CHAPTER 24

ANCILLARY INCOME FROM RUBBER PLANTATIONS

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Although the main source of income for the small grower is the rubber produced from the holding, certain ancillary products also fetch supplementary income to him. The most important ancillary product is of course the rubber wood. This is discussed separately (Chapter 23). Rubber seed is also a supplementary source of income for the grower though on a moderate scale. The other source is the honey produced from the rubber plantations.

RUBBER SEED, SEED OIL AND OIL CAKE

Among the rubber producing countries, perhaps it was in India that rubber seed began to be used commercially for extracting oil. Around 1965, the Khadi and Village Industries Commission of India took the initiative to introduce the processing of rubber seed. It has now assumed the proportion of a small scale industry. The industry is concentrated in the state of Tamil Nadu (Haridasan, 1976). Rubber seed is a minor source of non-edible oil in India.

Rubber seed production

Rubber seed production is not stable every year. Even within one year inter-clonal and intra-clonal variation in production is noted. Apart from the climatic factors, the incidence of diseases affect the availability of useful seeds for extracting oil. In India the attack of Phytophthora can restrict the number of seeds available for commercial use. The occurrence of severe rainfall during the seed fall season can also affect the availability of good quality seeds (Haridasan, 1976).

Large variation in the rubber seed production is noted all over the world. In a study published from Nigeria, seed production per hectare was found to vary from 73 kg (PB 86) per hectare to 424 kg (PB 5/51) per hectare (Adindu and Aghaka, 1985). Based on the studies undertaken in India, around 150 kg of useful seed can be obtained from one hectare

of rubber plantation. The seed production can be considerably higher, if the incidence of disease is insignificant.

Studies show considerable variation in the seed weight. A study conducted in Nigeria showed the mean whole seed weight as 3.25 g for GT 1 and 4.57 g for RRIM 600. In India the weight of seeds (as on received basis) was found to vary from 5.2 to 5.7 g. However, on moisture free basis the weight is found to be around 4 g (Adindu and Aghaka, 1985). In a study conducted in India the percentage of shell and kernel was found to be at 42 and 58 respectively on moisture free basis (Azeemoddin and Thirumala Rao, 1962). From published literature, the figures are found to vary from 41% to 48% for kernel and 34% to 55% for shell. Fresh seed may contain moisture even upto 25% by weight.

Reports from Nigeria show the oil recovery from the kernel in the laboratory at 43%. In the study carried out in India mentioned above, oil content of kernel on moisture free basis varied from 38% to 46% with an average of 42%. This becomes 37% and 40% on 10% and 5% moisture basis respectively (Adindu and Aghaka, 1985). Under the commercial conditions in India, oil recovery is around 35%.

There are some problems in the collection and storing of rubber seeds. If the seeds are not collected, dried and stored in disease and insect free atmosphere, the seeds will become useless for extracting oil. Studies show that fresh seeds are more susceptible to the attack of fungi than dried seeds. Fungicidal treatment and drying of rubber seeds have to be carried out before storage, to ensure good quality seeds.

A certain percentage of seeds will be used in the plantations for raising stock material and only the balance will be available for extracting oil. In India, around 10% of the collected seeds is thus used in the plantations as stock materials (Haridasan, 1976).

The mobilisation of the collection of seeds is also a problem. In India most of the plantations allow the dependents of the workers to collect the seeds, while rubber dealers form the link between the oil millers and the collectors of seeds.

Method of processing

Three methods of extracting rubber seed oil are reported, viz., (1) solvent extraction, (2) by expeller, and (3) by rotary machine. To get the maximum yield from the seeds, solvent extraction process is the ideal method. But this process requires relatively higher investment and expertise. For optimum efficiency under this method large quantity of seeds will have to be mobilised. In India where the commercial production of

rubber seed oil has been in vogue over two decades, the rotary and expeller machines are used for the purpose; the expeller being limited in number. These machines have been in use for extracting oil from other seeds as well.

In India rubber seed oil extraction is carried out by oil millers so as to utilise the mills fully. Although 90% of the rubber producing areas are located in Kerala on the western part of the Western Ghats, the oil mills are located in the rain shadow side of the Western Ghats, in Tamil Nadu. These mills were set up mainly for extracting groundnut oil. The groundnut crop reaches the mills after December, while the rubber seed fall season is between July and September and this enables the mills to fully utilise their capacity. In the recent past, a few mills have been operating exclusively for rubber seed throughout the year.

The rotary form of extraction is the simplest one, and is suited to the people of the developing countries where rubber is mainly grown. It is relatively more labour intensive. The machinery can be operated by a semi-skilled worker. A pair of rotary machines is necessary for giving full employment to one person. As a result, the number of rotary machines to be installed will have to be in multiples of two. A reasonably efficient worker can crush around 250 kg of dry rubber seed kernel during an eight hour working shift.

The main equipment required for processing are the rotary machine and an electric motor. A platform balance is also used in most mills. For removing shells, machines are available, but in the state of Tamil Nadu manual removal is practised widely. There is no additional expenditure for drying the seeds in Tamil Nadu, as the state is endowed with plenty of sunshine during the seed fall season. In other parts of the world where the above favourable climatic conditions are not available, machinery may be required for decortication and a kiln, for drying.

For processing rubber seed kernel under the above method, a certain amount of molasses is required. Usually for every 100 kg of dry rubber kernel, 20 to 25 kg of molasses is necessary. In the course of extraction of oil, around 10% to 15% of the total weight of the kernel is lost (Haridasan, 1976). Under normal conditions, the oil recovery would be around 35%.

Uses of rubber seed oil

In India rubber seed oil is mainly used in the manufacture of washing soap. Small quantities are used in the paint industry as a substitute for linseed oil (Haridasan, 1976). Studies conducted in India and other countries

have shown that rubber seed oil suitably treated with sulphur produces factice which finds use in rubber compounds. Epoxidation of rubber seed oil with hydrogen peroxide and acetic acid has also been reported. Epoxidised oil is used in the formulation of anti-corrosive coatings, adhesives and alkyd resin casting (Vijayagopalan, 1971; Vijayagopalan and Gopalakrishnan, 1971). Rubber seed oil has been used for the production of fat liquor for the leather industry (Vijayalakshmi et al. 1988). The properties of rubber seed oil are given in Table 1.

TABLE 1

Acid value	4-40
Saponification value	190-195
Iodine value	132-141
Hydroxyl value	12-32
Unsaponification (%)	0.5-1.0
Refractive index, 40°C	1.466-1.469
Specific gravity, 15/15°C	0.924-0.930
Titra (°C)	28-32
Fatty acid composition (%):	
Palmitic acid	11
Stearic acid	12
Archidic acid	1
Oleic acid	17
Linoleic acid	19
Linolenic acid	24
	100

Rubber seed oil cake

Research carried out in India has shown that rubber seed oil cake is a good ingredient in cattle and poultry feed. In the cattle feed, upto 20% of the weight can be rubber seed oil cake and in India important cattle feed manufacturers use rubber seed oil cake for the purpose. The Kerala Agricultural University, Trichur, India conducted a 12 year long study utilising rubber seed cake in the ration of cattle, pigs and poultry. The University obtained the following results (Ananthasubramaniam, 1980):

The rubber seed cake had a crude protein content of 25% with a DCP of 15 and a TDN of 66 for cattle.

The DCP and TDN of the cake in respect of pigs were 16 and 78 respectively.

The cake contained nearly 9 mg/100 g of hydrocyanic acid which had no deleterious effect on feeding at the recommended levels.

Rubber seed oil cake can be fed up to 30% of the concentrate mixture for cattle and at 10% level in the ration for pigs and chicken.

RUBBER HONEY

Beekeeping as a vocation in the rubber plantations in India was introduced by European Missionaries in the twenties of this century. Since 1950, the Khadi and Village Industries Commission of the Central Government of India and the Khadi and Village Industries Boards of the State Governments have taken up the promotion of beekeeping by offering financial, technical and training facilities to the beekeepers (Haridasan et al. 1987). Since 1988, the Rubber Board of India also gives help in taking up beekeeping in rubber plantations.

Beekeeping in the present context means the rearing of certain varieties of domesticated bees. Although there are four such bees, Apis [illegible] indica is the one reared in the bee hives in the rubber plantations in India. Attempts are also made in rubber growing countries, particularly in Malaysia, to develop beekeeping in rubber plantations.

The rubber tree is a prolific producer of honey. Honey in the rubber tree is found in the extrafloral nectary glands at the tip of the petiole where the leaflets join (Jayarathnam, [illegible]). It is collected in India from January to March, when the rubber tree sheds its old leaves and produces new ones. About 45% of Indian honey originates from rubber plantations.

Studies made by the Rubber Research Institute of India indicate that an optimum number of 15 to 20 hives can be placed in a hectare of rubber plantation. Under experimental conditions about 20 kg of honey per hive per year has been produced in rubber plantations. Under commercial conditions it is reasonable to assume 10 kg per hive per year. Assuming a production potential of 10 kg of honey per hive and 15 hives per hectare, a minimum of 150 kg of honey can be produced from one hectare in a normal year (Haridasan et al. 1987). It can give a gross income of Rs. 3000 ha^{-1} (US$ 120). An average of 30 hives (2 hectares) can be managed by a beekeeper.

Qualitatively, the most important drawback of rubber honey is the higher moisture content in it. The internationally accepted standards of quality tolerate moisture content only upto 19% (Haridasan et al. 1987). The higher moisture content creates problems during storage. Yeast is

attracted to honey when the moisture content is higher and this leads to fermentation. Therefore, there is the need of reducing the moisture content immediately after collection to maintain the quality. The vacuum concentration process could be introduced for upgrading the quality of rubber honey. Granulation of honey, though not a symptom of bad quality, is suspected by the consumer, due to adulteration. To prevent granulation and fermentation, honey should be heated at around 63 degree celsius under controlled conditions.

The honey gathering activity in the rubber plantations lasts until the end of March. Afterwards the beekeeper has to see that the bee colonies are sustained till December. Honey provides the carbohydrates and pollen, the protein, required by the bees. An assured source of honey and pollen should be available in the vicinity of the plantations if beekeeping is to be carried out throughout the year. The need for raising plants which will flower in a cycle throughout the year is therefore all the more important.

The Rubber Research Institute of India has identified five promising bee forage plants along with twenty one major and minor sources of nectar and pollen for off-season bee management (Nehru et al. 1983). These plants provide a source of nectar and pollen during the long dearth period from April to December every year. These can be raised on the hedges, boundaries, bunds or vacant spaces in the plantations.

Nehru et al. (1983) have reported the technical properties of rubber-honey (Table 2).

TABLE 2

Properties of honey from rubber estates

		Range	Average
1.	Viscosity (in centipoise) at 27°C	550-3800	1358
2.	Specific gravity at 27°C	1.3985-1.3400	1.379
3.	Moisture (%)	21.50-25.50	22.00
4.	Reducing sugars:	69.08-74.80	72.80
	(a) Levulose (%)	34.80-40.70	37.14
	(b) Dextrose (%)	33.57-37.97	35.98
5.	Non-reducing sugars (%)	0.78-3.14	1.71
6.	Acidity (%)	0.06-0.20	0.127
7.	Ash (%)	0.09-0.39	0.216
8.	Protein (%)	0.054-0.249	0.138
9.	Yeast (Million/g)	103.9-159.0	139.39

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