GROWTH PERFORMANCE OF TEMPERATE BAMBOO SPECIES IN PENINSULAR MALAYSIA

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Temperate bamboo species, namely, *Phyllostachys glauca, P. nigrahexonis, P. pubescens* and *P. viridis* were introduced into Peninsular Malaysia from China in mid 1986 (Abd. Razak 1989). For this purpose, planting materials from the Nanjing Forestry University were brought in as rhizome-offsets and planted a Fraser's Hill and Genting Highlands, Peninsular Malaysia. In 1991, planting materials were propagated from the clumps in Fraser's Hill and were then planted at Tanah Rata, Cameron Highlands, Pahang (4.5° N, 101° E). Cameron Highlands is situated at 1545 m asl and has an average temperature of 18.5 °C. The average annual rainfall and percentage humidity are 2000 mm and 87% respectively. The soil is shallow with sandy loam layer.

This paper reports a three-year-growth performance of five bamboo clumps from each species of *P. glauca, P. nigrahexonis, P. pubescens* and *P. viridis* from 1997 to 2000 at the Tanah Rata plot. No treatment was applied to the planting site. The clumps, from seven- to nine-year-old stands, were observed and selected randomly based on bamboo culms produced after three years. The parameters measured were number of culms per clump, height of the culms and diameter at breast height (dbh).

From the clumps, 10 bamboo culms of each species were randomly felled to determine the green weight of the culms, branches and leaves. A total of 15 samples (300 g green weight) each of culms, branches and leaves for every species were then oven dried at 103 ± 2 °C to constant weight. Conversion to total dry weight was based on the method used for moisture content determination (Suzuki & Jacalne 1986).

The growth performance of the *Phyllostachys* species are summarised in Table 1. *Phyllostachys glauca* produced the highest number of culms with an average of 31 culms and this was followed by *P. nigrahexonis* and *P. pubescens,* producing an average of 28 and 18 culms per clump respectively. *Phyllostachys viridis* produced the lowest number of culms with an average of only 14 culms per clump.

Table 1 Mean number of culms per clump, mean height and mean dbh of *Phyllostachys* species propagated by rhizome-offsets

Species	Mean no. of culms per clump	Mean height (m)	Mean dbh (cm)
Planted at Tanah Rata, Cameron Highlands			
P. pubescens	18	7.1	3.4
P. glauca	31	8.1	2.9
P. nigrahexonis	28	7.9	3.1
P. viridis	14	8.7	3.8
Planted in China*			
P. pubescens	-	20	6–15
P. glauca	-	10–12	2–5
P. nigrahexonis	-	8–12	4–8
P. viridis	-	10–15	4–10

* Wang & Shen (1987).

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The study also shows that *P. viridis* attained the highest mean culm height of 8.7 m compared with *P. glauca, P. nigrahexonis* and *P. pubescens,* which were only 8.1, 7.9 and 7.1 m respectively. From the data recorded, it was found that the mean range of dbh varied between 2.9 (*P. glauca*) and 3.8 cm (*P. viridis*).

For comparison, Table 1 also gives the mean height and diameter of the four species of *Phyllostachys* planted at Nanjing Forestry University. The growth rate of *Phyllostachys* species in China was generally superior to those planted in Peninsular Malaysia. The difference in growth rate could be due to climatic conditions. The original habitat of *Phyllostachys* species in China is colder with an annual mean temperature of 15 °C, mean annual rainfall of 1038 mm and a relative humidity of 80% (Wan 1990).

Table 2 shows the mean aboveground biomass of *Phyllostachys* species produced after field planting in Cameron Highlands. The highest mean aboveground biomass per culm recorded was for *P. pubescens.* This was followed by *P. viridis, P. glauca* and lastly *P. nigrahexonis.* The total dry weight produced by *P. pubescens* was 2563.5 g comprising 2124 g of culms, 345 g of branches and 94.5 g of leaves.

From the above results, it is clear that in terms of culm production, *P. glauca* performed better than the other three species studied. *Phyllostachys viridis* produced the highest culm height and dbh. Generally, growth performance was poor when compared with the same species planted in the country of origin, China. *Phyllostachys pubescens* gave the highest aboveground biomass. In terms of total biomass production, the temperate bamboo planted in Peninsular Malaysia is lower compared with that of the same species planted in China (Fu 1992) and that of the Malaysian local bamboo species used for industry (Abd. Razak 1994).

Table 2 Mean aboveground biomass per culm of *Phyllostachys* species at Tanah Rata, Cameron Highlands

Measurement	*P. glauca*	*P. nigrahexonis*	*P. pubescens*	*P. viridis*
Fresh weight of culms (g)	2450	2320	3600	3250
Fresh weight of branches(g)	300	150	750	160
Fresh weight of leaves(g)	450	320	270	230
Dry weight of culms (g)	1494.5	1438.4	2124.0	1950.0
Dry weight of branches (g)	156.0	76.5	345.0	88.0
Dry weight of leaves (g)	166.5	156.8	94.5	119.6
Total dry weight (g)	1817.0	1671.7	2563.5	2157.6

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