

# Citrus Cultivation in China

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China is taking measures to update one of its ancient horticultural arts—citrus culture, which was practiced in this country for millenniums before it spread to the tropical and sub-tropical regions all over the globe.

Successes have already been achieved in the breeding of some fine varieties of orange and tangerine. In experiments conducted in recent years, some whole citrus plants have been bred in test tubes from endosperm calluses (cell formations over cut surfaces of nutritive tissues in embryo sacs). Such plants are triploids, which on reaching maturity, will bear fruit containing no seed.

China is the home of the citrus plant. According to one historical record, citrus culture began 4,000 years ago, and had become quite widespread in China during the Qin and Han periods (221 BC-220 AD). In the early 1970s, seeds of oranges were found among the objects unearthed in a 2,100-year-old tomb outside Changsha, capital city of Hunan province, Central China.

In his book "Trees and Grasses of South China," written in AD304, Ji Han dealt with the citrus regions south of the Changjiang (Yangtze) River, and the use of ants to combat harmful insects on orange trees. This is probably the world's earliest literature on the use of biological means to keep insects under control in citrus groves.

The year 1178 saw the publication of "Orange Trees" which classified 27 citrus species and varieties and touched on a wide range of subjects—from seed selection, grafting and tillage to pest control, harvesting and storage of fruit.

Chinese citrus growers had in ancient times developed many varieties, some of which, like the citron, sour orange, sweet orange, mandarin and kumquat were later introduced to Japan, the Mediterranean countries and the New World.

However, citrus cultivation in China did not make significant progress because no encouragement was given to research. An attempt to revive the long neglected citrus industry got underway following the establishment of the People's Republic in 1949. A citrus research center was established by the Academy of Agricultural Sciences of China in Chongqing, Sichuan province, while research groups also came into existence in the provinces of other major citrus growing areas.

Scientific farming groups made up of professional people and staff were formed at the county and commune levels, and they too conducted experiments on citrus culture.

Through selective propagation, crossing and hybridization, Chinese researchers have succeeded in breeding many fine citrus varieties. A new variety of orange called Glorious Orange, whose fruits contain few seeds, has a moderately sweet and sour flavor, and is juicy and of good eating quality. It has become popular in Sichuan province. This variety yields 50 kilos of fruit on a 10-year-old tree and 300 kilos on a 30-year-old tree.

An object of citrus research in China is to experiment and collect data on possible new species. Some headway has been made in the studying and collecting of citrus species still found growing wild in the hilly regions of Guangxi, Guangdong, Hunan and Yunnan.

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Fig. 1. A good harvest of the famous "Huangyan tangerine" is reaped on a people's commune in Huangyan county, Zhejiang province, east China.

Some species have been found which are valuable for the breeding of new varieties. A very hardy species with wing leaves several times larger than normal leaves has been discovered in Honghe county in Yunnan province, providing a new object for scientific research. Experiments are now under way to see if it has value as a rootstock. And the Golden Fragrant Pomelo, a single fruit of which can perfume the air in a house, was found in a grove in Hunan province.

Since chemical insecticides came into use much later in China than in the agriculturally advanced countries, many natural predators that devour



Fig. 2. The pomelo produced in Guangxi, south China.

harmful insects to citrus plants are still to be found. Recently, researchers have discovered a tiny insect no bigger than the point of a needle that can destroy scores of red spiders in a day. It is now artificially bred for use in orange groves.

Ways also have been found to raise orange yields in the red soil regions of southern China where most of the citrus groves are located. New techniques have been worked out which enable citrus trees to be grown on the sandy beaches along the coast. In Zhejiang province, trees budded on saline resistant rootstocks have been successfully grown on land reclaimed from the sea.

Citrus fruit is now cultivated in 20 provinces and autonomous regions, most of which are situated south of the Changjiang (Yangtze) River. The total acreage has expanded six times over the past three decades. But the average per-hectare yield is low compared with that in Japan or the United States. In many areas it is as low as 7.5 tons per hectare, although yields as high as 75 tons per hectare are obtained in some places.

For the most part citrus is cultivated on terraces carved out of the hillsides, as the best land is given over to the growing of foodcrops to feed China's enormous population. This is one reason for the relatively low citrus yields.

Another factor inhibiting the growth of the citrus industry in China is the small size and scattered nature of citrus groves. For many centuries Chinese peasants used to plant orange trees in the backyards of their homes, or on tiny plots of marginal land beside fields growing foodcrops. This ruled out the possibility of introducing modern methods of cultivation on a sizable scale.

The situation has somewhat improved with the establishment of farm

cooperatives, which after 1958 merged to form communes. Since then some large citrus orchards have been introduced by the production teams or brigades under the communes, but they still are small compared with those in the leading citrus growing countries of the world.

A plan is now being drawn up to establish large orchards in areas most suited to citrus cultivation. This, coupled with the application of modern cultural practices, will transform the Chinese citrus industry in the years ahead.

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## Blackberry Production and Cultivar Situation in North America

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Wild species of blackberry are indigenous in most temperate areas of the northern hemisphere and are usually the most abundant of wild fruits (2). Strangely, blackberries are among the more recent fruits to be domesticated, being largely developed as a cultivated crop in the latter half of the 19th Century. The abundance and availability of wild blackberries may have made early cultivation unnecessary. More likely, the thorny, unmanageable character of most wild blackberries created a prejudice against them as a garden fruit, and this prejudice was brought to the New World by the pioneers from Europe (2).

The first pomological articles to recommend the cultivation of blackberries in the U.S. began to appear about 1829 (2), and little by little

blackberries were brought under cultivation. In the meantime, during the 200 or so preceding years, the clearing of forests and subsequent spread of wild blackberries had created a massive natural breeding program among the various, interfertile, heteroploid, and highly heterogenous blackberry species (1). Blackberry enthusiasts had only to select the best from among the vast array of wild seedlings.

Two cultivars, Lawton and Dorchester, selected from the wild in the 1830's and introduced in the 1850's, contributed greatly to the new interest in selecting and cultivating blackberries. Soon other superior sorts appeared, some selected from the wild, some resulting from sowing open-pollinated seeds, and a little

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