# NATURAL RUBBER PRODUCTION : PROSPECTS ON A LONG TERM BASIS*

P. Mukundan Menon
Rubber Production Commissioner
&
RG. Unni
Dy. Director (Statistics & Planning)
Rubber Board, Kottayam - 686 001.

Rubber plantation industry in India has recorded all round progress during the last 10 year period as can be seen from the following:

* Area under rubber increased from 2.62 lakh ha in 1979-80 to 4.40 lakh ha in 1989-90.
* Production of rubber more than doubled from 148,470 tonnes to 297,300 tonnes during the same period.
* Productivity measured in terms of yield per ha per year improved from 771 kg to 1,030 kg.
* Growth rate in production surpassed all major crops in the country recording 9.8 per cent growth during 7th Plan period.

The annual growth in the area, production and yield per hectare in the past decade were as shown in Annexure - 1.

As rubber planted on ground takes 6 to 7 years to start yielding, the impact of extensive new plantings and replantings carried out during the 7th Plan period will be visible only during the coming years. Thus the plantation industry is poised for giving further spectacular results.

Rubber goods manufacturing industry has also recorded remarkable progress during the decade. The consumption of rubber which is considered as the index of growth of rubber industry showed an average compound growth rate of 7.6 % per year during the period. During the last 5 year period alone, the average rate of growth had gone up 8.9 % per year. It is particularly noteworthy that the value of exports of rubber products had surged up from Rs. 22.83 crores to Rs. 214.87 crores during the ten year period.

The relevant parameters of rubber production are :

* Area under existing plantations.
* Future scales of newplanting & replanting.
* Choice of cultivars.
* Age structure of the trees on the ground.
* Technological advances in agronomic and production practices.
* Price of rubber.

## 1. Newplantation.

Rubber tree flourishes and yields best in warm, equable tropical climate. Such conditions are normally obntained at low elevations in certain regions of the world lying within 10° latitude on either side of the Equator. In India, Kanyakumari District of Tamilnadu, southern districts of Kerala and Nicobar group of islands are the only regions falling within this geographical limits. Areas lying outside this belt experience pronounced seasonal variations such as excessive rainfall, prolonged drought, low winter temperature etc which are all factors adversely affecting the growth and yield of rubber depending on the severity of the incidence of each or all of these climatic variations. Of the total existing area of 4.40 lakh ha, as much as 89 % is in Kerala and Kanyakumari District of Tamilnadu which together form the traditional rubber growing region of the country. The remaining 11 % is in non-traditional regions composed of North East States/Union Territories, Orissa, Andhra Pradesh, Karnataka, Goa and Konkan Region of Maharashtra, Andaman & Nicobar Islands etc.

Expansion of rubber cultivation in the traditional region can be only limited in view of the high pressure on land. Non-traditional areas, on the other hand, offer very good scope for extension planting. According to the tentative estimates of the Rubber Board, this can be of the order of 1.2 million ha as shown below :

| | | |
|---|---|---|
| Assam | : | 200,000 ha |
| Tripura | : | 100,000 " |

* Paper presented at the Seminar on availability and growth of rubbers in India by 2000 AD organized by the All India Rubber Industries Association, Southern Region at Cochin on 7th July, 1990.

| | | |
|---|---|---|
| Meghalaya | : | 50,000 ha |
| Mizoram | : | 50,000 " |
| Other NE States | : | 50,000 " |
| A & N Islands | : | 50,000 " |
| Orissa | : | 200,000 " |
| MP (Bastar Dt.) | : | 100,000 " |
| Goa & Konkan Region | : | 100,000 " |
| Karnataka | : | 150,000 " |
| Andhra Pradesh | : | 100,000 " |
| West Bengal | : | 50,000 " |
| **TOTAL** | | **: 1,200,000 ha** |

The availability of these areas would, however, depend on release of waste lands and degraded forest lands for cultivation. Taking into account the potential vis a vis various constraints, the target proposed for expansion during the 8th Five Year Plan period is 80,000 ha comprising 65,000 ha in non-traditional areas and 15,000 ha in traditional areas. The pattern of growth of rubber area in traditional and non-traditional regions during the last two Plan periods was as shown in Table I :

The ground work done during the 7th Plan period in non-traditional areas would facilitate large scale development in the coming years. For achieving the overall target, it would be necessary to offer on continued basis all the existing forms of assistance with upward revision of financial assistance commensurate with increased cost of cultivation. When the entire targeted area of 80,000 ha would reach full yielding stage,the production therefrom would be of the order of 120,000 tonnes.

**TABLE I**

| | 6th Plan period | 7th Plan period |
|---|---|---|
| Traditional : | 82,000 ha | 63,000 ha |
| Non-traditional : | 9,000 ha | 25,000 ha |
| Total : | 91,000 ha | 88,000 ha |

**2. Structure of existing area and replantation.**

The old plantations require immediate replantation. The target proposed for replantation during the 8th Plan period is 40,000 ha. The achievement in this regard during 7th Plan period was 23,000 ha. Almost the entire area requiring replantation is in tradiltional region and to a small extent in Karnataka State. Increased financial and technical assistance is necessary to achieve the target as in the case of newplantation. When the entire area of 40,000 ha reaches full yielding stage, the net increase in production therefrom would be 72,000 tonnes.

Age structure of the existing rubber area is estimated as under :

| | | ('000 ha) |
|---|---|---|
| 5 years and less old | : | 110 |
| 6 to 16 years | : | 157 |
| 16 to 25 years | : | 72 |
| 26 to 30 years | : | 63 |
| Above 30 Years (old area) | : | 38 |
| Total | : | 440 |

**3. Choice of cultivars.**

Genetic improvement through breeding and selection has brought about significant improvement in productivity. With unselected seedlings used as planting materials in the initial years of rubber cultivation, productivity was only around 300 kg per ha. Systematic breeding and selection, which followed subsequently, have brought about development of a good number of high yielding varieties some of which have a production potential of around 3,000 kg ha. The clone RRII 105 evolved and released by the Rubber Research Institute of India during the close of 1970's and now in extensive use yields between 2,000 to 3,000 kg per ha. The high yielding cultivars now under use would provide the mainstay for continued productivity improvement.

**4. Reduction of pre-bearing period.**

The pre-bearing period of rubber has been around 7 years. Technology has now been developed for obtaining early maturity. Introduction of various agro-management techniques like planting of polybagged plants of advanced growth, balanced nutrition, early branch induction, irrigation, scientific cover crop management, proper soil and moisture conservation, timely and effective protection of plants from diseases and pests etc are helpful in this regard and these are being popularised amongst all categories

of growers. It should therefore be possible to ensure that the immaturity period of rubber is by and large reduced to 5 or 6 years. However, for purposes of projecting the production, the average pre-bearing period is assumed as 6 years.

**5. Short term measures for enhancing production.**

Production from existing plantations can be enhanced significantly through adoption of discriminatory fertiliser application based on soil and leaf analyses, systematic plant protection, efficient crop exploitation through improved methods of tapping, rainguarding rubber trees for enabling tapping during rainy season and chemical stimulation of yield in older plantations. Productivity enhancement so achieved can range from 10 per cent to 50 per cent depending upon various factors. In order to tap this potential in small holdings, the Board has evolved schemes and the action programmes which include :

* Organising small holders under the Rubber Producers' Societies (RPSs) which *inter alia* would enable identification of small holdings requiring adoption of each of the above technologies and act as vehicle for effective transfer of technology.
* Educating, motivating and training the identified small holders for adoption of the improved practices.
* Supplying the required inputs to small holders through the RPSs and making them use the inputs in the prescribed manner.

The Rubber Producers' Societies are organised at the village level and registered under Charitable Societies Act. Each society covers a service area of 2 to 3 km radius and membership of 50 to 250 small holders. About 1000 such societies have been already established and the target is to increase the number to 3,000 by the end of 8th Plan. Material inputs such as fertilisers, fungicides, sprayers, yield stimulants, rainguarding materials, tapping and processing equipments are procured in bulk and distributed with marginal price concessions. The target is to bring 50,000 ha of small holder rubber under this productivity improvement programme during the first year and to progressively increase it thereafter to 250,000 ha by the end of 8th Plan.

**6. Price.**

Maintenance of a steady and remunerative price is essential for the sustained development of the rubber plantation industry. Small holders react very quickly to price changes. During 1970-75 period when the market price was below the remunerative level, there was steep fall in planting tempo and price support operations including export of small quantity of rubber had to be carried out. During this period, a considerable number of small growers even replanted their holdlings with other crops. Newplanting during 1971-77 fell to around 3,000 ha per year as against 6,000 ha during 1963-70 and 13,000 ha during 1956-62. The recovery of price in the 1980s and introduction of new plantation development schemes brought about a spurt in planting in the 1980s to the average level of 18,000 ha per year.

**Projection of production of NR.**

Projection of production can be based more or less on reasonably predictable criteria under the prevailing market conditions, with the exception of climatic factor which however can bring in only transient variations in the general trend. The position in regard to demand projection is however far different as it involves many imponderables which are being touched upon briefly later in this paper. A glance through the

various earlier projections and forecasts both on supply and demand, vide Annexure-2, would reveal how unknown and hidden factors had resulted in the actual developments getting far removed from those anticipated. However, the exercise of looking towards the future and preparing ourselves for whatever that can be reasonably anticipated will have to continue as an essential and inescapable part of long term planning for development.

Taking into consideration the various parameters that could touch upon NR production and the position obtaining against each as discussed above, production of NR upto the year 2,000 can be in fairness projected as shown below.

Projected production of natural rubber.

| Year | Total area ('000 ha) | Tapped area ('000 ha) | Yield (kg/ha) | Production ('000 tonnes) |
|---|---|---|---|---|
| 1990-91 | 454 | 312 | 1075 | 335 |
| 1991-92 | 469 | 329 | 1125 | 370 |
| 1992-93 | 485 | 343 | 1180 | 405 |
| 1993-94 | 502 | 358 | 1240 | 444 |
| 1994-95 | 520 | 370 | 1300 | 481 |
| 2000-01 | 640 | 460 | 1500 | 690 |

**Synthetic rubber.**

Synthetic rubber is produced mainly in two factories owned by M/s. Synthetics & Chemicals Ltd., and M/s. Indian Petro Chemicals Corporation Ltd. The first unit which is producing Styrene Butadiene Rubber (SBR) and Nitrile Rubber (NBR) is now expanding its SBR capacity to 80,000 tonnes and NBR capacity to 7,500 tonnes with Government approval. M/s. IPCL are producing Polybutadiene Rubber (BR) and the licensed capacity of the unit is 20,000 tonnes. They have proposed enhancement of the capacity to 50,000 tonnes by 1992. According to the norms laid down by the Government of India, the minimum economic size of SBR and BR units in Indian canditions are 100,000 tonnes and 50,000 tonnes respectively. The SBR capacity of M/s.Synthetics & Chemicals Ltd could ultimately go up to 100,000 tonnes. Two small units viz., M/s. APAR(P) Ltd., and M/s. Asian Paints Ltd are also producing synthetic rubber in limited quantities. The former unit is manufacturing SBR with a capacity of 3,000 tonnes. The company is now also implementing a project for producing NBR with a capacity of 6,000 tonnes per year, M/s. Asian Paints Ltd are manufacturing SBR latex, VP latex and NBR latex with a total capacity of round 2,000 tonnes. M/s. Herdilia Chemicals Ltd are creating capacity for manufacturing Ethylene Propylene rubber (EPDM)to an extent of 10,000 tonnes per year.

Thus the total production capacity of various types of BR by the mid 1990s will be around 178,000 tonnes made up of 153,000 tonnes of general purpose varieties (SBR & BR) and around 25,000 tonnes of special purpose varieties. Rubber goods manufacturing lindustry requires a variety of other special purpose rubbers also of which Butyl rubber (IIR) is the most important one. About 16,000 tonnes of IIR is now imported annually. Its demand could more than double towards the turn of this century. The minimum economic size of an IIR plant being 25,000 tonnes, there is scope for its indigeneous production. Already three firms have made proposals for establishing Butyl units. If at least one of them succeeds in the venture, the country would be in a position to dispense with continued imports of IIR. Requirement of each of the

other special puprpose rubbers is rather limited and hence it may not be economical to produce those indigenously. The total import of these varieties may be only 10,000 to 20,000 tonnes per year during 1990s.

**Projection of rubber consumption**

Rubber is the basic raw material required for manufacture of a large variety of products. The pattern of use shows that automobile tyre and tube sector is by far the single largest user of rubber accounting for 48.4% of the total consumption of NR and SR. The other important sectors are of cycle tyres and tubes (12.1%), footwears (11.6%), belts and hoses (7.0%), tyre retreads (6.5%), latex foam (3.8%) and dipped goods (3.1%), vide Annexure 3. About 95% of the output of various rubber products is used for domestic consumption and only about 5% is exported. 1980s witnessed an upsurge of the general manufacturing activities as a result of easing of import restrictions, relaxation of Government controls and general improvement of investment climate. The recent announcment of de-licensing of tyre industry is another beneficial move in this direction. As a result of all these, the annual compound growth of rubber consumption during 1979-80 to 1989-90 went up to 7.6% as against 6.0% in the previous decade, vide Annexure 4.

With the advances in the areas of transportation, industrial production and agricultural activities and excellent potential for increased exports, the demand for rubber products in India is bound to increase. The fast growing motor vehicle population would result in increased demand for tyres and tubes and tyre products. There are reports that 4 large automobile tyre units are being newly set up. However, some of the recent developments in rubber technology help to increase the service period of

many products which may in turn also adversely affect the growth and demand for rubber. Switch over from conventional cross ply tyres to radial ply tyres for automobiles, wide-spread use of pre-cured retreading and down sizing of motor vehicles and resulting shift to small size tyres are some of the examples. Implementation of recent amendments to Motor Vehicles Act is also reported to bring in a negative effect in the demand for rubber. Production trend of different types of tyres during the last one decade reveals that the growth is highly biased towards small size tyres, vide Annexure 5.

Forecasts available also indicate that the future demand will be more for two and three wheeler tyres and passenger car tyres compared to truck and bus tyres. Whereas bus and truck tyres now account for 70% of the total production of auto tyres and tubes in tonnage, ATMA has reported that the domestic demand growth for truck and bus tyres can be "optimistically estimated at 3% per annum during the 8th Plan period". It is however possible that this estimate could not have absorbed the likely impact of the recent Government ordered curbs on the use of petroleum fuels. It might not be out of tune with the existing outlook to conclude that there would be a slow down in growth rate in demand for rubber in the auto tyre & tube sector. However, the demand in the non-tyre sector, especially in regard to cycle tyres & tubes, conveyor & transmission belting, foot-wear, examination & surgical gloves, condoms, etc could keep burgeoning.

Exports of tyres and tubes and other rubber products are expected to pick up substantially over the coming years. At present only about 5% of the turn-over of rubber products is exported. Various incentives are given for exports like subsidy to compensate the difference between Indian and international price of NR, cash compensatory support, duty draw back and favourable export credit. Many NR producing countries with developing economy are earning substantial amount of foreign exchange through the export of rubber products, as shown below:

Export of rubber products in million US$

| | | | |
|---|---|---|---|
| India | (1988) | : | 79 |
| Malaysia | (1988) | : | 397 |
| Indonesia | (1987) | : | 43 |
| Thailand | (1987) | : | 110 |

It may be seen from the above that factors that are to decide the future demand of rubber are not only numerous but also complex and difficult to yield any firm conclusions. It would, therefore, be only prudent to aim at a projection within a range comprising of a low, medium or acceptable and high estimates. The medium or acceptable levels of estimates might themselves follow a growth rate ranging from 8% in 1990-91 gradually declining to 6.5% by 2000-01 in view of the fact that during the 10 years from 1980-81 the average annual growth rate has been 7.6% and that during the 5 year period from 1985-86 to 1989-90 alone it was 8.9%. On this basis, the consumption during 1994-95 would reach a level between 5.93 lakh tonnes and 6.51 lakh tonnes and by 2000-01 it would be between 8.12 lakh tonnes and 10.03 lakh tonnes, vide table given below:

Projection of Consumption of NR and SR

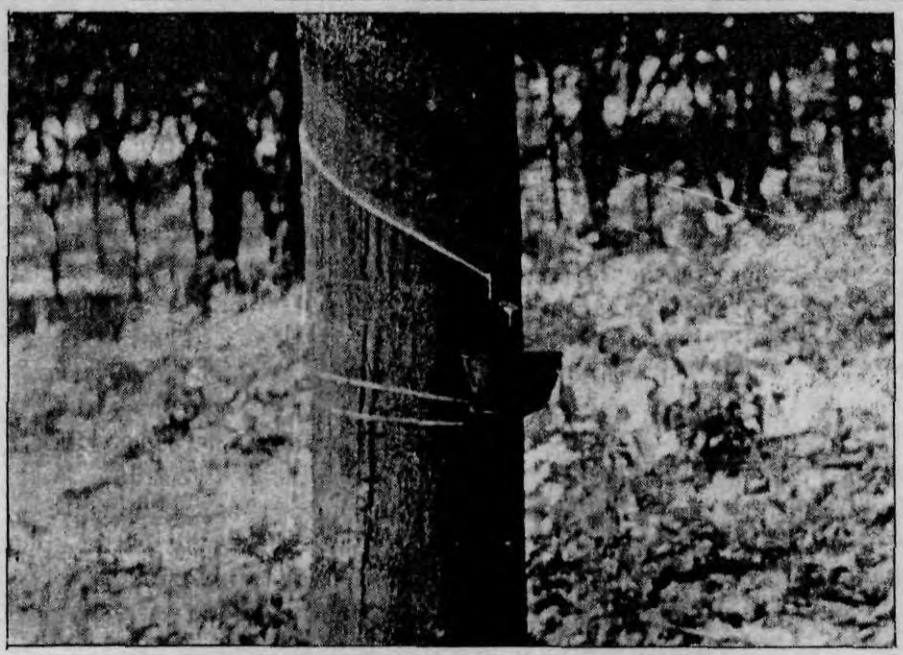
('000 tonnes)

| | Low | Medium (Reasonable) | High |
|---|---|---|---|
| 1979(Actual) | 433 | 433 | 433 |
| 1994-95 | 593 | 621 | 651 |
| 2000-01 | 812 | 906 | 1003 |

Some of the recent forecasts of production and consumption of NR and SR for 2000 AD are excerpted in Annexure 6 for comparison.

The average pattern of use of NR and SR in the country during 1989-90 was in the ratio 79:21 as against a global ratio of 34:66. There can be change in the use pattern in future mainly depending upon the availability and ralative price of NR and SR. Domestic prices of SBR and BR are right now 70% and 25% higher than that of NR for comparable grades. With the implementation of expansion programmes and utilisation of full capacities, economies of scale could be derived with the result that prices of SR could come down. It would, however, be too much to expect SR to become lower priced than NR in any foreseeable future.

In the circumstances, the ratio of NR & SR usage which averaged around 78:22 during the 7th Plan



period may remain more or less unchanged in the coming years. On this basis, the break up of use of NR & SR during 1994-95 and 2000-01 would be as follows:

Share of NR in total projected consumption

('000 tonnes)

| | Low | Medium (Reasonable) | High |
|---|---|---|---|
| 1994-95 | 462 | 484 | 508 |
| 2000-01 | 633 | 707 | 782 |

In conclusion, it may be stated that domestic production capacity of general purpose SR does not require to be augmented by establishing additional units till at least the turn of this century. Establishment of a Butyl rubber plant with capacity of 25,000 to 30,000 tonnes capacity would be a highly welcome addition to the rubber industry in India. As regards NR, the country is poised for achieving short term self sufficiency in supply by 1994-95 or even earlier. There could be marginal deficits by 2000-01 which could also be matched by production by suitably gearing up production efforts. Temporary or short-term surpluses in production during certain years cannot altogether be ruled out. In that event, the country would have to undertake exports as well.

**Annexure - 1**

AREA, PRODUCTION & YIELD PER HECTARE OF RUBBER

| Year | Total area ('000 ha) | Tapped area ('000 ha) | Yield per ha (kg) | Production (tonnes) | Growth in production (%) |
|---|---|---|---|---|---|
| 1979-80 | 262 | 193 | 771 | 148,470 | |
| 1980-81 | 278 | 194 | 788 | 153,100 | 3.1 |
| 1981-82 | 296 | 196 | 779 | 152,870 | - |
| 1982-83 | 313 | 200 | 830 | 165,850 | 8.5 |
| 1983-84 | 332 | 205 | 857 | 175,280 | 5.7 |
| 1984-85 | 352 | 211 | 886 | 186,450 | 6.4 |
| 1985-86 | 369 | 223 | 890 | 200,465 | 7.5 |
| 1986-87 | 389 | 237 | 926 | 219,520 | 9.5 |
| 1987-88 | 405 | 249 | 944 | 235,197 | 7.1 |
| 1988-89 | 423* | 266 | 974 | 259,172 | 10.2 |
| 1989-90 | 440* | 289 | 1030 | 297,300 | 14.7 |

* Provisional.

**Annexure - 2**

Forecasts of consumption and production made in the past for 1989-90 vis-a-vis actuals obtained.

| | | Consumption | Production ('000 tonnes) | |
|---|---|---|---|---|
| 1. NCAER (1980) (Sponsered by AIRIA) | | | | |
| | NR | 386 | Low | 216 |
| | | | High | 235 |
| | SR | 97 | Low | 42 |
| | | | High | 57 |
| | | **483** | | **258/292** |
| 2 Sub Group on Rubber (1980) | | | | |
| | NR | 342 | | 268 |
| | SR | 63* | | |
| | | **405** | | |
| (*SBR, BR, Butyl only) | | | | |
| 3. R.G. UNNY (1980) (Rubber Board) | | | | |
| | NR | 370 | | 290 |
| 4. HIDDE P. SMITH (1983) | NR | - | | 200 |
| 5. K M. PHILIP (1980) | NR | | | |
| | SR | 425 | | 225 |
| | | | | 61 |
| Actuals | NR | 342 | | 297 |
| | SR | 91 | | 53 |
| | | **433** | | **350** |

The above figures indicate that the consumption forecasts are generally on the high side while production forecasts are on the lower side.

Sources:
1. 'Ten Year Pespective Plan for Rubber'
2. 'VI Five Year Plan for Rubber'
3. 'Study on production potential of NR upto 2000 AD'
4. 'Demand & Supply of Rubber, Un ESCAP"
5. 'Review of the pattern of demand & supply in the 1980's and measures t aken to bridge the gap' AIRIA Seminar in New Delhi on Sept. 1980.

**Annexure - 3**

Usage pattern of rubber during 1988-89

| | | Natural | Synthetic | Total | tonnes Percentage share |
|---|---|---|---|---|---|
| 1. | Auto tyres & tubes* | 148,088 | 44,407 | 192,495 | 48.4 |
| 2. | Cycle tyres & tubes | 38,210 | 10,012 | 48,012 | 12.1 |
| 3. | Tyre retreades | 21,611 | 4,153 | 25,764 | 6.5 |
| 4. | Footwears | 33,891 | 12,263 | 46,154 | 11.6 |
| 5. | Belts & hoses | 21,724 | 6,212 | 27,936 | 7.0 |
| 6. | Latex Foam | 15,230 | - | 15,230 | 3.8 |
| 7. | Dipped goods | 12,236 | - | 12,236 | 3.1 |
| 8. | Others | 22,840 | 7,103 | 29,943 | 7.5 |
| | Total | 313,830 | 84,150 | 397,980 | 100.00 |

(*Including tractor, ADV, off the Road & Aero).

**Annexure - 4**

CONSUMPTION OF RUBBER

| | Natural | Sunthetic (tonnes) | Total | Incease % |
|---|---|---|---|---|
| 1979-80 | 165,245 | 43,238 | 208,483 | |
| 1980-81 | 173,630 | 47,050 | 220,680 | 5.9 |
| 1981-82 | 188,420 | 52,650 | 241,070 | 9.2 |
| 1982-83 | 195,545 | 55,250 | 250,795 | 4.0 |
| 1983-84 | 209,450 | 62,300 | 271,780 | 8.4 |
| 1984-85 | 217,530 | 85,000 | 282,910 | 4.1 |
| 1985-86 | 237,440 | 70,035 | 307,475 | 8.7 |
| 1986-87 | 257,305 | 71,765 | 329,090 | 7.0 |
| 1987-88 | 287,480 | 76,410 | 363,890 | 10.6 |
| 1988-89 | 313,830 | 84,150 | 897,980 | 9.4 |
| 1989-90 | 341,840 | 91,055 | 432,895 | 8.8 |

**Annexure - 5**

GROWTH OF PRODUCTION OF AUTO-TYRES

('000 Nos.)

| ( | | 1979 | 1988 (Provisional) | Growth % |
|---|---|---|---|---|
| 1. | Truck & bus | 2,858 | 4,872 | 70.5 |
| 2. | Light truck & Jeep | 609 | 1,296 | 112.8 |
| 3. | Motor Car | 1,057 | 1,969 | 86.3 |
| 4. | Motor Cycle & Scooter | 1,820 | 5,704 | 213.4 |
| 5. | All (including others) | 7,275 | 17,800 | 144.7 |

**ANNEXURE - 6**

Some of the recent forecasts of consumption and production of rubber for 2000 AD (1000 tonnes)

| | | Consumption | | | Production | Consumption Ratio |
|---|---|---|---|---|---|---|
| | | NR | SR | Total | NR | (NR : Sr) |
| 1. | Dr BC Sekhar (1987) (Study sponsored by AIRIA) | | | | | |
| | Conservative | 483 | 136 | 619 | 436 | 78 : 22 |
| | Pragmatic | 559 | 158 | 716 | 480 | 78 : 22 |
| | Optimistic | 646 | 180 | 828 | 574 | 78 : 22 |
| 2. | IRSG/ESI (1988) | 490 | 148 | 638 | 500 | 77 : 22 |
| 3. | AIRIA (1989) (Forecast for 1999-01 | 745 | 200 | 945 | - | 78 : 22 |
| 4. | KK. Philip (1988) | | | 835 | 444 | |

1. 'Natural Rubber Supply in India, Scenario upto 200 AD.'
2. 'World Rubber Economy, changes and challenges' IRSG and Economics and Social Institute, Amsterdam.
3. 'Address of President of AIRIA - Sept 1989.
4. 'Estimate on Elastomer Requirments of Rubber Industry upto 200 AD'.

# Do insects talk ?

Depending on the season, many places resound with insect music. Crickets, locusts, katydids and others call incessantly in aid of love and war — or courtship and defence, to use the biologist's less emotive terms. But what of insect talk?

Entomologist Philip J. DeVries of the University of Texas at Austin (US) has found that caterpillars of a number of butterfly species communicate with ants by tapping on leaves and twigs. The sound travels through the leafy twiggy substrate rather than through the air. Its purpose seems to be to recruit an ant bodyguard for the caterpillar.

In a research paper in Science,. he says that it is one of those mutually beneficial arrangements that econogists call symbiosis. The caterpillars produce amino acids, sugar secretions and other goodies that the ants collect. The ants, in turn, protect the caterpillars. In fact, Dr. DeVries says, if insect predators find one of these caterpillars without the anti bodyguard, the caterpillar has "no chance of survival".

If that was all there were to it, the caterpillars would get the worst of the bargain, for the ants would tend simply to collect the food and run off to their nests. Thus, as Dr De Vries notes. "There is a premium for any caterpillar species involved in symbiosis with ants to maintain a constant cadre of ant guards." Ants communicate by vibration. The caterpillars have "learned" the ants' vibration language. They tap out calls that "persuade" ants to linger and defend them.

Here is a finding that points to a previously unknown aspect of insect evolution, Dr. De Vries explains that "our current understanding of insect communication suggests that accoustical signal evolved in response to courtship and rivalry, mate recognition, short-distant communication between colony members of social insects, or as defence. Now, this study points to the possibility that, under selection for symbiotic associations, the calls of one insect species have evolved to attract other, distantly related insect species."

The caterpillars involved belong to the Riodinidae and Lycaenidae butterfly families — the only butterfly families in which some members are known to form symbiosis with ants. Dr. DeVries notes that, until now, entomologists did not know butterfly caterpillars made sounds or that sound was involved in symbotic relationships with ants.

But, as he researched the subject, Dr. DeVries found that the ability of butterfily caterpillars to tap out calls has evolved independently at least three times — twice among riodinid species and once among the lycaenids. Moreover, it has always evolved as part of a relationship with ants. His survey covers butterfly species from Australia, South Central and North America, Europe and Thailand. He also carried out experiments, in the field in Panama and in the laboratory.

Speculation as to whether insects can be said to think or be conscious is controversial and is dismissed by many biologists. But there are many subtle modes of insect communication. Eveny chirp, buzz or tap has a meaning.

Thailand and Indonesia should both produce around 1.19 million tonnes, while Malaysia will produce 1.28 million tonnes. However, the report also casts its eye forward twelve months, and forecasts that this time next year Thailand will be the world number one producer with 1.25 million tonnes, followed by Malaysia with 1.24 million and Indonesia with 1.20 million tonnes.

Demand for NR and SR will recover somewhat next year, the EIU predicts, though prices will probably not see any benefit from this trend. This is not the fault of the INRA 2 agreement, the report adds, but rather the consequence of competition from cheap SR, in which there is 'massive overcapacity'.

The outlook for prices is stable, the report says, despite some encouraging fundamentals. If SR had not been invented, NR producers could be looking forward to a significant price recovery over the next eighteen months.

Production is expected to increase by significantly less than demand and by the end of 1992 stocks are likely to reach a very low level, equivalent to less than two months' global consumption. However, SR is expected to take up much of the extra demand.

Demand for tyre is expected to fall 2.8% in 1991 but will likely rise by a similar figure in 1992, while in non-tyre sectors, a 5.5% fall in 1991 is expected to be followed by a 2.9% increase this year.

*Bulletin Karet*, 5 January 1992.

# Special Topic

## INDIA'S DEMAND AND SUPPLY POSITION OF NATURAL RUBBER TO THE YEAR 2000

P. Mukundan Menon and R.G. Unny
Rubber Board, Kottayam, India.

### INTRODUCTION

The rubber plantation industry in India has recorded all round progress during the last 10 years as can be seen from the following:

- the area under rubber increased from 278,000 ha in 1980/81 to 451,000 ha in 1990/91;
- rubber production more than doubled from 153,100 tonnes to 329,615 tonnes during the same period;
- productivity measured in terms of yield per hectare per year improved from 788 kg to 1,076 kg; and
- the production growth rate surpassed all major crops in the country recording 9.8% growth during the Seventh Plan period (1985/86-1989/90 April/March); for 1990/91 it was 11%.

The annual growth in area, production and yield per hectare for the past decade is shown in **Appendix 1.**

As rubber trees require 6 to 7 years to start yielding, the impact of extensive newplanting and replanting carried out during the Seventh Plan period will only be visible during the coming years. Thus the plantation industry is poised for giving further spectacular results.

The rubber goods manufacturing industry has also recorded remarkable progress during the decade. Rubber consumption, which is regarded as the index of growth of the industry showed an average compound growth rate of 7.7% per year during this period.

Similarly, the value of rubber products exported had surged from Rs 313.6 million to Rs 2,597.5 million.

### PRODUCTION

The relevant parameters of rubber production are:

#### Natural Rubber (NR)

- area under existing plantations;