

it lies. The chapter on Bending of Wood, for example, contains only two references – one on bending plywood and one on ammonia plasticisation – whereas Boas contains 15 up to 1947, many of which are still readily available. Similarly the chapter on Some Wood Utilisation Aspects of Tree Breeding has only one reference. Incidentally this chapter rather naively restricts itself to topics which the wood user would wish the plant physiologist and silviculturalist to consider in their aims. It therefore dodges the real problem of choosing between desirable but unrelated features in order to select for those of greatest economic value at a level which will achieve useful genetic gains. Tree breeding is no magic wand, as most wood scientists have reluctantly had to acknowledge.

No doubt these are matters that can be considered when the well-deserved second edition is called for. Perhaps consideration could also be given to the wider use of simple line drawings. Descriptions of cell wall structure and of tests for mechanical properties, to name just two topics, would have benefited greatly from simple illustrations.

The book is cleanly printed, and well set out with chapter heading and number at each opening – a useful feature for ease of reference. Printing errors are remarkably few, and the illustrations and few line drawings that have been used are for the most part very well done. This book should find many appreciative users in New Zealand which, regrettably, has nothing comparable to offer. Perhaps some technical college might produce a list of New Zealand rules, regulations, and standards applying to timber, which, if used in conjunction with Keith Bootle's book, would convert it to an ideal text for local use.

J. M. Harris

BIOTECHNOLOGY IN NEW ZEALAND

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In recent years powerful new techniques of genetic manipulation and cell fusion have been developed. These techniques permit the modification of microbes or eucaryote cells to enable them to utilise substrates, or produce substances normally outside their competence. The potential for application of these techniques to industrial technology has created a great deal of excitement, resulting in the formation of a number of new multi-national companies, and the "new" science of biotechnology. International awareness of the importance of biotechnology has at last influenced thinking in New Zealand, resulting in this discussion paper.

Biotechnology is defined in the paper as "the application of scientific and engineering principles to the processing of materials by biological agents to provide goods and services". Four major sections of the paper deal with various aspects – Technologies and Sciences Contributing to Biotechnology; Biotechnology and New Zealand Industry;

The Organisational Framework for Biotechnology R and D in New Zealand; Issues for New Zealand.

A major point made in this paper is that research and development within New Zealand is a prerequisite to the exploitation of high technology, for, "no-one else will do it for us; if others do the work, it is they who will benefit".

Another major point is that biotechnology offers prospects "for increasing the quantity, quality, and processing of products from our biological raw materials, to meet both local and export demands". The upgrading of raw materials is of immediate relevance to forest industries in New Zealand, and indeed considerable attention is given to bioconversion of lignocellulose. There is substantial research overseas into the biological degradation of lignocellulose, and in this report it is suggested that New Zealand should develop specific research niches appropriate to our needs and skills, and to the plant species of importance to us. The greatly increased quantity of *Pinus radiata* that will be available in the early 1990s is identified as a suitable area for specialisation.

The discussion paper has an obvious and declared bias towards biological conversion of wood, but makes no convincing case that biotechnological processing of residues is economically more attractive than the methods identified by the Forest Research Institute – that is, direct combustion, pulp and paper manufacture, and wood gasification. (This topic calls for informed debate – see below.)

A plea is made for research into biochemistry and genetic control of lignin synthesis because "this could ultimately lead to the manipulation of lignin biosynthesis. This in turn would enable lignocellulose to be produced, which is more amenable to biological attack and processing". Existing New Zealand research on lignocellulose utilisation is slated as "unco-ordinated".

"Biotechnology in New Zealand" is a mixed bag. On the negative side, its descriptions of activities by agencies other than DSIR are dated and incomplete. For instance, in Appendix 2 no mention is made of Forest Research Institute research into production of edible fungi on wood residues, or that FRI has for some time had a group working on clonal propagation of *P. radiata* by tissue culture. Descriptions of work carried out in other institutions may be equally inaccurate.

Furthermore, while on page 38 there is a list of establishments which have pilot-plant equipment, no indication is given of the nature of this equipment or its uses!

On the positive side, the paper identifies the need for biotechnology research in this country if added value from biological raw materials is to be maximised. It also calls for identification of suitable projects and for research co-ordination at the national level. On the whole, it is a commendable and useful document.

The key to the whole paper is found in the preface by Dr G. W. Butler: "DSIR invites feedback, criticism, and suggestions in response to this discussion paper, so that a national consensus can be reached on the aspects of biotechnology which should receive emphasis because of our comparative advantage and opportunities. This will form the basis of a second follow-up publication".

Observers of the national scene will be aware that "High Technology Future" is a current political catchcry. If this movement gains popular support, biotechnology will

rank highly as a candidate for financial support. In this context, I would recommend that "Biotechnology in New Zealand" and its implications be given serious consideration. It is essential that both supporters and opponents of biotechnological biomass utilisation make submissions on this important document so that rapid progress can be made in determining priorities and co-ordinating future research and development.

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