

**Fundamentals of Temperate Zone Tree Fruit Production**

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The cultivation of fruit trees, which originated mainly in China or South Asia, has a long and intriguing past. Its spread throughout the Eurasian land mass is a reflection of historical exploration and trade. Continued success of commercial tree fruit horticulture is based on the accumulated knowledge of processes and mechanisms underlying growth and development of both trees and fruit. This book provides encyclopaedic coverage of the many topics and issues that have exercised both the growers of fruit trees and the scientists involved in tree fruit production. The twenty-six chapters provide an effective synthesis of the principles underlying management and manipulation of tree and fruit growth, post-harvest quality and the major pests and diseases which often limit economic returns.

Chapter 1 describes the origins and traces the distribution of the major temperate tree fruit species, including apple, pear, plum, cherry, apricot, peach and nectarine. Considerable genetic diversity is evident in remaining wild fruit tree forests and the rich gene pool of, for example, apple, will continue to provide parents for new fruit cultivars. This genetic diversity has provided the basis for some of the management tools described in subsequent chapters, such as the development of size-controlling rootstocks (Chapter 13) and varieties with a range of desirable traits including good fruit quality, high and consistent yield, frost tolerance, variable growth habit and disease and pest resistance (Chapter 12).

Although many tree fruit species are remarkably adaptable to a range of conditions, site selection (Chapter 2) is an important consideration when seeking to maximize return on the high cost of establishing a commercial fruit orchard. Climate and microclimate play dominant roles in determining site suitability, as they are less easily manipulated than soil properties. Many tree fruit orchards are irrigated and the availability of high quality water is important. Existing knowledge of tree fruit water use and water relations is well summarised in Chapter 3. Metabolic processes governing carbon and nitrogen acquisition and partitioning are described in Chapter 4 and nutrient requirements and limitations to growth are discussed in Chapter 5. The importance of dormancy in allowing fruit trees to adapt to temperate zone winters and other adverse climatic conditions has led to a substantial body of work on dormancy mechanisms, summarised in Chapter 6, and the related topic of cold hardiness (Chapter 7). As the majority of fruit trees are heterozygous and many are self-sterile, sexual propagation techniques, described in Chapter 8, are used mainly for rootstock production. The causes of juvenility and strategies for shortening the juvenile period are also described. Vegetative propagation techniques, ranging from cuttings to *in vitro* micropropagation, are used in both the rootstock and the scion

production techniques described in Chapter 9.

With the exception of Chapter 12, which covers topics ranging from methodologies for creating genetic variability to breeding for selected traits, Chapters 10 to 15 are primarily concerned with the vegetative components of the tree. Function, morphology, anatomy and ecophysiology of roots are discussed in Chapter 10 and of shoots in Chapter 11. The authors point out that much more is known about shoot growth than about root growth, which has resulted in far greater understanding of the factors influencing top growth. This in turn has enabled the development of tree management techniques for manipulating tree growth, such as pruning (Chapter 14) and the “harvesting” of light through the design of tree canopy shape and planting systems (Chapter 15). Nevertheless, a major factor in the design of planting systems is the breeding and selection of rootstocks that impart size control, precocity and resistance to pests, diseases and some abiotic stresses (Chapter 13).

Chapters 16 to 20 deal with topics related to flower and fruit development. The formation of flower buds in most fruit trees is a complex response to multiple internal and environmental stimuli, thus, as reported in Chapter 16, although there have been many studies describing the morphology, timing and induction of flower buds, the underlying mechanisms remain poorly understood. Nevertheless, as the production of flowers and fruit is of great importance to the business of tree fruit horticulture, considerable effort has been expended to understand the factors affecting flower quantity and quality, pollination and fruit set (Chapter 17) and subsequent fruit growth and development (Chapter 18). There has long been interest in finding chemicals that regulate crop load to achieve year to year consistency not only in crop load but also in fruit size and quality. The development and use of plant bioregulators is described in Chapter 19 as are the associated issues of market acceptability and the lack of long term alternatives, e.g., cultivar development. The section of the book focusing on fruit is rounded out with a discussion of fruit ripening and quality (Chapter 20) from a physiological viewpoint and with regard to the practicalities of harvesting for the market. After harvest, many fruits are stored. The factors involved in choosing fruit for storage including cultivar, harvest quality and harvest time. Storage methods and respiratory metabolism and ethylene production driving storage are discussed in Chapter 21.

Disorders, diseases and pests are examined in the remaining chapters (22–26). Chapter 22 details the factors associated with the development of storage disorders and diseases. As pome fruits are kept in storage much longer than other temperate tree fruits, there is a greater understanding of the relationships between orchard production practices and storage

disorders for apples and pears than for other fruits. Disorders caused by the storage environment are also discussed. The modern horticultural practice of integrated pest management (IPM), which is based on an enhanced understanding of pest ecology, is described in Chapter 23. Because of the wide range of pests and management tools, only illustrative examples of how knowledge of pests and their natural enemies can be used in controlling economic losses are given. A similar approach is taken in Chapters 24 and 25, which examine disease control and weed control from cultural management and IPM perspectives. The final chapter on viral diseases outlines viral classification, vectors for viral transmission and methods for the detection and prevention of viral infections.

As pointed out by the editors, this book does not seek to be a manual of cultural practices for horticulturists, but rather a summary of the current knowledge of the principles and mech-

anisms that underpin tree fruit production practices. In this aim, it succeeds well. Twenty of the chapters were written or co-written by the three authors and are excellent summaries of their own work over the course of long and distinguished careers and of the work done by others in the field. The additional contributions round out the subject matter well. Although more detailed reviews of every chapter topic have been written (many of which are referenced in this book), it is the collection of information and insights that make this volume a valuable contribution to the literature on deciduous tree fruit horticulture.

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