

Book reviews

Quality improvement in field crops. Edited by A. S. Basra and L. S. Randhawa. Published in 2002 by Food Products Press, 10 Alice Street, Binghamton, NY 13904-1580, United States (<http://www.haworthpressinc.com>). (Published simultaneously as the *Journal of Crop Production 5 (1–2)*.) 431 p. Price: US\$49.95 (softcover, ISBN: 1-56022-101-1.); US\$119.95 (hardcover, ISBN: 1-56022-100-3) (orders@haworthpressinc.com).

As chapter after chapter of this volume fell before the reviewer's scythe, the British television comedy "Never mind the quality, feel the width" sprang ever more insistently to mind. Unfortunately, the selvedges of what should have been a most timely addition to the plant breeding literature are also more than a little ragged. At all levels, from sub-editing to overall editorial leadership, the reader is sold short. Throughout the text, authors have missed errors of spelling, punctuation, grammar, and fact that detract markedly from the reader's appreciation of the quality of information conveyed.

Of course, the responsibility for the standard of communication also lies with the editors and the publishers, but this particular aspect of the book is not the only one where they have failed to reach a satisfactory standard. In Doehler's chapter on oat improvement, a number of references contain extended ASCII characters (e.g., Brückner et al.) which have been misinterpreted by the layout software (producing Brñkner et al. etc). Reproduction of some figures is poor, particularly in the chapters on rice and pigeon pea, and the index is somewhat patchy. In a number of chapters, misleading, contradictory, or erroneous information is given. For instance, in McVetty & Scarth's chapter on oilseed rape improvement the C20:0 fatty acid is named both behenic and arachitic acid, whereas behenic acid is said to be both C20:0 and C22:0, and both saturated and unsaturated! The two chapters on wheat improvement are contradictory on the matter of the importance of both starch and non-starch polysaccharide properties in determining the quality

of bread. The chapter on barley improvement would have benefitted from the input of a malting technologist or plant physiologist who could have contributed a deeper understanding of the malting and brewing processes. Their understanding of, for instance, the consequences of seed-to-seed variation and plant regulatory processes for final malt quality might have provided greater insight into the reasons why the various QTL maps differed. These more egregious errors should not have survived the peer review system, presuming that it was applied with full rigour to the papers in this volume. On top of this, sorghum, forage brassicas, and the entire fields of crop quality for monogastric animal nutrition and barley for food have been omitted.

It is the editors whose names are on the spine of this volume. To quote them:

"In this context, the primary aim of this volume is to provide an intelligent synthesis of the available information based on exciting research that has been going on to discover, characterize, modify and manipulate genes controlling key quality traits and point out directions for future research."

It is a further lapse in the execution of their responsibilities that the only intellectual contribution they appear to have made to this volume is to prepare a two-page preface, the critical statement in which is the sentence quoted above. There remains a huge gulf of understanding between the geneticists, agronomists, and plant pathologists who make up the vast majority of plant breeders on the one hand, and the biochemists and food technologists who convert the world's commodity crops into products suitable for human and animal consumption on the other. What was required was a solid introduction detailing the definition of quality adopted by the editors, and the brief extended to the authors when soliciting their contributions. The contributions then required extensive summary, integration, and comment in a concluding chapter. Some points that could have been made include:

(1) A product of satisfactory quality made of one or more plant-derived raw materials usually results from a number of parallel or serial biochemical

reactions. If the raw materials for one or more of these is present at the wrong level, or the reaction rate is wrong due to the incorrect level of the catalysing enzyme, the final product will not be up to standard. The plant breeder or agronomist can turn this to advantage, particularly in early generations of the breeding programme, by adopting the approach of selecting against inadequate expression of target characters, rather than trying to get food and textile technologists to develop early generation tests that attempt to select lines whose descendants will certainly meet quality standards.

(2) Plant breeders need to recognise that technologists prefer to use a wide range of raw materials in manufacturing their products, so that attempts, for instance, to induce soya to produce the nutritionally perfect protein are wasted on soya consumers. No one protein composition is perfect for all the manifold end-uses of soya protein. What is required is reliable composition, with minimal variability, reducing the cost of soya utilisation by reducing the need for over-formulation.

(3) Plants produce components valued by technologists at levels meeting the plant's needs for survival, reproduction, and competition, and many species have mechanisms to ensure phenotypic variation among their progeny despite a high degree of genetic homogeneity. Clearly, many of the authors in this volume understand this, but plant breeders have generally failed to convey this limitation on plant product quality to their technologist clients.

(4) Many of the plant components most desired by technologists, such as essential amino acids, fatty acids, and oligosaccharides, are highly reactive. For instance, glucose is a fundamental material in the energy economy of living organisms, but as a reducing sugar it is highly reactive, and potentially harmful to the cell if present in the cytoplasm at a significant concentration. Linking glucose to fructose via the reducing carbon deals with this problem, but produces sucrose, whose osmotic potential leaves the cell with another problem, dealt with by sequestering this substance in vacuoles. In the barley endosperm, glucose is converted to starch and to β -glucan, sequestered in the amyloplast and apoplastic space respectively. This behaviour has allowed the selection of barley types with caryopses 2–3 times larger than necessary for the plant to reproduce itself, and only thus has man been able to develop a crop accumulating glucose in a manner suitable for malting and brewing. Sexton et al.

present an excellent discussion of this issue in relation to sulfur metabolism in soya, which could have provided a lead in many of the other chapters.

(5) Most chapters discuss the use of QTL for monitoring the transfer of quality-related genes at the genotypic, molecular level. Although this approach has been thoroughly worked out for such tasks as pyramiding single genes for disease resistance, its application in the area of quality breeding demands full understanding of the way a particular quality characteristic achieves expression. Conventionally, grain β -glucan content in barley has been thought to be controlled by three major genes, but with only moderate heritability. However, there is a body of work (Coles 1979; Coles et al. 1991; Wallwork et al. 1998a,b,c) that indicates that grain β -glucan is turned over during grain maturation, with final content dependent on the interaction of assimilate flow from the rest of the plant, competition for substrate from starch synthesis, and possibly, remobilisation from the apoplastic space before harvest ripeness. Furthermore, it appears that the extractability of grain β -glucan varies markedly during grain maturation, dormancy, and initial steeping before germination, meaning that estimating true content is difficult. In light of this, it is perhaps not surprising that β -glucan content of seeds from adjacent florets in a single spike may differ by 100%. These factors may provide at least a partial explanation for the wide range of locations and sizes of QTL for grain β -glucan content found in the crosses discussed in this volume by Igartua et al.

The image alluded to in the first paragraph of this review was confirmed by an insert inside the back cover of this book, advertising a number of new titles. The principal recommendation for most seemed to be that they exceed a large number of pages in length. It is to be hoped that the principal motivation of this volume is to advance the cause of science, not to lengthen the CVs or bookshelves of the authors and editors. However, I suggest that the interested reader awaits the publication of a second edition, in which, hopefully, the synthesis claimed by the editors will be provided.

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Fruit quality and its biological basis.

Edited by Michael Knee. Published in 2002 by Sheffield Academic Press, Mansion House, 19 Kingsfield Road, Sheffield S11 9AS, United Kingdom. 279 p., hardback. ISBN: 1-84127-230-2. Price: £89.00/US\$149.95 (email: orders@crcpress.com, crcpress@itps.co.uk).

Consumers of fresh fruits and vegetables throughout the world are becoming more discerning about purchasing products with the quality attributes of appearance, flavour, texture, and nutrition they remember and desire. With the increasing globalisation of supermarket chains and year round supply of many produce lines, and with fresh fruits being sourced from around the globe, it is sometimes difficult for consumers to know the country of origin or the time since harvest for many of the fresh fruits they intend to buy.

Fresh fruits are variously perishable, they are picked, packed, and stored far from point of sale, and may be transported large distances around the world before reaching the consumer often many months

after picking. The increasing challenge for those in the logistics chain is to understand and manipulate aspects of the fruits physiology and biochemistry to maintain the quality attributes demanded by the consumer, so that the entire exercise will remain beneficial, profitable, and viable for all those involved.

This very timely book explores some of the main biological factors and processes that influence important quality attributes of fruit. Rather than deal with aspects of specific fruits, a thematic approach is adopted whereby substantive principles are addressed that impact all fruits (and by association vegetables).

The authors have been carefully chosen to represent scientists who have extensive applied and basic research experience in the key areas that have a significant impact on final quality. Each author has specialist experience in the topic they address and include recent advances in knowledge as well as outlining actual and potential and biotechnological information where appropriate.

The book comprises 10 chapters and opens with an overview of fruits in the global market by Adel Kader who stresses the importance of flavour and taste as critically important quality traits in return purchases by consumers and introduces the important aspect of food safety assurance. Ian Ferguson and Linda Boyd next review the importance of inorganic nutrients and fruit quality; because of its importance calcium receives attention. However, contributions made by other major and trace elements influencing colour, flavour, firmness, ripening, decay, and physiological disorders are dealt with, as is their relevance to human health.

Robert Redgewell and Monica Fischer remind us that many aspects of the structure of the fruit cell wall remain enigmatic. Despite much research the key events occurring at the very early stages of fruit softening are not well understood. This chapter outlines the current understanding of the structure of the cell wall, how it contributes to fruit texture and to consumer perceptions of this aspect of fruit quality.

Consumers increasingly are demanding fresh products that have taste and flavour. Successful repeat purchases will be determined by these internal quality attributes, yet there has been little success in developing cultivars or preservation techniques of fruits and vegetables that maintain or enhance these elusive traits. Elizabeth Baldwin reviews the major flavour components present in fruits, how they are

measured and perceived and stresses the need for more information to be made available to plant breeders.

Susan Lurie reviews postharvest temperature management succinctly stressing the need to understand product metabolism and physiology in order to utilise the most efficacious systems to optimise quality in the cool chain from producer to consumer.

Use of controlled (CA) and modified (MA) atmosphere storage is used widely in postharvest preservation of horticultural crops but only for a relatively few products, including apples, pears, kiwifruit, and bananas. The ability of these systems to maintain product quality for extended periods is well known and yet there are many crops where the benefits are only slight. Nazir Mir and Randy Beaudry provide a comprehensive review of respiratory metabolism and how varying CO₂ and O₂ concentrations influence this process. The link between atmosphere modification and ethylene in influencing storage life of fruit is highlighted, as is the relative effectiveness of CA/MA on climacteric and non-climacteric fruit.

Mechanical injuries caused by physical damage during and after harvest can result in development of physiological or pathological deterioration in fruits and substantial economic losses. Michael Knee and Ray Miller briefly describe the nature of fruit anatomy and fruit cells, before outlining the features influencing impact, compression, and vibration injuries. The affects of such damage on respiration, ethylene synthesis and secondary metabolites are discussed.

Chris Watkins has provided a timely update on ethylene biosynthesis, mode of action, consequences of exposure, and recent information about methods to manipulate ethylene responses. Of note is a current list of climacteric and non-climacteric fruit accompanying a discussion on the uncertainties that still exist in allocating individual fruits to a particular group, and the potential for very low concentrations of ethylene in the coolchain for decreasing shelf/storage life of climacteric and non-climacteric fruits and vegetables. The section on ethylene synthesis and perception, in particular the potential for ways to influence these processes, and the extraordinary ability of members of the cyclopropene family, in particular 1-methylcyclopropene, to antagonise ethylene responses, are a most valuable contribution to this book.

Most fungi do not infect most plants. However a relatively small number of very successful, highly specific postharvest pathogens are responsible for a very substantial proportion of the quality and economic losses that occur in the food chain. David Sugar reviews the nature of these diseases including the features that aid infection and that influence fruit susceptibility to diseases, before analysing several strategies for disease management, including biological control.

The final chapter on "Genetic control of fruit ripening" is presented by Graham Seymour and Ken Manning. The complex series of events that constitute ripening in fruit, including colour, texture, and flavour are controlled in part by the endogenous plant growth regulators, such as ethylene and auxin. However knowledge of developmental signals and the genes that control responsiveness of tissues to various stimuli, is increasing rapidly. There is still much to learn about how the specific endogenous and exogenous signals that are part of the inexorable developmental programme of fruit development from flower to fruit to quality food are controlled at the gene level. Within the next decade the current information on genetic control of quality attributes will have increased enormously, and we would expect to see such knowledge used to reduce food losses, and to improve food security, quality, and safety throughout the world.

This excellent book is required reading for all those with an interest in factors that influence the quality of fruit. It synthesises current understanding of such factors at the molecular and physiological level and identifies some of the limitations and potential of current postharvest technologies. Each chapter contains a comprehensive and up-to-date (to 2000) reference list that allows further reading on specific topics. As well as being essential reading for all postharvest biologists and technologists, I recommend this book highly to senior students involved in studies on postharvest physiology and quality of fresh fruit. It should be on the library shelves of every university and research institution undertaking teaching and research in horticultural science.

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