was suggested that the WFGA sponsor a short course in quantitative methods. During planning meetings prior to holding the course it became clear to the organizers that no definitive text existed that covered all the ground of quantitative genetics as it applies to tree breeding. The various instructors therefore decided to adapt their course notes into a handbook that would serve as a text for current and future students and as an important reference tool for professional forest geneticists and tree breeders.

The actual short course took place in March 1989 and the editors worked hard for the next 3 years to make sure the style of each chapter was similar and without to much overlap. And what a good job they have done. It is certainly destined to be a new text-book classic for tree breeders. Every aspect of quantitative tree breeding is covered by one author or another.

Cheryl Talbert gives a good introductory chapter on 'Why bother?' and explains how quantitative genetics assists with decision making in a far from ideal world. After that it's down to the nitty-gritty. Hans van Buijtenen delivers a chapter on 'Fundamental Genetic Principles', which clearly sets out genetic principles and acts as a good reference for essential equations regarding predicted gain and correlated response. Floyd Bridgewater gives a rather 'dry' chapter on mating designs which just reels off all the design types without much comment on their use in actual programmes throughout the world. There is only passing mention of 'nucleus breeding', although admittedly this was little heard of in tree-breeding circles when the chapter would have been initially drafted. The chapter by Judy Loo-Dinkins on 'Field Test Design' is comprehensive and comes complete with suggested computer programs to tackle certain analysis problems. Gary Hodge and Tim White present an excellent chapter on breeding value calculation for single and multiple traits, which is effectively a condensed version of their recent book on the topic.

Other chapters cover 'Computation Methods' by Roy Stonecypher and 'Estimating Yield' of actual forest plantations by Sam Foster. The subject of how quantitative genetics can be used to assist decision making by evaluating alternative strategies is tackled in a most interesting and thought-provoking chapter by Sharon Friedman (also one of the editors), whilst Bob Westfall closes the book with a rather complex, sophisticated look at how analysis of provenance tests can lead to decisions regarding breeding zones.

The book really brings together a rich collection of experts. Of course it is highly north America-orientated. The work of Paul Cotterill and Christine Dean (Australia) is barely considered in multi-trait analysis, whilst good work from New Zealand on the practical implication of genotype environment interaction is not mentioned at all. But that does not detract from the fact that each chapter is a marvellous overview of its particular topic; a (fairly) comprehensive cover of the subject with a good collection of references to take it further if the student or tree breeder wants to.

At £54 it doesn't come cheap. There are no photographs and some pretty ropy diagrams and graphs, as well as some obvious typing errors and in one case errors in a table of presented data which is confusing if you are trying to follow the example through. I would certainly want it on my shelf, however, and if you are a tree breeder or student of tree breeding, you need it to.

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*Mutants at* xantha *and* albina *Loci in Relation to Chloroplast Biogenesis in Barley* (Hordeum vulgare *L.*). By KNUD W. HENNINGSEN, JOHN E. BOYNTON and DITER VON WETTSTEIN. *Biologiske Skrifter* 42. The Royal Danish Academy of Sciences and Letters. 1993.

A large number of barley mutants which affect chloroplast developments have been collected over the years in the hope that they would help to identify the primary products of the genes affected and, by causing blocks in chloroplast biogenesis, help dissect the structural and functional development of these organelles. This issue of the *Biologiske Skrifter* specifically describes over a hundred mutants at *xantha* and *albina* loci which were collected by Diter von Wettstein over the period 1954–1962. Other similar monographs have appeared before describing *tigrina*, *viridis* and *chlorina* mutants of barley. The authors express the belief that the mutants will be increasingly useful in the elucidation of the mechanism of chloroplast biogenesis as more information is obtained on the macromolecules of the chloroplast and their physiology. If this does prove to be correct this issue of the *Biologiske Skrifter* will indeed be very useful, provided that stocks of the mutants are freely available.

The main feature of the book is the presentation of 115 electron micrographs to illustrate the effects of the *xantha* and *albina* mutants on chloroplast morphology. These are of superb quality and worth having just for their aesthetic appeal. As far as the text is concerned, the genetic analysis of the mutants is described first, then there is a brief introduction to the processes of chlorophyll synthesis and of chloroplast biogenesis, followed by an assessment of how these processes are affected by the mutants. Finally there is a more detailed general discussion of chloroplast biogenesis with particular reference to the mutants, and there are tables listing how the mutants were made, how they segregate and what their properties are. One gets the impression that an enormous amount

of work has involved in assembling all this information, and the authors are no doubt anxious that all of this should have been worthwhile.

Over thirty years has elapsed now since these barley mutants were collected, and we are in a position to make some judgements as to how useful they have been or are likely to be. This is especially so as during the past decade the macromolecular structure of chloroplasts (and especially of their thylakoids) has been determined in considerable detail. What have the mutants contributed to this? Sadly, the answer is that most has been achieved by strategies other than the use of mutants. Many of the protein components of thylakoids are encoded in the chloroplast genome, and therefore their primary structures were deduced when this DNA was sequenced. Isolation of coding sequences for nuclear-encoded chloroplast components has been achieved mainly by screening cDNA libraries with antibodies or oligonucleotide probes. What mutations have shown (but *Chlamydomonas* rather than barley mutants) is that the regulation of synthesis and processing of particular chloroplast components may be very complicated, with even chloroplast-encoded components needing the participation of several nuclear-encoded components to bring about their maturation.

There are various technical problems which make it very difficult to use the barley mutants more effectively. One is that it would be a huge job to home in on even one mutant by a method such as chromosome walking, and to do it by complementation is also not yet feasible. Furthermore, in most cases it is not at all clear what the product of the mutated gene is or could be, as most mutations have pleiotrophic effects. Hopefully, when some of these problems are overcome the wonderful collection of barley mutants so meticulously described in this publication will really come into its own. By the time this happens, though, your copy of this issue of *Biologiske Skrifter* may have started gathering a bit of dust.

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