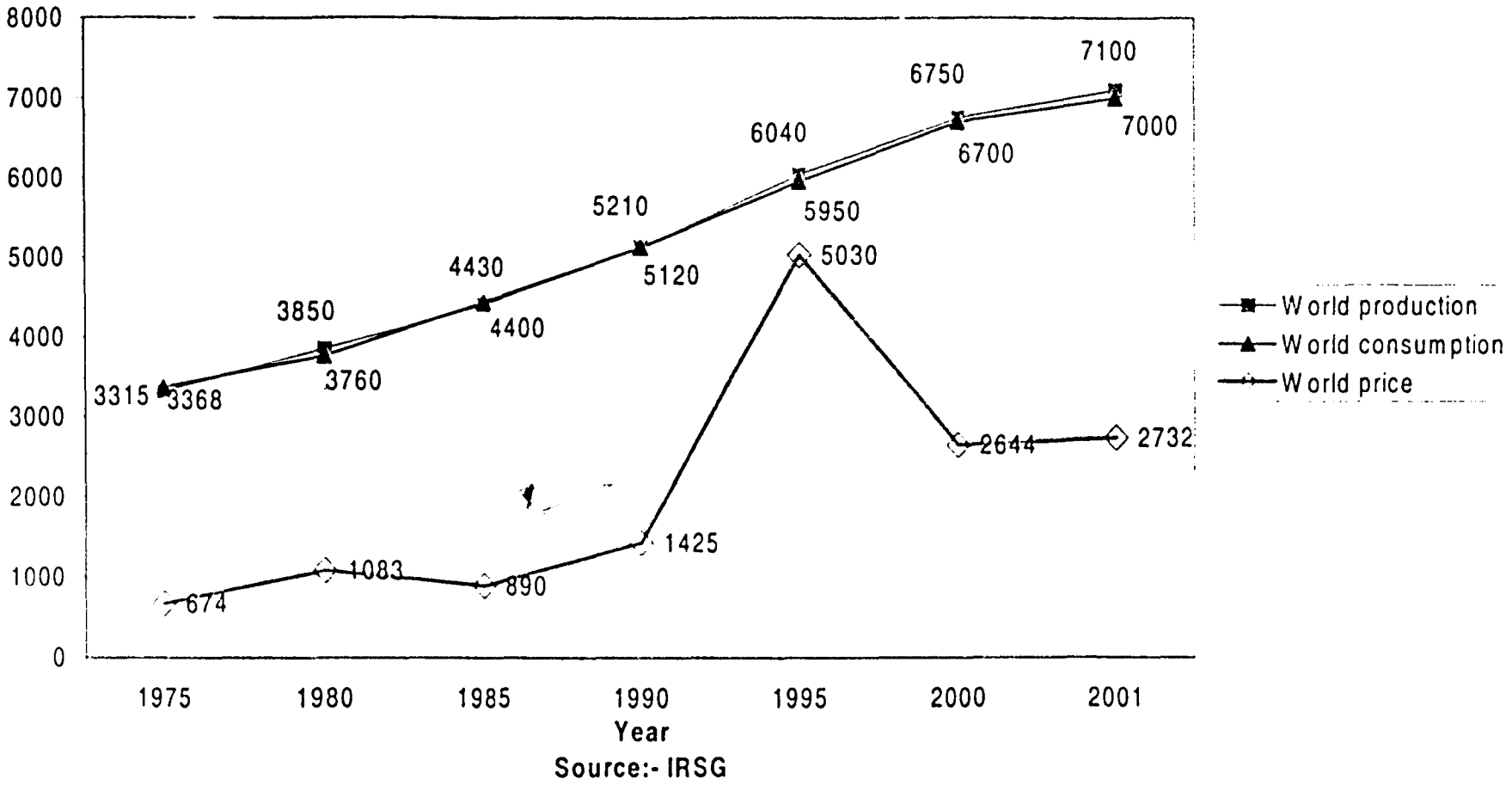
FORECASTING NATURAL RUBBER PRODUCTION AND CONSUMPTION

A close watch of the world scenario shows that prospects of world natural rubber industry are closely related to the level of economic development in the NR exporting and importing countries. The ongoing process of globalisation presents deep implications on natural rubber industry. Owing to substitutability between NR and SR, cost efficient production process of the latter can pose threat to the former. The proportion of NR in the global elastomer usage is forecasted to decrease from the present level of 40 percent to 37.5 percent in 2010. Due to relatively higher price of NR and progress in SR industry it may still reduce to 35 percent by 2020. World consumption of NR which was 66.8 lakhs during 1999 is forecasted by the International Natural Rubber Organisation to reach 100 lakh tones by 2010.Table 5.2 shows the consumption trend of major consuming countries.

The World Bank forecasts NR price to recover. NR prices rose by 9.1 percent in 1999 and by 8.3 percent in 2000. The growth rate is expected to slow to an annual rate of 4.8 percent during 2001 – 2005 and 1.8 percent during 2006 – 2010 [2].It has been recognized that international price of NR is a significant factor influencing the long term movement of price in India. The forecasts of NR price in India are mainly built upon the forecasts of the international price made by the World Bank. Accordingly it is forecasted that the price of RSS 4 grade of NR in India would increase to Rest 4666/Qtl during 2005-06 and to Rs 66884/Qtl during 2010-11.Since the World Banks projection on international price are subject to change during each quarter, the forecasts of Indian price would also change correspondingly. Forecasts of Indian price may change owing to potential changes in the exchange rate of rupee against US dollar also.

The outlook on rubber supply also shows increasing prospects. Most of the major rubber producing countries is getting rapidly industrialized and there is still untapped rubber potential. Small producing countries like Vietnam (tab 5.1), Cambodia, and Brazil etc. are showing signs of increasing their NR production in the future. The global output of NR which is 66.0 lakh tones during 1999 is likely to increase to 77.2 lakh tones by 2005 and 85.4 lakh tones by 2010.

Fig 5.1-World Production ,Consumption and Price of NR



Source:- IRSG

Tab 5.1 :- **Production of natural rubber in main producing countries (In Thousand Tonnes)**

COUNTRY	1975	1980	1985	1990	1995	2001 P
THAILAND	355 [10.70]	501 [13.01]	724 [16.50]	1275 [24.90]	1805 [29.88]	2357 [33.19]
INDONESIA	823 [24.83]	1020 [26.50]	1130 [25.70]	1262 [24.65]	1455 [24.09]	1543 [21.73]
MALAYSIA	1459 [44.01]	1530 [39.75]	1470 [33.41]	1291 [25.21]	1089 [18.03]	546[11.39]
INDIA	136 [4.10]	155 [4.01]	198 [4.50]	324 [6.32]	500 [8.28]	632 [7.69]
CHINA	69 [2.08]	113 [2.94]	188 [4.20]	264 [5.16]	424 [7.02]	451 [6.35]
VIETNAM	20 [0.60]	46 [1.2]	52 [1.18]	103 [2.01]	154 [2.55]	317 [4.46]
Rest of the World	453 [13.67]	485 [12.6]	638 [14.5]	601 [11.74]	613 [10.15]	1254 [17.66]
TOTAL	3315	3850	4400	5120	6040	7100

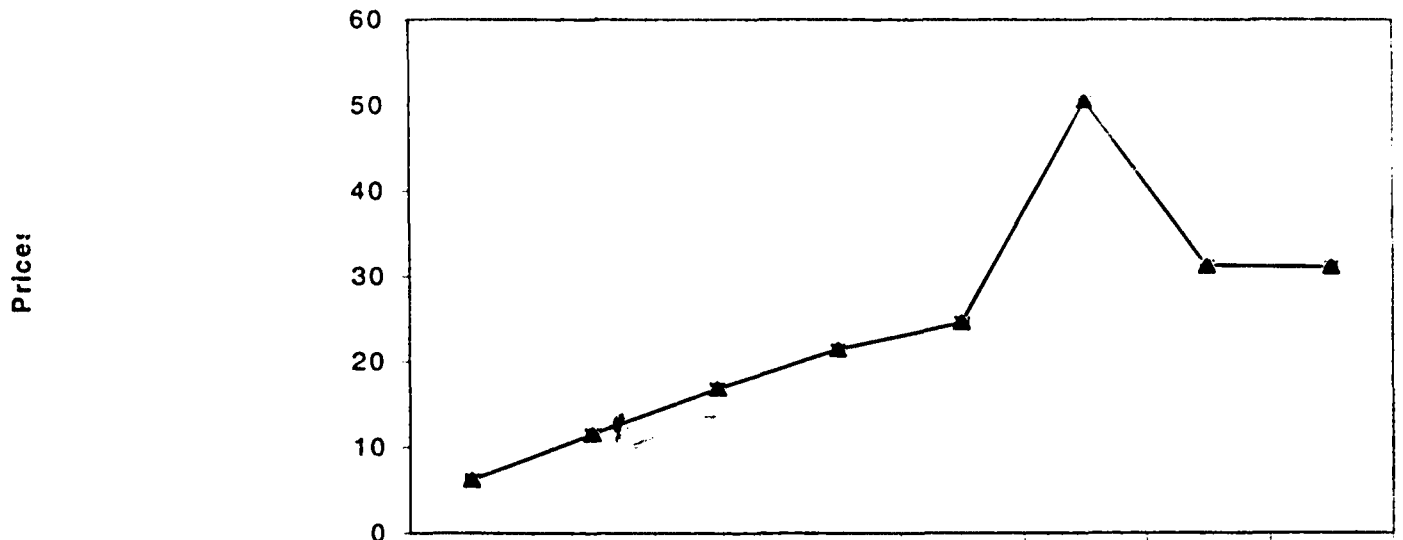
Source : **Rubber Statistical Bulletin of International Rubber Study Group (2001)**

Tab 5.2:Consumption of natural rubber in main consuming countries
In Thousand Tonnes / [Percentage]

COUNTRY	1975	1980	1985	1990	1995	2001 P
U S A	666 [19.77]	585 [15.56]	764 [17.25]	808 [15.51]	1004 [16.87]	972 [13.89]
JAPAN	285 [8.46]	427 [11.36]	540 [12.19]	677 [12.99]	692 [11.63]	724 [10.34]
CHINA	225 [6.68]	340 [9.04]	415 [9.37]	600 [11.52]	780 [13.11]	1215 [17.36]
INDIA	129 [3.83]	171 [4.55]	233 [5.26]	358 [6.87]	517 [8.69]	631 [9.01]
KOREA	NA	NA	155 [3.50]	255 [4.89]	300 [5.04]	330 [4.71]
MALAYSIA	31 [0.92]	45 [1.20]	69 [1.56]	184 [3.53]	357 [6.00]	330 [4.71]
Rest of the World	2032 [60.33]	2192 [58.30]	2254 [50.88]	2328 [44.68]	2300 [38.66]	2798 [39.97]
TOTAL	3368	3760	4430	5210	5950	7000

Source : Rubber Statistical Bulletin of International Rubber Study Group (2001)

Fig 5.2- International and Indian rubber prices



	1975	1980	1985	1990	1991	1995	2000	2001
Inter national prices	6.2	11.5	16.9	21.47	24.6	50.5	31.25	31.09
Indian prices	6.2	11.5	16.9	21.47	24.6	50.5	31.2	31.09

Source: IRS

Section 5 .1 :- Results of the Correlation Analysis

Considering the time series data from 1984–1985 to2001–2002, the correlation between the world NR production and Indian NR production worked out to be 0.9778. The corresponding correlation for consumption worked out to be 0.851. For the same time period, domestically the correlation between consumption and production is in tandem with the global results i.e. somewhere in the range of 0.98 to 0.99. Correlation between domestic consumption and price also show close association with the global correlation of the two i.e. between 0.73 to 0.75.Figure 5.1 shows the correlative trend in world production consumption and price of NR. In table 5.3, forecasts of world production and consumption reasserts the concept of consumption production gap in the future.

Tab 5.3: Forecasts of world production and consumption of NR

YEAR	PRODUCTION (' 000 tonnes)	CONSUMPTION (' 000 tonnes)
2000	6970	7030
2005	7720	8200
2010	8535	10000
2015	9730	12500

Section 5. 2 :-Forecasting

With the help of forecasting policy makers are not dependent merely on guess work, but has a sound footing for his decision on the future course of action. Forecasting future values of supply and demand helps the farmers to adjust the timings of his response. It helps policy makers to identify demand supply gap and thereby in formulating policies, regarding supply adjustment, crop development,

import, export. It helps integrated agricultural development since a comparison of forecasted values of NR production with their actuals pinpoints constraints and comparative advantages.

Methods of forecasting are classified into three 1)Naive method 2) Barometric method 3) Analytical method. Analytical or econometric method combines economic theory with mathematical and statistical tools to analyse economic relations. Econometric forecasting method have several distinct advantages over alternative methods.

1. Forecaster can make explicit assumptions about the linkages among the variables in the economic system under study. This reduces the probability of logical inconsistencies in the forecast model.

2. Past forecasting errors can be fed back into the model and new parameter estimates can be generated which improves future forecasting results. Not only the direction but also the magnitude of future change can be known in advance.

3. It explicitly explains the inter relations in the model. Forecasting exercise becomes all the more relevant due to peculiar characteristics of natural rubber production viz.

1. Long gestation period: Technically it is the time gap between initial input and the first output. The gap length of this gap depends on the type of clones and the quality of seedlings used. Long gestation period necessitates the use of lagged variables in the model. On an average RR 11- 105, the most commonly used clone start giving yield from seventh year onwards.

2. Long productive life span: - The long gestation period is followed by a long productive life span. We could say that like men, the life of the rubber tree has three phases. 1) The baby stage of 1-7 years 2) The young and active period of 7-29 years and 3) The old deteriorating phase of 29-32 years. In the longer phase viz second phase the cost of cultivation shows a drastic decline since the grower has to incur only maintenance costs as against heavy establishment costs. Also in the second phase, the yield from the tree goes on increasing till it stabilises itself in the twelfth year. Thus the yield profile may be approximated by a flattened distribution curve.

Production estimates are made by Rubber Board after collecting monthly returns from manufacturers, dealers, processors and estates which provide opening

stock, closing stock, purchases and sales/consumption on monthly basis. The formula for computing production is,

$$Q = CS - OS + C + E - I$$

Where,

Q = Production

CS = Closing Stock

OS = Opening Stock

C = Consumption

E = Export

I = Import

This data can be used for simple trend estimation of future values of the variable. Generally, the results of the trend estimation are in tandem with estimated values using complex econometric methods.

Section 5. 3:- Results of Trend Estimation

Time series regressions were estimated for both production and consumption for the 15 year period from 1987 to 2002 for understanding the trend. Both the regressions have high R^2 showing high significance of the trend variable. It proves that behavioral variables do depend on time variable in their adjustment process.

Regression I – Consumption

$$C = 7448873.79 + MA(1)\ -0.26603X_t \quad (0.4534) \quad (-0.3381)$$

$$+MA(2)\ -0.64033\ X_t \quad (-1.1074)$$

$$+AR(1)\ 1.8353\ 3X_t \quad (2.6341)$$

+AR (2) -0.848983 Xt

(-1.2009)

Adjusted R^2= 0.991765 F = 422.5404 D. W = 2.136

Regression II – Production

P = 462704.82 +MA (1) -0.79683X_t

(2.0788) (-2.1939)

+MA (2) -0.21034X_t

(-0.6363)

+AR (1) 1.92334X_t

(9.3767)

+AR (2) -0.95163 TX

(-4.5539)

Adjusted R^2 = 0.997864 F = 1635.888 D.W =2.1727

Tab 5.4:Estimated production and consumption of NR in India 1st approach

YEAR	ESTIMATED CONSUMPTION	ESTIMATED PRODUCTION
1999	630841.6	646713.5
2000	660091.1	681673.3
2001	659250.6	674150.6
2002	688410.0	708304.3
2003	717569.4	742458.1
2004	746728.8	776611.8
2005	775888.3	810765.5
2006	805047.7	844919.3
2007	834201.1	879072.9
2008	863366.6	913226.7
2009	892525.9	947380.4
2010	921685.4	981534.1
2011	950844.8	1015688.0

Estimation results using the first approach is revealed. Estimated consumption for the year 2003 is 717569.4 lt and estimated production is742458.1 lt. By 2011 the figures are estimated to be 950844.8 lt and 1015688.0 lt respectively.

Section 5. 4:-Approximation using yield profile

Area currently occupied by rubber, scale of new planting and replanting, type of planting materials used, their yield potential and technical progress are the potential factors determining the supply. To a large extent, all these are influenced by price.

The data on area under cultivation each year is published in the Indian Rubber Statistics. Rubber Board has been collecting the area discarded until 1980. During 1980, new planting subsidy was sanctioned since then the rates have been periodically increased till it came up to 50 percent of the cost of cultivation. This increased the number of applications for new planting subsidy. This persuaded the Rubber Board to stop updating statistics like discarding. Recently however, the subsidy disbursement has come down to less than 25 percent.

In order to find clone wise, year wise area certain assumptions are made,

1. There is no discarding until the age 20.
2. From 20-32 years certain percentage of discarding would be done at the rate of the average discarding percentage from the area statistics before 1980
3. All trees would be discarded from the age of 32 onwards

These assumptions may induce certain amount of error in the year wise estimated area and has to be adjusted using regression technique. They also form the basis of table 5.8.

Yield Profile

Since the growers don't keep proper accounts, collection of yield data from small holders is a difficult task. According to the scientists of RRII only RRII105 is planted from 1983 onwards. The currently yielding trees mostly belong to the 1980 vintage. The yield profile of various clones is reported by RRII. Earlier RRII studies reveal that there is not much difference in the yield profiles of estates and holdings. So yield profiles of estates can be used for computing production estimates.

Using the formula

$$Qt = \sum_{t=0}^{31} [NP+RP]_{t-i} \quad Yi$$

NP = new planted area [ha]

RP = replanted area [ha]

Yt = yield / ha during the ith year [kg]

T = 1980 to 2009

And $AQ = a_0 + a_i CQ + n$

Where

AQ = actual production estimates of Rubber Board

CQ= computed first stage estimates of production

Computed estimates show a high probability of error since actual data is not readily available and assumptions are made to arrive at these estimates. It needs to be adjusted with the help of regression of the actual production data.

Tab 5.5-: Area New planted / Replanted per Year

Period	NP	RP
1955 - 56 to 1977 - 78	7669	2242
1978 - 79 to 1989 - 90	18289	5440
1990 - 91 to 2000 - 01	29877	23083

Source – Rubber Board

Table 5.5 shows the area new planted and replanted per year of three time periods.

New planting function is specified as,

$NP = \alpha + \beta GS + \gamma MOP + \delta CCP + U$

Where

GS = Government Subsidy deflated

MOP = Deflated five year moving Average of Prices of Rubber

CCP = Deflated prices of Competing Crops (only Cashew and Coconut)

Replanting function is specified as,

$RP = \alpha + \beta MOP$

Replanting decision is a function of price of the crop, time (t) and the age of the tree. After the age 20 years productivity shows a declining trend. The decision to replant can be made at any time between 20–32 years of age. So total area with tree of age between 20–32 becomes one of the considered variables.

Section 5. 5:- Regression Results

It is assumed that discarding normally takes place after 20 years and 100 percent of trees will be discarded after 32 years.

Production

$AQ = 1656.84 + 0.919066\ CQ$

(0.296) (65.14)

Adjusted $R^2 = 0.995$ F = 4121.20 D. W = 0.512

New planting

$NP = 25013.94 + 20.12(MOP) + 0.7(GS)$

(-4.02) (50212) (3023)

Adjusted $R^2 = 0.893$ F = 83.45 D.W = 0.91

The results show that moving average of price is the most crucial factor for determining the new planting followed by government subsidy.

Replanting

$RP = 1425.69 - 0.365\ (MOP) + 182.62\ (t) + 0.016\ (A)$

(1.52) - (0.52) (11.212) (3.33)

$R^2 = 0.96$ F = 176.33 D.W = 1.79

Using the second approach, natural rubber in India is estimated in table no 5.6.Forecasts for new planting is 88203 lakh tones for the year 2005 and replanting is 9983 ha for the same year. Production is forecasted to reach 6777201 lakh tones by 2010.

Tab 5.6-Estimated production of natural rubber in India- 2 nd approach

YEAR	NEW PLANTING		REPLANTING		PRODUCTION	
	ACTUAL NP	FORECAST NP	ACTUAL RP	FORECAST RP	ACTUAL PRODUCTION	ESTIMATED PRODUCTION
1990	15143	13913	7154	6874	329615	320030
1991	13851	11783	7100	6927	366745	367663
1992	1100	10371	7200	7030	393490	394914
1993	9200	10830	6000	7097	435160	433510
1994	7500	10571	7000	7111	471815	474468
1995	7800	12580	7500	7118	506910	516651
1996	10400	14591	7000	7240	549425	550105
1997	13300	16870	7500	7419	583830	582131
1998	8800	12914	6000	7726	605045	608763
1999	6000	11551	6000	7928	622265	628517
2000		8405		8264		642566
2001		6108		8720		651723
2002		5961		9120		660914
2003		6902		9528		673589
2004						685809
2005						693025
2006						696618
2007						692871
2008						685135
2009						678303
2010						677201

As against the regression result of newplanting it was found here that MOP is not significant. Most significant is the trend variable.

Tab 5.7-Yield Profile

YEAR OF TAPPING	YIELD PROFILE RRII 105
1	0.81
2	1.25
3	1.56
4	1.79
5	1.70
6	1.84
7	1.78
8	1.66
9	2.00
10	2.64
11	2.11
12	2.10
13	1.90
14	1.85
15	1.82
16	1.81
17	1.80
18	1.76
19	1.72
20	1.61
21	1.48
22	1.36
23	1.27
24	1.16
25	1.01
26	1.00

Table 5.7 shows the yield profile of the popular clone RRII 105. Yield increases and reaches the highest by the 10nth year and then it is assumed to decline and reaches a stable level till the twenty sixth years. After the age of 26, the yield is assumed to remain stable for a couple of years and then decline till discarding.

Tab 5.8-Discarding function

DISCARDING PERCENTAGE	
AGE	PERCENTAGE
20	13.91
21	15.74
22	20.48
23	25.64
24	28.06
25	28.45
26	30.21
27	33.04
28	35.49
29	44.20
30	44.19
31	50.35
32	52.30

As shown in table 5.8, in the twentieth year, the discarding percentage is assumed to be 13.91. By the twenty sixth years about 30 percent would be discarded and at the age of thirty two about 52 percent would be discarded. Under this approach, we assume that after 32 years of age all tress should be discarded.

Section 5. 5:-Production Forecasts based on Normal Production Approach

Full capacity utilization is defined as maximum possible production. As against this normal production I defined as the level of production which is assumed to be 75 percent of the total capacity, in a certain year, at average level of tapping, which would have been realized without taking into account the price influence. In the short run, actual production will be above or below normal production level depending on price fluctuations.

This method is different in the sense that it investigates the age distribution or the vintage of rubber trees, the distribution of the planting material, yield profile etc... Future potential production level is then calculated after making some assumptions on future new planting and the rate of replanting.

Vintages refer to the composition of the total area for NR according to the year of planting or in other words a vintage of NR is the NR planted in a particular year and still available in some other year. Information about the vintages are important because of the technical progress in the quality of the trees and also because older trees become less productive with age. Such information provides an opportunity to obtain more accurate forecasts of normal production. However, such a vintage of a composition of rubber area is not available.

The probability of a particular area being discarded as the area grows older is called the discarding function. This function follows the shape of an elongated S – curve. Discarding of area can be derived for total area but cannot be split according to vintages. In other words it is not known how much of the 1955 vintage is discarded in 1956, 1957, and so on.

If the area distribution by vintage is known in a certain year t – 1 eg. 1999, thus splitting the area up in area planted on year ago, two year ago and so on and if one would know the discarding percentage P1, P2 for age 1, 2 years etc. then it would be easy to calculate how much would be left for each vintage in the year 2000.This is

shown I tables 5.9 and 5.10 One does not know P_k exactly. It is assumed that P_k approximately follows a sigmoid curve. P_k must be chosen in such a way that the calculated discarded area in each year equals the actual discarded area in each year. By assuming all discarded area over the vintages in 2000, we obtain the total discarded area in 2000 as similarly for years after.

Tab 5.9-Discarding percentage and remaining percentage

AGE	DISCARDING PERCENTAGE PER YEAR	REMAINING PERCENTAGE END OF YEAR
1	0.002	99.998
2	0.002	99.996
3	0.003	99.992
4	0.005	99.988
5	0.007	99.981
6	0.009	99.972
7	0.013	99.960
8	0 017	99.942
9	0.024	99.918
10	0.033	99.885
11	0.046	99.839
12	0.064	99.775
13	0.089	99.686
14	0.123	99.563
15	0.170	99.394
16	0.236	99.159
17	0.326	98.836
18	0.450	98.391
19	0.621	97.780
20	0.854	96.946
21	1.170	95.811
22	1.597	94.281
23	2.167	92.238

Tab 5.9-(cont'd) Discarding percentage and remaining percentage

AGE	DISCARDING PERCENTAGE FER YEAR	REMAINING PERCENTAGE END OF YEAR
24	2.918	89.546
25	3.890	86.063
26	5.120	81.656
27	6.631	76.242
28	8.423	69.820
29	10.461	62.516
30	12.671	54.595
31	14.949	46.434
32	17.174	38.459
33	19.238	31.060
34	21.064	24.518
35	22.611	18.974
36	23.875	14.444
37	24.878	10.851
38	25.655	8.067
39	26.245	5.950
40	26.688	4.362
41	27.017	3.183
42	27.259	2.316
43	27.437	1.680
44	27.566	1.217
45	27.660	0.880
46	27.728	0.636

Fig : 5.3 - Discarding percentage and percentage of area remaining

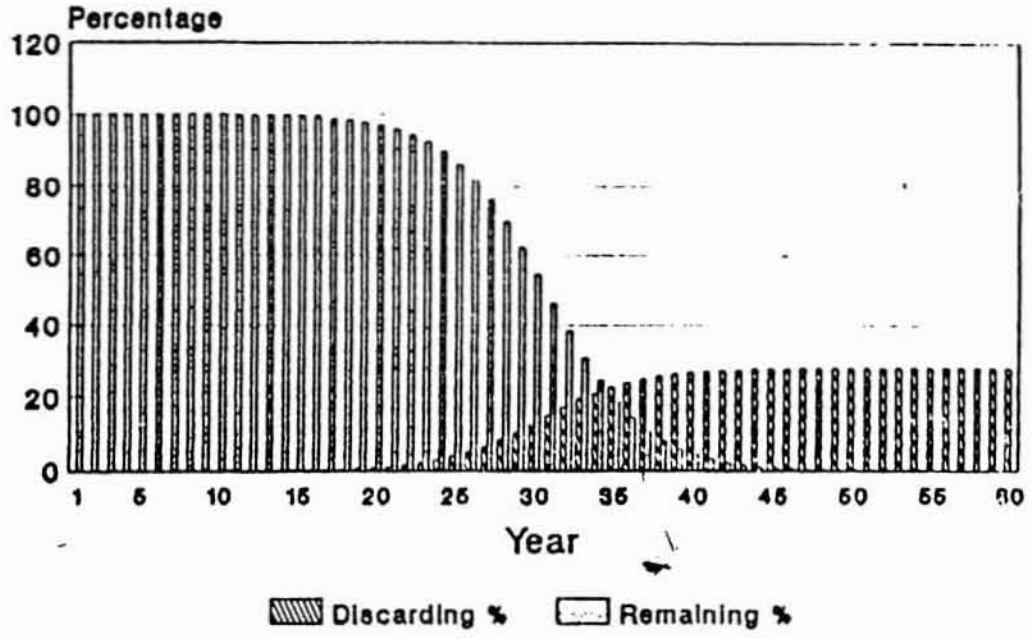
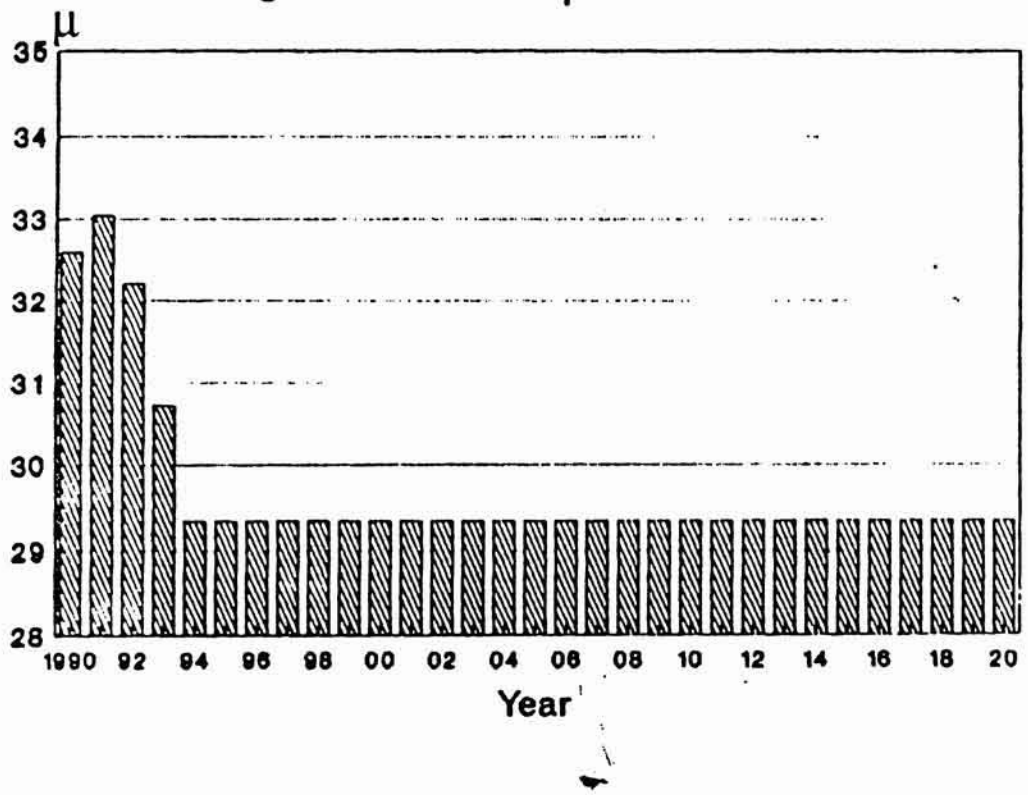


Table-5 .10 Value of μ

YEAR	μ
1990	32.59
1991	33.04
1992	32.21
1993	30.72
1994	29.35
1995	29.35
1996	29.35
1997	29.35
1998	29.35
1999	29.35
2000	29.35
2001	29.35
2002	29.35
2003	29.35
2004	29.35
2005	29.35
2006	29.35
2007	29.35
2008	29.35
2009	29.35
2010	29.35
2011	29.35
2012	29.35
2013	29.35
2014	29.35
2015	29.35
2016	29.35
2017	29.35
2018	29.35
2019	29.35
2020	29.35

Fig : 5.4 - Value of μ



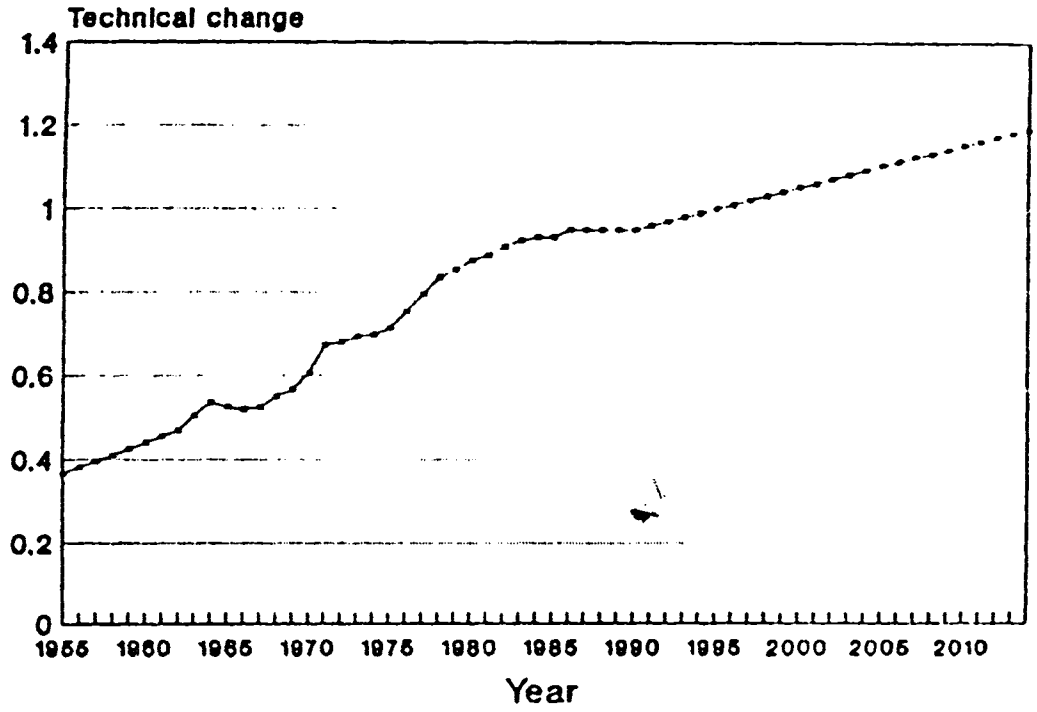
Tab 5.11-Technical change from 1955-56

YEAR	TECHNICAL PROGRESS
1955	0.365
1956	0.380
1957	0.395
1958	0.410
1959	0.425
1960	0.440
1961	0.455
1962	0.470
1963	0.5048
1964	0.5346
1965	0.5252
1967	0.5197
1968	0.5226
1969	0.5503
1970	0.5657
1971	0.6064
1972	0.6712
1973	0.6803
1974	0.6928
1975	0.6970
1976	0.7125
1977	0.7516
1978	0.7950
1979	0.8355
1980	0.8552
1981	0.8786
1982	0.8909

Tab 5.11(cont'd)-Technical change from 1955-56

YEAR	TECHNICAL CHANGE
1983	0.9246
1984	0.9331
1985	0.9339
1986	0.9500
1987	0.9500
1988	0.9500
1989	0.9500
1990	0.9500
1991	0.9600
1992	0.9700
1993	0.9800
1994	0.9900
1995	1.0000
1996	1.0100
1997	1.0200
1998	1.0300
1999	1.0400
2000	1.0500
2001	1.0600
2002	1.0700
2003	1.0700
2004	1.0800
2005	1.0800
2006	1.0800
2007	1.0900

Fig : 5.5 - Technical Change from 1955 - 56



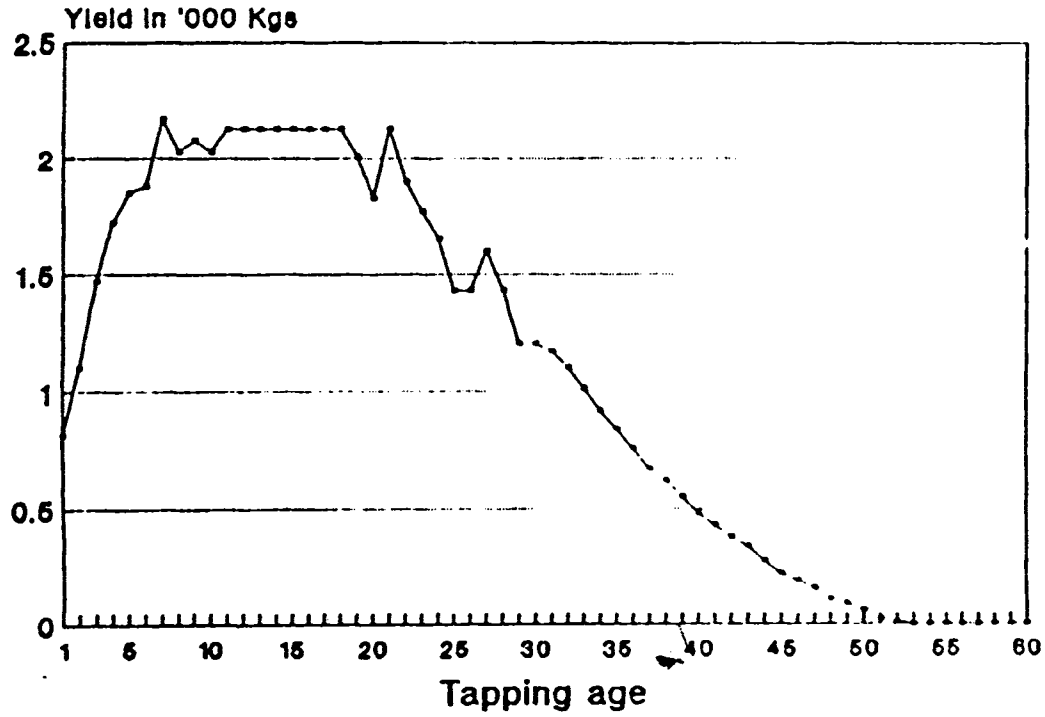
Tab 5.12 Yield profile

YEAR OF TAPPING	YIELD PROFILE 1000 KG / HA INPUT
1	0.82
2	1.10
3	1.47
4	1.72
5	1.85
6	1.88
7	2.17
8	2.03
9	2.08
10	2.03
11	2.13
12	2.13
13	2.13
14	2.13
15	2.13
16	2.13
17	2.13
18	2.13
19	2.01
20	1.83
21	2.13
22	1.90
23	1.77
24	1.65
25	143

Tab 5.12(cont'd) - Yield profile

YEAR OF TAPPING	YIELD PROFILE 1000 KG / HA INPUT
26	1.43
27	1.60
28	1.43
29	1.20
30	1.20
31	1.17
32	1.10
33	1.01
34	0.92
35	0.84
36	0.76
37	0.67
38	0.62
39	0.55
40	0.48
41	0.43
42	0.38
43	0.34
44	0.28
45	0.22
46	0.19
47	0.16
48	0.11
49	0.09
50	0.06
51	0.02

Fig : 5.6 - Standard yield profile used in the study



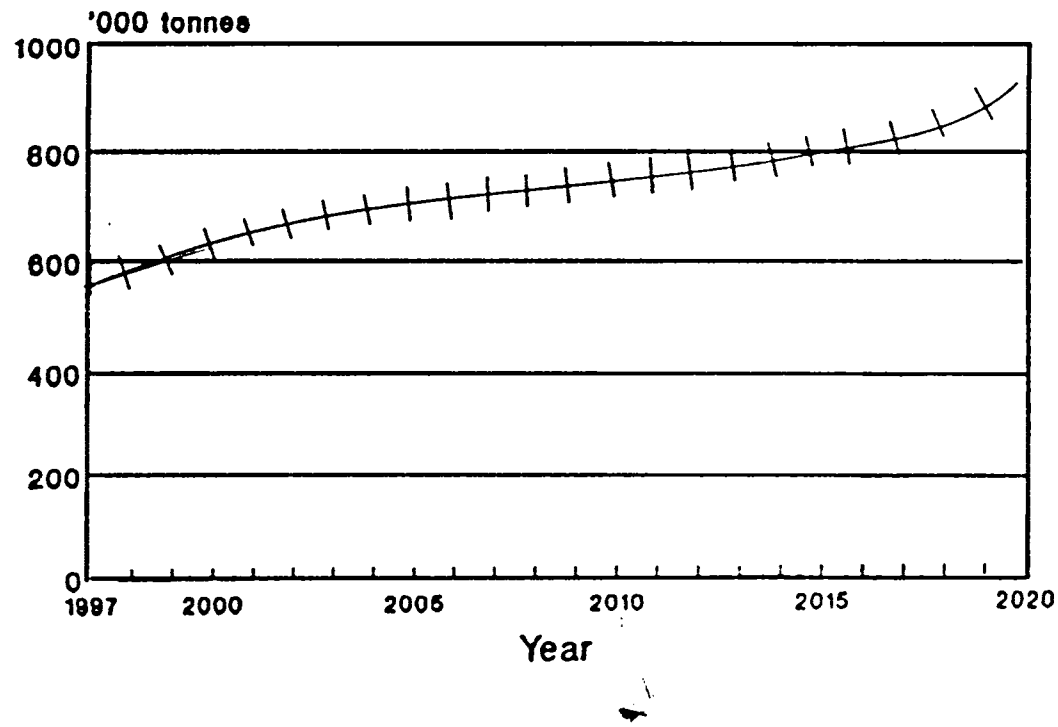
Tab5.13:-Estimated production of Natural rubber in India

Year	New planting	Replanting	Total planting NP+RP	Total area	Total discarding	Replanting Percentage	Production trend Estimate
1990	15143	7154	22297	475083	7555	0.95	331552
1991	13851	7100	20951	488514	7520	0.94	365696
1992	11000	7200	18200	499374	9432	0.57	422321
1993	9500	7100	16600	508420	12512	0.52	434250
1994	8400	7000	15400	515572	15042	0.50	466721
1995	10000	6500	16500	518105	13967	0.49	499180
1996	15000	6027	21027	526180	12952	0.48	530092
1997	15000	5605	20605	534741	12044	0.47	558650
1998	15000	5246	20246	543713	11274	0.47	584000
1999	15000	4965	19965	553009	10669	0.47	605883
2000	15000	4772	19772	562527	10254	0.47	625699
2001	15000	4679	19679	572152	10054	0.47	643819
2002	18000	4696	22696	584757	10091	0.47	660608
2003	18000	4832	22832	597205	10384	0.47	676164
2004	18000	5091	23091	609357	10940	0.47	690309
2005	18000	5469	23469	621073	11753	0.47	702272

Tab5.13 (Contd.):-Estimated production of Natural rubber in India

Year	New planting	Replanting	Total planting NP+RP	Total area	Total discarding	Replanting Percentage	Production trend Estimate
2006	18000	5957	23957	632230	12800	0.47	712817
2007	19000	6533	25533	643724	14040	0.47	721561
2008	19000	7171	26171	654485	15410	0.47	728927
2009	19000	7835	26835	664483	16837	0.47	736113
2010	19000	8487	27487	673733	18238	0.47	742927
2011	19000	9091	28091	682288	19536	0.47	750178
2012	20000	9619	29619	691237	20670	0.47	758450
2013	20000	10050	30050	699691	21596	0.47	768406
2014	20000	10372	30372	707775	22287	0.47	780263
2015	20000	10581	30581	715619	22736	0.47	794070
2016	20000	10679	30679	723351	22948	0.47	810079
2017	21000	10675	31675	732086	22939	0.47	828596
2018	21000	10583	31583	740928	22742	0.47	849744
2019	21000	10423	31423	749953	22397	0.47	873426
2020	21000	10219	31219	759213	21959	0.47	899376

Fig: 5.7 - Estimated Production of Natural Rubber in India



A shift of the discarding function to right means that more younger trees would discarded while discarding percentage of older trees remain constant. If discarding is high in a certain year it would be quite unlikely that very high percentages of a given vintage would be discarded in a particular year. It also means that there is more of a shift in discarding towards younger trees. A similar way of reasoning can be set up in case of low level of discarding.

The figure 5.2 shows that approximation by one discarding function describing all age classes is only partially successful as the planned discarding of lower age groups is not adequately represented by estimated line. There appears to be a tendency towards discarding at later age for trees that are still young in 1995. This may be due to the nature of the answer. It is planned rather than observed discarding. The actual practice may be that trees are discarded at an earlier age than now envisaged. Data reveal that discarding is not confined to old age groups and it implies that some area of virtually any age class can be found to be discarded in each year.

Table 5.10shows the value of μ from the year 1990 till 2000. It can be seen that the value of μ which was 32.59in 1990 reaches the level of 29.35 and stabilizes itself thereafter. Figure 5.3 graphically illustrates this.

There have been considerable improvements in technology since 1955-56. From the first year of tapping onwards the yield per hectare is determined by the type of materials, intensity of tapping and density of trees. Technical progress in planting materials causes increases in yield i.e. positive effects of embodied technology. Improvements in disembodied technology like scientific tapping, its intensity, plant protection, rain guarding etc. also causes increases in yield.

Table 5.11 and 5.12 shows the technical progress due to embodied and disembodied technical changes from the year 1955-56.The technical change parameter for the year 2003 is 1.07 and it is assumed to be 1.09 in 2007.Figure 5.4 illustrate that technical change parameter which was around 0.4 in 1955-56 attained unitary value by 1995 and would be around 1.2 by 2010.

The yield profile used under this approach is shown in table 5.12 and 5.13. Figure 5.5 shows that skewed bell shaped shape of yield profile of NR clones. A standard yield profile for various vintages is estimated by aggregating an assumed average of various yield profile for each vintage. If a yield profile for a vintage is estimated to be for example 0.3 times standard yield profile, then the profile is

suppressed to 30 percent of the original shape. The fractions are estimated per vintage by relating area and standard yield profile to production and then deriving the fractions which create actual yield profiles that are consistent with area composition and production.

Section 5.6:-Results of the forecasting with normal production approach.

We start from a standard yield, profile in terms of production per ha in which constant tapping pattern is assumed along with good tapping practice and decline of density .If we apply this yield profile to all the years for which we have the age distribution and calibrate the results to the average amount produced in the period we end up with an estimate that is too low in the earlier period and too high in the later part of the period.

The yield profile is calculated by multiplying the estimated yield profile of 2000 by a technical adjustment factor. In one application, the formula is as follows. For the yield of vintages at the age K,

$$yld\ (s,k) = yld\ est\ (K)\ [\ tp\ (s)\ ]$$

Table 5.13 shows the estimated production of NR in India. The supply forecast of 2002 is 660608 lakhs and 2003 is 676164 lakhs. Estimated NR supply is 702272 lakhs by 2005. At the terminal point of the analysis i.e. 2020, the estimated production is 899376 tonnes. Figure 5.6 outlines the steadily upward rising trend of production.

CHAPTER - VI

SUMMARY AND CONCLUSIONS

Rubber has always been an important commercial crop in Indies agricultural history. India is the fourth largest producer of natural rubber in the world. India also ranks fourth in the case of NR consumption and first in the case of productivity as such an analysis of factors affecting NR supply and prices is highly relevant especially in the wake of liberalization and changing global economic scenario.

The first objective of the study was to estimate the short term and long term supply response of NR in India.In the study two types of multiple regressions were run for estimating the short term response of output of rubber to the price for the period 1976-77 to 2001-2002. The first one includes the trend variable and the second one excludes it.

In the simple regression of production of rubber as a percentage of tappable area or yield per hectare of tappable area in year t on the actual price of natural rubber in year t,both the price coefficient and trend variable are significant at 5 percent level of significance. The F ratio which shows the overall significance of the regression model is 86.56 which are significant at 1 percent level. The price elasticity is estimated to be 0.25.

When production of rubber as a percentage of tappable area is regressed on trend variable, $\bar{R}^2$ and F ratio (0.877and 156.96) are highly significant and it shows that short run production is greatly influenced by time variable.

In the third equation, production in metric tonnes was regressed on pt along with two more new variable i.e. newly planted area and tappable area. All the variables are significant at 0.05 level of significance. The price coefficients and the coefficent of T_t are positive revealing positive response of O_t to N_t and T_t.

But the presence of the additional variable N_t and T_t leads to negativity (-199833.63) of the intercept term. The negative sign of N_t shows that output in the short run is negatively related to the newly planted area. This is expected as tapping of these plants planted now can only be under taken after 5-7 years. The price elasticity in this case is 0.39.$\bar{R}^2$ and F ratio in this case is 0.969 and 234.43 respectively.

The fourth regression is run to estimate the short term supply response of holdings.

Though adjusted R^2 is high (0.917) price coefficient (26.47) is relatively less significant. The price elasticity is 0.12 and the F ratio is122.35. This means that output of holdings in the short run is relatively inelastic. The trend variable shows high significance (6.16).

When trend is eliminated intercept term became positive and price coefficient showed greater significance. The price elasticity in this case is 1.38.But the adjusted R^2 is lower at 0.771.

In the fifth regression, when O_E i.e. Output of estates is regressed on both P_t or market price of rubber and T_t or time variable showed greater significance in the short run. Adjusted R^2 is 0.953 and F ratio is 222.882 in this case. As the price elasticity is -0.28, output of estates does not seem to be responsive to current price.

Eliminating the time variable the price elasticity (0.40) becomes positive and price coefficient becomes more significant. But adjusted R^2 (0.779) and F ratio is (78.91) is comparatively lower.

For estimating long term response, both Nerlovian and Fisherian types of regressions were tried which involve lagged independent variables and in the case of Nerlovian model even lagged dependent variables.

In the case of declining weighted specification, in the Fisherian equation (1) with the time variable included when the price variable is PW2 both the long run and short run elasticity estimates (-0.17,-0.07) The intercept terms(159.85) is positive and the price coefficient is significant 0.05 level of significance in the case of variables PW2 .For the price variable PW3 also both the long run and short run elasticity estimates are negative (-0.22,-0.09).Price coefficient (-0.004) attains significance at 0.05 level. This is in confirmation with expectations as the price variable takes into consideration of a lag up to two years. When the price variable isPW5and PW7, elasticity estimates (0.07, 0.099) turned positive due to the increase in lags. Similarly in Fisher II the weighted sum of the logarithms of these prices was taken Two equations were estimated with Pl x W 3 and Plx W5 short and long run elasticities are positive. The long run and short run elasticity estimates for PlxW3 are2.90 and 0.55 respectively and the long run and short run elasticity estimates for PlxW5 are 5.10 and 0.55 respectively. Price coefficients of both equations (66.98, 89.09) were significant at 0.05 level of significance.

In the case of un weighted specification also the coefficient of the price variable (-0.006) attains significance at 0.05 level. Adjusted R2 (0.386) and Durbin Watson statistic (0.160) are not satisfactory. The long run and short run elasticity estimates are (0.001,-0.003).

A number of equations were estimated starting with regressing the sum of the newly planted area and replanted area (N_t / T_{t-1}) on P_t and P_{t-1} and so on till we included P_t, P_{t-1},P_{t-2}, P_{t-3}, P_{t-4}, P_{t-5}, P_{t-6}, P_{t-7}. We found the coefficients of P_{t-4}, P_{t-5}, P_{t-6}, P_{t-7}, positive while the coefficients of P_{t-1}, P_{t-2}, P_{t-3} were negative. Choosing the estimated $(N_t /T_{t-1})_{t-1}$ from the equation where terms up to P_{t-7} were included as explanatory variables, we ran the Second stage of Least Squares regression(N_t /T_{t-1}) on P_t, and $(N_t /T_{t-1})_{t-1}$, i.e. the lagged endogenous variable to get our Two stage Least Squares Nerlovian estimates.

Another set of Nerlovian Two Stage Least Squares regressions with six year lag using in the stage 1, terms up to P_{t-5} as explanatory variables. These two lags were chosen, because the rubber tree matures after 5-7 years.

In the six years lag equations the price coefficient is negative (-0.00977) and the coefficients of lagged dependent variable (0.90829) are positive. Though the price coefficient is not significant, the lagged dependent variable is significant at 0.05 level. The trend coefficient (-0.956) is negative. In the case of eight years lag equations the trend coefficient (0.281) was found to be positive. A comparison of the eight years lag equations and six years lag equations would throw light on the long term decision. It was found that coefficient of elasticity increased from -0.06 to 0.02 in the case of short run and from -2.01to 0.01 when the number of lags were increased in the price variable. This leads to the conclusion that new planting positively responds to the past prices of rubber.

The results obtained from the Nerlovian model substantiate the findings. The lagged dependent variable is positive and significant at 0.05 level. Price coefficient was found to be positive. While the coefficient of elasticity is positive for an 8 years lag specification, it is found to be negative for the 6 years lag specification.

We may conclude that producers supply responds more to current price in the short run. The estates supply does not seem to be responsive to current price. The long run planting decision is influenced by past 8 years prices. The results also

indicated that the time variable, do significantly influence the decision making on replanting or new planting. It is felt that further exploration on the average response needs to be carried out taking into consideration of factors like Age composition, effects of alternative crop etc, which is beyond the scope of the present study.

The second objective of the study was to analyse the macro economic environment of NR industry and the causative factors of rubber price crash. . One can see that between 1985-1990 the prices remained in the 16 to 20 range during early nineties. In the post liberation era the prices were contained with in the band of 20-25. The mid nineties showed a rise to the 35 level and from 1995 on wards it continued its upsurge to reach fantastically high levels like 57 to Rs 60 at a point of time. In the year 1997-98 saw the plummeting of prices to Rs 30 level. Sometimes fluctuating downwards to Rs. 25 after 1998 the down ward tendency was reaffirmed. Prices were again with in the 25 to 30 level.

An analysis of the macro economic environment of the rubber industry during the time period between 1995-2000 involves an analysis of the four major sectors of the economy viz the Government sector, the business sector, the foreign sector and the household sector. Each sector was found to have its share in causing and accentuating rubber crisis.

The causative factors of rubber crisis reveal a complex interrelated nexus. But one can say that the setting was provided by the liberalisation of Indian economy. Slashing of duties to the extent of 60 percent changed the whole foreign trade scene. Import duty for poly urethane, a major substitute of latex was cut down to 25 percent. At the same time a 35 percent excise duty was imposed on foam products, a major end using sector of latex. To complicate things, dumping duty provisions of DSAD favoured SR and ignored poly Urethane or its raw materials favouritism was shown to SR at a time when instead of East West compartmentalisation in NR:SR production there was emerging complementarity with India and China in the forefront. Prices touched low levels in mid 97. This accentuated the threat of SR substitution .Lack of restriction on poly urethane imports crashed the above 45 percent price differential between sheets and latex which was a result of the Aids scare and glove boom.

Post liberalisation industry sluggishness led to low effective demand influenced movement of goods and tyre demand. Original equipment demand as well as replacement demand fell sharply. Retreading of tyres became wide spread. Rubber

crisis year was also a year where there was 40 percent power cut in North India. Again it was a year when the regular power cuts are more strictly enforced in Kerala.

The role of state run institutions like STC was very much inhibited in the Post liberalisation scenarios. Ministerial orders for fund procurement were often delayed and there was great uncertainty about the procurement funds. Delayed payment caused procurement by agencies like Rubco and Rubmark impossible at times. The proclaimed procurement had a slow pace with a time limited 200 days. This was made at a time when stocks were piling up daily. STC is alleged to quote below market prices to procuring agencies and giving them minimal time to finalise the deal. STC's insistence on procuring good grades is necessitated by the business sectors insistence on them. An attempt to join the dealers in the procurement chain proved fruitless due to STC payment in installments and rejection of at least 10 percent of the delivery on the grounds of low quality causing loss transport charges to the dealer. STC bought at the market level not at BMP level. As a result there was not much support to the BMP level. Faced with glutted go downs and delayed payment from STC, the procuring agencies released their stock in the market thus crashing prices further. Companies would adopt speculative procurement policies when agencies start their procurement, making further procurement impossible by the fund hungry agencies. Business sector created a situation after a lot of negotiations whereby it became more profitable to buy from domestic market.

Business sector as expected continued with their lobbying, media management; stock management policies like joint buying strategy, joint market invisibility, time management of BMP announcement etc. But Indian business big fishes are facing the threat of MNC whales and have to fight tooth and nail to sustain their market share. Competition is forcing Indian bigwigs to adopt SR orientation.

Exports possibility as a saviour was ticked off due to low quality of Indian rubber .Lack of export culture due to strong domestic demand resulted in lack of basic infrastructural facilities and the lack of a well developed futures market.

While the opening up of China gates and rise in Chinese demand can be cited as a cause for the historic price rise; South East Asian economic crisis can definitely be pointed out as the factor behind the historic price fall. Due to increased global integration the South east Asian waves were reflected everywhere. It slowed down progress in India who was waking up from industrial sluggishness causing further pressure on its already overvalued currency. South East Asian devaluation increased

their competitiveness forcing countries like India and Srilanka to lower prices. International agreement became pointless as INRO DMIP was fixed in terms of Malaysian currencies.

They advocated the availability tyre technologies of NR at international rates while tyre a not available at international rates.

There was not much help from the State government. Though both parties took it up as a political issue. State Revenue orders giving sales tax exemption to natural rubber were short term covering only a few months and served little purpose. State budget were non supportive and no positive measures were taken on a time bound manner for exporting away the surplus. State government's purchase tax of 11 percent led to the continuance of massive rubber smuggling.

Rubber Board being a developmental data providing agency could do little to save the grower. In post liberalisation era statistics of rubber production is collected from check posts and industry and hence highly unreliable. There is no estimate of rubber smuggling, interstate as well as inter country. In the wake of termination of world bank loan rubber increased the cess by 50 ps which though levied from estates and manufactures is in effect a tax on the growers. Their price realisation would lower by the labour charges which increased proportionately. But rubber prices refused to decline proportionately thus accentuating the crisis. The absence of co-operation between Estates and small holders caused led to absence of common price fall resistance policy. Lack of reinvestment of rubber proceeds in rubber related industry led to heavy dependence on tyre companies whims and fancies.

SWOT Analysis

Strengths

1. Geographical suitability which makes rubber cultivation highly suitable.
2. Indian industrial climate is showing signs of revival. A good crop period and the resultant income effect are expected to increase goods movement leading to increase in original and replacement equipment demand.
3. Government of India has banned import under license against public notice after 1995-96. Import under Special Import License (SIL) is discontinued from April 2001. Also Advance Licensing scheme was banned from February 20,1999. This shows that state role is effective even after liberalisation.

4. Long gestation lag and initial high investment which ensures commitment from growers.

5. New innovations in tapping which would double the productivity of existing trees viz; inclined upward tapping developed by Scientists

6. India exports tyres to 51 countries and they even enjoy a premium status in US market. The market share of US in Indian exports is almost 30 percent. Though tyre export growth fell by 10 percent in 1998, it is fast picking up.

7. Revival of South East Asian economies since globalisation means interdependent fortunes countries like the US is taking keen interest in investing for South East Asian revival.

8. Under GATT developing countries like India enjoy "Green Box Treatment" under which India need to reduce subsidies for values greater than 10 percent only over a period of 10 years. Since India's share in the world trade is less than 3.25 percent and per capita income is less than $1000, she is exempt from the prohibition of export duties.[42] Bop difficulties can be cited to prolong the time span for tariffication.

9. High level of cooperation and grower awareness in the wake of crisis which led to industrial venture in some areas.

10. Since India is a "Developing Country", rise in demand for tyres and other end products a sure certainty.

11. High level of literacy and alternative employment among small growers enabling them to bear short term price fluctuations.

12. Strong religious, institutional and political support. Rubber votes being a deciding factor for both parties and hence their causes are actively taken.

13. Rising population trend would add an extra dose of purchasing power each year.

Weaknesses

1. Smallness of 95 percent of growers reduces economies of production. Small holders do not enjoy the advantage of efficient organisation like estates. In the absence of smoke houses, go downs etc they cannot hoard and speculate to get higher incomes. Estates thus become the price maker and the growers the price taker.

2. Absence of a strong and transparent supply chain from grower to dealer and to the producer

3. Linkages between rubber related small industries are weak.

4. Lack of cooperation among estates and small holders make it impossible to adopt production control measures in the wake of price crisis, along the lines of OPEC

model cartel. Since small growers are vulnerable to price fluctuation, they cannot afford to adopt measures like production cut or stock keeping.

5. Since rubber is a perennial crop, capital investment is for long term and it becomes impossible to form rational expectations about future. They can respond with respect to cropping pattern, cropping intensity and productivity. But they are unable to change acreage in the short run, since it would take another 6-7 years and the then price situation is obviously impossible to predict.

6. It is said that rubber cultivation has led to a highly skewed agricultural growth in Kerala. It enjoyed the highest rate of subsidy. As cultivation of subsistence crops were neglected, general cost of living rose. Income proceeds from rubber were frittered away in conspicuous consumption with no productive reinvestment in rubber related industries. Though increase in rubber incomes had shown multiplier effects ,it is lesser when compared to the multiplier effects which would have been achieved by general increase in real incomes owing to low cost of living.

7. In countries like Indonesia and Malaysia, rubber cultivation is considered as a means for removing unemployment. So it enjoys 90-95 percent state subsidy. Both India and these countries face equal level of international prices, but different levels of domestic support. As against India, in these countries devaluation would work towards increasing exports as domestic consumption is less than 20 percent

8. State Trading Corporation (STC) proved to be a "weak player" in the procurement scene. There were delays in ministerial order for fund granted for procurement. Fund granted was also inadequate. There were no supports to Rubmarks efforts through a centrally sponsored scheme. Lack of coordination and cooperation between STC and the procurement agencies viz Rubco and Rubmark. Procurement was for a time span of 100 days in the first phase and 200 days in the second phase. By that time period excess stock accumulated and accentuated the glut. As far as latex was concerned, no procurement was done since ammoniated latex has minimal storage life. State sales tax of 11 percent stood in the way of STC procurement till it was withdrawn in 17-11-1999. STC lost Rs 8 crores in this account[43]. Delay and procedural formalities with STC, fear of rejection of stocks on the basis of quality, delayed payments etc. created frequent frictions between STC procurement agencies, rubber dealers.

9. There is no price support procurement mechanism to ensure that the BMP is maintained at the fixed level. A lot of calculations and government efforts goes into the fixation of BMP. Whenever they are short of money, the growers themselves

would ignore BMP level and sell at levels below it. BMP being partially protectionist in effects. It cannot be relied upon particularly in the WTO era.

10. Breaking up of INRO as a price stabilising agency made international prices weak. As the intervention price was pegged in terms of Malaysian currency, its devaluation resulted in the pegging of intervention price level below the "Must Buy" level. Though, it was later linked to the US dollar, there was lack of cooperation among member countries resulting in fund shortage and breakup of price stabilisation scheme.

11. Since domestic demand had always been sufficient to absorb the excess production until recently, there wasn't any necessity to expand basic infrastructural facilities for export. We are unable to offer a steady supply for longer periods. Quality of our products is not known internationally. We cannot offer forward market rates in the absence of a well developed forward market system. This makes exporting away of surplus production difficult.

Opportunities

1. Crop Substitution is impossible in the present agricultural situation of Kerala as all crops are suffering badly. There is no crop viable enough to substitute rubber. The other option is sale of land. But land prices show a proportionate relationship with rubber prices. Due to the growing disinterest among Gulf based NRI to invest in the real estate sector, registered land deals have come down. So opportunity for rubber cultivation is still alive in Kerala.

2. Green box provision in WTO will boost agricultural exports.

3.GATT provides protection to plant breeders under which new range of seeds, bio-fertilisers, bio- pesticides and successive generations of plant variety are protected. This provides an opportunity for further research in rubber.

4. To reap the benefits of trade liberalisation under WTO, government should take measures like.

a. Technology up gradation, land reforms, optimal use of fertilisers and irrigation.

b. Analysis of price formulation of agro products and taking steps to avoid distortion in food production.

c. Maintaining Export Oriented units in agriculture with further foreign collaboration.

d. Research on Aggregate Measure of Support (AMS) to quantity protection in Indian agriculture.

e. Formation of Trading Blocs and Common Agricultural Policy among developing countries.

d. Conducting state agricultural projects with foreign collaboration.

5. Central government is taking measures to expand export opportunities in rubber. Rubber Board has set up Export Cells for technological specification and information. A rubber park is proposed to be set up in Airapuram in Perumbavoor. This would set up additional small scale rubber related industries with better linkage.

6. Rising demand for rubber wood

7. Road rubberisation is emerging as a new source of demand supported by state governments.

8. Rubber honey is emerging as a new source of additional income to growers.

9. It was the emergence of new demand sources like opening up of China gate, which had led to the sporadic rise in prices in 1996. Again, the emergence of Economic Union as a contending force against the US will increase competition in the rubber market since both the EU and the US are top NR consumers which might lead to future rise in prices.

10. There is a possibility of signing up of a "third generation agreement" between India and EU which will increase Indo-EU trade and prop up rubber prices.

Threats

1. Though imports through Advance Licencing Scheme were banned since February 1999, imports continued. Since Advance License has a normal validity for 18 months after issue and can be extended twice for duration of six months each, imposition of ban didn't help much.

2. Liberalisation policies have favoured SR imports. Growth in SR production and consumption is showing steady increase since 1995-96. Since SR is petro based fall in oil prices can favour SR at any time. Indian industries are copying SR based foreign technologies to achieve price competitiveness.

3. Under TRIPS, the national treatment clause gives the foreign investor the same right in area and magnitude of investment. MNCs have entered the domestic scene and set up tyre plants. They have the advance licensing facility for making export related imports, while utilising cheap domestic labour. There is a threat of import of NR from African countries where labour is cheaper. TRIPS stipulate no qualitative restrictions on imports and exports and performance obligations like usage of local raw materials and equipments, technology transfer etc.

4. There is also the threat of import of second hand tyres. Lobbyism has succeeded in suppressing this threat for the present. Import of SR and its raw materials are protected by levying anti-dumping duty. But import of NR does not enjoy the same protection.

5. Lowering of import duty on Poly Urethane from 75 percent to 20 percent lowered the price advantage in latex production by 50 percent. This has prevented reaping the benefits of global aids scare and glove boom.

6. Since Kerala's electricity is hydro based frequent power cuts upset industrial climate.

7. Domestic demand is insufficient for glut removal though it is always on the rise. If we take the per tyre requirements, of the total quantity of all kinds of tyres imported, less than 15,000 tonnes would form additional consumption requirement in the absence of imports.

8. Business lobbying has always been a threat to stable rubber prices. Whenever rubber prices rises, industrialists raise tyre prices more than proportionately. Within months they would agitate for imports and bring down rubber prices while tyre prices would remain at the raised level. Tyre companies like MRF & CEAT which have about 40 percent share in rubber market cite various reasons and jointly appear or disappear from the market to manage prices. Bribery and corruption is used to formulate favourable policies at the government level. If they fail at this, they influence officers to prevent the implementation of such policies. They reject STC's stocks citing low quality as a reason and influence STC officials to make procurement ineffective. Media is influenced to create false panic and lower prices. Due to development of transportational facilities time period of business inventory is reduced two weeks. Business lobbying resulted in imports for in excess of import requirements and is said to heve resulted in the loss of revenue of Rs 125 crores.

9. Retreading of tyres have become popular reducing replacement demand for tyres.

10. China's presence in the tyre export market is much larger than ours. India sustains due to quality which makes its exports costlier. Secret of low priced chinese tyres is not known.

11. Bangkok agreement provides 10% duty concession for tyre imports from Korea which makes sustaining of domestic profit margins difficult.

12. Psychological bondage towards white collar jobs has led to voluntary unemployment even though better paid blue collar jobs are available. This has

resulted in artificial labour shortage and rise in labour wages. Trade Unionism prevent proportionate downward movements in rubber prices and rubber wages thereby reducing price competitiveness.

13. From August 1998 rubber can be imported duty free from SAARC countries.

14. Newer HYV could be evolved with sowing patents in other countries and they would avail protection under Plant Breeders Rights.

15. Kerala growers might favour a multicrop model of agriculture if the prices continue to fall.

16. Possible shifting of cultivation to North Eastern region due to rising labour costs as evident from increased interest taken by the Rubber Board in extension and development to North Eastern areas.

The third objective of determining the minimum cost of production of NR is analysed with aid of an all Kerala primary survey covering a total mature area of 16553 ha. having 70056 tappable trees and an immature area of about 22 ha. The time period spans from November 1999 to February 2001.

In the primary survey of immature area, about 60 percent of the cost is shared by the labour component. Almost 90 percent of the surveyed units had no immaturity costs in which labour cost share is very high. The remaining 10 percent is found to follow the recommended cultivation norms of the Rubber Board.

Rubber Board estimates of labour requirements was found to be higher for the years of immaturity period. Though the no: of surveyed immature sample units are few, the results are in tandem with the general practice, since the sample is a representative one. Also, cultivation practices are more or less similar area wise especially in the case of immaturity period wherein growers are keen to follow the Board instructions implicitly.

Variation in wage rates across different geographical regions was also found. Shortage of labourers both male and female was acutely felt in all the geographic regions. Northern and Southern Kerala were identified as low wage regions. This should be due to the influence of the availability of immigrant labourers from the neighbouring Tamil Nadu state at a cheaper rate. Central Kerala showed comparatively higher wage rates. The area form an industrial belt of the state and therefore high wage rates reflect the opportunity cost component in the industrial and construction sector. Compared to estate where wages are uniform and is fixed based on a tripartite agreement between the employee, employee and the government, the

wages prevailing in the small holding sector are heterogeneous and is fixed on the basis is of supply and demand. As a result high level of wage rate prevails in the small holding sector.

Most of the cultivation works were carried out on a daily wage system. Same wage rate prevailed for all the works associated with rubber in same areas pitting and refilling was undertaken on a contract basis. Wage rates for pitting depended on the type of soil. Greater effort is required for pitting hard rocky areas. Higher pitting wage means higher refilling wage as while refilling is done stones are to be removed from the soil.

Gender inequality in wage rates was observed. Female wage rate comes to only 66 percent of the male rate (Rs. 80.3 as against Rs. 120.1 for male on an average). This is justified on the ground that the type of works undertaken by women involves less physical exertion than that of men. Female work participation rate during immaturity period was 58 percent. 94 percent of the female labourers are employed for weeding and mulching.

Work participation of family labour is negligent in the immaturity period. During maturity period also, less than 5 percent were engaged in tapping and other plant protection measures. This is in tandem with the sample survey results of the Rubber Board which reveal the sole income dependency of sample units as only 40.5 percent. Out of this 95 percent don't engage in cultivation activities. It was found that in practice watchmen were not kept by small holders for supervision. Supervision is under taken by family liability. Perhaps the cost of supervision is included in Board estimates to incorporate the opportunity costs of family labour.

It was found that protection measures like construction of wind belt and fire belt was net practiced widely. Manurial recommendations of the Rubber Board for immaturity period were strictly followed by the growers. During tapping stage, however discriminatory fertilizer application was practiced on the basis of price realisation. 90 percent of the surveyed units made their own fertilizer mixture. Only those who are members of the co-operative society or those who live in remotest areas bought fertilizers at market price. However for estimating material costs market price of fertilizers was made use of.

Though chemical weeding is more profitable than manual weeding when considering the labour cost component, it was found that majority practiced manual

weeding. This could be on account of ignorance or due to slow rate of change of habitual cultivation practices.

Micron spraying is more cost efficient. Spraying costs are 48 percent less than that of Bordeaux spraying. This is due to the fact that labour cost component under micron spraying is only 42 percent whereas under Bordeaux spraying it is 75 percent. Here again, a slow change of habit was found. Mulching is a widely prevalent cultivational practice. Mulching using African Payal is also found to be widely practiced.

Mulching is a widely prevalent cultivational practice. Mulching using African Payal is also found to be widely practiced. Variation in wage rates across different geographical regions was also found. Shortage of labourers both male and female was acutely felt in all the geographic regions. Northern and Southern Kerala were identified as low wage regions. This should be due to the influence of the availability of immigrant labourers from the neighbouring Tamil Nadu state at a cheaper rate. Central Kerala showed comparatively higher wage rates. The area form an industrial belt of the state and therefore high wage rates reflect the opportunity cost component in the industrial and construction sector. Compared to estate where wages are uniform and is fixed based on a tripartite agreement between the employee, employee and the government, the wages prevailing in the small holding sector are heterogeneous and is fixed on the basis is of supply and demand. As a result high level of wage rate prevails in the small holding sector.

The survey covered on an average to a total mature area of 16553 ha. with about 70056 tappable trees. Average all Kerala level of production was found to be 16003.68. Sheet production was 88 percent of total production. On an average 12 percent of total production was lost as scrap. There is a 20 percent lose of income from sale of scrap when compared to the sale of sheet.

On an average the all Kerala price level for the sample period was recorded at Rs 30 for sheet and Rs 18 for scrap. Average yearly output per tree was found to be about. 210kgs.

All Kerala Average total cost of production is found to be Rs. 183205.3. Wage costs had an 87 percent share is the total cost of production. Tapper wages alone had a 69 percent share in the total cost of production and a 79 percent share in total wage costs.

Overheads and depreciation had a share in the gross cost figure while the remaining is accounted for by materials cost. Per hectare average cost of production of NR per hectare is recorded as Rs. 61.7115 recorded to Rs. 62 per hectare average total production is 1820.069 per hectare sheet production is 1617.578 and per hectare scrap production is 202.4695. Average percentage of scrap of total production is 61.7.

Average total sales are Rs. 4706529. Average total sales of sheet alone in 93% of this gross figure. Average gross margin at the all Kerala level is 4507254

Average equivalent total production is 16229.17 tonnes. Average total cost of production up to latex stage is 184854.4 costs per kg up to latex stage are about Rs. 12. Average total cost of production of sheet is Rs. 188385.8. Taking into consideration the equivalent production cost/ kg works out to be 13.912 rounded to Rs. 14. This is the basic per kg cost of production.

Basic cost of production of sheet is adjusted by adding the land rent; amortization of deflated development cost Interest on loan, interest on working capital Adjustment of loss on scrap, grade difference, managerial expenses and return as capital risk to arrive at actual cost of production .Actual average cost of production worked out to be Rs. 360688.82 .On a per kg basic it works out to Rs. 22 i.e., Rs. 12 below BMP level.

This cost figure is worked and without taking into account opportunity cost explicitly interest rate is considered as the opportunity cost for finance.Oppurtunity cost of land is not taken into consideration as it is a highly complicated and widely debated issue.

In the first place opportunity cost or cost of next best alternative does not exist in the case of rubber. In the agricultural field no other crop yields better than rubber even when rubber prices are crashing. Annual crops are subject to violent seasonal fluctuations .Kerala's overall economic climate is slowly rooting out paddy and coconut cultivation.

Therefore no other crop has been officially identified as a substitute so far and data are not available for comparison. Thus we see that the aspects of rubber scenario outlined in the SWOT analysis are quantitatively verified in the present chapter

The characteristic industrial sluggishness of Kerala, though showing signs of improvement in various corners does not have enough force to drive people from agriculture to industry in the Lewis fashion to raise prices and costs in the agricultural sector.

Rubber Board sample survey reveals that only 40 percent of the growers depend solely on rubber as a main source of income.

As per Boards questionnaire for sample survey, a grower is solely dependent on rubber as main source of income when his income from rubber is greater that all the other alternative source of income. This means that even the 40 percent does not stand for a true estimate of the sole dependents on rubber for income among 9.5 lakh small growers. So rubber cultivation itself has become a next best alternative for a tertiary sector dominated state like Kerala. When majority is engaged in alternative occupations rubber cultivation requiring only supervision once the plant reaches maturity is the most viable alternative.

Land was converted into rubber plantations to come under the exemption enjoyed by rubber plantation under the land ceiling Act. Most of the plantation was purchased years back and data on the land prices is not available for calculating its imputed value. In Kerala the concept of mortgage land is outdated as all such lands have been given to the users. Leased land (after 10-12 years) is also given out. So for rubber opportunity cost concept on such lands are irrelevant. So there remains only owned and inherited land.

In the cost of production study under Ministry of Agriculture imputed value of land is not taken. This is because continuation of the use of land for the same crop is considered itself as an indicator that there is no next best alternative use.

The methodology adopted by United Farmers Front takes cost of production of the first stage and adds opportunity cost at the rate of 12 percent per annum for the next seven years up to the start of yielding to get total cost of first stage. For second stage total cost is also got by adding up opportunity cost. Then a minimum of Rs. 5000 per year net of all expenses is taken as opportunity cost of the land if, it is least out at 12 percent interest rate for each of the seven years is taken. Cost up to yielding stage is the sum of costs of stages I and II plus total opportunity cost for land. Again interest rate of the cost up to yielding stage is taken and is added to yearly maintenance cost of production. Thus there are a lot of opportunity cost calculations in a situation where there are a lot more controversies regarding the calculation of opportunity cost for rubber.

In the wake of global price competitiveness, the adjusted basic average cost is an efficient one. But the condition is that Bench Mark level of Rs 34/kg is above the calculated level and so stands for a "fair" return for the growers. Or in other words

what the grower is justified to get so that he remains in the cultivation of rubber. The peak level attained in mid 1997 can be explained away as seasonal fluctuation's or in other words wind fall gains. It may recur depending on the post WTO global changes. But to use the peak prices as a base for price calculations amounts subscribing to "ratchet effect" phenomenon of Duesenberry.

The concept of normal price is fixed on the theory that the investor should get a return which is enough to cover the cost of production and yield a normal level of profit such that he is not tempted to shut down. There is a normal level of exit and entry. The price level of Rs 18 worked out by the ICWAI methodology can be classified as a normal price under a perfectly competitive situation. Theoretical price levels are not enough for boosting the growth of any industry. Sample survey results based on this methodology (Rs 26)can be considered as the range above shutdown point.

Peaks and troughs in price level are common phenomena whether it is an agricultural or industrial good. It is the result of wind fall gains or losses. But having attained a high level once there is a psychological fixity to that level. The price level between Rs 55-60 can be classified as a peak price level. Using peak prices as a base for price calculations amounts subscribing to "Ratchet effect" of Duesenberry.

The midway level worked out using the second methodology is Rs 38.5 and is higher than the BMP level. At present it is unattainable since international price hovers around Rs 32 We may conclude that the question of how fair is the fair price is a matter of growers view point. Opting for the economically feasible level is the best option for growers.

Though a major share of rubber returns leaked out as conspicuous consumption, changes in Business scene and attitude will definitely bring forth positive reinvestment of the surplus. As it is most suited for Kerala's peculiar industrial climate and as there are no viable alternative, rubber cultivation should be shown green flag. For this the grower should at least get the BMP level in the present situation or else exit would be the most viable alternative.

The improved technology in rubber cultivation has improved the potential for greater output and the prospects for sustained growth of the industry in the face of both fluctuating prices and increasing cost of inputs.Therefore, the fourth objective is to forecast the future potential production and demand of NR. Since the majority of

rubber suppliers are small holders and there fore economically back ward than the rubber consumers, it is relevant to determine the future potential so as to verify whether encouragement of productivity is a viable option or not .

The proportion of NR in the global elastomer usage is forecasted to decrease from the present level of 40 percent to 37.5 percent in 2010 [1]. Due to relatively higher price of NR and progress in SR industry it may still reduce to 35 percent by 2020. World consumption of NR which was 66.8 lakhs during 1999 is forecasted by the International Natural Rubber Organisation to reach 100 lakh tones by 2010.

The World Bank forecasts NR price to recover. NR prices rose by 9.1 percent in 1999 and by 8.3 percent in 2000. The growth rate is expected to slow to an annual rate of 4.8 percent during 2001 – 2005 and 1.8 percent during 2006 – 2010.

The outlook on rubber supply also shows increasing prospects. Most of the major rubber producing countries is getting rapidly industrialized and there is still untapped rubber potential. Small producing countries like Vietnam, Cambodia, and Brazil etc. are showing signs of increasing their NR production in the future. The global output of NR which is 66.0 lakh tones during 1999 is likely to increase to 77.2 lakh tones by 2005 and85.4 lakh tonnes by 2010.

Considering the time series data from 1984–1985 to2001–2002, the correlation between the world NR production and Indian NR production worked out to be 0.9778. The corresponding correlation for consumption worked out to be 0.851. For the same time period, domestically the correlation between consumption and production is in tandem with the global results i.e. somewhere in the range of 0.98 to 0.99. Correlation between domestic consumption and price also show close association with the global correlation of the two i.e. between 0.73 to 0.75. Forecasts of world production and consumption reassert the concept of consumption production gap in the future.

Three approaches were employed for the purpose of forecasting future production. In the first approach, time series regressions were estimated for both production and consumption for the 15 year period from 1987 to 2002 for understanding the trend. Box Jenkins method was applied to correct autocorrelation. Both the regressions on production and consumption have high R^2 (0.997, 0.991) showing high significance of the trend variable. It proves that behavioral variables do depend on time variable in their adjustment process.

Estimation results using the first approach are revealed that estimated consumption for the year 2003 is 717569.4 lt and estimated production is 742458.1 lt. By 2011 the figures are estimated to be 950844.8 lt and 1015688.0 lt respectively.

Using the second approach, forecasts for new planting is 88203 lakh tones for the year 2005 and replanting is 9983 ha for the same year. Production is forecasted to reach 6777201 lakh tones by 2010. The results show that moving average of price (MOP) is the most crucial factor for determining the new planting followed by government subsidy. As against the regression result of new planting, in the case of replanting, it was found that MOP is not significant. Most significant is the trend variable

Based on normal production function method, the supply forecast of 2002 is 660608 lakhs and 2003 is 676164 lakhs. Estimated NR supply is 702272 lakhs by 2005.In 2011, the supply would be 750178 tonnes. At the terminal point of the analysis i.e. 2020 AD, the estimated production is 899376 tonnes. Of the three approaches, results of the third approach are thought to be reliable as it is more in tandem with the actual figures.

In the case of NR, an analysis of macro economic environment of the rubber industry throws light on the causative factors and areas where remedial measures can be applied., Here a microscopic view of the past is made available, Past experience can be made use of to improve the situation and if measures suggested under SWOT analysis is an optimistic way out subject to the condition of observance. Analysis of the cost of the cost of production of NR shows that grower got the subsistence price level even at the trough level. It also revealed that at present there is no viable alternative to rubber cultivation. Higher price level of Rs.65 and lower price level of Rs.24 are just cyclical fluctuations due to global factors a rational rubber must be realistic and accept global influences in the post liberalization era. Supply response analysis reveals positive long term responses and as there is price recovery at present, there is the possibility of positive rubber supply in the future. Forecasting exercise also promises both production and consumption increases and positive demand supply gap.

In short supply response and analysis, forecasting, macro economic environment as well as sort analysis and cost of production study all combine to show that rubber cultivation will not only be sustain but will flourish in the future.

Appendix

Bibliography

Articles

1 Ady peter (1968) "Supply functions in Tropical Agriculture" Bulletin of the Oxford University Institute of Economics and Statistics vol - 30 (2:157-188)

2. Akiyama T and Trivedi P.K. (1987) vintage production approach to perennial crop supply. An application to tea in major producing countries. Journal of Econometrics 36 p.p. (133-161)

3. Allen Peter (1969) "Analysing Price Patterns" Rubber Developments vol. 22 (4:122-125)

4. Allen P.W. Thomas and B.C Sekhar (1974) The Techno-Economic potential of Natural Rubber in Major End uses. MRRDB Monograph No. 1 Malaysian Rubber Research and Development Board, Kuala Lumpur.

5. Arak Marcelle (1968) "The price Responsiveness of Sao Paulo Coffee Growers" Food Research Institute studies of the University of Stanford vol 3 (3:211 - 223)

6. Bacon R (1968) Supply Function in Tropical Agriculture, Bulletin of the Oxford University Institute of Economics and Statistics.

7. Barlaw colum (1970) "Prospects for Natural Rubber" Economics Record, vol 46 (482-496)

8. Bate man, Merril J (1968) "Aggregate and Regional supply functions for Ghanian Cocoa" Journal of farm Economics, vol 47 (2:384 - 401)

9. Bateman MJ (1969) supply relationships for perennial crops in less developed areas in CR wharf on(ed) substance agriculture and economic development Chicago Aldine.

10. Bateman "Aggregate and Regional supply functions for Ghanian Cocoa "Journal of Farm Economics - May – 1965

11. Berger K. Smit H.P. (1994) Natural rubber in the coming decade's shortages ahead. Proceedings of international rubber study group Colombo Srilanka 23-28 May

12. Behrman "Monopolistic cocoa pricing, American journal economics August - 1968.

13. Behrman J. R. (1971) "Econometric model simulations of the world Rubber Market 1950-1980" In L.R. Kleen (ed.), Essays in Industrial Economics vol III Universal of Penny Sylvania. .

13. Burger K Smith HP (1994) Natural Rubber in the coming decades Shortages ahead. Proceedings of the International Rubber Study group, Colombo, Srilanka

14. Chew [1984] - Measuring the rate of Technological change and in Chinese rubber small holdings. A Micro economic Approach - journal of Rubber Research Institute of Malaysia - Vol. 32 part 3 pp 191 -197.

15. Dowling J.M. (1979) "The Supply Response of Rubber in Thailand", Southern Economic Journal, vol 45(3:795-805)

13. French. and. Mathews (1971) "A supply Response Model for Perennial Crops." American Journal of Agricultural economics vol. 53(3: 478-490)

14. French . King. And Minami (1985) "Planting and removal relation ships for perennial crops, an application to ding peaches" American Journal of Agricultural Economics vol 67.no 2 May (1985)

15. George and Joseph - Cost Benefit Analysis of investment in Tree crops. "Indian Journal of Agricultural Economics. October December 1973 p - 73

16. Hartly M.J. Nerlove M and Kyle Peters Jr. R (1987) "An analysis of rubber supply in Srilanka. American Joumal of Agricultural Economics vol 69 (4:755-761)

17. Herdt, Robert W., the Elasticity of Aggregate Agricultural Supply in the Punjab 1907 - 1946 and 1951 - 1964, PhD Thesis.

18. Ipe.and Prabhakaran-Price Response of a perennial crop: - A case of Indian natural rubber IJAE – Vol. 43 No: 4 Oct-Dec 1988.

19. Jose Thomas - The rubber plantation industry in Kerala - Thesis submitted for the degree of the Doctor of Philosophy in Economics 1979 [unpublished] University of Cochin

20. Kerala State Co-operative Rubber Marketing Federation Ltd. The report of the study into the working of Co- operative Societies dealing in Rubber 1980. P. no: 6

21. Kerala State Co-operative Rubber Marketing Federation Ltd. Beasent Raj Consultants [p] Ltd "Market Study on Natural Rubber 1982 p. no: 1 8

22. Man, Abu Baker and D. Blandford (1980) "The World Market Outlook for Natural Rubber "Malayan Economic Review Vol XXV (1: 82 – 93)

23. NCEAR - Ten year perspective Plan for Rubber 1980 - 81 to 1989 -90 New Delhi 19809

24. Nerlove Marc (1956) "Estimates of the Elasticities of supply of selected Agricultural commodities Journal of farm Economics, vol 38 (2: 496 - 509)

25. Nerlove Mark (1958) "The Dynamics of supply estimates of farmers Response to price, The Johns Hopkins Prers Baltimore

26. Nerlove M (1983) Expectations Plans and realization in theory and Practice.

27. Parikh (1972) "Market Responsiveness of Peanut cultivators" Some evidence from Pre-war Indian Journal of Development Studies vol 8.

28. Pal S.P. (1975) Supply Response and Optimal agricultural policy in a planned under development economy. Indian Journal of Agricultural Economics.

29. Pillai. P. P., "Impact of Price movements of Area, Productivity, and Production of paddy its Kerala State, "Agricultural Situation in India, 24 [9] Dec 1969, pp. 819 -821.

30. Rajkrishna-"Farm Supply Response in India-Pakistan: A Case study of the Punjab Region," The Economic Journal, 73 [29 11 September 1963, PP477-87

31. Rubber Research Institute of Malaya Financial performance of commercial Estate Annual Report [1 975] p. no: 1 7

32. Sethi. , "Some Analytical and Quantitative Aspects of Agricultural Supply and substitution Function: India, Indian Journal of Agricultural Economics, 21 [2], April - June 1966, pp. 16-30.

33. Smit H.P. (1978) "A vintages model of Malaysian small holder's Natural rubber production" In Ani ben Arope et al. (eds). The progress and Development of Rubber small holders. The Association of Natural Rubber Producing Countries Kualalumpur

34. Smit H.P. (1981) "Demand and Supply of Natural Rubber Part I" Economic and Social Institute, Free University Amsterdam Research memorandum 1981 – 2

35. Sunil Mani, "An analysis of Indian Natural rubber market M.Phil. Dissertation [unpublished] JNU; New Delhi [1982

36. Tusdell C.S. and Desilva N.T (1986) Supply maximising and variation minimizing replacement cycles of Perennial crops and similar assets. Theory illustrated by coconut cultivation." Journal of Agricultural Economics vol 37 (2: 243 - 251)

37. Trivedi P.K. and A. R. pagan (1976) "Estimating polynomial Distributed Lag Models" (memis) Australian Natural University.

38. Trivedi, Pravin K [19911: A case study of Cocoa New planting and Replanting in Bahia Brazil [1966 - 85], journal of Development Economics Vol - 39 No :2

39. Umadevi S. (1977) Perennial crop supply Response - The case of Indian natural rubber Indian Journal of Agricultural Economics.

40. Uma Devi S. (1981) Short run and longrun responses to the price in the case of natural rubber in India. Indian Journal of Agricultural Economics.

41. Uma Devi- "Plantation Economy of the third World" [1988]

42. Unni and Jacob - Rubber small holdings in India. Report of Sample Survey 1969 - 70 Rubber Board, Kottayam

43. Wickens M.R. and Green Field J. N. (1973). The Econometrics of Agricultural supply. An application to the world Coffee Market" Review of Economics and Statistics' vol 55 (4:433 - 440)

44. Worth, and Strong S.M [1984] "Impact of Technological changes in the input demand and cost functions in the Malaysian Rubber industry, journal of Rubber Research Institute of Malaysia." Vol 31, No: - 2 pp 71 -87.

45. World Bank (1980 b), World Development Report 1980, The World Bank Washington D.C.

Journals and Reports

1. Rubber (Malayalam monthly), (Rubber Board)

2. Rubber Mithrum (Malaylam Monthly)

3. Rubber Board Bullettin (Rubber Board)

4. Indian Journal of Natural Rubber Research (Rubber Board)

5. World Development Report (1993), World Bank Washington DC

Books

1. Cagan (1956) the Monetary Dynamics of Hyper Inflations

2. Hand book of Natural Rubber Production in India (Rubber Board)

3. Herman World. "Demand Analysis: A Study in Econometrics"

4. Nerlove, Mark. (1983) Expectations, Plans and Realisations in Theory and Practice.

5. Rubber and cultivation [.Rubber Board]

6. Rubber enna kalpadhenu [1990] Rubber board

7. Rubber Growers Companion (Rubber Board)

8. Rubber Growers Companion (Rubber Board)

9. Rubber (Rubber Board)

10. Rubber Mithram

11. Smith H. P. (1981) "Demand and Supply of Natural Rubber Part – I. Economic and Socials Institute Free University Amsterdam. Research Memorandum.

Statistical Sources

1. Government of Kerala "Economic Review 1989 to 1993

2. Government of India "Report of Tariff Commission on the Revision of raw rubber prices Bombay 1954.

3. Government of India - Report of the small holdings Economics Enquiry commitee 1968

4. Government of Kerala "Statistics for planning" Directorate of Economics and Statistics Thiruvanthapuram.

5. Hand book of Natural Rubber Production in India (Rubber Board)

6. Indian Journal of Natural Rubber Research (Rubber Board)

7. International Rubber study group, London, Rubber statistical bulletin (Monthly)

8. Indian Rubber statistics Rubber Board various volumes

9. Rubber Statistical Bulletin of International Rubber Study Group various volumes

10. Rubber (Malayalam monthly), (Rubber Board)

11. Rubber Mithrum (Malaylam Monthly)

12. Rubber Board Bullettin (Rubber Board)

13. Rubber Statistics news (Rubber Board)

14. Rubber Growers Companion (Rubber Board)

15. Sample survey Report of the Rubber Board. (1998)