Horticulture in Kenya: An Overview

Kenya is one of the more than 50 nations constituting the vast continent of Africa. Richly diverse, culturally and geographically, Kenya lies astride the equator in East Africa, in the same time zone as Moscow and Iraq. Kenya's size ($5.8 \times 10^5 \text{ km}^2$) equals that of Wisconsin, Minnesota, Iowa, and Indiana combined. The Indian Ocean forms the eastern coast of Kenya, from which the land gradually rises westward into the upland plains of 900-to-1800-m elevation and mountain ranges $>2700 \text{ m}$ (Fig. 1). In the southern portions of the upland plains, annual precipitation averages $\approx 500 \text{ mm}$. To the north and east, generally $<250 \text{ mm}$ of rain falls annually, rendering that area ($\approx 60\%$ of Kenya's total area) unsuitable for nonirrigated agriculture.

The Great Rift Valley, averaging ≈ 32 to 56 km wide and part of a 5600-km-long geological formation along rift faults in Africa's tectonic plate, bisects Kenya along its north-south axis. Large mountain ranges and plateaus are found on both sides of the Rift Valley, many $>2500 \text{ m}$ elevation. During the coldest months (July–August), radiation/valley frosts occasionally occur at elevations $>2500 \text{ m}$, damaging frost-sensitive crops. East of the Rift Valley is Mount Kenya; hence, the name of the country. Mount Kenya, at 5199 m , is the second highest mountain in Africa and the world's largest shield-type volcano. The mountain is centrally located in the country and can be seen from as far away as 100 km . Even though it is almost directly on the equator, perennial snow and ice can be found above 4500 m . Permanent streams flowing off the mountain are a vital source of water to millions of people. On the southern border of Kenya is Mount Kilimanjaro (5895 m), Africa's high-

est mountain. Mount Elgon (4321 m), the third highest, is on the western border. West of the Rift Valley, the elevation decreases in a series of progressively lower foothill ranges to the level of Lake Victoria (1135 m), the second largest freshwater lake in the world and source of the Nile, the world's longest river. Three countries border the lake—Kenya, Uganda, and Tanzania. In Kenya, the land slopes downward to the plains of the Masai Mara game reserve, a northern extension of the Serengeti Plains of northeastern Tanzania.

Agriculture is Kenya's major enterprise. About 20% of Kenya's land area has outstanding capacity for agriculture (without irrigation); $\approx 75\%$ is either mountainous or arid. With Kenya's population surging past 26 million (almost three times the number 30 years ago) and with nearly 80% of the population living in rural areas, the demands placed on agricultural lands are significant. Kenya has a bimodal rainfall pattern, which largely determines the seasons. From March through June,

the Intertropical Convergence Zone (ICZ) migrates northward across Kenya, lagging behind the sun's apparent northward movement by ≈ 3 to 4 weeks. This marks the season of the "long rains," when staple crops (i.e., maize, beans, and assorted vegetables) are planted. Low rainfall periodically can lead to famine in the region. Rain frequently falls as heavy downpours, which cause significant erosion and runoff. In some upland farming districts, frequent hail seriously damages crops.

As the ICZ moves northward out of Kenya in July, the rains in nonmountainous portions of Kenya cease, while the frequency of thundershowers decreases greatly in the mountainous regions and the Lake Victoria basin. Nevertheless, there is still adequate moisture available to mature crops. This situation prevails until the "short rains" of October through November, when the ICZ again migrates across Kenya, this time southward. Early maturing crops are planted, mainly in upland areas, during these months. From December through early March, there is minimal rainfall throughout Kenya, and daytime temperatures reach their maximum (33 to 38°C along the coast, 35 to 40°C in the upland plains, and 30 to 35°C in the mountainous regions).

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Front cover: (clockwise from top left) Research aides harvesting tomato variety trials at the Kenya Agricultural Research Institute (KARI) Horticultural Research Station, Thika; horticultural produce on display at the Nairobi city market; temperate and tropical fruit and vegetable selection at the Nairobi city market cut-flower selection at the Nairobi city market and *Alstroemeria* variety trial at the KARI Horticultural Research Station, Tigoni.

Fig. 1. Horticultural production areas of Kenya. (Source: *Kenya: A Travel Survival Kit* by Geoff Crowther and Hugh Finlay. 1991. Lonely Planet Publications, Hawthorn, Australia.)

(continued from inside front cover)

Prehistorical aspects

According to archaeological evidence, people have inhabited this region of Africa for at least the past 1 million years. These indigenous peoples have learned how to survive and prosper in what can be, at times and in certain places, a parched and barren land. They raised a variety of crops, many of which are now grown only in isolated areas. They also developed farming systems and learned to use native plants in ways compatible with the ecosystem. Today, we recognize that the knowledge acquired over the millennia can be valuable in our quest for sustainable agricultural practices. Toward this end, programs have been established at several Kenyan universities, the Kenya Agricultural Research Institute, along with numerous donor agencies, including the U.S. Agency for International Development, World Bank, European Economic Community, and the Overseas Development Corp., to strengthen Kenya's agricultural, educational, and technology transfer capacity.

Historical development

Most horticultural crops grown in Kenya are exotic and few records exist to date their introduction. Many fruit species probably were grown before the colonial era (i.e., before 1860). These were brought to Kenya by Arab and Indian traders from Asia, either directly or via southern Africa. Citrus (*Citrus* spp.), mango (*Mangifera indica* L.), and banana (*Musa acuminata* Colla) may be the earliest introductions, arriving before the 6th century. Papaya (*Carica papaya* L.), avocado (*Persea americana* C. F. Gaertn.), passion fruit (*Passiflora edulis* Sims), and pineapple [*Ananas comosus* (L.) Merrill] are more recent introductions and probably were imported by Portuguese explorers, missionaries, or colonialists. Most of the commercial cut-flower crops were introduced into Kenya from Europe within the past-50 years. Certain tropical vegetables from southwestern Asia also were introduced at that time.

Since prehistoric times, Africans have used wild native plants for their fruits and vegetables. Some care likely was given to certain wild plants, but there was no systematic cultivation. These food plants include: *Solanum nigrum* L., *Amaranthus* spp., *Commelina* spp., *Gynandropsis* spp., and a range of legumes and cucurbits. Until recently, there was almost no interest in ornamental plants for gardens or interior decoration because of the rural life style of most Kenyans and the abundance of ornamental species in the landscape. Trees, however, were commonly planted for their shade and ornamental value. While livestock and field crop production were developed and practiced during and after the colonial period (1860-1963), fruits and vegetables were still collected from wild plants. Today, though many of these plants are not used and some are regarded as weeds, a few wild-type fruits and

vegetables may still be collected or even cultivated.

During the colonial era, the government encouraged development of commercial farming of coffee (*Coffea arabica* L.), tea [*Camellia sinensis* (L.) O. Kuntze.], pyrethrum [*Chrysanthemum cinerariifolium* (Trev.) Vis.], cotton (*Gossypium hirsutum* L.), wattle (*Acacia* spp.), sisal (*Agave* spp.), wheat (*Triticum* spp.), barley (*Hordeum vulgare* L.), and maize (*Zea mays* L.) while ignoring indigenous crops. Many vegetables were introduced from Europe and Asia to cater to the needs of European and Asian immigrants and the growing urban population. The exclusive production of exotic crops was promoted strongly near urban centers, and the major vegetable-growing areas are still adjacent to large cities, such as Nairobi, Nakuru, and Kisumu.

In the postcolonial era, the demand for horticultural produce has increased, and improvement of exotic crops continues. Until the late 1960s, coffee was the major export commodity, but after the 1973-74 oil crisis, it became clear that reliance on a single commodity was undesirable. Additionally, periodic fluctuations over the past 25 years in the prices of primary agricultural commodities in the world market make revenue from coffee and tea unreliable. Because the market potential for Kenyan horticultural products in Europe has increased rapidly over the past two decades, the Kenyan government has actively encouraged horticultural development as an alternative enterprise. New fruit, vegetable, and floral crop species and cultivars have been introduced to supply an expanding and evolving local and overseas market.

Current situation

Horticulture is one of the major farming activities in Kenya, providing food, income, and employment for the rural population while feeding the ever-growing urban population. Additionally, horticulture plays a major role in small-farm development. As a foreign exchange earner, it ranks with tourism and coffee and tea production, earning the local nickname "green gold." In the sessional paper no. 1 of the 1986 parliament, export capability for horticultural commodities was estimated to increase 8.7% annually between 1983 and 2000. Kenya's fresh produce exports have grown from 3224 tin 1970 to 22,266 t in 1980 and 57,363 t in 1992—a 2.57-fold increase in 12 years (Table 1). By weight, cut flowers constituted 34% of the total fresh produce exports in 1992, followed by french beans (*Phaseolus vulgaris* L.) (26%), avocado (11%), and assorted Asian vegetables (16%) (Table 2). Most Kenyan produce is exported to Europe and the Middle East, with the United Kingdom (29%), Germany (9%), France (22%), and the Netherlands (25%) being the major importers of Kenyan horticultural products in 1992 (Table 3). On the basis of revenue earned, the annual free-on-board (f.o.b.; i.e., the seller agrees to put an item on a truck, ship, etc. at no charge, but the transportation costs must be paid by the buyer) gate value of

Table 1. Export value of fresh and processed horticultural produce for Kenya, 1968-92.²

Year	Quantity (1000 t)	f.o.b. Value (KShs) (millions)	Value converted
			to U.S. (35 KShs/\$) (millions)
1968	1.5	3	0.09
1971	5.1	11	0.3
1981	23.3	251	7.2
1982	24.6	273	7.8
1983	28.8	351	10.0
1884	31.3	416	11.8
1985	30.0	469	13.4
1986	36.2	630	18.0
1987	36.5	1076	30.7
1988	59.1	1328	37.9
1989	49.5	1440	41.1
1990	49.1	1678	48.0
1991	49.8	2011	57.5
1992	57.4	2517	71.9

²Data obtained from Horticultural Crops Development Authority, Nairobi.

exported fresh and processed horticultural crops exceeds 2.0 billion Kenya shillings (KShs), up from 469 million KShs in 1985. In terms of U.S. dollars (given an exchange rate of 35 KShs/ U.S. dollar, Nov. 1992), annual horticultural exports exceed \$60 million and are growing at a steady rate.

Currently, the major constraints to horticultural exports are limitations on air cargo space, cost of air freight, and changing patterns of international supply and demand. Other countries that use sea transport have a competitive market advantage on produce having a high weight: value ratio. Thus, the Kenyan government has recommended that the highest-valued produce should be given priority for air freight. At the same time, plans are underway to transport horticultural products by sea and to construct cold-storage facilities. Various concessions also have been instituted for air-freight carriers handling horticultural produce, and internal trade regulations are being reviewed continually with an eye to promoting exports.

Availability of planting materials also has been an obstacle, as most seeds have to be imported, and, therefore, new or improved cultivars have not been available to meet local demand. This problem partly is related to the lack of appropriate stock plants and of a proper marketing system for nursery products. To ensure that growers receive appropriate planting materials, the government, beginning in 1990, instituted a nursery registration and inspection program for all fruit nurseries, with the likelihood that other types of nurseries will soon be involved. This initiative will be another step toward improving the quality of nursery products nationwide and reducing the risk of spreading diseases such as citrus greening.

While the export sector has continued to develop and expand rapidly, the local market has not kept pace. Production is limited to small-scale farms in the high- and middle-elevation areas, where rainfall is fairly reliable. These areas, however, have little market information, poor infrastructure (such as access roads), few wholesale marketing centers

Table 2. Annual export volume (in 1000 tonne) for Kenyan fresh horticultural exports by commodity, 1987–92.^z

Crop	1987	1988	1989	1990	1991	1992
Pineapple	0.9	16.7	3.2	0.8	0.6	0.6
Mango	1.9	3.5	3.0	2.6	1.7	2.3
Avocado	2.0	3.8	3.4	3.3	1.7	6.3
Strawberry	0.2	0.6	0.8	0.6	0.4	0.3
Passion fruit	1.2	0.7	0.4	0.4	0.6	0.7
Sweet melon	0.2	0.4	0.1	0.06	0.1	0.07
Papaya	0.1	0.1	0.1	0.09	0.07	0.09
Lemon/lime	0.06	0.06	0.04	0.03	0.03	0.04
Other fruit	0.7	0.5	0.3	0.3	0.6	0.8
French beans	9.8	12.0	15.2	16.3	14.9	15.2
Bobby beans	0.3	0.3	0.3	0.3	0.5	0.9
Peppers	0.04	0.04	0.03	0.03	0.01	0.3
Asian vegetables	9.6	8.4	8.6	9.2	9.2	9.4
Tomatoes	0.3	0.2	0.2	0.1	0.1	0.07
Other vegetables	0.5	0.5	0.4	0.3	0.4	0.6
Root crops	0.2	0.1	0.05	0.05	0.04	0.05
Cut flowers	8.6	10.9	13.2	14.4	16.4	19.8
Total	36.6	58.8	49.3	48.9	47.3	57.5

^zData obtained from Horticultural Crops Development Authority and Kenya Export Development Support Project Report-Kenya Horticultural Subsector Survey (1992).

Table 3. Kenyan export percentages of fresh horticultural commodities by country, 1987–92.^y

Country	1987	1988	1989	1990	1991	1992
United Kingdom	43.0	36.9	33.5	34.8	33.9	29.3
Germany	12.1	12.8	12.6	11.8	12.9	9.1
France	12.0	14.5	17.0	18.6	19.8	22.3
Switzerland	2.2	2.2	2.1	1.9	1.9	2.1
Belgium	5.7	5.0	3.6	6.8	3.6	3.8
Netherlands	14.4	15.9	16.7	19.2	21.8	25.2
Italy	0.6	0.5	6.3	0.4	0.6	0.4
Middle East ^y	6.0	7.1	6.1	4.5	3.2	1.8
Others	4.0	5.1	2.1	2.0	2.3	6.0

^yData obtained from Horticultural Crops Development Authority and Kenya Export Development Support Project Report-Kenya Horticultural Subsector Survey (1992).

Includes Djibouti, Saudi Arabia, Kuwait, Bahrain, United Arab Emirates, Yemen, and Oman.

or cold storage facilities, and generally poor marketing practices. To improve this situation, horticultural processing factories recently have been constructed in Kenya's major production areas. Demand for horticultural products, particularly leafy vegetables, has continued to increase. Local consumption is estimated to grow 5.6% annually through 2000. Increased urbanization and modern housing have increased demand for ornamental and flowers, with a resulting expansion of flower and ornamental plant nurseries.

Several private and public institutions are now actively involved in the horticultural industry. The Horticultural Crops Development Authority (HCDA) was established in 1967 as a statutory board to promote and expand the export of horticultural crops. To improve the

quality of horticultural exports, the HCDA has provided materials, information, and other services to Kenya's horticultural industry.

Academic aspects

Exposure to horticulture starts in Kenya's primary schools. Students in most schools gain hands-on experience planting and maintaining school gardens and through 4-K Clubs (similar to 4-H Clubs in the United States). Secondary school students continue learning about various aspects of agriculture, including horticulture, and may join the Young Farmers Club for further experience. After high school, students who want to learn more about horticulture, but who are not qualified to attend a university, may enroll in a 2-year Certificate

in Horticulture program at Embu or Bukurra institutes or the Harambee (self-help) Institutes of Technology. From 1972 to 1990, 414 diplomas in horticulture were granted to students completing a 3-year structured program that emphasized horticulture but also included a wide range of other agricultural sciences. Most horticultural extension officers received this type of training. Recently, BS programs in horticulture have been instituted at Egerton Univ. and Jomo Kenyatta College of Agriculture and Technology. Egerton Univ. awarded undergraduate degrees to 161 students in its first two classes. Graduate training in horticulture (to the MS level only) has been available at the Univ. of Nairobi since 1977. Periodic short courses are conducted at the National Horticulture Research Center at Thika for extension workers, while other short courses are organized as needed at district agriculture offices throughout Kenya.

Career opportunities

About 80% of horticulture graduates are employed in the agricultural extension service, where many serve as technical officers. The rest likely will become involved with agricultural research, also as technical officers. After 5 years, $\approx$ 25% will work in the private sector (e.g., chemical, food, or rural-based nongovernmental organizations, or church missions). Others will join institutes of technology or in-country para-statal organizations.

Some graduates may teach in private schools, colleges, or institutes, while others may work for large farming operations, chemical companies, or larger municipalities. Graduates with advanced degrees may serve universities as teaching/research assistants or lecturers.

For readers interested in horticultural research in Kenya, see p. 770 of this issue.

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