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Saw doctoring practices in Peninsular Malaysia

By

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Introduction

The sawmilling industry has developed from the pit sawing to circular sawing and then to band sawing. Band sawing technology was introduced to Peninsular Malaysia (then the Malaya) just after the Second World War, and now almost all the sawmills are band saw mills. The option for band sawing was an appropriate one from the points of large cutting depth adapted for timber of varying diameters or thicknesses, narrow saw kerf, accuracy and high production capacity. Although the demand of skill in maintaining band saw blade is generally higher than that of circular saw blade, the long existing of the industry (at the moment there are over 700 sawmills in Peninsular Malaysia) has also shown the capability of acquisition and sustaining the technology and skill for both the sawing as well as the saw doctoring or saw maintenance.

The job of saw maintenance is done by a saw-doctor. His main duty is to maintain saw blades in good condition such that they remain sharp and can perform cutting with minimum downtime in the sawing process. This is realized by going through various procedures of leveling, tensioning, swaging, tipping, side dressing and sharpening with the help of equipment, hand tools and gauges. At the initial stage, most saw-doctors learnt the technique of saw doctoring under expatriates during the installation period of mill machinery. Subsequently, the existing saw-doctors are trained on-the-job from these senior saw-doctors starting as assistants. Some, however, were trained from the MARA Skill Institute (Institut Kemahiran MARA) in Pekan, Pahang, but the certificate course on saw doctoring had been ceased some years ago.

With the assistance from the Malaysian Wood Industries Association, a survey was made to selected sawmills in Selangor, Johor, Perak, Pahang and Terengganu to look into the saw doctoring practices. During the survey, discussions were held with the saw-doctors on the practice applied and saw blade characteristics and specifications were recorded against the intended timber species to be processed. This article presents the findings from the survey against common practices for hardwood timber.

Saw doctoring facilities

All sawmills were equipped with most of the essential facilities for band saw maintenance like the stretcher roller including leveling bench, automatic sharpening machine and side dresser, welding outfits for joining, crack repair and stellite tipping, and hand tools such as swage, hammers and gauges (tension and back). Automatic swaging machines were seen in some mills too and were greatly appreciated by the saw-doctors to replace hard work of hand swaging. Most of the equipment were of simple design and comparatively inexpensive type, and old (more than 10 years). Being simple, adjustments for different tooth shapes in the equipment would take considerable time. Thus, once adjusted the setting will be kept forever avoiding re-adjustment.

Saw blade thickness

Most of the saw blades used for the 42" band saw and 36" recovery saw were of 18 BWG (1.24 mm) and that for the 56" or 60" breakdown saw 17 BWG (1.47 mm). One mill used one gauge thicker namely 17 BWG for the resaw and 16 BWG for the breakdown saw had experienced the problem of frequent cracks. The use of 19 BWG (1.06 mm) saw had been found in a mill cutting rubberwood. The thickness of 1.198 mm (in between 18 BWG and 19BWG) was used in the 42" resaws for cutting mixed hardwood timber.

Tooth characteristic

Tooth hook angle

From the survey, many hook angles were being used or preferred by the saw-doctors and ranged from 22° to 31°. Of the hook angles, the most common one was 26°, followed by 25° and 24° (Figure 1). No doubt the saw-doctors did recognize the relation of hook angle and timber density, they opted for a preferred angle based on practical reasons that it was rather too much work to set different angles in the sharpener and felt the effect of hook angle on cutting performance was not critical as compared to saw kerf.

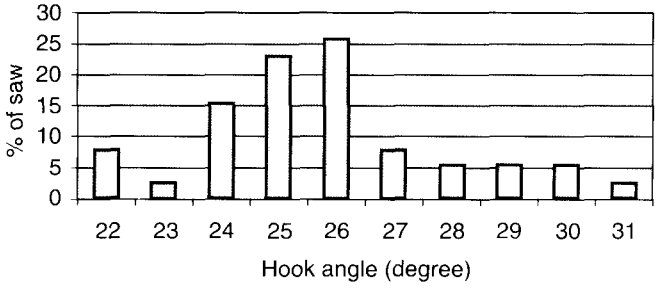

Figure 1 Distribution of hook angles in saws

Tooth clearance angle

The clearance angles ranged from 10° to 27° with 21° being the most common angle followed by 10° or 20° or 23° (Figure 2). Such rather large clearance angle (standard range is from 8° to 16°) would be used to reduce feed force due to high feed rate on the account of tooth strength and hence the life span of the blade.

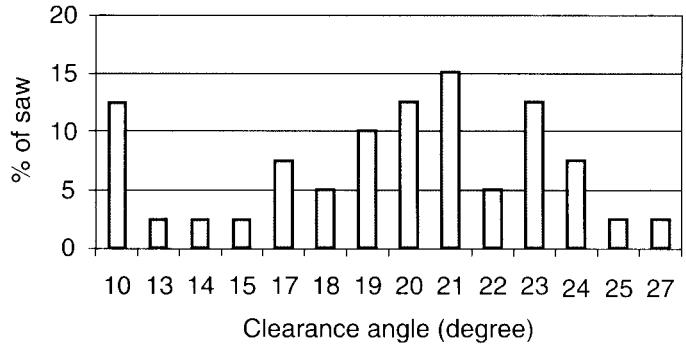

Figure 2 Distribution of clearance angles

Pitch

The common pitch for resaws was 32 mm. except one case with 38 mm. The pitches for breakdown saws were 44 mm with two cases of 48 mm and one case of 40 mm.

Gullet depth

For breakdown saws, the gullet depth ranged from 11 mm to 16 mm with the 14 mm being the most common (Figure 3). On the other hand, the gullet depth for resaws ranged from 6 mm to 13 mm with 11 mm the most common (Figure 3). The saw of 6 mm depth was used to cut a very hard timber known as perah.

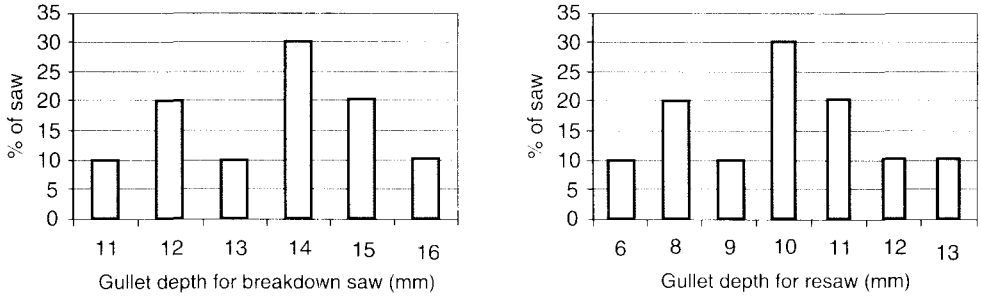

Figure 3 Distribution of gullet depths

Shape

Generally the LS shape was common except one mill was using O shape. In fact the LS shape was developed through grinding from the O shape, which was originally punched by the supplier.

LS shape

O shape

Tooth width

At the tooth point, it is made wider than the thickness of the saw in order to prevent the blade loosing tension as it heats up during the cutting process. The tooth width was the parameter that the saw-doctor varied in cutting timber of different densities. In general large tooth width is for light hardwoods and small tooth width for heavy hardwoods. The saw was first tipped and ground to a large tooth widtn and used for cutting light hardwoods. After the tooth width has been reduced though sharpening, it was then used for cutting heavier timber till the width was too small and then re-tipped. The maximum tooth width measured in the survey was 3.339 mm amounting to 2.67 times the saw thickness and was higher than the normal practice of twice the saw thickness. The efficient bite for this tooth width would then exceed the saw thickness. With the excessive clearance angle as mentioned above, the tooth might not be sufficient strong for such bite. If the bite would not be maintained at that value, there will more sawdust spilling out from the gullet causing problem of heating up of the saw blade.

The following table presents the range of tooth widths used in for cutting specific group of timber from the survey.

Timber species	Range of tooth widths (mm)	
	Resaw	Breakdown saw
Mixed hardwood	3.169 – 1.873	4.028 – 2.321
Mempisang (other soft timber)	3.339 – 2.257	
Meranti	2.870 – 2.265	3.539 – 2.749
Kempas	2.409 – 2.293	3.655 – 2.558
Keruing	2.564 – 2.161	3.409 – 2.386
Rubberwood	2.711 – 1.819	

The use of thinner saw gauge is to have less kerf loss in cutting. Looking at the tooth widths for the 19 BWG saw ranging from 2.727 mm to 2.202 mm (with tooth width to gauge ratios of 2.5 to 2.0), it appeared that absolute tooth width values were considered rather than the tooth width to gauge ratio.

Other saw doctoring practices

Tipping

All the saws were tipped with stellite, which is an alloy of highly wear-resistant metals, primarily cobalt and chromium, in order to increase the effective cutting time of the blade and to enable the cutting of highly abrasive timber species. The breakdown saw blade was tipped on alternate teeth, while the resaw blade was fully tipped for all the teeth. Re-tipping of saw teeth was done after about 7 to 30 sharpenings (probably in 3-4 months' time).

Saw change per shift

The saw was commonly changed 2-3 or 3-4 times per shift for sharpening purpose (Figure 4).

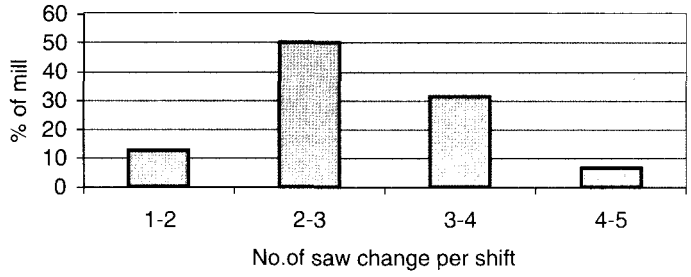

Figure 4 Frequency of saw change per shift

Blade usage

The 102 mm (4") blade might use down to 57 mm (2¼") but mostly to 70 mm (2¾"). The breakdown saw used down to 152 mm (6") and in a case the 152mm blade was used in the pony rig down to 89 mm (3½"). From a side study the amount of depth ground off during each sharpening process was 0.085 mm. The time taken to the final width would be extended when a number of saw blades were designated to a sawing machine. The number would be 3 to 10 saw blades per sawing machine.

Tensioning

The application of tensioning was done for new blade and after tipping or on areas where welding was carried out. Checking of tension during the saw change was not practiced and considered not necessary unless the saw was reported not performing well.

One saw-doctor did apply heat tensioning in addition to roller tensioning.

Saw-doctors' experiences

Most saw-doctors met in the survey had long experience (over 10 years) on the job. Some of their experiences and practices are listed below.

- Rubberwood is a timber of much easy to cut as compared to forest species. The only difference in cutting mixed hardwoods is the use of the short back as compared to longer back for light species such as rubberwood. In other words, a small clearance angle for mixed hardwoods and a larger clearance angle for light hardwoods.

- Resaw saw blade of 25 mm pitch would be tipped alternately and that of 32 mm pitch tipped fully.

- Breakdown saw blade of 44 mm would be fully tipped while those of 40 mm pitch tipped alternately.

- Medium tooth width is needed in cutting kempas, but those reduced by sharpening from large tooth width intended for seraya may not suitable for kempas as the swage would be shallow and easily chipped off. Deep swaged teeth with medium tooth width are preferred for cutting kempas.

- The saw blade is checked for tension when the tooth width has reduced to medium width and also to small width if the saw is used for cutting seraya. This is done to compensate the lost of tension due to the problem of resin on the saw and also on the saw wheel.

- Saw-doctors should not only concentrate on the saw blade maintenance, but also on the maintenance of sawing machine like wheel grinding, wheel face alignment, and alignment of rollers on the sawing table being perpendicular to the feed direction.

- Shallow gullet depth should be used for cutting harder species and the effect of cutting angle is believed less critical.

- In cutting very hard timber like perah, hook angle of 29° would be used. But for kempas (hard and tough) hook angle of 25° and medium tooth width are appropriate.

- Saw change for cutting soft timber would be 1-2 times per shift, for hard timber 3-4 times, and would be as high as 5 times for cutting timber like kembang semangkok and merpauh.

- Time taken for tensioning the new saw blade is 30 minutes while re-tensioning the used blade is 10 minutes. Auto swaging takes up 15 minutes. Tipping resaw blade takes 20-25 minutes, consuming 1½ stellite rods. Tipping for break- down saw takes 45 minutes. Sharpening usually takes 20 minutes for resaw and 30 minutes for breakdown saw. Side dressing requires 80 minutes.

- The saw blades are marked with respect to the sharpeners to be used for sharpening in order to retain their tooth angle and shape. They are arranged according to tooth widths: small, medium and large.

- The practice of reducing the hook angle by approximately 5 degrees in sharpening to increase the number of sharpenings is not followed by the saw-doctors.

Conclusions

The saw doctoring facilities and skill of saw-doctors are conforming to the standard norm providing an efficient cutting by the band sawing machines. Practices, that are deviated from the standards and would be improved, include the excessive tooth widths and clearance angle, and excessive grinding of both the cutting angle and tooth back. The practice of reducing the hook angle in sharpening to increase the number of sharpenings should be considered.

Revealing from the discussions with the saw-doctors was the lack of understanding of saw doctoring principles in relation to the cutting parameters of feed rate, saw speed, cutting depth and sawdust removal capability.