

Results of this experiment indicated that *D. aromatica* and *S. macroptera* showed no preference for the germination medium. They can be germinated in any of the media used in this experiment depending on the availability of the material. The higher germination percentage obtained in *D. aromatica* could be due to the fruits used being more fresh and uniform in maturity compared to those of *S. macroptera*.

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A NOTE ON THE ESTABLISHMENT OF A CLONAL SEED ORCHARD OF *TECTONA GRANDIS*

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Shortage of seed supply has considerably hampered the development of forest plantation programmes. This is attributed to several factors such as irregular flowering or as well as infestation by pests and diseases. In recent years, greater emphasis has been given to tree breeding and the main question to address is how to produce improved seed in sufficient quantities for large scale forestry programmes. In this respect, seed orchards play an important role.

According to Zobel *et al.* (1958), a seed orchard is a plantation of genetically superior trees, isolated to reduce contamination from genetically inferior trees, and intensively managed to produce frequent, abundant and easily harvested seed crops. It differs from

the concept of seed stands or seed production areas which are good natural or planted stands managed for immediate seed production from phenotypically superior trees. The design of seed orchards has been described by several workers like Zobel *et al.* (1958), Goddard and Brown (1961), Zobel and McElwee (1964), Nikles (1975) and Giertych (1975).

Tectona grandis, a high quality timber species, is becoming an important plantation species in Malaysia. A large hectarage of plantation has been established and more areas are to be planted with this species.

A clonal seed orchard of *Tectona grandis* has been established on a 1.6 ha of land at Bukit Sawak Forest Reserve, Pulau Langkawi. In the early 1980s, 100 plus tree were selected based on their phenotypic appearance such as

1. Straight stem form
2. Vigor in growth
3. Good clearbole height
4. Light branching habit and self pruning
5. Freedom from diseases

All of these plus trees were selected from the existing plantation at Mata Ayer, Perlis. After a re-evaluation of the plus trees in 1988, only 37 plus trees were re-selected.

In October 1992, bud sticks were collected from each of these 37 plus trees. The number of bud sticks collected from each plus tree varied from tree to tree. This was due to variation in bud initiation between plus trees. The bud sticks from each plus trees were packed in plastic bags together with saw-dust to avoid bud damage. The plastic bags were then tied up properly, tagged and placed in an ice-pack. The following day the materials were sent to the site at Pulau Langkawi to be budded on the root stocks.

These root stocks had been raised from six-month-old potted seedlings. They were planted in July 1992 in the 1.6 ha proposed orchard. The spacing used was 8 × 6 m between and within rows. The field budding operation was carried out four months after the root stocks had been planted in the field. The base diameter (at about 12 cm from ground) and height of the root stocks ranged from 1 to 3 cm and 0.4 to 0.8 m respectively. Transparent plastic tapes were used to cover and tie the scion firmly to root stock during field budding operation. The success of budding operation was checked two weeks after the field budding operation by removing the plastic tape. The budding was considered a success if either the bud developed or still remained in contact with root stock, or the bud remained green in color.

The percentage of success achieved in field budding operation was about 70%. The number of ramets for each clone varied from one to ten with an average of five ramets per clone (Table 1). Upon confirmation of the success, the root stocks were pollarded at 20 - 30 cm from the ground. New shoots, produced by root stocks were also cut to promote the new shoot from the scion to grow.

Weeding was carried out once at one month after establishment. The following month, ground cover was planted to suppress growth of the weeds. Subsequent weedings were carried out at four-month intervals.

Table 1. Clones with the respective number of ramets successfully budded in the orchard

Clone	No. of ramets	Clone	No. of ramets
A 4	7	B 38	1
A 9	5	B 47	7
A 11	4	B 49	7
A 12	5	B 51	7
A 13	5	B 53	4
A 15	6	B 63	4
A 16	2	B 77	8
A 17	10	B 79	7
A 18	7	B 80	6
A 21	4	B 82	7
A 93	7	B 83	7
B 1	6	B 84	5
B 3	4	B 94	7
B 4	4	B 95	5
B 20	5	B 97	5
B 32	5	B 98	3
B 34	2	B 100	4
B 36	7	B 105	8
B 34	7		

One year after the establishment, budding success was counted. At this stage, the percentage dropped by 2% to 68%. This was probably due to the poor union between root stock and scion. In April 1994, budding success was again assessed and found to have further dropped to 47%. Investigation revealed that the trees were badly damaged by cattle from the surrounding village which grazed on the area. This was very obvious as a few spots of the concrete fence were broken and had fallen down on the ground. Measures have been made to reinstall the broken fence. The first fertilizer application was carried out in April 1994 to further enhance the growth of the clones. Despite the drop in the overall success the missing of four clones did not affect the function of the orchard. Hence, this orchard will be properly managed to produce high quality seed for the plantation since from the genetic and tree breeding point of view, the orchard could still perform its original purpose. In addition, the performance of each clone could be estimated from the growth data obtained from the orchard.

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