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A NOTE ON DOUBLE ROOT SYSTEM FOR TROPICAL TIMBER SPECIES BY SPLICE APPROACH GRAFTING

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In agriculture, a splice approach grafting to produce a tree with double root system is normally carried out on some fruit trees. For example, it has been occasionally observed that *Durio zibethinus* clones imported from Thailand are grafted with local *Durio* varieties to produce a tree with a double root system. The reasons are: to induce rapid flowering and fruiting (Aumeeruddy & Pinglo 1988), to enhance faster growth; and to produce a stronger root system. We believe that the practice used in agricultural crops can also be applied to some commercial tropical timber species to stimulate a better growth performance as well as fruiting at an early age.

In this preliminary experiment, 1- to 2-y-old potted seedlings of several tropical timber species were used (Table 1). They were about 0.5 to 1 *m* tall and the stems were approximately 1 to 2 *cm* in diameter. The technique used here was the splice approach graft (Hartmann & Kester 1983). The two stems of the two chosen species (Species I and II) were approximately the same size. Then the bark and wood of both stems were sliced, about 4 to 5 *cm* long with a sharp knife so as to leave a smooth surface. The two cut surfaces were then bound tightly together with a plastic budding tape to get a proper and maximum cambial contact of the two stems. After the grafting was completed, they were placed under a 50% Sarlon netting shade to avoid direct sunlight. Observations on stem union were carried out every month. When the stems were strongly united and have healed, stem of the undiserable seedling was cut off above the union in order to produce a single stem tree with a double root system.

Table 1. The preliminary results of the splice approach grafting of some forest tree species

Species I	Species II	Graft unions	Time required for the graft to heal (months)
Dipterocarpus baudii	*D. baudii*	+++	4**
Alstonia angustiloba	*A. angustiloba*	+++	2**
Shorea leprosula	*S. leprosula*	++	4**
S. leprosula	*S. assamica*	+	4*
S. cyclocarpum	*S. leprosula*	+	4*
S. parvifolia	*S. parvifolia*	++	4**
S. roxburghii	*S. roxburghii*	++	4**
Milletia atropurpurea	*Intsia palembanica*	+	4*
Gmelina arborea	*G. arborea*	+++	2**
Acacia mangium	*A. mangium*	++	2**
A. mangium	*Hopea odorata*	-	4
A. mangium	*S. assamica*	+	4*
Entrolobium cyclocarpum	*S. assamica*	+	4*
E. cyclocarpum	*S. leprosula*	-	4
E. cyclocarpum	*G. arborea*	+	4*
E. cyclocarpum	*S. parvifolia*	-	4

(- No graft union, + Poor graft union, ++ Good graft union, +++ Excellent graft union; * Graft splits 3 to 4 *mth* after planting, ** Graft still intact even at 1 y after planting)

The results of this experiment indicate that the graft union as well as speed of the healing process depend on species used (Table 1). The combination of two seedlings of the same species such as *D. baudii, A. angustiloba, G. arborea, A. mangium, S. parvifolia, S. leprosula* and *S. roxburghii* produced good and excellent graft unions. At one year after planting, the grafted unions of these seedlings were still intact and the growth performance was faster and better compared to their normal single root seedlings. For example, the *D. baudii* seedling with a double root system grew faster and produced more and bigger leaves compared to the normal seedling (Figure 1).

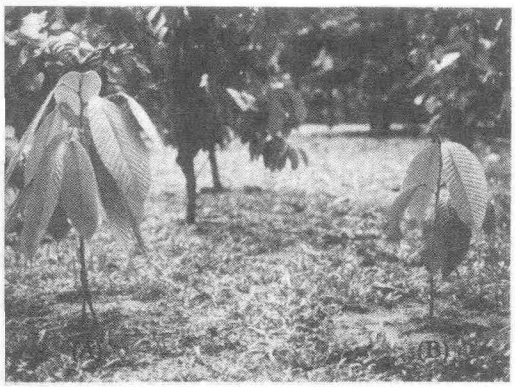

Figure 1. Eight-month-old *Dipterocarpus baudii* seedling with double root system (A) in comparison to its normal seedling of the same age (B)

The most interesting finding here was the success of a splice approach grafting on two different species like *S. leprosula* and *S. assamica, S. leprosula* and *S. parvifolia, M. atropurpurea* and *I. palembanica, S. assamica* and *A. mangium, S. assamica* and *E. cyclocarpum,* and *S. leprosula* and *E. cyclocarpum.* However, the graft unions of two different species were very poor and were split at three to four months after planting on the ground. This may be due to the slow or less callus formation which is necessary for healing of the union. There are some species in which the graft union did not contact each other even four months after grafting. For example, *E. cyclocarpum* with two *Shorea* species, such as *S. leprosula* and *S. parvifolia* and between *A. mangium* and *Hopea odorata* seedlings.

In conclusion, we are very positive that the slice approach grafting technique within the dipterocarp species and between dipterocarps and nitrogen fixing trees can be easily carried out. This may induce faster growth in a slow growing dipterocarp and produce timber trees with strong rooting systems.

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DO COPPER CHROME ARSENIC (CCA) TREATED KEMPAS PILES MEET MALAYSIAN STANDARDS?

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The Malaysian Standard MS 822:1983 (Anonymous 1983a) specifies a minimum Dry Salt Retention (DSR) of 16 *kg* m^3 for CCA treated piles. Commercially treated