Chapter 8

Kiwifruit

A.R. Ferguson and A.G. Seal

Abstract  Kiwifruit are still a relatively minor crop making up perhaps 0.2% of total world annual production of fruit. The kiwifruit of commerce are large-fruited selections of two closely related species Actinidia chinensis and A. deliciosa. Most current kiwifruit cultivars are selections from the wild or from seedling populations and only a few result from planned hybridizations. The main emphasis in the breeding programs underway is on fruit novelty, flavor, size, time of harvest, flesh color, length of storage life, environmental adaptation and vine productivity. Until recently, nearly all the kiwifruit grown commercially outside China were of one green-fruited cultivar of A. deliciosa; now yellow-fleshed, sweeter flavored kiwifruit are becoming important in international trade. To take advantage of the considerable diversity within the genus requires good germplasm resources and a better knowledge of the reproductive biology of kiwifruit. The main constraints to breeding include dioecy, the long generation time and the complexity of some key traits as well as the need for support structures, the exuberant vegetative growth and the need to control growth to ensure fruiting. Many of the traits associated with fruit quality are quantitatively inherited. Use of molecular biological and biotechnological techniques should facilitate improvement programs.

8.1 Introduction

The kiwifruit of international commerce are selections of two closely related species Actinidia chinensis Planch. and A. deliciosa (A. Chev.) C.F.Liang et A.R.Ferguson. Currently about 1.5–1.6 million t of kiwifruit are produced each year. Italy (25% of present world production), New Zealand (20%) and Chile (7.5%) are the three most important producing countries in terms of international trade. Italy exports c. 66% of

A.R. Ferguson
The Horticulture and Food Research Institute of New Zealand Ltd (HortResearch), Mt Albert Research Centre, Private Bag 92 169, Auckland, New Zealand
e-mail: rferguson@hortresearch.co.nz
its kiwifruit, New Zealand at least 94% and Chile c. 88%. The recently established plantings and rapidly increasing production in China (340,000 t in 2002) have yet to have a major impact. About two thirds of current kiwifruit plantings are in the northern hemisphere and one third in the southern hemisphere; there is an increasing tendency towards complementary marketing of fruit from the two hemispheres to ensure year-round supply in the marketplace.

Kiwifruit are large, long-lived vines that are demanding in their growth requirements. They require strong and expensive support structures. They need very well-drained soils but also an adequate supply of moisture, since their large leaves transpire 80–100 L of water per day. Throughout the vegetative period they can transpire in total the equivalent of at least 700 mm rainfall. They need a long frost-free period of about 270–300 days from budburst to commercial harvest and they are therefore susceptible to late spring or early autumn frosts. Although they cannot withstand winter temperatures much below 0°C, they do require a period of winter chilling to break dormancy and to ensure adequate flowering. Their young shoots are easily blown out by strong winds in spring and the fruit are susceptible to windrub throughout the whole season. High summer temperatures can result in extensive premature fruit drop and leaf fall. Kiwifruit can therefore be grown successfully in only a relatively narrow band between about 35–45° north or south of the equator. The two main species grown differ in their requirements: *A. chinensis* breaks dormancy earlier than *A. deliciosa* and is more likely to be damaged by spring frosts but it is more tolerant of hot summer conditions. These differences are probably due to the natural distribution of the species; *A. chinensis* is found at warmer altitudes to the east of China and *A. deliciosa* mainly higher in the inland mountains under cooler, wetter conditions.

Kiwifruit are amongst the most recently domesticated of all fruit crops (Ferguson and Bollard 1990, Ferguson and Huang 2007). *Actinidia deliciosa* was first cultivated outside China at the beginning of the 20th century. The first commercial orchards were established in New Zealand by about 1930, but it was not until the successful export of fruit from there in the 1970s and 1980s that serious attempts were made to grow kiwifruit commercially in other countries. The domestication of *A. chinensis* is even more recent. The first known systematic cultivation was in China in 1961 and significant quantities of fruit became traded internationally only at the end of the 20th century. Today, about 85% of the kiwifruit produced commercially are of *A. deliciosa*, 15% of *A. chinensis*.

The most widely planted kiwifruit cultivar is *A. deliciosa* ‘Hayward’ (Fig. 8.1), selected in New Zealand in about 1925. ‘Hayward’ and its associated pollenizer males account for about half of kiwifruit plantings throughout the world and ‘Hayward’ fruit represent about 90–95% of the kiwifruit traded internationally. The second most widely planted cultivar is *A. deliciosa* ‘Qinmei’ which is grown commercially only in China; this cultivar and its males account for c. 30% of Chinese kiwifruit plantings or c. 15% of the world total. The most widely planted cultivar of *A. chinensis* is ‘Hort16A’, the fruit of which are marketed as ZESPRI™ GOLD Kiwifruit. In 2006, ‘Hort16A’ accounted for about 20% of the kiwifruit plantings in