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PRODUCTION AND UTILIZATION OF RUBBER WOOD IN THAILAND : I. PLANTATION AREAS AND WOOD PRODUCTION

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บทคัดย่อ

ยางพาราเป็นพันธุ์ไม้ต่างถิ่น ได้นำจากมาเลเซียเข้ามาปลูกในประเทศไทยเป็นครั้งแรกที่จังหวัดตรัง ในราวปี พ.ศ. ๒๔๔๒–๒๔๔๔ ครั้นในปี พ.ศ. ๒๔๖๗ รัฐบาลได้จัดตั้งศูนย์วิจัยยางขึ้นที่อำเภอหาดใหญ่ จังหวัดสงขลา บัจจุบันสังกัดกรมวิชาการเกษตร เพื่อทำหน้าที่ศึกษาวิจัย ปรับปรุงบำรุงพันธุ์ยางพารา และในปี พ.ศ. ๒๕๐๔ ได้จัดตั้งกองทุนสงเคราะห์การทำสวนยางขึ้นเพื่อช่วยสงเคราะห์ชาวสวนยางเปลี่ยนพันธุ์ใหม่ซึ่งให้น้ำยางสูงกว่าพันธุ์ดั้งเดิม

เนื้อที่สวนยางพาราทั้งประเทศนับจนถึงปี พ.ศ. ๒๕๒๙ มีทั้งสิ้น ๑๐.๗๓๕ ล้านไร่ โดยร้อยละ ๑๐.๐๖ อยู่ในภาคตะวันออก และร้อยละ ๘๙.๙๔ อยู่ในภาคใต้ ยางพาราเริ่มกรีดได้เมื่ออายุ ๕ ปี เนื้อที่สวนยางที่มีอายุต่ำกว่า ๕ ปี มีอยู่ร้อยละ ๒๒.๒๙ ในขณะที่สวนยางอายุ ๕ ปี ขึ้นไปซึ่งกรีดได้แล้วมีเนื้อที่ประมาณ ๘.๓๔๒ ล้านไร่ หรือร้อยละ ๗๗.๗๑ ของเนื้อที่สวนยางทั้งประเทศ เนื้อที่ที่ได้รับการสงเคราะห์ให้เปลี่ยนพันธุ์ใหม่ไปแล้วตั้งแต่ปี พ.ศ. ๒๕๐๔ จนถึงปี พ.ศ. ๒๕๓๐ มีทั้งสิ้น ๔.๐๔๙ ล้านไร่ (ร้อยละ ๓๗.๗๒ ของเนื้อที่ทั้งหมด) และมีเป้าหมายที่จะทำการสงเคราะห์เปลี่ยนพันธุ์ต่อไปในอนาคตอีกปีละ ๓๑๒,๕๐๐ ไร่ รวมเนื้อที่ ๔.๒๓๖ ล้านไร่ ทั้งนี้โดยกำหนดให้การสงเคราะห์แก่สวนยางเดิมซึ่งมีอายุมากให้น้ำยางน้อย มีเนื้อที่ไม่น้อยกว่า ๒ ไร่ และมีต้นยางพารายอ่างน้อยไร่ละ ๒๕ ต้น

ในการโค่นยางพันธุ์เก่าเพื่อปลูกพันธุ์ใหม่ทดแทนนั้นทำให้ได้ไม้ยางพาราเป็นผลพลอยได้ โดยร้อยละ ๔๙.๐๕ เป็นไม้แปรรูป ร้อยละ ๓๙.๗๒ เป็นไม้ฟืน เศษไม้ ปลายไม้ และร้อยละ ๑๒.๒๓ เป็นไม้เสา หากยึดเอาระยะปลูก ๓×๘ เมตร เป็นเกณฑ์ก็พบว่าไม้ยางพาราที่ได้จากสวนอายุ ๑๙, ๒๐, ๒๑, ๒๒, ๒๓ และ ๒๔ ปี มีปริมาตรเท่ากับ ๒๓.๓๑, ๒๕.๘๐, ๒๖.๘๗, ๒๗.๒๘, ๒๘.๓๐ และ ๓๓.๒๔ ลูกบาศก์เมตรต่อไร่ ตามลำดับ หรือเฉลี่ยเท่ากับ ๒๗.๔๗ ลูกบาศก์เมตรต่อไร่ ไม้ยางพาราที่ได้จากการสงเคราะห์เปลี่ยนพันธุ์มีปริมาณร้อยละ ๔,๕๘๔,๓๗๕ ลูกบาศก์เมตร โดยจำแนกเป็น เศษไม้ ปลายไม้ ไม้เสา และไม้แปรรูป มีปริมาตรเท่ากับ ๓,๒๗๒,๓๖๔, ๑,๐๔๔,๘๖๔ และ ๔,๒๖๒,๑๔๒ ลูกบาศก์เมตร ตามลำดับ

ABSTRACT

Rubber tree has been introduced from Malaysia to southern Thailand since 1899. Total areas planted up to 1986 were of 1, 717, 561 ha, 10.08% in the East and 89.94% in the South. The Office of Rubber Replanting Aid Fund found in 1961 already replanted the low-yield-original varieties from 1961 to 1987 of 647, 809 ha. The areas of 677, 789 ha are expected to be replanted in future with the replanting target of 50,000 ha/year. Based on the standard spacing of 3x8 m, rubber wood gained from the 19, 20, 21, 22, 23, and 24-year-old plantations were of 145.69, 161.26, 167.94, 170.50, 176.88, and 207.75 m^3/ha with an average of 171.67 m^3/ha. This output consisted of 49.05% roundwood or sawn timber, 38.72% fuelwood or wood residues, and 12.23% pole and pile. It is expected that rubber wood harvested from the future replanting program should be about 8,584,735 m^3/year divided into 3,272,364 m^3 wood residues, 1,049,869 m^3/pole and pile. and 4,262,142 m^3 roundwood.

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INTRODUCTION

Rubber tree locally known as para-rubber (**Hevea brasiliensis**) in plantations is one of the man-made forests grown widely by private sectors. Its timber outputs can be converted as fuel and raw material for making more value-added productive commodities such as fuelwood, charcoal, pole and pile, particle board, furnitures and their parts, and other valuable products.

Because of these foreseeable significances, concerning informations upon production and utilization of para-rubber wood in Thailand should be collected and taken realistically into consideration in order to disseminate for public understanding and use. The reliable informations will contribute to planning and enhancing more effective uses of this additional forest resources and inducing higher incomes to people in the long run.

The study aims to identify the production and utilization of para-rubber wood in Thailand. The specific areas to be investigated are as follows : to elaborate the para-rubber plantations in Thailand by regions and provinces and to assess the potentiality of para-rubber timber outputs produced form the private plantations.

The study was mostly done on documentary researches employing secondary data from concerning government offices. Certain empirical study was undertaken to fill the information gaps. Furthermore, the study was investigated only in the southern, the central and the eastern regions of the country, because para-rubber is mainly grown and utilized in the said regions.

RUBBER PLANTATION IN THAILAND

The History :

In Thailand, rubber plantation has long been planted more than 90 years ago, less than 20 years after Malaysia. The initial seedlings brought to grow in the Kingdom came from Malaysia by the former Trang governor of the South during 1899–1901 and

they have been grown extensively in the 14 provinces of the South since then. Around 1911 rubber seeds and seedlings from Malaysia were also first introduced to grow in Chantaburi province of the East and later have extended their boundaries to the other eastern provinces until now. Thai rubber products could have been produced and exported to outside the country since 1926. So far, there are para-rubber plantation areas approximately 1, 717, 561 hectares throughout the country.

In 1924, Rubber Research Center was firstly established in Hadyai district of Songkha province which currently operates under the supervision of Rubber Research Institute and Department of Agriculture in Bangkok. The center's responsibility is to explore and experiment high efficient varieties of rubber seedling, such as high and good yields, and durable to diseases and wind, to distribute to publics for planting and replanting.

In 1960, the government has foreseen the important roles of rubber in helping well being of the people and country's economy. So, the government has introduced and issued the Act of Rubber Replanting Aid Fund (the Office has established in the following year) in order to help the owners of old stock para-rubber plantations and fruit orchards to replanting with new high yielded variety of para-rubber seedlings by granting money, fertilizers and other essential materials for early operation as well as providing technical know-how of replanting and tapping technigue and monitoring every steps of the implementation.

The Plantation

By assessing LANDSAT imageries and ground checks in 1978 Thailand has 1, 418, 698 hectares of total para-rubber plantations. The planting sites are divided into 131, 633 hectares in the east and 1, 287, 035 hectares in the south or approximately 9.28 and 90.72 percent respectively. For all plantation, as a whole, partly have 381, 646.36 hectares or about 26.90 percent of the total plantation areas within the national forest reserves (Tables 1 and 2).

Table 1 Rubber Plantation in Thailand by Provinces (1978)

No	Region/Province	Planted Area (ha)			
		Seedling	Tabable	Maturity	Total
	Central & East				
1	Chachoengsao	-	-	-	-
2	Chonburi	126	28	-	154
3	Rayong	6,154	40,654	1,163	47,972
4	Chanthaburi	4,735	43,280	2,258	50,273
5	Trad	3,981	28,068	1,215	33,264
	Sub-total	14,996	112,030	4,636	131,663
	South				
6	Prachuap Khiri Khan	-	-	-	-
7	Chumphon	1,875	8,628	17	10,520
8	Ranong	836	2,279	273	3,388
9	Suratthani	15,191	106,133	3,939	125,263
10	Phang-nga	8,037	57,785	2,443	68,265
11	Phuket	2,562	11,509	591	14,663
12	Krabi	8,339	75,424	1,995	85,758
13	Nakhon Si Thammarat	28,452	158,685	7,323	194,460
14	Sathun	5,829	16,629	565	23,023
15	Trang	22,865	118,906	4,115	145,886
16	Phatthalung	9,664	59,484	1,806	70,954
17	Songkhla	28,096	188,169	7,864	224,128
18	Pattani	5,792	40,559	2,010	48,360
19	Yala	17,214	120,272	2,602	140,088
20	Narathiwat	16,951	109,975	5,353	132,279
	Sub-total	171,701	1,074,438	40,896	1,287,035
	Total	186,697	1,186,468	45,532	1,418,698

Source : Rubber Research Institute

In 1986, para-rubber plantation areas are accumulating to 1, 717, 561 hectares or 17.40 percent higher than those of the year 1978. The areas are divided into 172, 820 hectares in east and 1, 544, 740 hectares in the south or approximately 10.06 and 89.94 percent of the whole 1986 areas. Furthermore, the areas are also classified into premature trees (less than 5 years old)

Table 2 Rubber Planted in National Forest Reserves (by Provinces in 1978)

No	Region/Province	Planted Area (ha)		
		in Protective Forests	in Denuded Forests	Total
	Central & East			
1	Chachoengsao	-	-	-
2	Chonburi	-	-	-
3	Rayong	-	1,668.80	1,669
4	Chanthaburi	-	1,206.56	1,207
5	Trad	-	1,022.08	1,022
	Sub-total	-	3,897.44	3,897
	South			
6	Prachuap Khiri Khan	-	-	-
7	Chumphon	369.32	1,468.18	3,438
8	Ranong	16.89	228.04	245
9	Suratthani	4,805.73	11,833.72	16,639
10	Phang-nga	5,617.28	13,314.28	18,932
11	Phuket	1,642.44	4,051.20	5,694
12	Krabi	7,392.24	12,995.69	20,388
13	Nakhon Si Thammarat	10,705.13	37,403.84	48,109
14	Sathun	6,378.20	5,777.24	12,155
15	Trang	11,234.94	39,141.56	50,377
16	Phatthalung	4,823.37	19,932.06	24,755
17	Songkhla	17,725.00	81,958.33	99,683
18	Pattani	838.82	10,238.49	11,077
19	Yala	14,345.24	29,652.78	43,998
20	Narathiwat	7,205.40	15,053.57	22,259
	Sub-total	93,100.00	283,049.00	377,748.92
	Total	93,100.00	286,946.44	381,646.36

Source : Rubber Research Institute

and ready to be tapped trees (5 years or over) with the area of 382, 871 and 1, 334, 690 hectares or about 22.29 and 77.71 percent of the total expanded areas (Table 3).

Replantation Areas

The Office of Rubber Replanting Aid Fund of the Ministry of Agriculture and Co-operatives has its main authority empowered by the Act of Rubber

Table 3 Rubber Plantation in Thailand by Provinces (1986)

No	Region/ Province	Planted Area (ha)		
		< 5 years	over 5 years	Total
	Central&East			
1	Chachoengsao	412	313	725
2	Chonburi	212	4,188	4,400
3	Rayong	9,529	54,121	63,651
4	Chanthaburi	10,247	53,260	63,507
5	Trad	5,644	34,894	40,538
	Sub-total	26,045	146,775	172,820
	South			
6	Prachuap Khiri Khan	81	462	544
7	Chumphon	7,612	15,706	23,318
8	Ranong	1,206	3,050	4,256
9	Suratthani	53,561	125,241	178,802
10	Phang-nga	17,574	70,972	88,546
11	Phuket	3,368	13,681	17,049
12	Krabi	24,588	78,669	103,257
13	Nakhon Si Thammarat	44,150	190,687	234,836
14	Satun	8,057	32,708	40,765
15	Trang	44,531	109,617	154,148
16	Phatthalung	25,235	58,296	83,531
17	Songkhla	54,555	205,238	259,793
18	Pattani	13,465	43,247	56,712
19	Yala	35,925	113,564	149,489
20	Narathiwat	22,917	126,777	149,695
	Sub-total	356,826	1,187,915	1,544,740
	Total	382,871	1,334,690	1,717,561

Source: National Research Council
Ministry of Science Technology and Energy

Replanting Aid Fund of AC 1960 amended by the Act issued in December 1987 having at least in assisting and enhancing the owners of each rubber plantations roughly after 25 years of operation to undertake replanting programme in their old plantations with conditions. The plantation owners have

to meet the said conditions in order to receive aid fund from the Office. Among these are the characteristics of the old plantation itself. It has to produce low yield and the areas shall not less than two rai (0.32 hectare) with having at least 25 trees per rai (or 156 trees per hectare). Furthermore, the replanting areas shall not locate within the national forest reserves or officially prohibited zones unless they have official permits from the government agencies concerned by granting aid fund (money, fertilizers, seedlings, and others) and techniques of replanting and tapping rubber trees. The first replantation program has been established since 1961. And so far (1987), there were 647,809 hectares of rubber tree replanting areas all over the country or about 37.72 percent of the total existing areas. The replanting areas are divided into 33,317 hectares in the east and 614,492 hectares in the south (Table 4). Currently, the Office has its replanting plan targetting to plant 50,000 hectares a year, with new high-yielded varieties to replace the old stock.

Existing Areas for Future Replanting Programme

The existing old stock of para-rubber plantations, having been left for replanting in the following years (after 1987), can be estimated by deducting the total planting areas in 1978 with planting areas in protective forests in 1978 and with the total replanted areas from 1961–1987. The calculated result of the planting areas of old stock left for replanting in the next few years by provinces are 677,789 hectares, divided into 98,346 hectares in the East and 579,443 hectares in the South (Table 5). If the replantation scheme is set for about 50,000 hectares annually, the existing plantations of old stocks will be replaced by new high-yielded varieties of rubber trees within 13–14 years. This excludes the first rotation of replantations (from 1961–1987) which will be ready to be cut down and replanted with new trees in the second rotation and so on. It, therefore, will be assured that Thailand will have para rubber wood for utilization sustainably as far as the old rubber trees having been cut continuously in the replanting cycle.

Table 4. Rubber Replanted Areas in Thailand (from the beginning to 1987)

No	Region/Province	Replanted Area (ha)							
		1961–1981	1982	1983	1984	1985	1986	1987	Total
	Central & East								
1	Chachoengsao	–	–	–	–	–	–	–	–
2	Chonburi	–	–	–	–	–	–	–	–
3	Rayong	8,154	987	1,123	1,039	752	828	889	13,772
4	Chanthaburi	4,172	893	664	927	690	1,065	1,160	9,571
5	Trad	3,760	782	775	1,097	1,098	1,365	1,097	9,974
	Sub-total	16,087	2,661	2,562	3,064	2,541	3,258	3,145	33,317
	South								
6	Prachuap Khiri Khan	–	–	–	–	–	–	–	–
7	Chumphon	717	83	111	49	164	81	135	1,340
8	Ranong	326	59	90	57	82	86	68	768
9	Suratthani	30,537	4,047	4,684	2,359	4,755	3,150	3,024	52,555
10	Phang-nga	17,040	2,549	2,194	1,711	2,159	2,634	1,943	30,230
11	Phuket	8,214	539	599	369	641	514	372	11,249
12	Krabi	15,238	2,313	2,568	1,678	2,100	1,560	1,709	27,167
13	Nakhon Si Thammarat	52,700	6,997	6,398	3,666	6,133	4,189	4,499	84,583
14	Sathun	5,390	1,319	1,078	874	1,270	766	1,080	11,778
15	Trang	48,602	8,207	7,863	3,607	7,787	5,602	3,907	85,574
16	Phatthalung	20,731	4,232	2,999	3,019	4,175	3,703	2,767	41,626
17	Songkhla	59,055	7,551	6,603	5,947	7,297	7,741	8,297	102,492
18	Pattani	18,776	2,943	1,620	1,908	2,252	1,506	1,738	30,743
19	Yala	31,769	6,156	4,032	4,932	5,243	5,579	5,295	63,005
20	Narathiwat	44,631	6,217	5,660	4,358	4,350	2,116	4,051	71,383
	Sub-total	353,725	53,213	46,497	34,535	48,408	39,227	38,887	614,492
	Total	369,812	55,874	49,059	37,599	50,949	42,485	42,032	647,809

Source : Office of Rubber Replanting Aid Fund
Ministry of Agriculture and Co-operatives

Productivity of Rubber Wood

1. Data-based Informations

In assessing the productivity of para-rubber wood, conversion factors are essential informations to be used in evaluating timber output. The informations concerned are as follows :

Table 5 Existing Old Rubber Plantations Left of Replanting (after 1987)

No	Region/Province	Total Planted Area in 1978	Planted Area in Protective Forests in 1978	Total Replanted Area from 1961-1987	Plantation Area Left for Replanting
	Central & East				
1	Chachoengsao	-	-	-	-
2	Chonburi	154	-	-	154
3	Rayong	47,972	-	13,772	34,200
4	Chanthaburi	50,273	-	9,571	40,702
5	Trad	33,264	-	9,974	23,290
	Sub-total	131,663	-	33,317	98,346
	South				
6	Prachuap Khiri Khan	-	-	-	
7	Chumphon	10,520	369	1,340	8,811
8	Ranong	3,388	17	768	2,603
9	Suratthani	125,263	4,806	52,555	67,902
10	Phang-nga	68,265	5,617	30,230	32,417
11	Phuket	14,663	1,642	11,249	1,771
12	Krabi	85,758	7,392	27,167	51,199
13	Nakhon Si Thammarat	194,460	10,705	84,583	99,173
14	Sathun	23,023	6,378	11,778	4,867
15	Trang	145,886	11,235	85,574	49,077
16	Phatthalung	70,954	4,823	41,626	24,504
17	Songkhla	224,128	17,725	102,492	103,911
18	Pattani	48,360	839	30,743	16,779
19	Yala	140,088	14,345	63,005	62,737
20	Narathiwat	132,279	7,205	71,383	53,691
	Sub-total	1,287,035	93,100	614,492	579,443
	Total	1,418,698	93,100	647,809	677,789

1) **Volume Table.** According to the RFD's recently random survey, the 931 rubber trees from various plantations dispersing throughout the eastern and the southern regions were cut down and measured. A feasible mathematical model of

$$Y = 0.0000461696 \times^{2.08164}$$

Y = total output, m^3/tree

X = girth at breast height (1.30 m), cm

has been introduced to evaluate total output of rubber tree (Table 6). In addition, the output is divided into rounded or sawn timber, fuelwood or wood residues, and pole or pile with the proportions of about 49.05, 38.72, and 12.23 percent, respectively. Furthermore, the other measurement is also

Table 6. Volume Table of Para-rubber Tree by Girth Limit

GBH (cm)	Volume (cu.m/tree)	GBH (cm)	Volume (cu.m/tree)	GBH (cm)	Volume (cu.m/tree)	GBH (cm)	Volume (cu.m/tree)	GBH (cm)	Volume (cu.m/tree)
40	0.099832	73	0.349240	106	0.759125	139	1.334570	172	2.079320
41	0.105097	74	0.359272	107	0.774112	140	1.354530	173	2.104570
42	0.110504	75	0.369452	108	0.789246	141	1.374850	174	2.129970
43	0.116051	76	0.379781	109	0.804533	142	1.395230	175	2.155530
44	0.121740	77	0.390257	110	0.819977	143	1.415760	176	2.181250
45	0.127570	78	0.400881	111	0.835568	144	1.436450	177	2.207120
46	0.133542	79	0.411654	112	0.851317	145	1.457290	178	2.233160
47	0.139657	80	0.422576	113	0.867213	146	1.478290	179	2.259360
48	0.145913	81	0.433646	114	0.883266	147	1.499450	180	2.285710
49	0.152313	82	0.448640	115	0.899472	148	1.520760	181	2.312220
50	0.158855	83	0.456232	116	0.915829	149	1.542230	182	2.338900
51	0.165540	84	0.467749	117	0.932340	150	1.563850	183	2.365730
52	0.172368	85	0.479416	118	0.949007	151	1.585630	184	2.392720
53	0.179340	86	0.491231	119	0.965822	152	1.607570	185	2.419870
54	0.186456	87	0.503198	120	0.982794	153	1.629660	186	2.447170
55	0.193716	88	0.515313	121	0.999928	154	1.651910	187	2.474640
56	0.201119	89	0.527575	122	1.017200	155	1.674320	188	2.502270
57	0.208668	90	0.539990	123	1.034630	156	1.696390	189	2.530060
58	0.216361	91	0.552553	124	1.052220	157	1.719610	190	2.558000
59	0.224198	92	0.565268	125	1.069960	158	1.742480	191	2.586110
60	0.232181	93	0.578136	126	1.087860	159	1.765520	192	2.614370
61	0.240309	94	0.591151	127	1.105910	160	1.788710	193	2.642790
62	0.248582	95	0.604319	128	1.124110	161	1.812060	194	2.671380
63	0.257001	96	0.617634	129	1.142470	162	1.835570	195	2.700120
64	0.265566	97	0.631101	130	1.160980	163	1.859240	196	2.729030
65	0.274277	98	0.644722	131	1.179650	164	1.883060	197	2.758090
66	0.283134	99	0.658489	132	1.198470	165	1.907040	198	2.787310
67	0.292137	100	0.672414	133	1.217450	166	1.931180	199	2.816700
68	0.301287	101	0.686487	134	1.236580	167	1.955470	200	2.846250
69	0.310583	102	0.700711	135	1.255870	168	1.979930		
70	0.320028	103	0.715089	136	1.275310	169	2.004540		
71	0.329617	104	0.729614	137	1.294910	170	2.029310		
72	0.339354	105	0.744296	138	1.314660	171	2.054230		

Source : Forest Economics Subdivision, Planning Division, RFD

Table 7. Annually Expected Output of Para-rubber Wood

No	Region/Province	Annual Replanting Target (ha)	Annually Expected Output in 1989-1991 (cu.m/year)			
			Wood Residue	Pole & Pile	Round Timber	Total
	Central & East					
1	Chachoengsao	-	-	-	-	
2	Chonburi	-	-	-	-	
3	Rayong	1,376	90,055.45	28,892.40	117,294.15	236,242.00
4	Chanthaburi	2,944	192,676.78	61,816.29	250,954.93	505,448.00
5	Trad	1,376	90,055.45	28,892.40	117,294.15	236,242.00
	Sub-total	5,696	372,787.68	119,601.08	485,543.24	977,932.00
	South					
6	Prachuap Khiri Khan	-	-	-	-	
7	Chumphon	640	41,886.26	13,438.32	54,555.42	109,880.00
8	Ranong	256	16,754.50	5,375.33	21,822.17	43,952.00
9	Suratthani	5,648	369,646.21	118,593.21	481,451.58	969,691.00
10	Phang-nga	272	17,801.66	5,711.29	23,186.05	46,699.00
11	Phuket	608	39,791.94	12,766.41	51,827.65	104,386.00
12	Krabi	208	13,613.03	4,367.46	17,730.51	35,711.00
13	Nakhon Si Thammarat	6,304	412,579.62	132,367.49	537,370.89	1,082,318.00
14	Sathun	656	42,933.41	13,774.28	55,919.31	112,627.00
15	Trang	4,752	311,005.45	99,779.56	405,073.99	815,859.00
16	Phatthalung	2,160	141,366.11	45,354.34	184,124.54	370,845.00
17	Songkhla	7,344	480,644.79	154,204.77	626,023.44	1,260,873.00
18	Pattani	1,120	73,300.95	23,517.07	95,471.99	192,290.00
19	Yala	5,936	388,495.02	124,640.46	506,001.52	1,019,137.00
20	Narathiwat	4,880	319,382.70	102,467.22	415,985.08	837,835.00
	Sub-total	40,784	2,899,576.07	930,267.98	3,776,598.95	7,606,443.00
	Total	46,480	3,272,363.75	1,049,869.06	4,262,142.19	8,584,375.00

undertaken to reveal the solid volume of short-length timber which is about 0.673 time of the stack volume.

2) **Productivity of the plantation.** According to the RFD's recent random survey, 235 sample plots (1 rai or 0.16 hectare/plot) from different plantations throughout the eastern and southern Thailand were measured. The productivity was assessed by using volume table model mentioned. The calculating result was that, at the 3 × 8 m spacing basis, the total productivities of rubber plantations were approximateiy 145.69, 161.26, 167.94, 170.50, 176.88, and 207.75 m^3/hectare (true volume) at the ages of 19, 20, 21, 22, 23, and 24 years, respectively.

3) **Recovery Rates.** Also, by the RFD's recent random survey 1,402 of short-length timbers and 65 of long-length logs from 35 sawmills and wood working plants spreading throughout the East and South were cut and measured. The results are that the recovery rate of each short-length timber and long-length timber are approximately 38.47 and 41.01 percent of solid volume of logs, respectively.

2. Annual Expected Timber Outputs

Pending annual replanting target areas (50,000 hectares) to assess the output of para-rubber timber supplies, and average productivity of each plantation (1 hectare = 171.67 m^3) as mentioned above, the rubber plantations throughout the country can produce timbers to be utilized in each year with the expecting volume of 8,584,735 m^3. The volume can be estimated and divided into wood residues, pole and pile, and roundwood with the annual volume of 3,272,364, 1,049,869 and 4,262,142 m^3, respectively (Table 7).

CONCLUSIONS

Currently, there are 1.72 million hectares of rubber plantation grown in Thailand. Most of them are private-owned existing in the South with the area of 1.55 million hectares or approximately 90% of the total plantation areas, the rests are in the East. Year by year, the rubber trees are cut down and replanted the high-yielded varieties with the target areas of about 50,000 hectares all over the country, However, only 42,032 hectares of old stock rubber plantations were cut and produced utilizable timbers of 10.72 million m^3 in 1987. The rubber wood harvested consisted of 49.05% sawn timber, 38.72% fuelwood or wood residues, and 12.23% pole and pile.

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