Leaflet No. 15/83-84

Government of the Union of Myanmar
Ministry of Forestry
Forest Department
Forest Research Institute
Yezin

Preliminary Study on Acid Stimulation Method in Oleoresin Production

Htun Aung and Myo Aung
Forest Research Institute
February, 1984

ထင်းရှူးဆီထုတ်လုပ်ခြင်းလုပ်ငန်းတွင် အက်စစ်ဖြင့် ထွက်နှုန်းမြှင့်တင်ခြင်းနည်းအား ကနဦးစမ်းသပ်လေ့လာခြင်း

ဦးထွန်းအောင် နှင့် ဦးမျိုးအောင်
သစ်တောသုတေသနဌာန-ရေဆင်း

စာတမ်းအကျဉ်းချုပ်

ရှမ်းပြည်နယ်တောင်ပိုင်း ထင်းရှူးသစ်တောကြိုးဝိုင်းများတွင် ထင်းရှူးဆီကြမ်းများကို ယူဘာရီးကေနည်းဖြင့် ထုတ်လုပ်လျက် ကလော ထင်းရှူးဆီစက်ရုံတွင် ပြည်တွင်းသုံးအတွက် ချက်လုပ်လျက်ရှိပါသည်။ ထင်းရှူးဆီကြမ်း အထွက်နှုန်း တိုးတက်စေရန် ရည်ရွယ်ချက်ဖြင့် အက်စစ်ဖြင့် ထွက်နှုန်းမြှင့်တင်ခြင်းနည်းအားဖြင့် လေ့လာခဲ့ပြီး ထွက်နှုန်းမြှင့် ပစ္စည်းအဖြစ် အသုံးပြုသော ဆာလ်ဖျူရစ်အက်စစ်ဖြင့် ထင်းရှူးဆီကြမ်း အထွက်နှုန်းအပေါ် အကျိုးသက်ရောက်မှု ပဏာမ လေ့လာချက်ကို ဤစာတမ်းတွင် ဖော်ပြထားပါသည်။

Preliminary Study on Acid Stimulation Method in Oleoresin Production.

U Tun Aung and U Myo Aung
Forest Research Institute

Abstract

Oleoresin in the Pine Forest Reserves of Southern Shan State, is still produced by the U B A R I - K method and distilled in Kalaw Turpentine plant for domestic use. With the object of increasing the yield in oleoresin production, the acid stimulation method was studied and this paper describes the preliminary study of the effect of sulphuric acid as the stimulant on the gum yield.

Introduction

Oleoresin, found only in pine trees, yields turpentine and rosin on distillation. It may be found in pine parenchyma and thin walled epithelial cells surrounding longitudinal and transverse resin canals (Mirov, N.T., 1967). When the resin canals are exposed by wounding, the oleoresin in the sapwood, oozes from the epithelial cells into the resin canals. This resin flow is collected in the receptacles hung on the tree. On the other hand, the gum from heartwood is not fluid and does not flow from newly opened canals (Panshin, A.J. 1950).

Young trees with full rounded crowns on one-third to one- half of the bole, with a high percentage of sapwood, are usually chosen for resin tapping for peak production. In practice, trees should be more than 17 years old and about 56 inches girth before starting a turpentine operation (Panshin, A.J., 1950).

Although it is possible to tap the tree throughout the year, the tapping season lasts about eight months. The hottest weather may produce large portion of their yearly flow and the winter chipping yield the least amount (Panshin, A.J., 1950). In the rainy season, the rain increase the moisture content in the resin decreasing the quality of the oleoresin.

In tapping, various methods are used modifying the two basic methods, " The light tapping" and " Tapping to death". Oleoresin can be obtained in the former method without causing the death of the trees, allowing collection for a longer period. The later method is used for the trees which are about to be felled (Saw Tun Khaing. U., 1975).

The resin tapping procedures include all operations such as selection of trees, making of blaze on face on the trees, fixing the receptacles to collect the resin, freshening the blaze, collection of oleoresin and removal of solidified oleoresin from the surface (Saw Tun Khaing U., 1975).

The fresh method and American Bark -Chipping Method are among the other tapping techniques widely used. The former method involves complete removal of bark from a long (4-5 foot) vertical surface forming a narrow inverted U-shaped face (Panshin, A.J. 1950). The American method involves cutting a deep V-shaped streak diagonally across the bole removing bark and most of the sapwood (Browning, B.L., 1975). Freshening the face was done by cutting an overlapping streak above the old one. Following World War Two this method modified to cut shallower streaks with a chemical spray as a stimulant on it (Saw Tun Khaing, U., 1975). Some chemicals, like sulphuric acid solution, increase the rate of gum flow (Ostrom, C.E, 1946), while the others, like paraquat are used to increase the resin content. This practice was originated in Germany around 1933 and now a wide variety of chemicals, both inorganic and organic, have been used in treating the freshly cut face (Saw Tun Khaing, U., 1975). In the American Bark- Chipping method, 40 to 60 % aqueous solution of sulphuric acid is applied over the freshly cut streak in the form of a fine mist using a spray gun. Special care to assure a light and uniform spray over the streak is required as an excess of acid can diminish the efficiency of the working face. This method is now becoming a regular feature of oleoresin tapping in the United States of America. It was found that yield increased from 100 to 200 % (Saw Tun Khaing U., 1975).

In Burma, a tapping experiment commenced in 1961 and 1962 in Kalaw Pine Forest Reserve by Union of Burma Applied Research Institute (now Central Research Organization). With the aim of developing the pine -gun-naval stores industries in the country, a new technique, UBARI - K* a modification of the American and India method was developed. Although this method was widely used later in Southern Shan State to fulfill the domestic requirement of oleoresin, chemical stimulation method is not still developed in the country (Aung Lin, U., 1962).

Materials and Methods

A group of at least 90 pine trees (Pinus insularis Endl. syn. P. khasya Royle), located in the unclass forest at the edge of Kalaw was chosen and 70 trees above 5 ft. girth at breast height were selected for oleoresin production in November 1982. Measurements of girth at breast height were taken and weeding out around the trees in a six foot circle was done in preparation for the tapping.

The tools used in the resin operation were a hack with a 1 inch blade, a 2 inch long tin gutter strip, a dip iron to remove resin from cups, a 300 ml tin cup, and one nail.

` First, the rough outer bark 9 inches above the ground was removed and a V-shaped streak 9 inches in width and 2.5 inches in height was made on the debarked surface using the hack blade. The surface of streak was scraped no deeper than 1 inch into the sapwood. At the lower edge of V-shaped streak, a 1.5 inches long vertical trough was cut for resin flow and the 300 ml capacity tin cup was hung below the lowest end of the trough (figure 1).

The gum collected in each cup was removed and weight daily using a spring balance and rehung. Daily weighing was continued for all cups until either the resin flow stopped or freshening was started.(Daily collection was made for five days before an every freshening .).

After flow from the first face stopped, a one - quarter inch freshening cut was made above it and overlapping the first face by one-sixteenth inch (Fig. 1.). and not to exceed one inch deep. A 60 % solution of sulphuric acid ** was used as the chemical stimulant.

The chemical was sprayed on the fresh-cut as a fine mist using a hand sprayer.

The total yields of every fine days after each batch of ordinary tapping was tabulated with respect to their girth at breast height. These yield data were collected according to their girth range and the relationship between the average yield per tree per tapping and the girth range was observed graphically. Before the study on the advantage of acid stimulation method, the data of total yield occurred from 5 day collections of one ordinary tapping was treated to divide the tree into two groups. Both the two groups contained the trees with the near same yield to be able to compare their yield when the tapping was carried on by the acid stimulation method on one group.

---

* The method is to cut the first face in 9 inches width just like that when the American method is employed. In India method width of the face is between 4 to 5 inches (Watt. G., 1980). The only difference is instead of having gutters to guide the flow of gum, the base of the V-shape was cut in such a way as to form a channel- like shape along which the exudate is led into a cup hanging below. This method gave a yield slightly higher than by the American method about 8 % (Aung Lin, 1962).

** Prepared from 95-98% W/W, sp. qr. 1.84 acid from E. Merek, and strength determined by titration with standard sodium carbonate solution.

Results and Discussion

The gum yields, in gram, obtained from the ordinary continuous tapping in November 1982, without applying the acid stimulant, are as illustrated in Table (1). Each result represents the total yield for each tree for five days interval of ordinary tapping before the face was freshened.

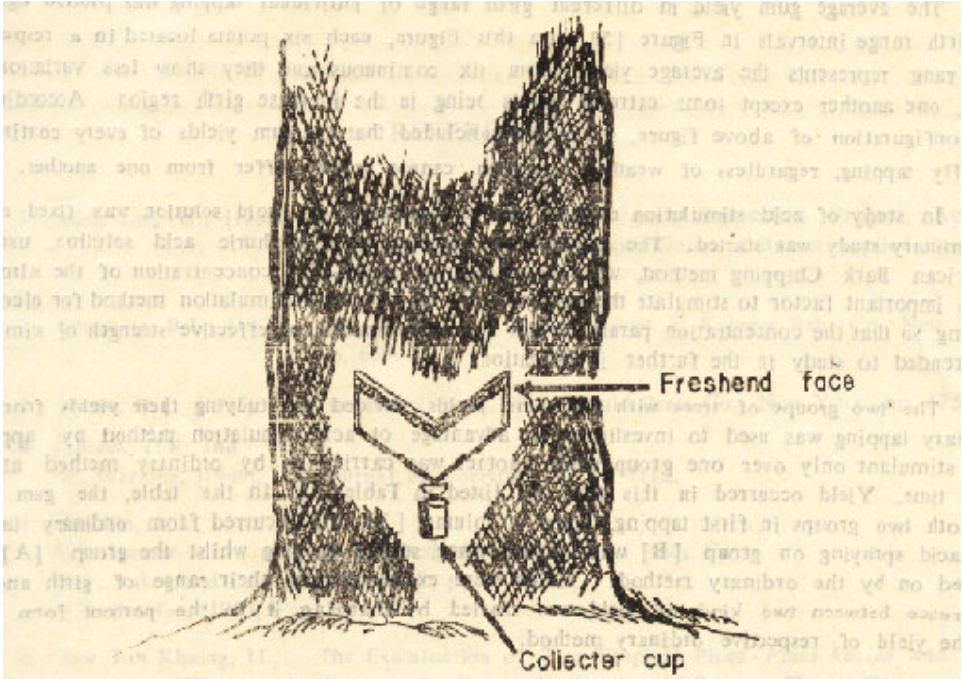

Figure 1. Illustration of the face type of UBARI-K method [The upper part of V-shape streak is the freshening face in which the overlapping area is shown with lined space.]

By studying the gum yields of a tree from every exudations, shown in table (1) there seem to be no great different each other in a continuous operation whilst the yield of separate trees were found to vary considerably. The trend of the gum yield related to the girth can be studied in Table (2 & 3). The frequency tally of girth at breast height in Table (2) and histogram in figure (2) which is a simple image of the frequency distribution of the population show the predominant class of girth of the stem in the experimental site. And the frequency distribution of population with respect to the yield can be studied in Table (3) and Figure (3). They show the maximum class population of girth lies from 60 to 84 inches and that of yield lies from 51 to 100 g.

Study of relationship between the average yield of six times of tapping and the girth, shown in Table (4) and Figure (4), evident that the gum yield is not directly proportional to the girth. The trend of yield is upwards in the range of 96-108 inches in girth. Whilst the maximum population of gum yield lies between 51-100 g as shown in figure (3), the high-yield trees possess the girth from 96 to 108 inches in Figure (4) showing the decreasing of yield in increase in girth over 108 inches.

The average gum yield in different girth range of individual tapping was plotted against, the girth range intervals in Figures (5). In this Figure, each six points located in a respective girth range represents the average yield from six containuous and they show less variation, in yield, one another except some extreme, points being in the increase girth region. According to the configuration of above figure, it can be concluded that the gum yields of every continuous serially tapping, regardless of weather condition, cannot greatly differ from one another.

In study of acid stimulation method, the concentration of acid solution was fixed as the preliminary study was started. The maximum concentration of sulphuric acid solution, used in American Bark Chipping method, was chosen for this study. The concentration of

the stimulant is an important factor to stimulate the gum yield in the chemical stimulation method for oleoresin tapping so that the concentration parameter for the determination of effective strength of stimulant is intended to study in the further investigation.

The two groups of trees with the same yields, divided by studying their yields from the ordinary tapping was used to investigate the advantage of acid stimulation method by applying acid stimulant only over one group while another was carried on by ordinary method at the same time. Yield occurred in this test, are listed in Table (5). In the table, the gum yield of both two groups in first tapping, listed in colum (3), are occurred from ordinary tapping. The acid spraying on group (B) was started since second tapping whilst the group (A) was carried on by the ordinary method. Yields were examined with their range of girth and the difference between two kinds of yield was studied by changing it to the percent form based on the yield of respective ordinary method.

Table (6) shows the average yield and percent of two kinds of yield in continuous tapping. Figure (6), a plot of the percent yield of acid stimulation methods against the number of the times of tapping shows the surprising increase in yield in introducing the stimulant to the tree but becoming decrease in the continuous operation of acid stimulation method.

The average gum yield of the first acid stimulation method was 217% higher than that of the ordinary method. The cause of increase in yield in the later continuous tapping is considered to be due to the application of strong acid. The period of rest is also an important factor for under tapped pine tree for the recovery of loss of gum. By using the more diluted sulphuric acid solution or by alternative acid spraying to the ordinary tapping, it must be possible to maintain the high yield by effective use of stimulant.

Observation

The sulphuric acid, although 60% solution used in this investigation gave unsatisfactory result in the flow of gum yield, was found to be a propective acid stimulant for pine-gum-naval stores production if the proper strength for stimulation can be determined. But the high concentration of acid solution and continuous acid spraying over every freshening should be avoided in observation of the appropriate conditions.

In order to get the higher yield of oleoresin, the concentration parameter study should be carried out on more experiments for sufficient information and definite conclusion. Similarly, the proper period of rest, another important factor in acid stimulation method, also have to be studied. At present, testing with the different concentrations of sulphuric acid solution under 60% and different number of times of acid spraying, one per two times of tapping and one per three times of tapping are being undertaken.

Table 1. The total gum yields of 5 days collections obtained from the ordinary continuous tapping done in November 1982.

Girth * (in.)	Gum Yield (gram)						
	1st Tapping	2nd Tapping	3rd Tapping	4th Tapping	5th Tapping	6th Tapping	Mean
52	39.0	35.0	50.0	50.0	40.0	50.0	43.0
54	54.0	54.0	50.0	50.0	50.0	50.0	51.0
55	88.0	60.0	60.0	30.0	30.0	30.0	50.0
56	60.0	60.0	55.0	55.0	50.0	50.0	55.0
56	10.0	10.0	10.0	10.0	10.0	10.0	10.0
57	90.0	90.0	50.0	50.0	90.0	90.0	77.0
58	65.0	65.0	70.0	70.0	65.0	65.0	67.0
59	120.0	120.0	70.0	70.0	100.0	100.0	97.0
60	50.0	50.0	40.0	40.0	50.0	50.0	47.0
60	226.8	226.8	150.0	150.0	120.0	150.0	171.0
61	50.0	50.0	40.0	30.0	30.0	40.0	40.0
62	50.0	50.0	40.0	40.0	50.0	60.0	48.0
63	80.0	80.0	70.0	70.0	80.0	80.0	77.0
64	92.0	90.0	90.0	95.0	95.0	95.0	93.0
65	80.0	70.0	70.0	80.0	80.0	85.0	78.0
66	120.0	120.0	110.0	110.0	120.0	120.0	117.0
69	80.0	50.0	60.0	80.0	80.0	80.0	72.0
69	54.0	54.0	50.0	40.0	50.0	50.0	50.0
69	50.0	60.0	50.0	60.0	60.0	60.0	57.0
71	226.0	100.0	150.0	150.0	200.0	200.0	171.0
71	58.0	58.0	50.0	50.0	55.0	55.0	54.0
71	130.0	120.0	110.0	120.0	120.0	130.0	122.0
71	80.0	80.0	70.0	70.0	60.0	60.0	70.0
72	118.0	100.0	100.0	70.0	70.0	80.0	90.0
72	60.0	60.0	55.0	55.0	50.0	60.0	57.0
73	96.0	80.0	90.0	90.0	80.0	100.0	89.0
74	158.76	158.76	150.0	150.0	120.0	120.0	143.0
74	72.0	72.0	70.0	70.0	70.0	70.0	71.0

* Girth at breast height.

Table 1. The total gum yields of 5 days collections obtained from the ordinary continuous tapping done in November 1982.

Girth * (in)	Gum Yield (gram)						
	1st Tapping	2nd Tapping	3rd Tapping	4th Tapping	5th Tapping	6th Tapping	Mean
75	128.0	130.0	130.0	120.0	100.0	110.0	120.0
76	20.0	50.0	50.0	60.0	50.0	85.0	53.0
76	128.0	120.0	100.0	120.0	120.0	180.0	128.0
77	54.0	50.0	50.0	30.0	40.0	40.0	44.0
77	50.0	50.0	40.0	40.0	50.0	50.0	47.0
77	90.0	90.0	85.0	85.0	90.0	95.0	89.0
80	120.0	80.0	80.0	100.0	120.0	120.0	103.0
80	20.0	20.0	20.0	20.0	20.0	20.0	20.0
81	115.0	115.0	110.0	110.0	120.0	120.0	115.0
83	50.0	50.0	70.0	70.0	70.0	70.0	63.0
84	100.0	100.0	70.0	70.0	80.0	100.0	87.0
84	80.0	80.0	100.0	100.0	110.0	110.0	97.0
84	75.0	70.0	75.0	75.0	70.0	70.0	73.0
88	50.0	50.0	60.0	70.0	70.0	70.0	62.0
90	96.0	90.0	80.0	80.0	90.0	90.0	88.0
91	60.0	40.0	50.0	60.0	60.0	60.0	55.0
91	60.0	60.0	55.0	50.0	50.0	50.0	54.0
93	80.0	80.0	70.0	70.0	80.0	100.0	80.0
94	74.0	70.0	70.0	75.0	80.0	80.0	75.0
94	226.8	150.0	150.0	180.0	120.0	120.0	158.0
99	226.8	226.8	180.0	180.0	130.0	130.0	179.0
100	226.8	226.8	130.0	130.0	150.0	150.0	169.0
104	70.0	70.0	50.0	60.0	70.0	70.0	65.0
107	50.0	40.0	40.0	50.0	50.0	50.0	47.0
108	70.0	70.0	60.0	50.0	50.0	60.0	60.0
109	90.0	90.0	95.0	95.0	100.0	100.0	95.0
114	226.8	226.8	120.0	150.0	150.0	150.0	171.0
118	100.0	100.0	90.0	80.0	80.0	90.0	90.0
118	226.8	226.8	180.0	150.0	150.0	150.0	181.0
153	28.0	28.0	20.0	20.0	10.0	10.0	19.0

* Girth at breast height.

Table 2. Frequency tally of girth at breast height data.

Class Symbol	Interval (in.)	No. of trees
A	48-59	8
B	60-71	15
C	72-83	15
D	84-95	10
E	96-107	4
F	108- above	10

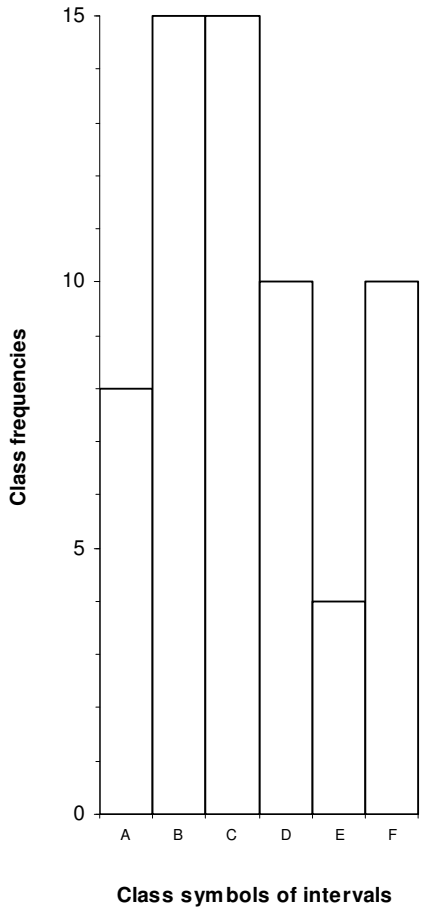

Figure 2. Plot of the class frequencies (or number of frees) as a function of the class symbols of intervals.

Table 3. Frequency tally of gum yield data.*

Class Symbol	Interval (g)	No. of trees
A	0-50	13
B	51-100	29
C	101-150	8
D	151-200	1
E	201-250	7

* Date of mean yield listed in table 1. are used to process.

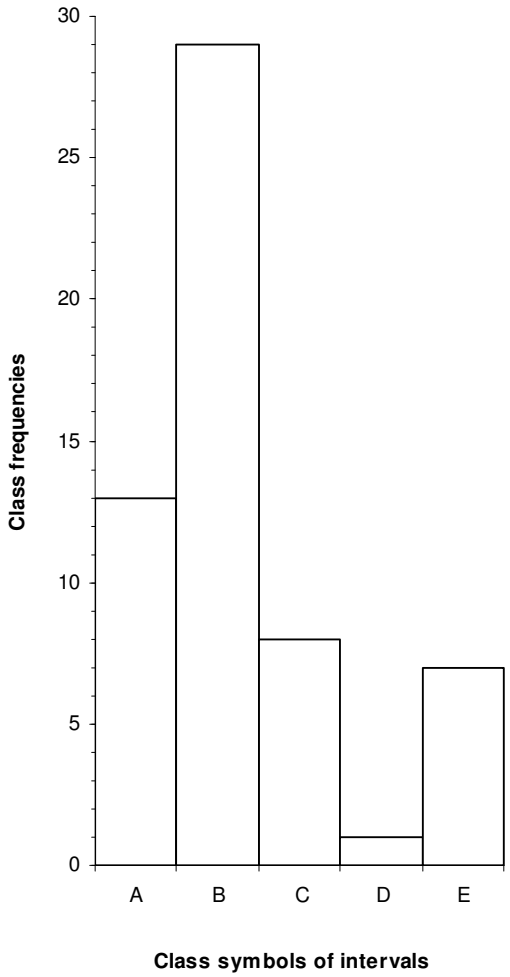

Figure 3. Plot of the class frequencies (or number of frees) as a function of the class symbols of intervals.

Table 4. The average of the total yield of 5 days collection with respect to their interval of girth at breast height.

Class Symbol	Girth Interval (in.)	Average yield (g)						
		1st	2nd	3rd	4th	5th	6th	Mean
A	48-59	65	62	52	48	54	54	56
B	60-71	95	84	77	79	83	88	84
C	72-83	85	82	80	79	78	88	82
D	84-95	90	79	78	83	81	85	83
E	96-107	143	141	100	105	100	100	115
F	108-above	124	124	94	91	90	93	103

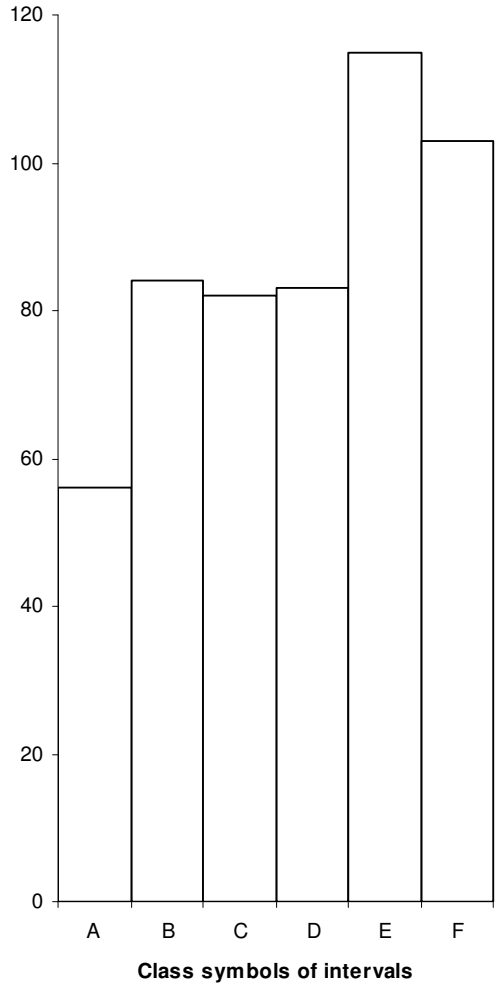

Figure 4. Plot of the average gum yield as a function of the class symbols of intervals.

Table 5. The total gum yields of 5 days collections from the ordinary tapping and from acid stimulation method done in February 1983.

Group *	Girth (in.)	Gum yield (g)				
		1st	2nd	3rd	4th	5th
A	54	90	240	50	130	90
	56	50	180	20	70	60
	59	220	80	80	40	110
	63	140	90	50	70	50
	65	265	90	40	90	60
	69	250	140	100	110	100
	69	340	80	160	210	200
	72	140	210	80	140	80
	72	140	40	90	120	100
	77	200	260	120	150	160
	77	240	100	120	110	70
	79	195	150	260	300	220
	80	300	180	130	180	20
	80	350	400	340	310	280
	82	100	120	180	280	190
	83	220	210	150	150	110
	84	170	180	90	80	90
	87	290	140	270	260	220
	88	210	120	150	200	100
	90	120	20	20	30	80
	93	180	40	20	20	50
	100	240	100	200	110	160
	104	240	180	220	180	160
B	52	140	70	20	50	30
	55	205	240	20	30	10
	56	45	170	20	50	50

Table 5. (Concld)

Group *	Girth (in.)	Gum yield (g)				
		1st **	2nd	3rd	4th	5th
B	57	150	460	90	170	130
	58	80	60	20	40	20
	60	180	240	170	70	10
	61	100	230	40	60	50
	62	110	340	70	90	100
	66	120	355	170	140	220
	69	190	330	20	70	40
	69	160	390	20	60	50
	71	290	550	40	100	100
	71	15	260	30	50	30
	72	230	470	120	20	20
	73	150	260	20	90	40
	74	330	390	80	90	40
	74.5	210	200	100	80	20
	76	230	360	70	90	80
	76	230	410	60	80	60
	76	330	305	10	190	10
	77	90	390	20	60	70
	79	80	10	30	20	0
	81	260	390	220	90	20
	84	280	540	70	80	60
	86	195	240	90	20	20
	91	130	160	20	30	30
	94	230	210	20	90	40
	107	20	40	20	40	20
	114	130	355	170	80	50

* Trees in group A were tapped ordinarily & those in group B were acid treated.
** Both group A and B were ordinarily tapped in first chipping to study their normal yield.

Table 6. The average of the total gum yield and percent yield obtained from the ordinary tapping and acid treated tapping with respect to their girth at breast height.

Girth range (in.)	Average yield and percent yield *									
	1st**		2nd		3rd		4th		5th	
	A***	B****	A	B	A	B	A	B	A	B
48-59	120	124	167	200	50	34	80	68	87	48
%	100.00%	103.33 %	100.00 %	119.98%	100.00%	68.00%	100.00%	85.00%	100.00%	55.36%
60-71	249	146	100	337	88	70	120	80	103	75
%	100.00%	58.52 %	100.00 %	336.90 %	100.00%	80.00%	100.00%	66.67%	100.00%	73.17%
72-83	221	214	186	339	163	73	193	81	136	36
%	100.00%	97.01%	100.00%	182.38%	100.00%	44.70%	100.00%	41.90%	100.00%	26.57%
84- above	207	164	111	258	139	65	126	57	123	37
%	100.00%	79.29%	100.00%	231.15%	100.00%	46.90%	100.00%	45.11%	100.00%	29.86%
Mean	199 ± 56	162± 38	141+42	284+67	110 ±51	61± 18	130± 47	72±11	112± 22	49±18
%	100.00 ± 0	84.54 ± 20.10	100.0 ± 0	217.60±91.76	100.00± 0	59.90 ± 17.01	100.00 ± 0	59.67 ±20.15	100.00 ± 0	46.24± 22.09

* Percent yield was calculated based on the yield of group A.

** Both the group A and B in first tapping were operated without acid treatment.

*** Group A was tapped ordinarily throughout the experiment.

**** Group B was acid treated in second to fifth tappings.

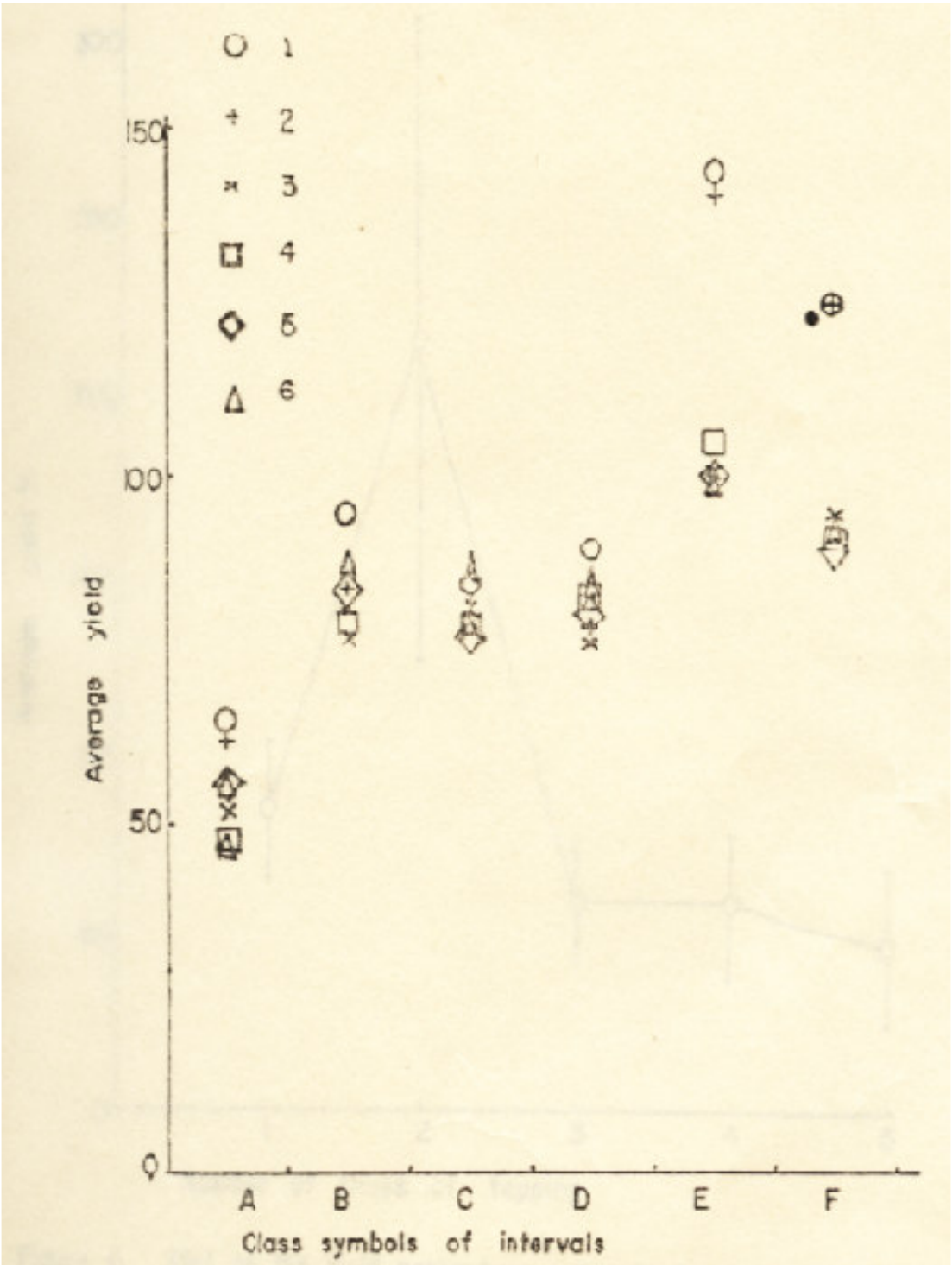

Figure 5. Plot of the yields of six times of tapping as a function of the class symbols of intervals (girth).

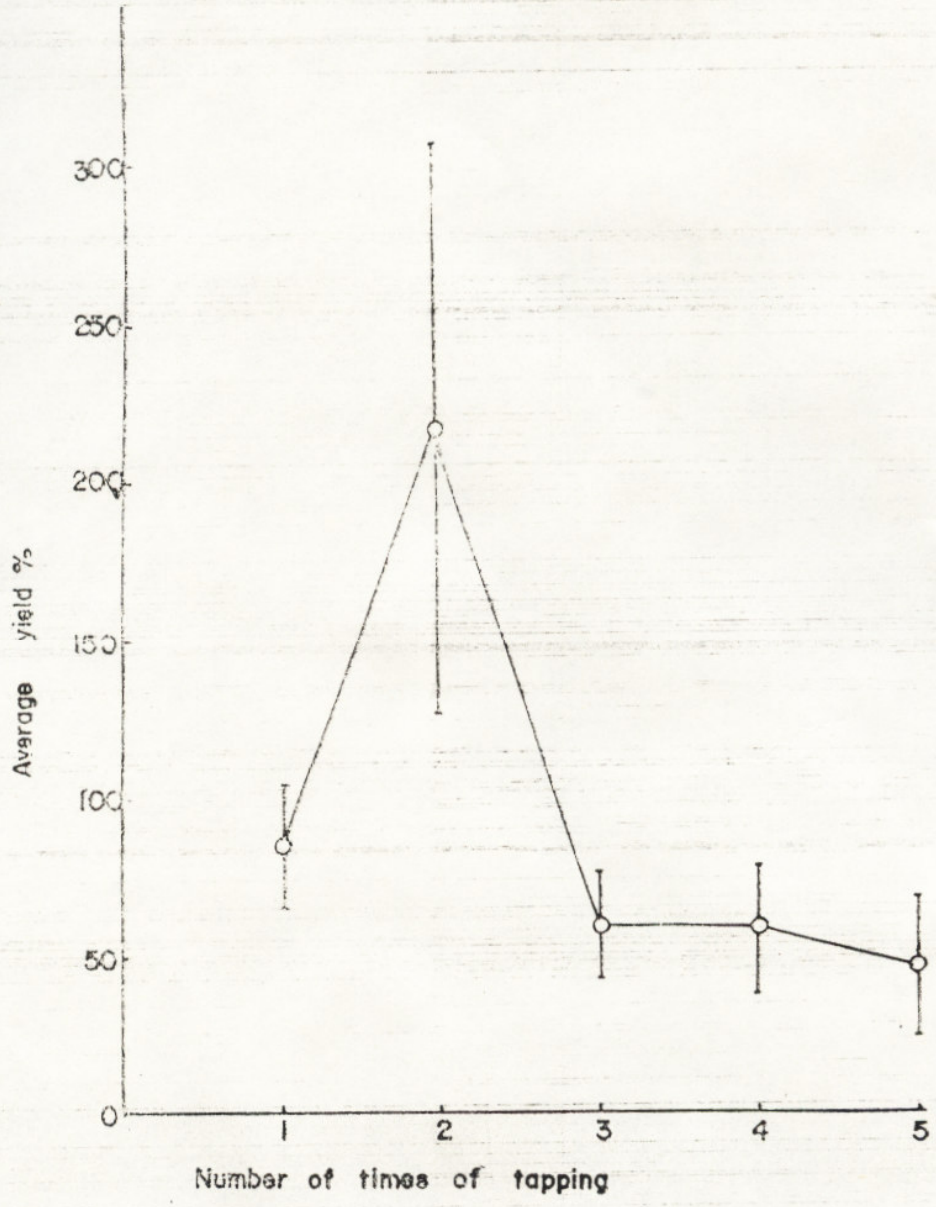

Figure 6. Plot of the yield percentage of acid-treated trees as the function of number of times of tapping.

References

1. Aung Lin, U., (1962). Interim Report on Rosin and Turpentine Project, Applied Chemistry Research Department, Union of Burma Applied Research Institute, Rangoon ,pp. 4.
2. Browning , B.L., (1975). The Chemistry of Wood, Robert E. Krieger Pub Co. New York, pp 666.
3. Mirov, N.T., (1967). The Genus Pinus, The Ronald Press Co., New York, pp 575.
4. Ostrom , C.E. and W. Warning, (1946). Journal of Forestry, pp. 44,1112.
5. Panshin, A.J., E.S. Harrar, W.J. Baker and P.B Proctor (1950), Forest Products, MoGraw-Hill Bock Co., New York, pp 526
6. Saw Tun Khaing, U., (1975). The Examination of two Tropical Pines-Pinus kasiya and Pinus merkusii for Future Application in Burma, Thesis, Department of Forestry, University of Aberdeen, pp 171.
7. Watt, G., (1890). The Economic Products of India, Office of the Supritendent of Government Printing Calcutta, pp. 643.