Kenya is a tropical East African nation with a wide diversity of climatic and geographical regions. This diversity allows many horticultural crops to be introduced and grown successfully. Horticultural production has contributed significantly to the Kenyan economy in the past decade, and it will continue to do so. This paper attempts to summarize significant horticultural events and research in Kenya and describe possible future developments.

Historical developments

The earliest recorded work on horticultural crops was in 1911, when a few tropical fruit plants were planted at the coastal Matuga Station [45 m above sea level (ASL)]. Various fruit and vegetable species from Europe and other parts of the world were introduced later. In 1920, apples (Malus domestica Borkh.), persimmons (Diospyros kaki L.), plums (Prunus sp.), and avocados (Persea americana C.F. Gaertn.) were imported from South Africa and planted at Kabete (1737 m ASL), near Nairobi. Agricultural research for the (then) colony was centered in Nairobi at the Scott Agricultural Laboratories, now named the National Agricultural Laboratories. Many research programs were moved from Nairobi to other sites in 1927, when the coastal station turned its focus to tropical fruits and warm- and hot-season vegetables, among other crops. Work on temperate-zone (TZ) fruits and cool-season vegetables was moved to higher elevations. A systematic plant introduction service was begun in 1931 to facilitate introducing and testing many crop species and cultivars (Kenya Dept. of Agriculture, 1933).

A few TZ fruits were planted on an experimental site at Tigon (2100 m ASL), in the central highlands near Nairobi. In 1946, all such work was moved to the Molo Station (2550 m ASL) in the highlands west of the Rift Valley. This site has an annual mean of 14.4°C, but drops below 13°C during the July–August dry season—a temperature low enough to satisfy chilling requirements of low-chilling TZ fruits. Additional fruit crop research was conducted at other stations located at medium elevations: apple and citrus at Kitale (1860 m ASL) in the western highlands and citrus, avocado, and fig (Ficus carica L.) at Ruiru (1670 m ASL) in the central highlands. In 1955, an irrigation research station opened at Perkerra (550 m ASL in the hot, arid northern Rift Valley) for studies on hot-season fruits and vegetables. Thus, when Kenya gained independence in 1963, several stations already had established horticultural research programs.

Soon after independence, all horticultural research was coordinated through the National Horticultural Research Station (NIRS) at Thika (1549 m ASL), ~45 km northeast of Nairobi. The Thika station was established in 1957 for experiments on isial (Agave sisalana Perrine) and pineapple [Ananas comosus (L.) Merrill]. Horticultural research activities were also included in the programs of several other stations throughout Kenya. Since 1963, minimal horticultural research has been conducted, and it is often limited to client-oriented adaptive trials; e.g., cultivar adaptability, spacing requirements, propagation, production of planting materials, fertilizer and manure application, crop rotations, irrigation frequency, and chemical or cultural pest control. Only recently has there been interest in studying cropping systems, seed production methods, cultivar breeding, food technology, postharvest handling, and production economics.

The low overall importance of Kenya’s horticultural industry in the past is one explanation for the slight emphasis on research. In the postindependence period, research on staple food products (maize and beans) was emphasized to ensure national food sufficiency; thus, horticulture (especially fruits and ornamentals) did not receive high priority. Because Kenya is a young, developing nation, there has been a shortage of qualified scientists, scientific literature, and well-equipped laboratories. Although the problem of insufficient literature and laboratory equipment still exists, the current emphasis on specialized personnel training, together with collaborative international assistance, is helping to alleviate the shortage of scientists.

Tropical and subtropical fruits and nuts

Mango (Mangifera indica L.), avocado, pineapple, passion fruit (Passiflora edulis Sims), and papaya (Carica papaya L.) are Kenya’s most important export fruits. Banana (Musa acuminata Colla), plantain (M. paradisiaca L.), and citrus fruits are mainly eaten locally. Macadamia nut (Macadamia integrifolia Maiden & Betche), coconut (Cocos nucifera L.), and cashew (Anacardium occidentale L.) are grown for local and export markets.

Since the first citrus plants were established along Kenya’s coast early in the 20th century, there has been continued interest in developing citrus production to meet local demand. As early as 1932, many stations had citrus nurseries for supplying budded trees. Sweet orange [Citrus sinensis (L.) Osbeck] is the most important citrus crop for the local market, while lime [C. aurantiifolia (Christm.) Swingle], lemon [C. limon (L.) Burro. f.], and grapefruit (C. x paradisi Macfadye) are grown primarily for export. Citrus research, focusing on rootstock evaluation, propagation methods, cultivar trials, plant nutrition, and pest control, has been attempted at other stations located at a range of elevations. Citrus crops grown on the coast and at Perkerra had better growth, yield, and quality than those at higher, cooler elevations. Until 1985, the NIRS served a large collection of citrus and related species for future breeding work, but all the plants at this and other highland stations were destroyed when citrus greening became established in Kenya. This viral disease is vectored by the citrus psyllid (Trioza erytreae), which does not live at lowland (warm) locations. Consequently, all propagation and research work on citrus was moved to low-elevation stations.

Bananas have been grown in Kenya for many years, and various cultivars of cooking and ripening types have been evaluated. Most of the work has involved cultivar adaptability, fertilizer application, pruning, and insect pest control.

Fresh pineapple was the leading export fruit from Kenya until the 1970s, when Kenya lost its comparative advantage. Pineapple research was initiated at the coastal research station before 1954 and was later moved to the NIRS. Research is concentrated on cultivar adaptability, planting materials, spacing, fertilizer use, cropping cycles, mulching, and crop protection.

Avocado, papaya, and passion fruit are among the early introductions that grow well at many low and medium elevations in Kenya. Local demand for all three crops is low, but production has increased to accommodate the expanding export market. Research on avocado and passion fruit primarily has focused on spacing, fertilizer application, and disease control. At present, most work on these crops has been done at the NIRS, because their economic potential as exports has only recently become evident. Propagating avocado and pruning and trellising passion fruit have been well investigated, but little work has involved papaya.

Virtually no research has focused on mango in Kenya, even though the crop has been grown there for hundreds of years (Sharma, 1993).
Research on TZ fruits was directed principally toward finding cultivars suitable for local growing conditions; e.g., those with minimal chilling injuries, resistance to disease pressures under high relative humidity, and tolerance to adverse soil conditions (insufficient nutrients, nematodes, and diseases)—all factors that could be ameliorated with suitable rootstock/scion combinations. Additional work focused on postharvest requirements, fertilization, and propagation.

Apple cultivars found suitable for these growing conditions include 'Winter Banana' and 'Fouke Beauty' (Erez, 1980)—two cultivars still widely grown in Kenya. The 'Methley' plum, grown mainly from cuttings, is the predominant plum cultivar in Kenya, but many other cultivars produce fairly well and are maintained at the Molo station. 'Kieffer' pear is virtually the only pear grown commercially in Kenya because of its high productivity, although it has poor eating quality. Peaches do not grow well in Kenya. Almond (Prunus dulcis Mill.), apricot (P. armeniaca L.), walnut (Juglans regia L.), chestnut (Castanea crenata Siebold & Zucc.), olive (Olea europaea L.), and quince (Cydonia oblonga Mill.) also were tested at Molo, but they lack economic potential.

The departure of European research scientists after independence brought the TZ fruit research program to a standstill around 1969, and the scientists who remained had inadequate knowledge of these fruits to continue the work. In addition, there was pessimism about what contribution TZ fruits could make to the economy of a newly independent Kenya. Nor were geographical factors favorable for TZ fruit cultivation. Some cultivars that initially seemed promising had generally poor yield due to insufficient chilling. Minimum temperatures often were not sufficiently low or did not last long enough, and chemical control of budbreak was unreliable. High relative humidity contributed to the spread of fungal diseases and to the development of lichens and parasitic plants (Erez, 1980). There have been attempts to revive the program, but these crops have not been grown in high priority because they are unknown locally, with consequent low local demand, and have little export potential. However, there are many possible growing areas in the country and local demand is increasing, so research on these crops recently has been expanded.

Small fruits

Strawberry (Fragaria xananassa Duch.), grape (Vitis vinifera L.), blackberry (Rubus spp.), youngberry (R. ursinus Chain.), raspberry (R. idaeus L.), and cape gooseberry (Physalis peruviana L.) were tested at the Molo station during the colonial period. Grapes also were tested at Thika and Perkerra, and strawberries at Thika and Limuru. But, in general, research on small fruits has not been extensive, because of their perishable nature. As with TZ fruits, research on small fruits has emphasized cultivar adaptability and production practices suitable for local conditions.

'Cambridge Favourite' is one of many British strawberry cultivars tested and still grown in Kenya. To obtain the best yield and quality, strawberry plants are deflowered for 6 to 8 months, then harvested for 2 to 3 months during the start of the long rainy season (April-June). Deflowering may omit if fruits are used for processing, when size is not important. This cycle can be repeated for 3 years before replanting is necessary. Punnets that hold 0.5 kg of strawberries and are covered with cellophane make satisfactory packaging for export. The export market for fresh strawberries is increasing, thus research on strawberries is continuing.

Grapes grow well at medium and low elevations; however, bird damage and fungal diseases limit production. Most of the work has involved table grapes, since wine grapes are a recent introduction. With the exception of raspberry, berries (Rubus spp.) grew well, with good productivity and quality. Only small amounts are grown, however, because of limited processing capabilities and the crop’s high perishability. Cape gooseberry yielded 25 t ha-1 in trials conducted in 1958-60, but production is limited.

Vegetables

Vegetable species have been tested in the various ecological zones of Kenya, but, in most cases, only a few cultivars are grown. Research during the colonial era consisted mainly of testing various species and cultivars, whereas in the postcolonial period, cultural practices, pest control, and cultivar introduction have been the main focus. Crops receiving the most attention include cole crops (Brassica spp.), potato (Solanum tuberosum L.), tomato (Lycopersicon esculentum Mill.), pepper (Capsicum annuum L.), onion (Allium spp.), carrot (Daucus carota L.), bean (Phaseolus vulgaris L.), pea (Pisum sativum L.), squash (Cucurbita spp.), and melon (Cucumis melo L. and Citrullus lanatus (Thunb.) Matsum. & Nakai).

Potatoes, cole crops, and carrots grown well in the highlands at >1500 m asl and are eaten locally and exported. Research has been mainly directed toward cultivar evaluation, production methods, and pest and disease control.

Tomatoes and peppers are grown widely in medium- and low-elevation areas having warm climates. Several processing and fresh-market tomato cultivars have been tested, and some germplasm has been collected for breeding work. Selection for resistance to late blight and bacterial wilt is a major goal. Pepper research has emphasized cultivar adaptability and cultural practices.

Several onion cultivars have been grown successfully from the warm coastal areas to the cool highlands, as well as under irrigation in the hot, arid northern region. Trials on cultural practices, postharvest technology, and fungal disease control have been conducted, especially in the cool, humid areas. Research also is investigating seed production methods for the cool highlands.

Among the many leguminous vegetables,
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stroyed. Destroying this germplasm would be a long-term loss to Kenya and the world. Unfortunately, partly because of limited resources, present programs emphasize assisting projects that give immediate economic gains. Breeding programs to develop suitable cultivars of some indigenous species would assure sustainability of local production, and may encourage production overseas.

There is a growing interest in the application of biotechnology (mainly tissue culture) for the rapid multiplication of selected materials, disease indexing and elimination, and germplasm enhancement, conservation, and distribution. As biotechnology laboratories are developed and more scientists are trained, other more advanced biotechnology techniques could be tried. With the increased income from the horticultural industry and the general economic development of the country, more funds may become available to support horticultural research. KARI is expected to act as a liaison with other national and international centers to foster research and disseminate findings, thus improving research programs at the public centers and the universities.

References


