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Effects of Felling Intensities on *Gigantochloa ligulata* Bamboo for Improvement of Shoot Production

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ABSTRACT

Gigantochloa ligulata (buluh tumpat) is considered as one of the commercial bamboo species in Malaysia. Owing to its demand as food, especially in the northern part of the country and since it is relevant to improve production of bamboo shoots, a study on the effects of felling intensity as one of the silvicultural treatments on *G. ligulata* bamboo was conducted at Taman Wetland, in Putrajaya, Malaysia. Three culm felling intensities were applied for four months in 2005. The felling intensities of 0% (control), 30% and 60% were applied twice every two months within the four-month period. There were six replications done and 3kg of organic fertilizer was also applied. The number of shoots sprouted and their weights, including culm number, were monitored. The clump expansion pattern of selected treatment clumps were observed for dead and new shoots sprouted. The shoots were tagged and recorded every week. A shoot, which grew up to 30cm and from the ground, was considered as a shoot. The weights of the shoots with sheath were recorded on a weekly basis. The distribution pattern of the shoot sprouting was also observed. It was found that 30% felling intensity gave extra four shoots, as compared to other intensities, including the control with a value of 0.009 for both the treatments at 0.05 probability level.

Keywords: Gigantochloa ligulata, felling intensities, shoot, weight, culm, clump

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INTRODUCTION

Malaysian bamboos can be found in ex-logging areas and in rural villages throughout the country. There are about 70 species of bamboos, out of which 59 are found in Peninsular Malaysia. According to Wong (1995), there are 14 bamboo species (namely, *B. blumeana, B. heterostachya, B. vulgaris, B. vulgaris* var. *striata, D. asper, G. levis, G. ligulata, G. scortechinii, G. wrayi, S. brachycladum, S. grande, S. zollingeri*) that are commonly exploited for commercial purposes. Malaysian bamboos grow profusely in ex-logging areas throughout the country (Azmy 1991), including on hill slopes, riverbanks and flat lands (Ng & Md Noor, 1980).

Bamboo shoots have been relished as food since the early days. Ever since the increase in the consumption of bamboo shoots, the demands for the resources have increased as well (Razak & Jamaludin, 1998). In order to cater for the demands of bamboo shoots, silvicultural treatments such as felling of culms need to be adhered to so as to improve production of shoots, especially in the rural areas. There are two studies on the felling of *Gigantochloa scortechinii* natural stand bamboos in Malaysia. According to Azmy *et al.* (1987), there was a 30% increase in the number of shoots sprouting after 40% felling intensity was applied. Meanwhile, a 60% felling intensity showed an increase in the diameter of *G. scortechinii* (Abd Razak & Azmy, 2009). In 1986, a V-shaped formed of culm distribution pattern within the clump after felling treatments was found to have improved the productivity of *Dendrocalamus strictus* from 6.6 to 8.6 culms per clump. M-shaped thinning was also attempted in 1990 at Joldal area in Bhadravathi Forest Division, in India (Lakshmana 1990). Varmah and Bahadur (1980) stated that felling all culms, except the newly produced culms, would either result in high mortality or a number with poor quality culms.

According to Sharma (1980), bamboo grown areas in the forests of India, Bangladesh, Burma, and Japan bamboo are generally managed according to the "culms selection method". This method generally removes poor quality culms and retains one or two mature culms which are adjacent to new culms to provide better stability. Ueda (1960) suggested that bamboos of one to three year old must always be left in reserve, cutting culms only over four years old, for the development of new culms. In Indonesia, Yudodibroto (1985) reported that bamboo stands were also harvested selectively.

In order to have a sustainable supply of bamboo shoots in Malaysia and since felling of bamboo culms tends to increase the yield of bamboo shoots, based on studies of other species, it is relevant to conduct a study on the felling of *Gigantochloa ligulata* Gamble (buluh tumpat) to improve shoot production. Thus, a study on the effects of felling intensity on this particular species was carried out at Taman Wetland in Putrajaya to determine the best felling intensity terms of shoot yield. In addition, the distribution pattern of shoots pattern within the clump was also observed.

MATERIALS AND METHODS

The study on the effects of felling intensity on *G. ligulata* bamboo was conducted at Taman Wetland, in Putrajaya, Malaysia. It started from March to June 2005. Meanwhile, the thinning intensities of 0% (control), 30% and 60% were applied twice every two months within the four-month period. The three felling intensities, including the control, were done with six replicates and these altogether comprised of 18 samples clumps. Felling was based on the selection of culms of three year old and above out of the total culms available within the clump. For example, thinning of 30% means three mature culms of three year old and above out of ten culms within the clump were felled. Each clump in all the replicates was applied with 3kg of goat dung of granule form. The organic fertilizer was applied in a circular form around the clump's periphery. The parameters involved were the number of shoots sprouted and the weight of shoots. New shoots were tagged and recorded every week to determine the frequency of the shoots sprouted. A shoot up to 30cm from the ground was considered a shoot. The weights of shoots with sheath were recorded on a weekly basis. In addition, the distribution pattern of the shoots sprouting within the clump area was also observed. The climatic data for the study site from July 2004 to July 2005 and the average soil pH within the experimental area were also taken.

RESULTS AND DISCUSSION

Number of Shoots Sprouted

In Table 1, the F value is 13.13 and the significant level is 0.000. This means there is a significant difference in the number of shoots between the treatments. Only treatment 3 (60%) was found to be not significant.

As shown in Fig.1, Treatment 2 (30% thinning) produced more shoots as compared to Treatment 1 (control) and Treatment 3 (60% thinning) based on the number of shoots sprouted. The maximum number of shoots sprouted is 6, i.e. in week 8 for Treatment 2 (30% thinning). Meanwhile, Treatment 3 (60% thinning) gave the second highest number of shoots sprouted.

TABLE 1
ANOVA of the number of new shoots sprouted

Source of Variation	N	Df	Mean	Mean Square	F value
Treatment		2		62.235	13.13*
Treatment 1 (Control)	6		1.36*		
Treatment 2 (30%)	6		2.68*		
Treatment 3 (60%)	6		1.36ns		
Error		16		4.74	
Total	18	17			

*The mean difference is significant at 0.05 level.
Ns: The mean difference is not significant at 0.05 level.

Weight of Shoots

From Table 2, the F value is 5.826 and the significant level is 0.003. This indicates that there are significant differences between the treatments in terms of their weights of shoots with sheaths.

The total rainfall throughout the study period, i.e. from March to June 2005, was found to have affected the sprouting of the shoots. In March, the rainfall recorded was 200.6 mm and four shoots sprouted, whereas in April, 164 mm rainfall with three shoots sprouted, and in May and June, the rainfall recorded 70 mm and 26.4 mm, respectively, with only one shoot sprouted each. Meanwhile, the average soil pH was 4.87 and the soil temperature was 27.9°C.

Based on the three thinning treatments, Treatment 2 (30% thinning) showed a positive effect on shoot growth over the study period. Nonetheless, Treatment 3 (60% thinning) did not show any improvement over the control. With the increasing number of shoots sprouted, the weight of shoots also increased.

Clump Expansion Pattern

Fig.2 shows the original clumps with the distribution of all the initial available culms before the felling. After the first felling was done according to the assigned felling intensities of 0, 30% and 60% (see Fig.3), the new shoots of *G. ligulata* (buluh tumpat) sprouted not only along the clump peripheries but also within the clumps, especially with 60% thinning intensity (the first month after felling), as illustrated in Fig.4.

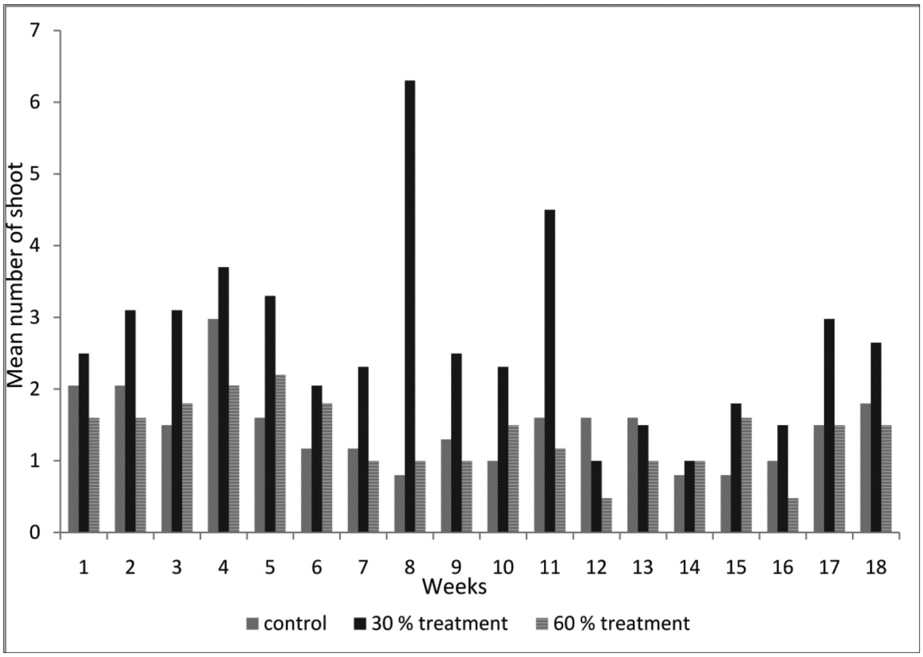

Fig.1: The mean numbers of shoots sprouted over the 18-week period

TABLE 2
ANOVA of the weights of shoots with sheaths

Source of Variation	N	Df	Mean	Mean square	F value
Treatment		2		62316.26	5.826*
Treatment 1 (Control)	6		147.23 *		
Treatment 2 (30%)	6		184.0 *		
Treatment 3 (60%)	6		138.84ns		
Error		16		10695.324	
Total	18	17			

*The mean difference is significant at 0.05 level
Ns: The mean difference is not significant at 0.05 level

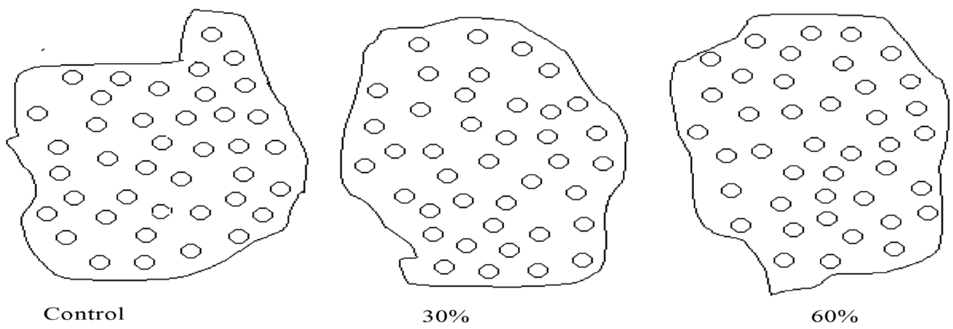

Fig.2: Dispersion map of the standing clump of *G. ligulata* in Putrajaya

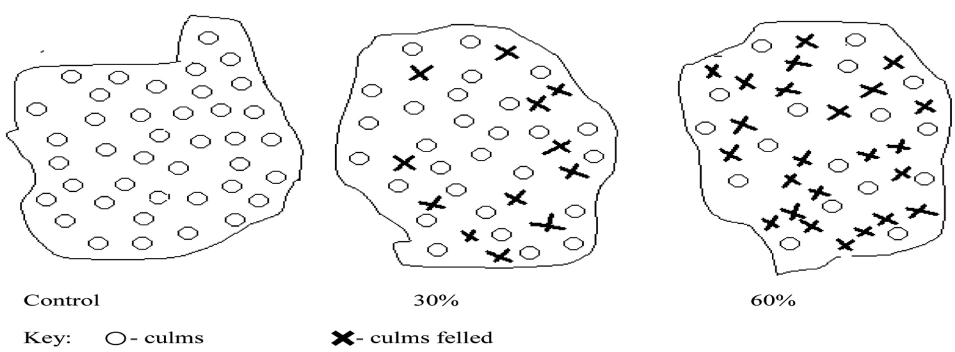

Fig.3: Dispersion map of *G. ligulata* clump in Putrajaya (the first felling)

The sprouting patterns of the shoots in Fig.5 and Fig.6 nearly resembled that in Fig.4, except that in Fig.6, dead shoots appeared within the clumps. Meanwhile, Fig.7 shows that the dead shoots were seen not only along the clump peripheries, especially for the control and the 60% felling intensity, but within all areas of the clumps, specifically for the 60% felling. From the observations, clumps might

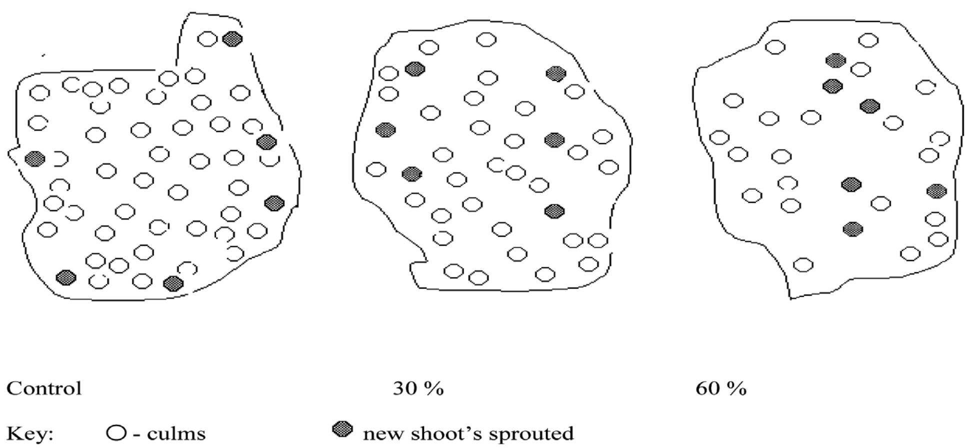

Fig.4: Dispersion map of *G. ligulata* clumps in Putrajaya (the first month after felling)

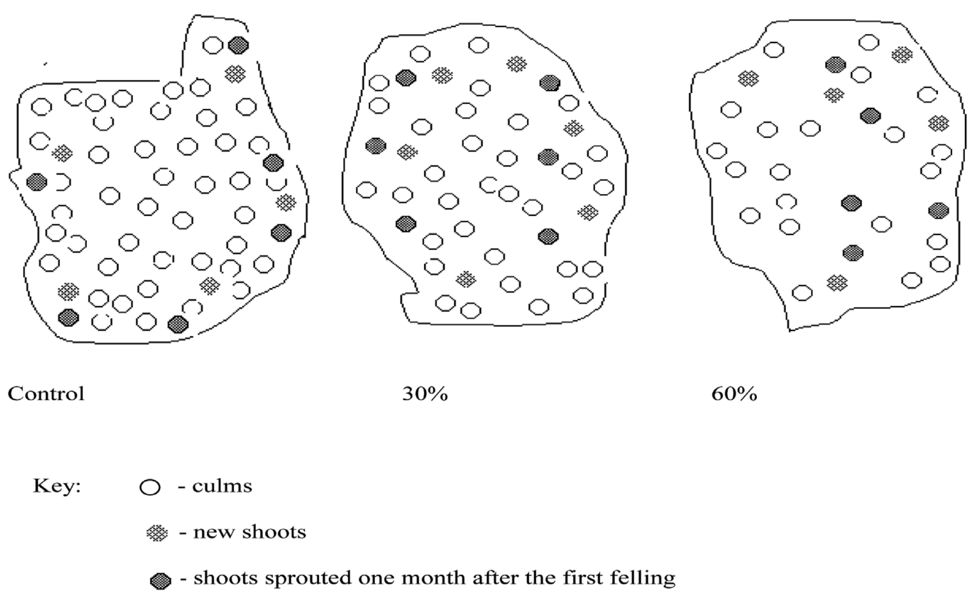

Fig.5: Dispersion map of *Gigantochloa ligulata* clump in Putrajaya (second month after the first felling)

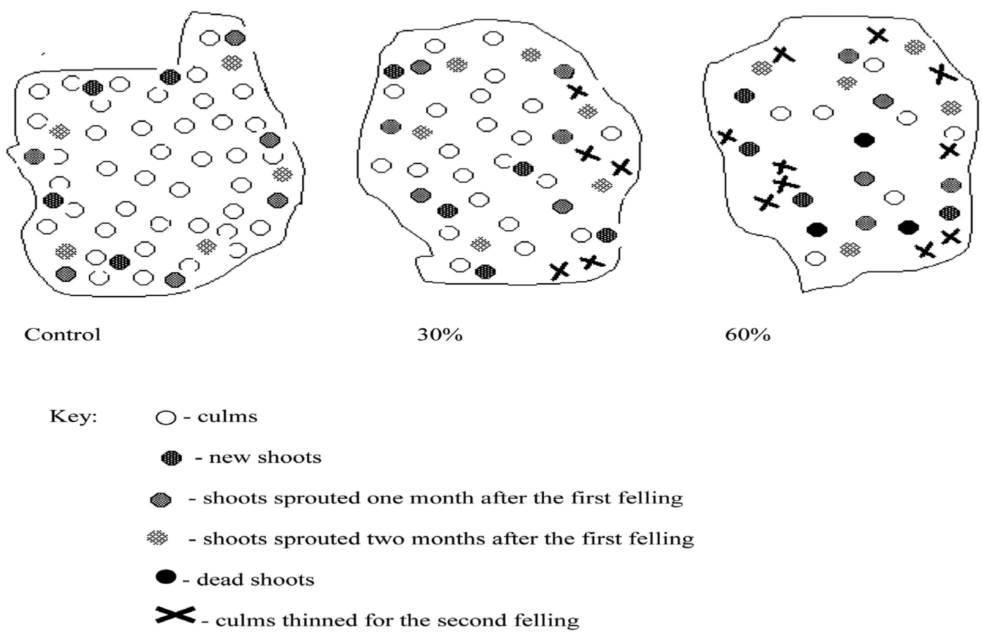

Fig.6: Dispersion map of *G. ligulata* clumps in Putrajaya (third month and after the first and second felling)

expand outwards, i.e. beyond their initial peripheries with the new shoots sprouting within the clumps at available spaces. When the felling was increased from 30% to 60%, it resulted in more dead shoots. According to Azmy (1999), from the regeneration sprouting pattern of shoots without any felling treatments, the clumps with 10 to 30 per clump tended to have the shoots sprouting along the clump's periphery and at the centre of the clumps. This sprouting pattern of shoots was also observed in this study for all the felling treatments. Thus, the shoot sprouting pattern is the same for both the natural stand bamboos of *Gigantochloa scortechinii* and *Gigantochloa ligulata* species in this study. As illustrated in Figure 8, the rainfall from February to April 2005 was between 210 and 180mm and this caused the increase in the number of shoots sprouted between 6 to 4.5 for week 8 and week 11 consecutively. Therefore, rainfall plays an important role in the sprouting of shoots.

CONCLUSION

In this study, 30% felling produced more shoots and higher maximum weights of shoots than 60% felling and the control. This 30% felling was shown to be the best treatment to yield quality and also more shoots of *Gigantochloa ligulata Gamble* (buluh tumpat).

According to Zhou (1981), climate, topography and soil affect the growth and distribution of bamboos. In addition, rain has also been found to help in bamboo shoot production, especially for *Gigantochloa ligulata*.

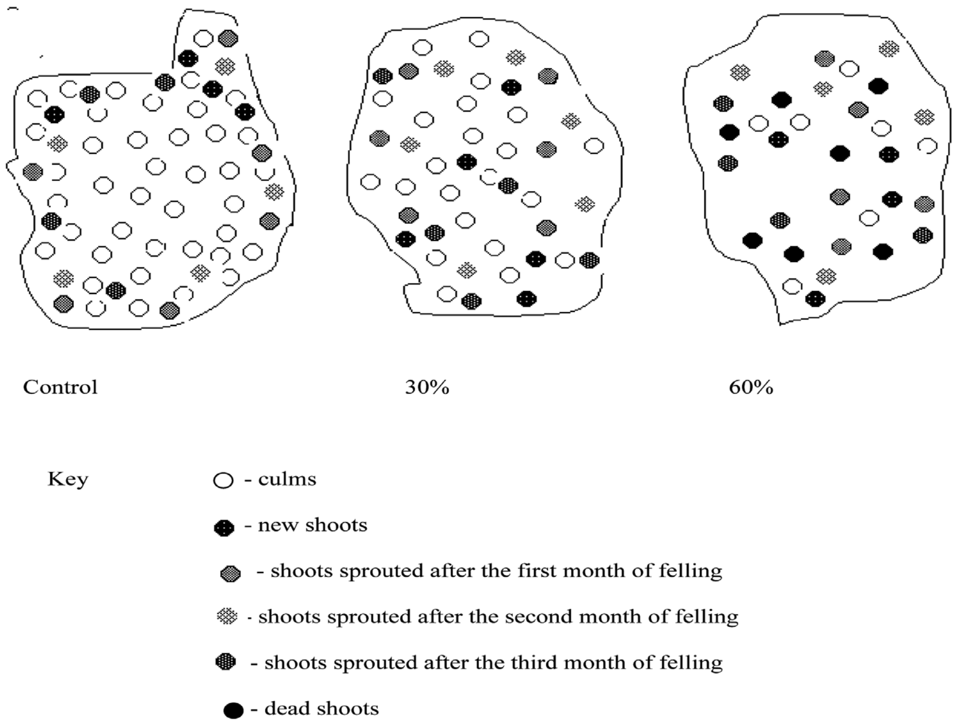

Fig.7: Dispersion map of *Gigantochloa ligulata* clump in Putrajaya (fourth month and after the second felling)

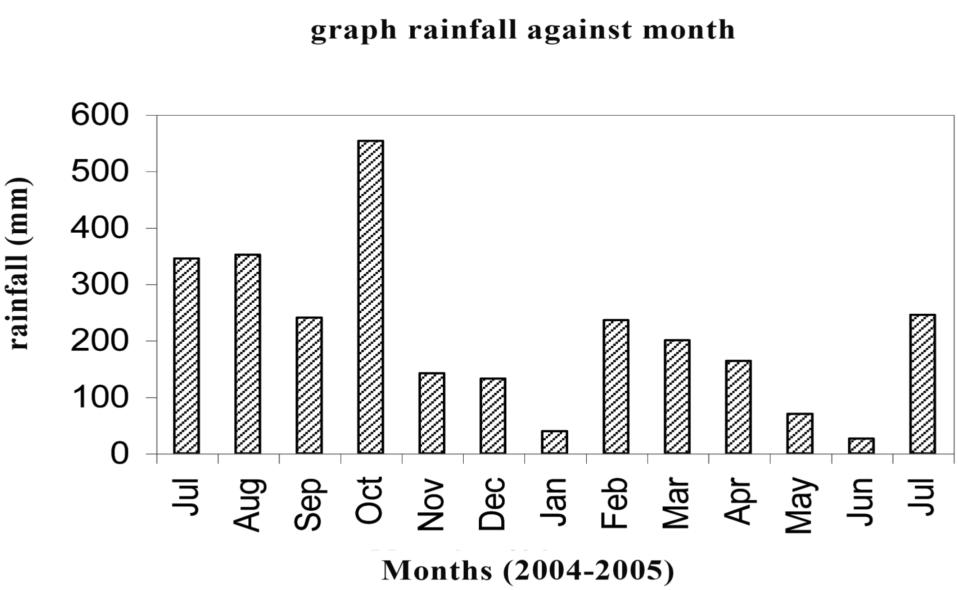

Fig.8: Climatic pattern at the study site (Taman Wetland, Putrajaya) (Source: Perbadanan Putrajaya)

Based on the results of this study, felling bamboo culms helps to increase the number of bamboo shoot sprouts of *G. ligulata*. This will have a bearing on the production of bamboo shoots as food supplement in combating and augmenting future food supply. Thus, the recommended bamboo treatments, especially ones that involve felling process, should be of help to managers and silviculturist involved in planting bamboos for future bamboo shoot productions. In addition, silvicultural can help to increase the income of entrepreneurs, especially for large scale bamboo plantations for shoot production.

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