COMPRESSION WOOD FORCE GENERATION: A REJOINDER

Sir,

It is pleasing to have B. A. Meylan's comment, partly because he and his colleagues have made outstanding contributions to the analysis of anisotropic dimensional changes during shrinkage of wood, and because I believe major benefits would result from wider appreciation of the value of their work for other important applications. However, while referring to microfibril angles which are not unusually large, as marking a critical change from normal to compression wood in *Pinus radiata,* indirectly Meylan has drawn attention to the very wide variations of microfibril angle that have been reported within and between species; my initial response is on this.

Recently, a study was made of the main causes of microfibril angle variations in a number of species and throughout the wide spectrum of tissues which are designated or accepted as normal wood (Boyd, 1974a). It was shown that the most careful measurements of microfibril angle could appear to give anomalous results and lead to quite misleading conclusions unless many complementary data were provided. Desirable details include: species, tree age, form and vigour, height at which samples are taken and their position in the growth ring, cross-sectional shape of cells and their wall thickness to diameter ratios, and whether data are for radial or tangential faces of the cell wall. As with differentiation of tissues in other biological systems, many interactions are involved, and their relative levels change greatly with conditions. Consequently, a sharp demarcation line cannot be drawn between normal and abnormal or reaction wood ("compression" or "tension" wood). In my paper on compression wood, I sought to demonstrate main points qualitatively, while providing approximate quantitative values.

Relative to Meylan's comment—that my estimates, as based on Barber and Meylan's (1964) analysis, were less precise than *apparently* they might be—I was well aware of this situation. However, in the paper and through its references to others, I demonstrated that that basis for analyses gave results qualitatively in accordance with the facts. Also, because of lack of adequate data at that time, I felt that it was not practical to show that a more complex, theoretically-precise analysis would give results of greater *actual* precision. At the same time, I considered that demonstration of the general importance of prime factors in differentiation was urgent, and could encourage scientists to apply greater effort to obtain adequate data.

More critical comment on precision was made in another paper (Boyd, 1974b). In that paper, references were made to the several papers, excepting I. D. Cave's thesis (unseen), on relationships between data and method of analysis, that are listed in Meylan's comment. However, I added—"Nevertheless, precision and range of practicable predictions of shrinkage are limited by inadequate knowledge of the swelling and elastic properties of the matrix materials (Cave, 1972). In addition, it may be a great disadvantage that allowance for lignification, in existing (mathematical) models, is limited to the extent of its average contribution to the elastic properties of the matrix materials." In fact, intensity of lignification varies around the cell wall. It was shown, also, that details of the average value of maximum transverse separation of adjacent

microfibrils between each pair of their bonding points, and the average longitudinal distance between those points were significant but unavailable (Boyd, 1974a).

REFERENCES

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J. D. Boyd,
CSIRO Division of Building Research,
Melbourne,
Australia.

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