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Investigation on the Suitability of Sit, Mezali, Bawzagaing and Paukpanbyu for Charcoal Manufacture

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မဲဇလီ၊ စစ်၊ ဘောစကိုင်းနှင့် ပေါက်ပန်းဖြူသစ်(၄)မျိုးတို့အား မီးသွေးဖုတ်ရန် ကောင်းမွန်ခြင်း ရှိ၊ မရှိ စမ်းသပ်လေ့လာခြင်း

ဦးစိုးမြင့်သိမ်း၊ M.Sc. (GDR) ၊ အကြီးတန်းသုတေသနမှူး
သစ်တောသုတေသနဌာန၊ ရေဆင်း

စာတမ်းအကျဉ်းချုပ်

မြန်မာနိုင်ငံတွင် စိုက်ပျိုးလျှက်ရှိသော အကြီးမြန်သည့် မဲဇလီ၊ စစ်၊ ဘောစကိုင်းနှင့် ပေါက်ပန်းဖြူတို့ကို မီးသွေးဖိုစနစ် (၄)မျိုးတို့ဖြင့် သစ်တောသုတေသနဌာန၊ ရေဆင်းတွင် မီးသွေးဖုတ် စမ်းသပ်ခဲ့ပါသည်။ မီးသွေးဖို တစ်မျိုးစီမှထွက်နုန်းများကို နှိုင်းယှဉ်ပြထားသည့်အပြင် ဖိုစနစ်တစ်မျိုးတည်းမှ ရရှိသော သစ်(၄)မျိုး၏ မီးသွေးများအား အတန်းအစားနှင့်အရည်အသွေး ခွဲခြားသိရှိနိုင်ရန် လိုအပ်သော စမ်းသပ်ချက်များကို တင်ပြထားပါသည်။

Investigation on the Suitability of Sit, Mezali, Bawzagaing and Paukpanbyu for Charcoal Manufacture

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Abstract

The performance of four fast-growing species, namely Sit (*Albizzia procera* Benth.), Mezali (*Cassia siamea* Lan.), Bawzagaing (*Leucaena glauca* Benth.) and Paukpanbyu (*Sesbania grandiflora* Pers.) in the carbonization process was conducted at the Forest Research Institute, Yezin using a beehive type mud kiln. The yields and quality of charcoal of the four species were compared. All species were acceptable for domestic consumption but Sit was the most suitable.

Contents

1. Introduction

About sixty percent of all wood taken from the forest is believed to be burnt as fuel either directly or by first converting it into charcoal. The amount of fuelwood used to make charcoal can only be estimated, but it is probably round about 20% of the fuelwood consumed per year throughout Burma. (FAO) (Anon)

Charcoal in the Socialist Republic of the Union of Burma is mainly used as domestic fuel for cooking and heating, etc. Raw material for charcoal-making is supplied from the reserved and public forests. Charcoal burning is not generally allowed in the reserves, except in the delta area. The mangrove forests produce large quantities of wood for charcoal and supplies the most densely-populated Irrawaddy Delta and the capital city of Rangoon. Generally, the people of the towns and cities are the main users of charcoal and the price continues to rise. To augment the shortage of fuelwood and charcoal supply, the Forest Department has planned to increase the local supply by establishing plantation. Fast-growing species like Sit, Mezali, Bawzagaing, Paukpanbyu, Kokko (*Albizzia lebbek* Benth.), Sha (*Acacia Catechu* Willd.) etc. are chosen for afforestation in the local supply plantations and village woodlots (Anon 1984).

In this paper, four fast-growing species were investigated as to their suitability for carbonization. They are Sit, Mezali, Bawzagaing and Paukpanbyu. The collected wood species were carbonized in a local beehive mud kiln. The yields from the different species were compared, and the quality assessed and graded at the Central Research Organization, Rangoon.

No evidence could be found of any recorded investigations of charcoal made from Sit, Mezali, Bawzagaing, or Paukpanbyu in Burma. A rating of some other species tested for use as charcoal is appended.

2. Materials and Methods

The woods

The woods of Mezali and Paukpanbyu were bought in the villages of Lebyin, Paukkone and Yezin, Pyinmana Township. Thinning poles of Bawzagaing, Mezali and Sit were collected near the Moswe Forest Research Station.

The sizes and age of materials varied. Paukpanbyu and Bawzagaing were about 6 years old and two feet in girth, while the Sit and Mezali were about 15 years old and 3 feet in girth.

The logs and poles were transported to the Forest Research Institute, Yezin. The wood was cut and split into the sizes appropriate for carbonization. The wood was measured for volume and stacked in the open air. When the moisture content of the wood was 30 to 35 percent (partially seasoned), it was considered ready for carbonization.

The Kiln

Several types of carbonization systems are used for charcoal production in Burma. In this study however, the local type mud beehive kiln was used. This type of kiln is commonly used in Burma, especially in the Forest and nearby villages. Locally, it is known as the "Chinese Type" charcoal kiln and generally has the following shape.

A round pit 6' x 6' in diameter and 5' deep is dug. The hole is topped with a mud dome, which is opened for loading and unloading (See Plate I & II). The mud dome is shaped as a beehive and is four feet ten inches high. Firing box is dug beside the kiln which is 3' x 3' wide and five feet deep into the earth. Two air outlets or smoke outlets 3 inches diameter are dug also opposite the loading hole and firing hole. These two smoke outlets and firing box are also 5 feet deep. They are connected to the base of the pit with horizontal dug channels through the pit wall.

The Method

About 300 cu.ft of wood can be carbonized in this kiln. The wood is loaded through the opened loading hole, and the wood poles or stacks are piled in the kiln vertically. The length of the poles are six feet long with an ideal diameter of eight inches. Above this woodpile, more wood is added until the kiln is completely filled. Then the loading hole is closed with stones and mud.

After ensuring that the loading hole is properly closed, the burning started and smoke issued from the outlets. When the fire is well established, the firing hole is closed with earth. The nature of smoke indicates the burning stage, which can be controlled by opening or closing the air inlet hole at the bottom of the kiln. When burning is judged complete, the smoke outlets and air inlet must be carefully sealed with sand and mud. The kiln will cool in about one week, while the whole carbonizing process takes about 10 to 14 days. When the kiln is cooled, it is opened and the charcoal removed from the pit.

The carbonization stage is decisive in charcoal production even through it is not the most expensive one. Unless it is carried out as efficiently as possible, it puts the whole operation of charcoal production at risk.

Experimental Procedure

The charcoal was graded as to amount of usable charcoal, fines (charcoal smaller than 0.5 sq, in), unburned brands and partially burned brands based on volume recovered. The charcoal pieces and brands were piled separately. The remaining charcoal was screened using a 0.5 sq.in. mesh. The ash and charcoal fines were separated on the basis of color. (ash-blue/grey)

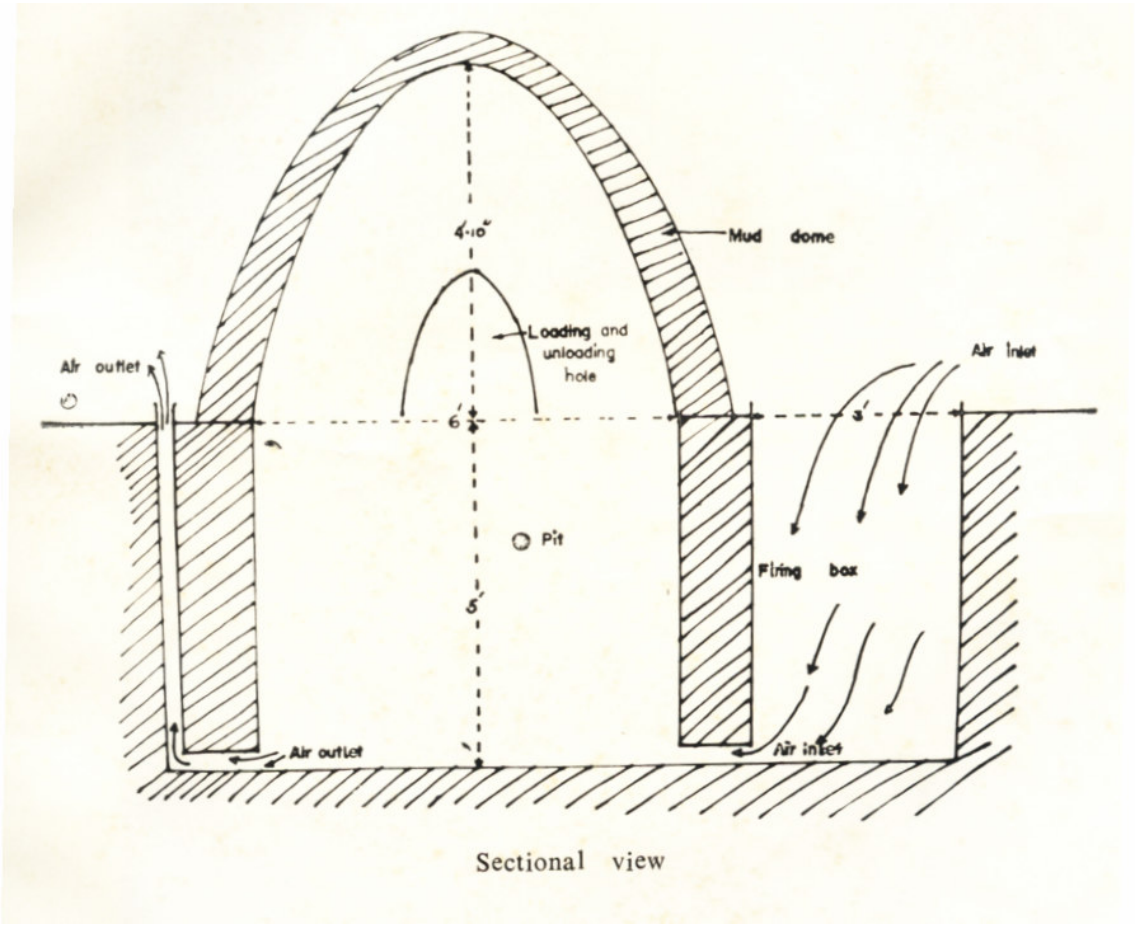
Samples of charcoal from each species were evaluated for use as domestic fuel in representative households. The consumers were asked to rate the charcoal as to: smoke, fire cracking, unpleasant odor, hardness and weight of charcoal and ability to burn cleanly.

Samples of each species were analyzed by the Central Research Organization (CRO) Rangoon and a report requested. According to the standard of quality adopted by the F.A.O, good charcoal of commercial quality should have a calorific value of 13,000 B.T.U per pound of oven dry material (FAO).

Observations were made for firing times, carbonizing time, cooling time as well as species behaviour. During unloading the charcoal was screened and sorted to determine the volume of each grade of charcoal produced.

PLATE I

Local Type Mud Beehive Kiln

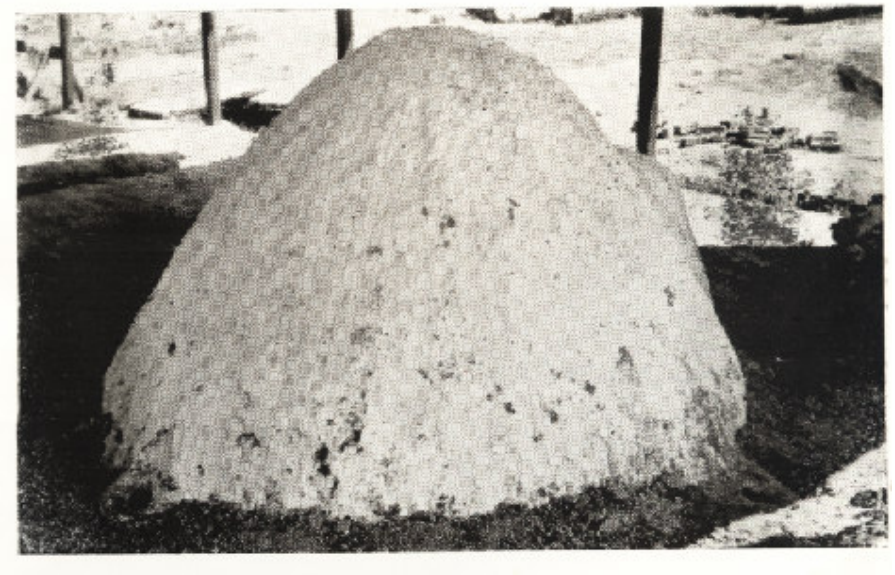


Sectional view

PLATE II

Local Type Mud Beehive Kiln

Front view



Back view

3. Results and Observations

Table I lists the time and yield from each species made into charcoal, Mezali took too much longer time in all stages of carbonization and Paukpanbyu took the least time but had the highest volume of ash fines. In charcoal yield, Sit gave the best results and Paukpanbyu the lowest.

The results of the analyses made by CRO is shown in Table II. It is to be noted that Sit gave the highest BTU value per pound and Paukpanbyu was second. Mezali, a heavier wood, produced the lowest BTU/pound.

The results of the consumer survey of 15 families in the Yezin area is shown in Table III. Each of the families used a sample of each species for about two weeks. Their opinions indicated that Sit burned better than the others but all were usable. There was no objectionable odor, smoke or sparking of any of the species.

4. Discussion and Conclusions

In comparing the charcoal yield, calorific value and acceptability of the four species to determine the most suitable wood, several things must be considered. The time for charcoaling and weight of the yield have economic importance. The calorific value indicates the energy of it produces for the household.

Considering all the factors, Mezali seems to be least useful. Sit, however, appears the most valuable. Paukpanbyu gave the least yields but was second in heat value. Bawzagaing is intermediate all factors.

In conclusion no technical difficulties were encountered with any of these species in the carbonization process. According to the results of the present investigation, Sit is the most suitable species all followed by Paukpanbyu. However, the charcoal obtained from any of the four species tested can be acceptable for domestic consumption.

Table I. Charcoaling Time and Yields- Yezin
Four Species - Local Type Mud Beehive Kiln

Wood Species	Firing* Time	Carbonizing Time	Sealing & Cooling Time	Percent Volume			
				Ash & Dust	Fines	Brands	Charcoa l Yield
----------Hours ----------							
Sit	90	96	90	4.5	8.9	2.3	45**
Mezali	130	116	106	5.0	12.5	7.5	40
Bawzagaing	60	72	50	11.4	11.5	4.3	35
Paukpanbyu	45	67	48	24.0	32.0	2.0	25

Moisture Content of Wood = 30 – 35 %
* Starting Time of Firing = 0 hour
Kiln Capacity = 300 cu. ft, of stack
** Proportion of charge remaining after charcoaling

Table II. Analysis of Charcoal Calorific Value of Four Wood Species

Sample	Moisture Content%	Ash %	Volatile Matter %	Fixed Carbon%	Calorific Value B.T.U/lb ovendry basis
Mezali	4.36	4.50	26.54	64.60	11,497.14
Bawzagaing	5.98	1.65	30.94	61.43	11,864.07
Paukpanbyu	6.36	2.05	8.12	83.47	12,964.83
Sit	4.77	1.25	9.44	84.54	13,943.34

Tested by Central Research Organization:
Reference; CRO- 1330/12-130/84-85

Table III. Consumer Acceptance Survey Charcoal in Domestic Use Yezin Area

Wood Species	Smoke Omission	Sparks	Odour	Hardness	Clean Burning
Sit	none	none	none	moderate	good
Mezali	none	none	none	moderate	fair
Bawzagaing	none	none	none	light	fair
Paukpanbyu	none	none	none	light	fair

Appendix

Rating of wood species for charcoal (Rodgers)

First Class Charcoal - For Domestic Purpose

Binga	*Mitragyna rotundifolia* O. Ktze
Sha (cutch)	*Acacia catechu* Willd.
Leza	*Lagerstroemia tomentosa* Presl.
Myaukchaw	*Homalium tomentosum* Benth.
Panga	*Terminalia chebula* Retz.
Petwun	*Berrya ammonilla* Roxb.
Taukkyan	*Terminalia tomentosa* W. & A.
Thabye	*Syzygium cumiui* (Linn.) Skeels.
Thitni	*Ammora rohituka* W. & A.
Yindaik	*Dalbergia cultrata* Grah.
Yinzat	*Dalbergia fusca* Picrre.
Zinbyu	*Emblica Officinalis* Gertn.

Second Class Charcoal - Suitable for Blacksmiths, Goldsmiths, etc.

Bebya	*Cratoxylom merrifolium* Kurz.
Chinyok	*Grauga pinnata* Roxb.
Gyo	*Schleichera oleosa* (Lour.) Merr.
Kyun (Teak)	*Tectona grandis* Linn. f.
Pyinkado	*Xylia dolabriformis* Benth.
Scikchi	*Bridelia retusa* Spreng.
Tein	*Mitragyna parvifolia* Korth.
Thitsein	*Terminalia belerica* Roxb.
Yon	*Anogeissus acuminata* Wall.
Zaunbale	*Lagerstromia villosa* Wall.

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