GENETIC IMPROVEMENT AND PROPAGATION OF MULTIPURPOSE TREE SPECIES

Kamis Awang, Nor Aini Ab. Shukor,
Dzulkifli Tukiman, Latifah The and Md. Lokmal Ngah

Faculty of Forestry
Universiti Putra Malaysia, 43400 UPM, Serdang, Selangor, Malaysia

Keywords: *Acacia, Azadirachta excelsa,* provenance and progeny trials, tissue culture, vegetative propagation.

Introduction

Plantation forestry is an important strategy in overcoming timber shortage in Malaysia. It is however based on a limited number of species including acacias (*A. mangium, A.auriculiformis* and their hybrids) and *Azadirachta excelsa.* Apart from having fast growth, these species offer a number of potential uses. But plantings have not so far relied on improved genetic materials and hence results have been variable. A high productivity of the future plantations of these species can be assured only if improved seeds and planting materials are used for their establishment Hitherto, there have been a limited amount of research conducted on the genetic improvement and propagation of *Acacia mangium, A. auriculiformis, A. crassicarpa* and *A. aulacorcarpa* (Kamis Awang et al. 1994; Nor Aini Ab. Shukor et al. 1994; Kamis Awang et al. 1995) and almost nonexistence on *A.excelsa.* Much of the works done so far on the acacias are on provenance trials and vegetative propagation. Therefore this researsch was undertaken with two objectives: (1) To select and improve several provenances of the chosen species, and (2) to develop appropriate technologies of mass propagation of the improved materials.

Materials and Methods

The research comprised three components; a trial of acacia progenies, multilocational trials of *A. excelsa* provenances and development of cloning techniques for mass propagation of improved materials. A trial of 80 progenies of *A. mangium, A.auliculiformis, A.crassicarpa* and *A. aulacocarpa* with seeds collected from Papua New Guinea and Queensland, Australia was established at Kampung Aur Gading, Kuala Lipis, Pahang to evaluate their growth performance. However, its establishment was delayed by the late arrival of seeds from Australia. For evaluation of *A. excelsa* provenances, trials were established on three sites: Batu Arang, Selangor; Merchang, Trengganu and Balai Ringin, Sarawak. Six provenances of *A.excelsa* from Bukit Lagong, Selangor; Manong, Perak; Pasir Mas, Kelantan; Pengkalan Arang, Trengganu; Semengoh, Sarawak and Narathiwat, Thailand were used in the trials. Concurrently, an isoenzyme study was conducted on these provenances to determine their actual genetic variation. The trials were monitored for survival and growth in terms of height, diameter and form. Two approaches were used for the cloning of the species, micropropagation through tissue culture and macropropagation through rooting of cuttings. The former involved development of micropropagation protocols for three species, *A.auriculiformis, A.crassicarpa* and *A. excelsa* while the latter examined various factors controlling rooting of cuttings of *A. excelsa* seedlings.

Results and Discussion

The acacia progeny trial was only planted in August 1998. Although survival was generally good, it was still too young to give any meaningful results. The one year assessment of the *A. excelsa* trials indicated that survival and growth were significantly different among the sites and provenances. For all the provenances, the best performance was generally obtained at Balai Beringin in Sarawak. Provenances from Bukit Lagong, Semengoh and Manong consistently performed better than the others at all the three locations. Analysis of morphological and genetic variatons showed that these provenences were closely related. Results of micropropagation studies indicated that calli of *A. crassicarpa* could be successfully produced from leaf and stem explants after 9 days of culture in MS medium supplemented with 4 mg/L BAP + 4 mg/L NAA. Shoot proliferation was observed in the same medium after 6 and 12 days on leaf and stem calli respectively. Development of micropropagation technique from marcots of *A. auriculiformis* and somatic embrogenesis of *A. crassicarpa* are in progress. on the other hand, micropropagation protocol of *A. excelsa* has been developed using nodal stem segment, petiole nodal segments, shoot tip and young leaves from seven month old seedlings. Shoot tip explants produced the highest percentage of shoot formation (93%). The combination of 2 mg/L BAP + 2 MG/l NAA was found to be optimum for rooting of *in vitro* plantlets with shoot proliferation rate of 2 within 53 days. In addition, 20 to 25% commercial Chlorox applied for 40 minutes, was the best sterilisation method for shoot tip explants that yielded 100% aseptic cultures. The study on coppiceability of stumped seedlings of *A. excelsa* examined the effects of stump heights; while in the rooting of cuttings, examined the effects of different materials, positions and hormones. Coppiceability was found to vary with stump heights i.e. 60 cm > 100 cm > 30 cm. However, 100 cm stumps produced more vigorous coppices in terms of length (mean = 37.29 cm). Generally, survival and rooting percentages of cuttings were low. Cuttings from coppice shoots survived and rooted better than those of seedlings. Both positions and hormonal treatments significantly affected the survival and rooting percentages. Terminal cutting position and hormonal treatment of Seradix 2 (0.3% IBA) recorded the highest rooting ability.

Conclusions

Initial selection of promising provenances of *A.excelsa* can be made from the results but further testings of the selected plus trees from the trials should be undertaken. Cloning of acacia species and *A.excelsa* is technically feasible either through micro- or macropropagation techniques. But refinement of the techniques is still necessary to increase the efficiency of the multiplication rate.

References

Kamis Awang, Venkateswarlu, P., Nor Aini, A.S., Adjers, G., Bhumibhamon, S., Kietvuttinon, B., Pan, F.J., Preecha, K. and Simsiri, A. 1994. Three year performance of international provenance trials of *Acacia auriculiformis. Forest Ecology and Management.* 70:147-158.

Kamis Awang, Nor Aini, A. S. and Abd. Latib Senin, 1995. Two year performance of *Acacia crassicarpa* provenances at Serdang, *Malaysia. Pertanika Journal of Trop.Agri.Science.* 18(3): 1-5.

Nor Aini, A.S., Kamis Awang, Venkateswarlu, P. and Abd. Latib Senin, 1994. Three year performance of *Acacia auriculiformis* provenances at Serdang, Malaysia. *Pertanika Journal of Tropical Agricultural Science.* 17(2): 95-102.

Supported by IRPA Grant 01-02-04-0189