

ORNAMENTAL PLANTS

Gabor Schmidt

Corvinus University of Budapest, Hungary

Keywords: ornamental plants, grouping, world-wide tendencies, roses, carnations, chrysanthemums (chrysanthemums), gerberas, lilies, tulips, bedding and balcony plants.

Contents

1. Ornamental plants
 - 1.1. Classification of ornamental plants
 - 1.2. Floriculture around the World
2. Introduction to selected flower crops
 - 2.1. Roses
 - 2.1.1. Breeding centers, varieties (cultivars)
 - 2.1.2. Growing roses for cut-flower production
 - 2.2. Chrysanthemums (*Chrysanthemum grandiflorum* hybrids, syn. *Dendranthemum grandiflorum* hybrids)
 - 2.2.1. Regions of production
 - 2.2.2. Origin and breeding
 - 2.2.3. Environmental requirements
 - 2.2.4. The production of chrysanthemums
 - 2.2.5. Harvesting and post-harvest care
 - 2.3 *Dianthus* (carnations)
 - 2.3.1. Origin and breeding
 - 2.3.2. The production of carnations
 - 2.4 Gerberas
 - 2.4.1. Origin and breeding
 - 2.4.2. Environmental requirements
 - 2.4.3. Cultivation of cut gerberas
 - 2.5. Tulips
 - 2.5.1. Classification of tulips
 - 2.5.2. Forcing of tulips
 - 2.6. Lilies (*Lilium*)
 - 2.6.1. The forcing of lilies
 - 2.6.2. The way of production
 - 2.7. Bedding and balcony plants
 - 2.7.1. Production of bedding and balcony plants
- Glossary
- Bibliography
- Biographical Sketch

Summary

Although flowers have always been used by human civilizations, commercial floriculture in the modern sense of word has only existed for the last two centuries. The production was initially concentrated near the market, but began to move further afield,

particularly to subtropical or tropical regions, through use of cheap labor and more optimal growing conditions. At present, the largest producers of flower crops are as follows: Europe: Holland (the largest exporting country in the world), Italy, Spain, Germany and France; Asia-Middle East: Israel; Asia-Pacific: Japan, Thailand, Taiwan, Korean Republic; Africa: Kenya, South Africa, Zimbabwe (supplying mainly Europe); North America: USA (being also a net importing country); South-America: Columbia, Brazil, Ecuador, Mexico (suppliers to North America). The main distribution centers of the world are: Holland (the biggest), Florida (for North America) and Japan (the largest importing country in the Far East).

This chapter gives a description of the major flower crops—roses, chrysanthemums, carnations, gerberas, tulips and lilies, including their origin, breeding, environmental requirements, cultivation practices, harvesting and post-harvest care. It also gives a short introduction to the wide range, production and use of bedding and balcony plants. The text also contains the production areas of flower crops in the most important producing and/or importing countries, and those of cut roses, cut carnations and chrysanthemums in tabulated form.

1. Ornamental plants

Ornamentals are all those plants which are cultivated with the main aim of being marketed and used for decorative purposes. With a few exceptions (such are the flowers of daylilies *Haemerocallis* or those of nasturtiums *Tropaeolum*) they are not edible, or at least, not used primarily as food sources. Their short discussion in EOLSS is justified by the fact that ornamental plants are, and have always been, an indispensable part of human life: planted outdoors, they improve our environment, while in indoor use they contribute to our health, well-being and creativity.

1.1. Classification of ornamental plants

The range of ornamental plants is enormously wide and diverse—it includes practically the whole Plant World. (Most of them, however, belong to the higher plants.) Their classification is not so much on a botanical (systematic) basis, but instead is usually on a practical basis:

According to the method of cultivation we can distinguish protected cultivation and open-ground cultivation.

According to the application, the two main groups are plants used for indoor decoration and plants used for outdoor decoration.

In most cases, ornamental plants grown under protection (in glasshouses, plastic houses, etc.) are used for indoor and those grown in the open (without protection) are for outdoor decoration. There are, however, many overlaps and exceptions. Bedding plants, for example, are produced in protected structures but the finished product is planted out in the open. Fewer ornamental crops are grown (at least partially) in the open and later used for indoor decoration. Such are the flower bulbs grown for forcing, or open-ground cut flowers. Other examples are some foliage plants (*Yucca*, *Dracaena*, *Cycas*, etc.) which are grown first to half-finished stocks in the tropics in open ground, and after being transported to the place of final destination, they are finished under glass to

market-ready products for use in the temperate zone.

Based either on the method of cultivation or on use, further subdivision of the two main groups is essentially the same, and goes as follows:

Protected cultivation (plants grown and used mainly for indoor decoration), subdivided to:

- Cut flowers
- Cut foliage
- Pot plants (flowering pot plants and foliage pot plants)
- Bedding plants and balcony plants (annual, biennial and partially perennial ornamentals, grown under cover but used mainly outdoors)

Open ground cultivation (plants grown mainly for outdoor decoration or as a starting material for protected cultivation), with a further subdivision as follows:

- Woody nursery stocks (deciduous trees and shrubs, broadleaved evergreens, climbers, and conifers, grown either in the field or in containers),
- Herbaceous perennials (usually container- or pot-grown in perennial nurseries),
- Rose bushes (grown in specialized rose-nurseries),
- Flower bulbs, corms, and tubers (grown for forcing in greenhouses or for planting out in the open),
- Open-ground cut flowers and cut foliage,
- Dried flowers, and
- Some bedding plants, grown (or finished) in the open.

All the above-listed groups are so wide that they are each the subjects of many books. This short chapter focusses on ornamentals grown under protection and for indoor decoration. Because most (but not all!) of them are flowers, their cultivation is commonly called “floriculture”.

First of all, a general overview of floriculture around the world will be given, listing the largest consumer- producer- and/or distributor-countries of floricultural products, along with their areas of production.

This introductory part is followed by a crop-to-crop description of the most important flower crops: roses, carnations, chrysanthemums (dendranthemums), gerberas, lilies, tulips, bedding and balcony plants

1.2. Floriculture around the World

Although flowers have always been used by human civilizations, commercial floriculture in the modern sense of word has only existed for the last two centuries. It was at the beginning of the 1800s that exotic flowers discovered in the tropics and subtropics, along with some temperate zone flowers forced during the winter and grown only in limited amounts for the private use of very rich people, started to become more widely available. Plants were taken from private conservatories and grown in increasing amounts for mass-marketing purposes by independent commercial horticulturists.

The production was initially concentrated on where the market was: the big towns and cities of developed countries in the temperate zone. It was, therefore, carried out mainly

under protection, in heated glasshouses.

Later, as transport and storage facilities technically improved, floriculture began to move further from the vicinity of market, using cheaper land, cheaper labor and more optimal growing conditions. The trend continued and accelerated after the Second World War, making more use of trucks and air cargo. It was given further impetus by the first energy crisis in the early 1970s.

Since then, huge new floriculture enterprises grew out of almost nothing in some tropical and subtropical countries. These countries gradually became the main growing centers for certain flower crops, particularly cut flowers. The crops are those which:

- need a lot of light, and an even and relatively high temperature;
- are labor-intensive, and, at the same time
- tolerate long-distance (air) transport relatively well, both physically and economically. (They are relatively light and small compared to their market price and can be tightly packed)

The new growing areas for the above mentioned crops were established either in the subtropics with a mediterranean climate or on high plateaus in tropical regions: at elevations of 1500 to 2500 m above sea level. The temperature at such elevations is optimal all the year around: neither too warm nor too cold. This is combined with optimal light conditions: irradiation, and continuous long days with only slight fluctuations around the year. Under such conditions, production is very effective and cheap: instead of sophisticated glasshouses, only light protective structures are needed, if any. Nevertheless, a high quality achieved. In addition, in most tropical countries labor is relatively cheap and the environmental regulations are not yet too strict.

Another group of crops that went to the tropics are.

- true tropical flowers like orchids;
- half-ready products from certain tropical foliage crops;
- stock-plantations (for producing super-elite cuttings) of most vegetatively propagated pot-plants, bedding plants and cut flowers.

In spite of this worldwide migration of major flower crops, protected areas of traditional flower-growing (and flower-consuming) countries have not decreased but have even increased almost everywhere (see Table 1.)

Country	1980	1990	1999-2003	Year of the last figure	Notes
Belgium - protected open ground	533	639 1042	693 1069	2002	Azaleas, other pot plants, bedding plants (1.)
Brazil			5165	1995	Protected areas only. (1.)
Canada			845	2001	(1.)
Caribbean Islands			600		Pot plants (half-ready) + tropical flowers, included open ground (1.)
Chile			340	1999	More than 2700 ha open-ground cut flowers! (6.)
Columbia		3500	5906	2002	Cut flower: roses, carnation, chrysanthemum, etc. The world's 2nd biggest flower exporter (12%!)

Country	1980	1990	1999-2003	Year of the last figure	Notes
					(1., 4.)
Costa Rica			4500	1999	included open ground
Denmark	335	344	359	1999	Pot flowers
Ecuador		286	3225	2005	Roses, carnations, chrysanthemums, gypsophylas, including open ground (4., 5., 10.)
France	2343	1889	2270	1998	Cut flowers only (1)
Germany - protected open ground	1797 1502	2713 1658	2683 4567	2000	Increasing areas of bedding plants; <i>a net importing country</i> (1.)
Greece	893	882	990	1995	(1)
Hawaii			>360	1998	Orchids (2.)
Holland - protected open ground	3971 1204	5140 2103	5927 2552 5756	2000 2000 2003	The Worlds largest flower <i>exporting country</i> with decreasing protected areas inside and increasing areas outside the country (1.)
Israel		1520	2700	2000	Cut flowers, including open ground (1.)
Italy - protected open ground	3052 4556	4236 3354	4402 3252	1994	Mainly carnations, roses and other cut flowers
Ivory Coast			690	1995	Mainly half-ready foliage plants (Yucca, Dracaena canes, etc.) (1.)
Japan		6318	8810	1998	The figure relates to cut flowers only (1)
Kenya			2180	2002	Mainly cut flowers, included open ground (1.) No.1. supplier of Europe
Korean Rep. protected open ground	180	1782	3244 2242	1999	Roses, chrysanthemums, <i>Gypsophila</i> (1)
Malaysia			750	1998	Orchids, other exotics, including open (2.)
Mexico			5000	1990	included open ground
Morocco			320	1998	mainly cut flowers, included open ground (1.)
New-Zealand			>800	1988	tropical cut flowers (2.) including open ground
South Africa			1900	2002	mainly cut flowers, included open ground (6.)
Spain, including Canary Isles	2451	3660	4989 6550	2001 2002 (5.)	Cut flowers (mainly roses, carnations) and pot plants, included open ground (3.)
Taiwan			6257	2002	Chrysanthemum, Eustoma, Dahlia, Orchids, included open ground (1.)
Thailand			8320	1998	Exotic cut flowers, orchids, including open ground (1.)
Turkey		~300	1600	1996	Carnations, roses, other cut flowers

Country	1980	1990	1999-2003	Year of the last figure	Notes
					under plastic or in the open (1.)
United Kingdom	847	999	964	2001	A net importing country
USA - protected open ground		3754	8652 16638	2001	The production is moving South, with about 4000 ha under temporary protection (1., 5.)
Zimbabwe			1150	2002	(6)

Notes:

If not stated otherwise, only the protected areas are given from the temperate-zone countries. From countries with a tropical or subtropical climate, however, both the protected and open areas under flower production are listed in the Table.

Sources:

(1): AIPH-UNION FLEURS International Statistics, Flowers and Plants 1996-2004. Inst. Gart. Ök. der Univ. Hanover, Vol. 48-52.

(2). Laws, 1998

(3): For years 1980-1990: AIPH-UNION FLEURS International Statistics (2004); For year 2001: Alvaraz, M. M-G., in FlowerTech, 2001. 4: 17-19.

(4): Pizano, 2005

(5): Petitjean, 2002a

(6): Petitjean, 2002b.

Other sources for the column “Notes”: Ryong Jeong, 1998; Winoground, 1997; ***, 2000; Saxtan, 1999; Miller, 1999; Vélues, 2001.

Table 1. Areas of protected flower crops and pot plants in selected countries (ha)

The reasons for this phenomenon are as follows:

- There has been a general increase in flower consumption all over the world.
 - Some of the production remains from each crop in the home country, satisfying the local demand for “freshly-picked” flowers.
 - Many glasshouses have been used for marketing purposes (“transit” glasshouses) or serve for the breeding of new varieties.
 - By keeping in hand the market and the breeding, the developed countries (as former producers) reserved their key positions in the market.
 - Several types of crops cannot be moved large distances, because they are too costly to transport. Such are:
 - bedding plants and balcony plants;
 - most of the finished pot flowers;
 - some major cut flower crops with large and fleshy flowers (gerberas, lilies) or those which are too bulky and heavy for long-distance transportation, e.g. gladioli.
- Growing of these products therefore remains at or near the place of consumption, or, at least, within reach of reasonable truck-transport (1500 km) on the same continent.

2. Introduction to selected flower crops

2.1. Roses

The rose has been deservedly called the Queen of Flowers for thousands of years. Roses were present in the gardens of Chinese emperors and mandarins as well in those of Japanese shoguns, Indian maharajas, Persian shahs, Roman emperors, Turkish pashas, and Christian kings and monasteries. They are, of course, still very popular in modern gardens and indoor spaces.

Roses are also grown for their aromatic compounds; the “rose oil” or “rose essence” extracted from their fragrant flowers is much used in cosmetics, and also in medicine. Above all, however, roses are ornamental plants. As cut flowers, they take the first place on the international market, but they are popular pot-flowers and landscape plants too.

2.1.1. Breeding centers, varieties (cultivars)

Roses have been bred and selected wherever they have been grown, and the process continues. The present varieties are results of multiple crosses between numerous oriental and European cultural types, interbred with wild species from Asia, Europe or America. The range of cultivars is, therefore, extremely wide and has a long history.

The most important breeding centers are: France, Germany and Holland, the southern states of the USA, and Japan.

Because of their hybrid origin, rose varieties are grouped on a practical rather than a systematic basis, though the practical classification has many features in common with genetics.

For outdoor (landscape) use we can distinguish:

The garden roses (continuously flowering) including the cultivar groups:

- Tea-Hybrids (TH),
- Grandifloras (Grfl),
- Floribundas (Fl),
- Polyanthas (Po) and Polyantha-Hybrids (PoHy).

Tea-Hybrids and Grandifloras are tall and large (or relatively large) flowered with one to three (-5) flowers on a slender stem and are planted individually as specimen shrubs or in small groups.

Polyanthas and Polyantha-Hybrids are lower in size (60-120 cm), bear many but small flowers in flat inflorescences (cymes), and are used mainly in rose-beds.

Floribundas are intermediate between the above two groups and are used individually in small groups, and also in flower beds.

Park roses, growing to large bushes, are relatively hardy and bear abundant cymes of (usually fragrant) flowers throughout the summer.

Climbing roses (flowering once or several times during the summer) are suitable for pergolas, rose-pillars and pyramids (always needing some kind of support).

Other roses include ground covering roses, botanical roses (wild and semi-wild), and

miniature roses.

For indoor decoration, different types have been bred for pot- and for cut-flowers. For pot-flowers, rose varieties belong to the so called miniature group, characterized by very compact habit, small leaves, small flowers and a gracile branching system.

Rose varieties for cut flowers have a more robust growth, and long stems, ending with one or more elegant flowers. They usually belong to the above listed groups of tea hybrids (TH), grandifloras (Grfl) or floribundas (Fl).

In the cut-flower industry, however, they are grouped according to the type of commodity (flower) they are grown for:

Standard roses: One individual flower on each stem. (If more than one develop, the side-buds are removed (disbudded) and only the terminal bud is left). This (standard) type is prevalent on the international market and, according to their flower size, is further subdivided into large flowered, medium and small flowered (“sweetheart”) groups.

Cultivars belonging to the large-flowered group give, under optimal conditions, extra quality (long stem, big bud) but relatively low yields: (180 to 220 stems/m² per year) while those belonging to the medium- and small flowered groups give smaller quality but higher yields (220-280 and 280-360 stems/m² or more, respectively.).

Spray roses have several relatively small flowers on each stem, forming a flat inflorescence. The terminal central flower bud opens first, and the others almost simultaneously afterwards. In such a way, one stem in itself forms a small bouquet. Spray roses are not so popular with the public as the standard types, never exceeding 10-20% on the market.

-
-
-

TO ACCESS ALL THE **37 PAGES** OF THIS CHAPTER,
Visit: <http://www.eolss.net/Eolss-sampleAllChapter.aspx>

Bibliography

- Aimone, T. (1998). Colombia's new air of optimism. *FloraCulture International*, February (1998). 18-23. p.
- Anon (2002). *The Tulip as a Cut Flower*, International Flower Bulb Centre. Ball Publishing Batavia, Illinois USA.
- Armitage, A.M. (1994). *Ornamental Bedding Plants*. CAB International, Wallingford, UK
- Ball, V. (1997) *BallRedbook*. Greenhouse Growing. Prentice Hall INC., Englewood Cliffs, New Jersey, USA.
- Carow, B. (1978). *Frischhalten von Schnittblumen*. Verlag Eugen Ulmer, Stuttgart

- Courtright, G. (1998) *Tropicals*. Timber Press, Portland, Oregon.
- De Hertogh A. (1995). *Holland Bulb Forcer's Guide*. Ball Publishing Batavia, Illinois, USA.
- Evans, A. (2004). Rose propagation seen as a profession In *FlowerTech* 7 (7): 14-16 p.
- Fenton, L.J. (2005). Estimating the power of Africa. *FloraCulture International* April 15 (4): 24-31. FloraCulture International, Ball Publishing, Batavia, Illinois USA.
- Francoise, M. (2002) Booming floriculture in Africa. *FloraCulture International* June 2002, 12, (6): 16-21. Gärtnerbörse und Gartenwelt Georgi GmbH, Aachen
- Graf, A.B. (1992). *Tropica. Color Cyclopedia of Exotic Plants and Trees*. Roehrs Company Publishers, East Rutherford, N.J. 07073, USA.
- Hakanson, L. (2003). Carnations: The Sim Stery *Floraculture International* 13 (3): 21-31 p.
- Hamrick D. (1996). *Grower Talks on Plugs II*. Ball Publishing Batavia, Illinois, USA
- Hamrick, D. (2002). World News in Floriculture. The Netherlands. Production area down slightly. *FloraCulture International* June 12 (6): 6 p.
- Hulst, J. (2004). Designer rose bush targets uniform production In *FlowerTech* 7 (6): 15-17 p.
- James, L. (2002). Water works. How hydroponics and other techniques are changing the Dutch bulb industry In: *FloraCulture International* April (2002 Volume 12, Number 4, 28-34. p.
- Larson, R. (ed.) (1992). *Introduction to Floriculture*. Academic Press, San Diego, New York, Boston, London, Sydney, Tokyo, Toronto
- Laws, N. (1998). Tropical flowers from grower to market. *FloraCulture International*, May (1998. 16-22. p.
- Laws, N. (2005). 2003: A Strong Year for Floriculture. *FloraCulture International* February 15, (2.): 26-29. p.
- Miller, M. N. (1999). (1998 American Floriculture Production In: *FloraCulture International* November 1999 Volume 9, Number 11, 33-35. p.
- Miller, W. B. (2004). Potted flower bulbs popular in North America In *FlowerTech* Volume 7 No. 7, 2004. 26-28 p.
- Miller, W. B., Ranwala, A. P., Legnani, G. Stewart B. B., Ranwala, D. 2003: Growth regulation with potted hybrid liliu *Floraculture International* 13 (5): 18-23 p.
- Pertwee, J. (2004: Rose ranking through 2003 In: *FlowerTech* Volume 7 No. 7, 2004. 24-25 p.
- Petitjean, M. F. (2002a: France. A diverse industry In: *FloraCulture International* April 2002 Volume 12, Number 4, 6 p.
- Petitjean, M. F. (2002b). Booming floriculture in Africa *Floraculture International* 2002 June 12 (6): 16-21 p.
- Pizano, M. (2005a). Ecuador-Agriflor de las Américas (2004 *Floraculture International* January 15 (1): 14 p.
- Pizano, M. (2005b). Holding the Line in Latin America. How growers in Columbia and Ecuador are maintaining their leading positions in the competitive world rose market In: *FloraCulture International* April (2002 Volume 15, Number 4, 18-23. p.
- Röber R. (ed) (1994). *Topflanzenkulturen* Verlag Eugenulmer, Stuttgart.
- Rogers, M.N. – Tjia, B.O. (1990). *Gerbera Production*. Timber Press, Portland, Oregon, USA.
- Ryong Jeong, B. (1998). Floriculture in Korea grows up. *FloraCulture International*, June (1998. 16-18.
- Saxtan, J. (1999). South America's big three. A brief overview of production in Chile, Colombia, an Ecuador In: *FloraCulture International* March 1999 Volume 9, Number 3, 32. p.
- Schmidt G. (2002). *Növényházi dísznövények termesztése* Mezőgazda Kiadó Budapest.
- Siegmund I. - Heinrichs F. (2000). 2000 Yearbook of International Horticulture Statistics. Ball

Publishing, Batavia, Illinois USA.

Styer, R.C. - Koranski, D.S. (1997). Plug & Transplant Production. Ball Publishing, Batavia, Illinois, USA.

Thomas, B. D. (2000). Educator: The challenge of infrastructure In: FloraCulture International October (2000 Volume 10, Number 10, 38-41. p.

Vakblad voor de Bloemistelij (2002-2003-2004). Redactie Reed Business Information Leiden, Holland.

Valenzuela, M. (2001). Gerbera. Ball Publishing, Batavia, Illinois USA.

Van der Velde, J. (2000). GrowerTalks on Plugs 3. Ball Publishing, Batavia, Illinois USA.

Winoground, H. (1997). Rose imports. FloraCulture International, November (1997. 44. p.

Zimmer, K. (ed.) (1991). Hauptkulturen in Zierpflanzenbau. Verlag Eugen Ulmer, Stuttgart.

Biographical Sketch

Gábor Schmidt DSc was born in October 1944, in Magyaralmás, Hungary. He is married with no children.

He studied at the Institute of Horticulture, Budapest, Hungary from 1962 to 1963, and from 1963 to 1967 at the Institute of Agriculture, Horticultural Faculty, Plovdiv, Bulgaria. After completing studies he spent two years in agricultural cooperatives. Since the end of 1969, has been working at the University of Horticulture at the Corvinus University of Budapest, Department of Floriculture and Dendrology.

He obtained his Dr. Univ in 1978, a PhD. (Candidate of Agricultural Sciences) in 1982, and DSc (Doctor of Agricultural Sciences) in 2003.

Professional progress:

1969: assistant lecturer

1974: Curator of the University Arboretum (the same at present)

1976: senior lecturer

1983: associate professor

1986-90: vice-dean, international relations

1991: head of Department of Floriculture and Dendrology (the same at present)

1994: habilitation

1995: professor

1996-1999: vice-rector, international relations

Field of teaching: Woody ornamentals (ornamental dendrology): propagation, production, breeding, botany and application).

Field of research: Woody ornamentals: application, breeding, asexual propagation.

Publications:

2 dissertations, 72 publications in scientific papers (26 international), 31 presentations in scientific symposia and congresses (14 international), 8 national standards, 8 books, and co-authoring in 10 other books, 5 university textbooks (scriptums), 62 other publications.

Membership in international scientific societies:

International Lilac Society,

International Plant Propagators Society,

International Society of Horticultural Sciences,

Contacts with institutions and scientists from nine European countries, Canada and the USA.

Participation in Hungarian scientific societies:

Association of Hungarian Biologists (member)

Association of Hungarian Agriculturists (member)

Hungarian Academy of Sciences, Horticultural Committee, Floricultural Subcommittee (President)

Hungarian National Plant Cultivar Committee (referent for Floriculture and Dendrology)

Gyula Magyar Foundation (president of curatorium)

Foliage Foundation (Member of the Curatorium)

Association of Hungarian Botanical Gardens and Arboreta (President)