ARAUCARIA HUNSTEINII: HAS RESEARCH HELPED US TO ARRIVE AT A DECISION?

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Araucaria hunsteinii (klinki pine) is a member of the *Araucariaceae* family. This family is naturally distributed in the Southern Hemisphere, especially South America, Papua New Guinea and Australia. *Araucaria hunsteinii* is native to Papua New Guinea and can be found growing in mountainous areas at elevations of 600 to 1500 m asl. It is most abundant in the Bulolo district at 700 to 1000 m asl. The wood of *A. hunsteinii* is suitable for making treated poles and piles, plywood, furniture, crates, and pulp and paper (Wyatt-Smith 1980).

The species was first introduced to Peninsular Malaysia in 1953 using seeds from Papua New Guinea. The species was trial planted in Field 18 (Bukit Lagong Forest Reserve) at the Forest Research Institute Malaysia (FRIM) in November 1954. Trial plantings of *A. hunsteinii* were later extended to other parts of the country including Cameron Highlands, Fraser's Hill, Field 51 at FRIM, Sungai Buloh as well as Mata Ayer, Perlis (Ng *et al.* 1983, Hashim 2005). These planting activities were part of the species trials under afforestation projects on lowland to high elevation sites which were considered not suitable for agricultural activities. Plots 18 and 51 at FRIM, totalling 12.5 ha, were established between 1954 and 1966 using seeds from Queensland, Australia and Papua New Guinea. The Pahang State Forestry Department established a total of 160 ha of this species in compartment 1C1, Kemasul Forest Reserve in the mid 1970s.

We wanted to determine the suitability of *A. hunsteinii* for afforestation purposes based on their growth performance. In this study, two trial planting areas, namely, Kemasul Forest Reserve in Pahang and Bukit Lagong Forest Reserve in Selangor were selected for monitoring the growth of *A. hunsteinii*.

The stand record for *A. hunsteinii* in Kemasul Forest Reserve are given in Table 1 (Ahmad Zuhaidi *et al.* 1996). The stand was established in October 1976 at a density of 1700 stem ha^{-1}. As a result of tree competition, mortality and low thinning at the age of 11 years, the density was reduced to 947 stems ha^{-1}. At the age of 17 years, the average height and diameter at breast height (dbh) were 20.3 m and 19.8 cm respectively. Despite having a wide dbh range (6.2 to 33.9 cm) the low average dbh for the population was not necessarily a disadvantage as the size of dominant trees stayed above the average dbh after 17 years. The 100 biggest trees ha^{-1} had an average dbh of 28 cm and average height of 24 m.

The trial plot in Field 18, FRIM was planted with 165 seedlings at a spacing of 3.7 × 0.6 m. The stand was measured for the first time 12 years after planting, then again in 1993 and recently in 2005. Early growth records of the species showed that survival after one year of planting was 90% with average and maximum heights of 4.6 and 8.5 m respectively (Ismail 1964). Mortality during stand life in 2000 was mainly caused by attacks of termites, *Coptotermus curvignathus* (Kirton & Brown 2000). Table 2 shows the growth records of *A. hunsteinii* trial plantation in Field 18, Bukit Lagong Forest Reserve, FRIM.

At 51 years, the average dbh of the stand in Bukit Lagong Forest Reserve was > 45 cm with a calculated average annual diameter and volume increments of 1.0 cm and 6.17 m^3 ha^{-1} year^{-1} respectively. Growth results indicated that the stand had passed the maximum point of average annual volume increment (6.17 compared with 9.67 m^3 ha^{-1} year^{-1}) and was approaching rotation age and constant rate of growth.

Table 1 Stand record of 17-year-old *Araucaria hunsteinii* in compartment 1C1, Kemasul Forest Reserve, Pahang

Age (years)	N (stems ha^{-1})	H$_{dom}$ (m)	D$_{dom}$ (cm)	hg (m)	dg (cm)	G (m^2 ha^{-1})	V (m^3 ha^{-1})	v (m^3 ha^{-1} year^{-1})
17	947	23.9	27.8	20.3	19.8	29.27	279.75	16.45

N = number of stems ha^{-1}, H$_{dom}$ = average dominant height, D$_{dom}$ = average diameter of dominant trees, hg = average stand height, dg = average stand diameter, G = basal area, V = volume, v = average production
From: Ahmad Zuhaidi *et al.* (1996)

From the series of diameter measurements at the beginning and end of the observation period, we developed the rate of diameter growth of the species (Figure 1). From the graph and also from Kemasul growth data we found that the age of 20 years fits the target of producing logs of average dbh 30 cm.

Araucaria is categorized as high-class light hard wood. Growth results from the two different sites in this study have indicated that *A. hunsteinii* is a very promising tree species for quality wood production in the country. For the objective of planting for producing round logs with an average dbh of 30 cm within 20–25 years, this species should be one of the most preferable options.

The problem of tree mortality within the stand which was mainly caused by termite attacks needs further investigation, either during future site preparation or through silvicultural attention during stand life. Early signs of termite on *Araucaria* trees are difficult to discern, as the attack starts underground. Thus, regular checking of trees, removal of old stump and prescription of suitable pesticides are important in *Araucaria* plantation. Difficulties faced in getting continuous supply of seeds can be overcome by vegetative propagation (Ng & Sabariah 1979). Seed production and natural regeneration has been observed at higher elevations in Cameron Highlands and Fraser's Hill.

ACKNOWLEDGEMENTS

Table 2   Stand record of *Araucaria hunsteinii* at Bukit Lagong Forest Reserve, FRIM, Selangor*

Age (years)	N (stem ha^{-1})	hg (m)	dg (cm)	G (m^2 ha^{-1})	V (m^3 ha^{-1})	v (m^3 ha^{-1} year^{-1})
39	230	35.6	38.3	26.48	377.04	9.67
51	133	32.2	48.3	24.42	314.82	6.17

*Assumed form factor of 0.4
N = number of stems ha^{-1}, H$_{dom}$ = average dominant height, D$_{dom}$ = average diameter of dominant trees, hg = average stand height, dg = average stand diameter, G = basal area, V = volume, v = average production
From: Ahmad Zuhaidi *et al.* (1996)
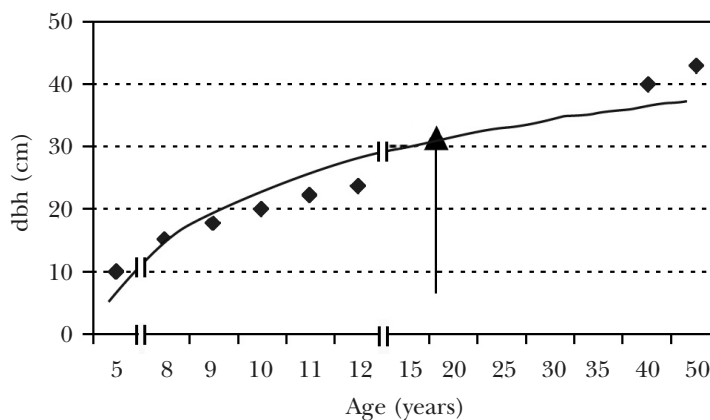
Figure 1   Rate of diameter growth with age for Bukit Lagong Forest Reserve (Field 18, FRIM)

REFERENCES

AHMAD ZUHAIDI, Y., AFZAL, M. & WEINLAND, G. 1996. *Araucaria hunsteinii*: marking trial for thinning. *Journal of Tropical Forest Science* 9(1): 6–15.

HASHIM, M. N. 2005. Survival and growth of two *Araucaria* species established at Mata Ayer Reserve, Perlis. *Journal of Tropical Forest Science* 17(2): 319–321.

ISMAIL, A. 1964. A note on the visit to the forests of Papua New Guinea with particular reference to *Araucaria hunsteinii. Malayan Forester* 27(4): 251–253.

KIRTON, L. G. & BROWN, V. K. 2000. Are exotic plantation tree species more susceptible to termite attack than native species? Poster presented at the XXI IUFRO World Congress 2000. 7–12 August 2000, Kuala Lumpur.

NG, F. S. P. & SABARIAH, A. 1979. Vegetative propagation of *Araucaria hunsteinii. Malayan Forester* 42: 71–72.

NG, F. S. P., ZULKIFLI, M. & ABDUL GHANI, A. 1983. *Leucaena luecocephala* as a tall cover crop for sawlog plantations. Pp. 113–118 in *Proceedings of Leucaena Research in the Asian-Pacific Region.* IDRC, Ottawa. 23–26 November 1982.

WYATT-SMITH, J. 1980. The wood utilization potential of the araucarias. Pp. 265–285 in *Forestry Problems of the Genus* Araucaria. *Proceedings of IURFO Meeting.* 21–28 October 1979. FUPEF, Curitiba.