CHAPTER TWO

From Small Shoots

Can you find another market like this?
Where, with your one rose you can buy hundreds of rose gardens?
Where, for one seed you get a whole wilderness?

RUMI (B.1207) 'THE SEED MARKET', TRANSLATED BY COLEMAN BARKS

Horticultural plants start as seeds, cuttings, spores, or bulbs. In the nurseries they become fragile shoots and careful tending prepares them for the fields. Add sun, soil, fertiliser and water, together with professional expertise, and the fields of horticultural plenty ripen ready for the harvest.

It is intense, sophisticated and hard work. Breeding and selection of the most desired plants makes sure that they are robust and most suited to the environment and to specific production methods. Cultivation techniques are adapted to suit local soil types, weather conditions, pest and disease risks, market standards and opportunities.

Having successfully reached harvest, there are then the challenges of sorting, packing and presentation to ensure that customers get the product in a condition that is fresh, safe, ripe and clean and to the quality specifications promised.

In addition, the product must meet the requirements of border security, trade regulations and retail requirements. Producers must use all the appropriate facilities of well managed transportation, storage and packaging to ensure that the product succeeds in meeting consumer expectations.

Horticulturalists and those who get their crops to you are highly skilled, professional and resilient people.

Plant breeding

The modern science of molecular biology is exciting as genomics and knowledge of the genetic structure of DNA is allowing development of molecular markers that breeders can use for determining if desirable and selected attributes/traits are present in breeding populations.

Increasingly there are new types and varieties of vegetables, an array of many different fruit, and a wonderful range of new flowers.

Scientifically managed plant breeding programmes can improve all crops, even ancient and traditional ones such as hops.

Hops have been used in beer since ancient Egyptian times. Higher yielding USA varieties were introduced to the world in the 1920s but became severely infected with root rot during the 1940s.

A science-based hop-breeding programme began in 1950 and decades later is now widely recognised for its innovation. Varieties resistant to root rot were released to industry in the 1960s. The world's first triploid (seedless) hops with up to 50% more alpha acid (the bittering pre-cursor in beer) were released during the 1970s.

Modern breeding programmes select apples with natural multiple resistance to a number of pests and diseases and with enhanced fruit quality.
PHOTO: NZ INSTITUTE FOR PLANT & FOOD RESEARCH LTD

At present, research and development in hops is focused on flavour and aroma characteristics, and this has been reflected in a dazzling variety of boutique, local and international brand beers.

Provision of high-quality plants from tissue culture and other nursery techniques is essential for premium production – orchids in Thailand.

Nursery production and tissue culture

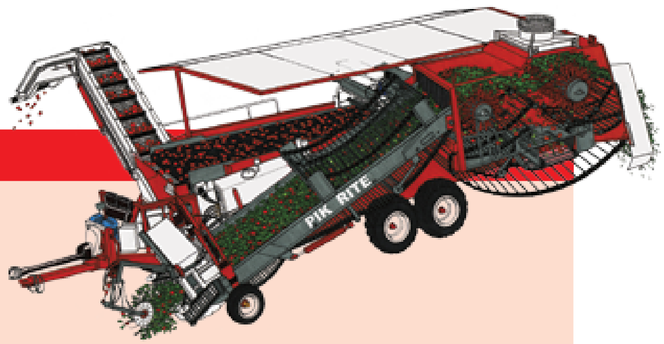
Horticultural producers employ a number of different methods to propagate the plant material used for specific fruit and vegetable crops and for ornamentals. Many crops are established from seeds – often as hybrids. Some are established from rooted vegetative cuttings. Others rely upon the desirable variety being grafted onto a selected rootstock – as occurs with many fruit trees – where the rootstock itself can control the vigour of the tree or provide resistance to soil-borne diseases.

Plant tissue culture is a specific technique that is used for vegetative propagation. It relies on starting with a very small part of plant tissue that is then grown up and multiplied under sterile conditions. All of the minerals and nutrients required for growth are provided and the hormonal balance in the growing medium can be adjusted to promote shoot and root growth independently. The plant shoots grow by being supported on an agar-based gel that also contains the mixture of compounds that are required to nurture growth.

The sterile conditions for plant tissue culture production ensure freedom from competing pests and diseases. This method is used to generate very large numbers of plantlets in a short time, especially where plants are difficult to grow from seeds or cuttings. It can also be used in laboratories to help in eliminating viruses from plants, to 'rescue' desirable plants from breeding programmes which would not survive under natural conditions, and even to store elite plants for long periods of time.

There are many different forms of tissue culture which range from using mini-cuttings, to growing tips, to even cell suspensions.

Many different crops can be grown using tissue culture including a wide range of orchid species and varieties.



A bottle of ketchup

Fifty years ago, tomato varieties destined for processing were the same as those sold in the markets. To ensure a full yield from the plants they were picked at least three times by hand over a number of days. Crop losses were high. Labour shortages made it difficult sometimes to secure crops for processing. One efficient worker could harvest approximately 1.5 tonnes in an 8-hour day.

In the 1950s and 1960s a revolution occurred based on science-led activities at the University of California in Davis. Scientists used diversity within the tomato family to breed a new type of tomato – one that ripened evenly, stayed on the vine for a good period of time, contained a high soluble solids concentration (making them well suited for processing), and with a thick skin and a special shape that was well-adapted to mechanical harvesting.

In close symmetry with these advances in conventional plant breeding, horticultural engineers developed the first mechanical tomato harvesting machine.

Subsequent continuous improvements in both breeding and horticultural engineering have seen these developments change the nature of process tomato cultivation world-wide.

Modern harvesters harvest the crop once, not three times, and some have on-board sorting sensors that automatically discard green and poorly-coloured fruit and wastage is minimised. An output in excess of 1.25 tonnes per minute (75 tonnes per hour) is typical.

This means that the harvesting rate with such machines is about 400-times higher than that per worker without harvesting machinery. Harvest costs are now about 12% of the grower's total costs. In California alone, more than 10 million tonnes of tomatoes from over 100,000 hectares are harvested each year for processing.

These very significant developments have meant that production has kept up with global demand and that this processed product remains affordable to many.

A 40 tonnes per hour tomato harvester as in the cut-away illustration above. Some models can harvest up to 80 tonnes per hour. PHOTOS: WWW.PIKRITE.COM

Thought Challenge #2

In 2011 the world's population reached 7 billion. By year 2045, world population is projected to reach 9 billion. At the present rate of production and supply chain efficiencies, this will require an increase in production from the present annual 2.4 billion tonnes of fruit and vegetables to over 3.1 billion tonnes.

Q. Where will that increased production of food come from?

Sack farms

In the poor villages around Nairobi there is simply no land for gardens. The ingenious response has been to grow plants in tall, recycled sacks filled with soil. Women make 'vertical farms' by poking holes in the sacks and putting seeds and seedlings at different levels. The usual crops are spinach, kale, sweet pepper and spring onions.

The owners of these unassuming sack gardens enjoy fresh food and better nutrition. Any surplus produced is sold to friends and neighbours who can also enjoy the benefit of fresh produce.

At the edges of the villages micro-gardens produce seed for traditional African vegetables.

Small plots (about 50 sq m) with double beds raise seeds faster. Fast-growing African varieties like amaranth and spider plant are raised from seed to seed in as little as three months. Using the top and slots in the sides, up to 60 seedlings can be grown in one sack.

It is a struggle fraught with peril. They have no tenure to the land. It can be taken from them at any time. Drought and the loss of access to wastewater (used also as fertiliser) can bring disaster.

Sack farming, Nakuru, Kenya.

Other initiatives by low-income households

Other examples of urban horticulture abound. FAO assistance has helped a municipality in Bolivia train some 1,500 low-income households in organic cultivation of fruit, vegetables and herbs in small greenhouses. In Burundi it has improved access to credit, inputs and training for 7,500 to 10,000 residents who practice urban horticulture. In Columbia 50,000 residents of Bogota, Medellin and Cartagena have now got garden plots and micro-gardens on terraces and rooftops.

Smart technologies for the control of pests

Crawling, flying and windblown pests and diseases can cost millions of dollars in lost production. Pests and diseases can spoil produce and waste wealth, and infestations can lead to loss of production, hence hunger and starvation.

Smart integrated technologies using both basic and applied scientific research aids in the control of pests and diseases and improves the environment.

Scientific management of pests and diseases before and after harvest can lower the use of chemicals yet still maintain high levels of production and give higher levels of consumer acceptance and lower production costs.

In the 1970s, growers and scientists observed that pests could develop resistance to a number of different pesticides.

In response, the knowledge workers got to work. The lifecycles of pests were studied and factors identified that determine pest numbers on target crops. Alternatives were sought to the current pesticides that were less persistent in the environment and more specific for particular pests.

This information became key to the 'Integrated Pest Management' (IPM) methods now used to control pests on vegetables such as brassicas (cabbages, cauliflowers and broccoli), process tomatoes, sweetcorn, potatoes, squash, lettuce and onions.

Monitoring crops at different development stages can ensure targeted and efficient use of pesticides and the protection of beneficial predators. PHOTOS: NZ INSTITUTE FOR PLANT & FOOD RESEARCH LTD

IPM programmes are dependent on crop monitoring of pest numbers on each vegetable crop by growers and trained crop scout specialists. From that information, growers can reduce pesticide use, avoid the use of broad-spectrum control chemicals, lower costs and adopt practices that will not harm natural predators.

The development and rapid adoption of IPM systems and practices was only possible because of the interpretation and application of science-based knowledge that horticultural scientists had accumulated over the previous 40 or more years.

The holistic 'all of everything' approach also led scientists to develop Integrated Fruit Production (IFP) systems. These were initially developed and adopted, for example, in the apple industry as a step toward ensuring the continued entry of apples onto global markets. IFP is now applied to a wide variety of fruit crops, for example, stone fruit in California and kiwifruit in virtually every country where kiwifruit are grown in large commercial quantities.

The core aim of IFP was to reduce the use of agrichemicals to control pests and diseases. It takes account of orchard location, rootstocks, varieties, soils and nutrition, water management, weed management, tree management, pests, and diseases.

IFP results in lower use of both insecticide and fungicide sprays and has eliminated the use of the most persistent and toxic pest control chemicals.

In one study, (the 'KiwiGreen' programme for kiwifruit in New Zealand), the internal rate of return (IRR) on R&D costs for development and implementation of the programme was calculated at between 31% and 79% depending upon the assumptions of how much world prices would have been depressed had that programme not succeeded. In 2004, the net present value (NPV) calculation for the programme was over US$250 million.

In 2000, the successful 'KiwiGreen' programme was expanded to include integration of environmental factors, ethical trading practices and hygiene, to become an environmental management system that maps, measures and monitors the entire progress of fruit from orchard to retail outlet and can trace product all the way back to a particular grower and orchard site.

Integrated Pest Management (IPM) and Integrated Fruit Production (IFP) systems now provide knowledge-based practices that use sustainable technologies that are safe in both environmental and human health terms.

Thought Challenge #3

Advanced horticultural systems with Integrated Pest Management (IPM) techniques and other improvements are now often close to organic system practices. Pesticide applications have been minimised over the past 30 years but some are still necessary in both advanced production systems, and contrary to commonly held perceptions, also in organics.

Q. Are consumers generally aware of the huge improvements that have been made in production systems for fruit and vegetables?

Decision support systems

The fast moving dynamism of horticulture requires decisions to be made successfully at the optimum point in time. Scientifically designed decision support systems allow better management decisions that enhance production efficiencies, shift harvest times and even extend the productive life of a crop. This systematised knowledge is transferable across the world.

Decision support systems – the example of asparagus

The yields and market returns from growing asparagus can be very cyclical.

Scientists found that non-irrigated asparagus crops consistently out-yielded the irrigated crop. ‘Curious’, they said. Tackling the matter with research, they observed that extra water and fertiliser increased the above-ground fern growth but this could reduce the accumulation of energy reserves.

As a result of the research and the design of a decision support system, growers can now measure and monitor these energy reserves throughout the year. The data from the field is sent via the internet to a research unit that formulates real-time interpretations and sends the resultant information back to growers. Armed with real-time information, growers can then make decisions on harvest timing, the length of harvest season, irrigation management and disease control practices.

By knowing what is happening in the soil, below ground, growers can more than double the outputs of an asparagus crop. Having online access to the technology and to the scientific knowledge that backs it up, means growers can extend the life of an asparagus plant from three to up to seven years.

Decision support systems are also being developed for other crops so that productivity and quality are optimised.

Scarce water resources

World fresh water (and indeed fertiliser) resources are limited. Consequently, it is vital to develop systems that optimise the use of water and the other critical inputs that are used in food production.

Knowledge technologies and skills that preserve, find and use water effectively for food production are essential. Hydroponics is one approach that horticultural producers have used to control the volume of water that is used in a production system together with closely regulating the amount of fertiliser applied and, in some approaches, removing the need for soil (and hence the need for cultivation, weed control and even sterilisation).

The increasing scarcity of water has led to improved irrigation scheduling and to new research that seeks ways of achieving more efficient resource use. Open irrigation systems are frequently being replaced by more efficient trickle systems. PHOTOS: (LEFT) UNIVERSITY OF CALIFORNIA, DAVIS, (RIGHT) D. KARP

Modern glasshouses are highly complex but very efficient in producing many different crop types; The Netherlands.
PHOTO: WAGENINGEN UR GREENHOUSE HORTICULTURE, THE NETHERLANDS

The greenhouse industry

Growing plants in environmentally controlled areas is not new. In the time of the Roman Emperor Tiberius (42BC - AD37), a greenhouse had thinly sliced selenite *(Lapis specularis),* a type of gypsum that forms crystal sheets that are nearly as clear as glass, that captured the warmth from the sun for the Emperor to have a cucumber-like vegetable year round. In the 13th century, The Vatican in Rome had a glasshouse for new species of plants brought back to Italy by traders. By 1825 greenhouses, first known as 'orangeries' for the propagation of orange trees, were heated by furnaces or built into earthen pits with windows facing the sun – a practical design still used.

In all greenhouses, crop yields and product quality typically exceed that of outdoor-grown crops. Furthermore, close control of the environment can markedly reduce the need for pesticides and enhance the efficient use of water and fertilisers. Design features optimise energy usage and the capture of rainwater can reduce demands on water supply.

Effective use of more complex structures requires the integration of plant science, plant pathology, entomology, plant nutrition, electronics, structural and ventilation engineering, lighting technologies, and computer control system programming and management.

The Netherlands alone has around 9,000 greenhouse enterprises that operate over 10,000 hectares of greenhouses and employ some 150,000 workers, efficiently producing US$4.5 billion worth of fruit, vegetables, plants, and flowers, some 80% of which is exported.

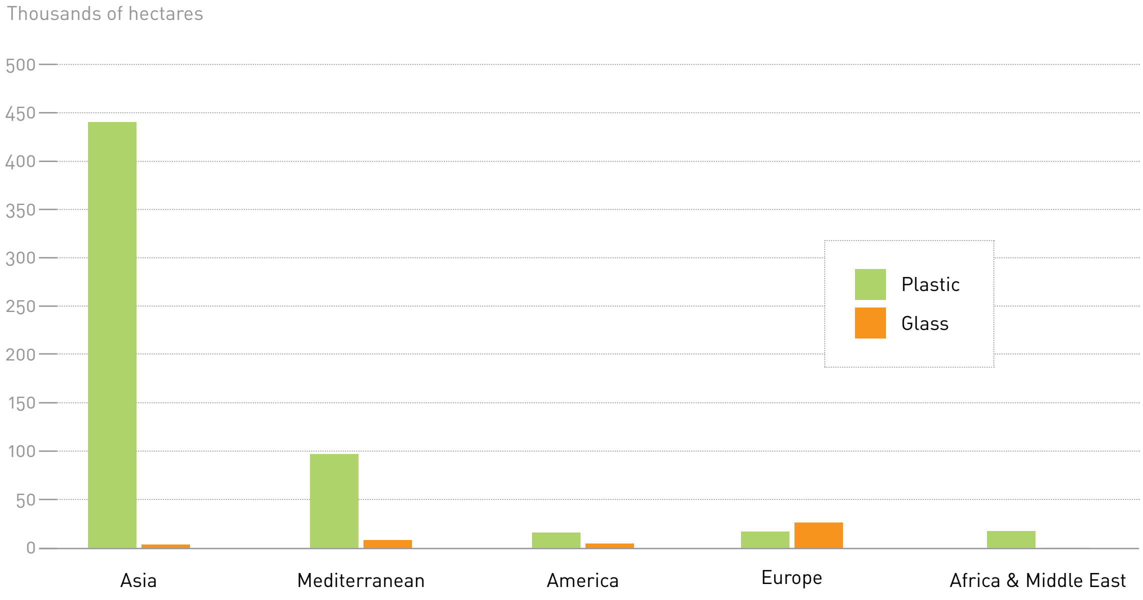
One of the largest greenhouse complexes in the world is in Almeria, Spain, where greenhouses cover almost 50,000 acres (200 km^2) and is sometimes referred to as the 'sea of plastics'.

Nonetheless, the greatest expanse of protected cropping occurs in Asia, especially in China, South Korea, Chinese Taipei and Japan. Extensive use is made of plastic greenhouses to modify winter conditions, achieve early and longer production seasons and to provide protection from adverse environmental conditions such as rain. Crops that are produced are most typically vegetables such as tomatoes and capsicums; flower crops such as roses, carnations and cymbidium orchids; and fruit crops as diverse as bananas and table grapes.

Protected crop areas in greenhouses and tunnels

(estimated areas under plastic and glass, thousands of hectares, year 2000)

SOURCE: 'GREENHOUSE HORTICULTURE.' *ENCYCLOPEDIA OF FOOD & CULTURE*. ED. SOLOMON H KATZ. VOL 2. GALE CENGAGE, 2003. *ENOTES.COM*. 2006. 18 SEP, 2011. HTTP://ENOTES.COM/FOOD-ENCYCLOPEDIA/GREENHOUSE-HORTICULTURE



Plasticulture is used in many forms to produce fruit, vegetable and flower crops over extensive areas – (upper photos) strawberries in Mexico; (lower left) flowers in Thailand; (lower right) extensive greenhouses, Granada Coast, Spain.

Flowers, foliage, bulbs and live plants are big business

For centuries, flowers have been a strong influence on our living environment. First century Romans had a highly developed flower trade. They manipulated flowers to bloom out of season and used hot water generated in a central location to heat baths and greenhouses.

Modern production is currently concentrated in a few countries: 77% of the world's cut flowers are grown by The Netherlands, Columbia, Ecuador and Kenya (2009). The major consumers of these crops are in Germany, United Kingdom, United States, The Netherlands and France.

The general trends are for newly developing countries to gain market share at the expense of the established producers. Newly emerging players in the international flower trade are India, China, South Korea, Malaysia, Malawi, Mexico, Palestine, Peru, South Africa and Zambia. Ethiopia is developing rapidly with flower exports increasing five-fold between 2006 and 2008. China intends to be a significant player and there has been a very large investment of local government funds into the flower industry.

These countries have good climatic conditions but face long transport distances to markets. Israel has a long-standing investment in flower production and as with The Netherlands has faced competition from the newly-emerging countries.

Despite many new entrant exporting countries, in 2009, 48% of exports of cut flowers, bulbs, foliage and live plants were from The Netherlands. In 2009, The Netherlands imported US$1.8 billion in these categories and exported US$8.3 billion. The total world exports for these categories exceeded US$17 billion, with the mix being:

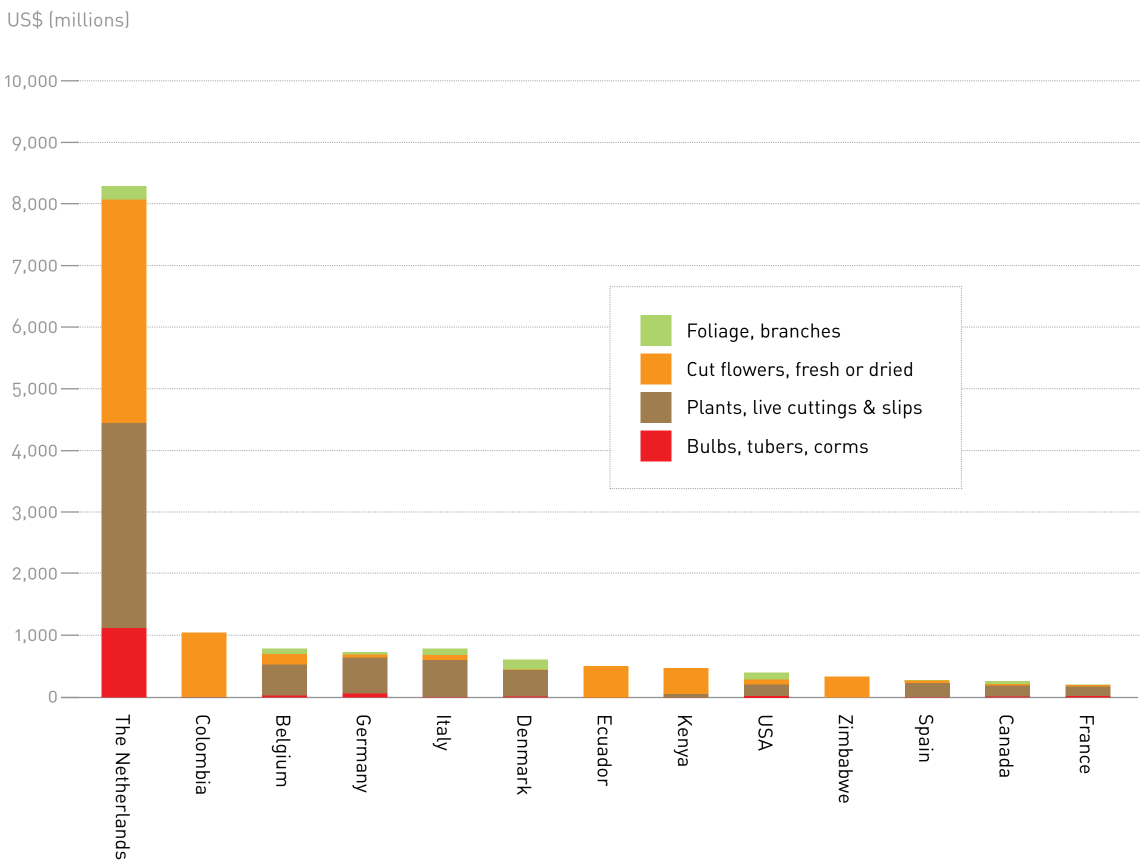
- Cut flowers (fresh or dried) US$7.3 billion
- Live plants and cuttings US$7.3 billion
- Bulbs, tubers and corms US$1.5 billion
- Foliage US$1.2 billion

Flowers are hard to transport over long distances. Countries distant from markets face expensive airfreight costs to get the flowers to consumers. For example, the cost of airfreight, marketing, handling in Europe and packaging make up 50% of all costs for Kenya and 62% for Uganda.

The reliability of air connections is an additional risk factor for exporters located far from their main markets.

Exports of cut flowers, foliage, bulbs and live plants: 2009

Total world exports of these categories: US$17.2 billion SOURCE: ITC CALCULATIONS BASED ON COMTRADE STATISTICS
(*Countries cited where combined export value in 2009 exceeded US$200 million*)



Orchids being prepared for market, Thailand.

Flowers are very sensitive to the treatment they receive once they are cut. They need strict temperature and humidity control, and good air quality to deliver an attractive product to market. The time to market is short. Organisation is the key to the success of the flower industry.

To grow flowers successfully you need the right seeds and planting material, excellent physical factors such as abundant water, clean soil (excepting hydroponics), good climate and high light intensity.

The industry is capital intensive with high costs for greenhouses and infrastructure and a need for high levels of working capital. Flowers need productive labour, a lot of expertise in growing techniques, very good management and a first class infrastructure including controlled temperature freight systems and cool stores.

There is also the need for pesticides and some special chemicals to maintain condition and to meet cross-border requirements, plus costly energy for heating and a high level of quality consciousness all along the production and postharvest chain.

All this calls for good management and organization.

The response of growers in established producing countries to challenges from the developing countries has been more extensive use of technology and science. Hand grading has been replaced with mechanical grading; digital computers control light, temperature and water use; natural gas has replaced coal and oil; new varieties that grow in winter conditions are being grown.

An example is rose growing in The Netherlands that has become a highly sophisticated, increasingly computerized, capital-intensive activity that requires sizeable investments, placing it increasingly beyond the capability of smaller growers.

Live plants and fresh cut flowers – Chelsea Flower Show displays.

The influence of supermarkets on selling channels for flowers

Flowers are still being sold through the traditional outlets: supermarkets, market and street vendors, florists and garden centres – but in some countries supermarkets already dominate the trade. Examples are in Switzerland where the two major supermarket chains together account for 60 to 70% of all sales, and in the United Kingdom where the market share of supermarkets is approaching 40%.

What is certain is that from Israel to the United Kingdom and from The Netherlands to the United States, supermarkets are targeting the flower trade as an area for expansion.

Supermarkets prefer to buy large quantities of cut flowers through long-term contracts and directly from known producers. Buying directly is the shortest route from grower to retailer to consumer, and buying directly allows supermarkets to have certainty about the conditions under which the flowers that they sell are being produced.

African producers are capable of producing large volumes and are willing to sell directly at an agreed price, making them attractive to supermarkets.

African producers appear to be the main beneficiaries of this change in purchasing habits. Supermarkets are interested in African flowers because they are inexpensive and because growers are willing to accept a set price.

To the growers, the arrangement is attractive because supermarkets buy large quantities at pre-arranged prices. But in order to live up to their side of the bargain, African growers must invest in optimal production methods. Often this includes investments in greenhouses, forced ventilation and heating and, in all cases, greater attention to quality.

Hydroponics

In its simplest definition, hydroponics is gardening without soil. Its earliest recorded use goes back to the Pharaohs of Egypt and the Hanging Gardens of Babylon that are believed to have used hydroponics.

Some points about hydroponics:

- hydroponic systems have some clear environmental benefits with the most significant being that they use 70 to 90% less water compared with many forms of conventional production
- there should be no nutrient run off – and hence reduced concerns about contamination of groundwater, rivers and streams
- systems can range from drip or trickle emitters with soil-grown plants through to aerated nutrient solutions for trough or tank-grown plants
- systems can succeed in places where the soil is poor or depleted or where water is very limited (such as in desert locations)
- hydroponics can be used both outdoors in field production and indoors in modern greenhouses.

By controlling the plant's growing environment, inclusive of the use of hydroponics, some impressive yield gains have been measured. In one study identical cucumber plants produced 3 tonnes per hectare in the field in soil but close to 13 tonnes per hectare when grown hydroponically. Tomato yields that ranged from 5 to 10 tonnes per hectare in soil produced 60 to 300 tonnes per hydroponic hectare.

Covered crops, Granada Coast, Spain.

Hydroponics

There are many variations of hydroponic systems, but all are variations or combinations of the six basic types in the table below:

Hydroponic system type	Drawback
Wick system. A passive system, which means there are no moving parts. it is the simplest type of hydroponic system where the nutrient solution is drawn into the growing medium with a wick from the reservoir.	Plants that are large or use large amounts of water may use up the nutrient solution faster than the wick(s) can supply.
Water culture system. The simplest of all active hydroponic systems where a platform, typically made of closed-cell extruded polystyrene foam, holds the plants and floats directly on an aerated nutrient solution. This is often the system of choice for fast growing leaf lettuce.	It doesn't work well with large plants or with long-term plants. Very few plants other than lettuce do well in this type of system.
Ebb and Flow system. Works by temporarily flooding the growing tray with nutrient solution and then draining the solution back into the reservoir, in a cycle that repeats several times a day.	As the roots can dry out quickly when the watering cycles are interrupted, the system is vulnerable to power outages as well as pump and timer failures.
Drip systems. The most widely used type of hydroponic system where a timer controls a nutrient solution to drip onto the base of each plant from a small drip line. Some include a recovery system where the excess nutrient solution that runs off is collected back to a reservoir for re-use.	A recovery system can have large shifts in pH and nutrient strength levels that require periodic checking and adjusting. A non-recovery system requires less maintenance.
Nutrient Film Technique (NFT) systems. A constant flow of nutrient solution is pumped into the growing tray (usually a tube) and flows over the roots of the plants, and then drains back into a reservoir. Typically the plant is supported in a small mesh or rigid basket with the roots hanging into the nutrient solution.	NFT systems are susceptible to power outages and pump failures and the roots dry out rapidly when the flow of nutrient solution is interrupted.
Aeroponic system. The most high-tech type of hydroponic production where the roots hang in the air and are misted with nutrient solution every few minutes.	The roots will dry out rapidly if the misting cycles are interrupted.

Hydroponic growing of tomatoes in The Netherlands. Note the detailed attention given to crop hygiene and the pest-free nature of the closed, computer controlled growing environment.
PHOTO: WAGENINGEN UR GREENHOUSE HORTICULTURE, THE NETHERLANDS.

Pollinators

Bees are the smallest workers on the land. They are the pollinators of many horticultural crops.

One of 20,000 known bee species, the Western honey bee (*Apis mellifera* L.) is the most common pollinator and the iconic provider of honey.

Between 15% and 30% of food consumed by humans in developed countries requires an animal pollinator. As a general rule, the fact it does not need expensive hand pollination makes food more affordable.

Pip fruit (eg. apples) and stone fruit (eg. apricots) rely heavily on insect pollination as do many berry and vegetable crops such as watermelon, cucumber, pumpkin and raspberries, and also many spices.

It is in the world's best interest to ensure the conservation of pollinators, but there has been a recent decline in pollinators in a number of countries. This decline includes the threat called Colony Collapse Disorder (CCD) that has been linked to many factors including parasites, climate change, habitat loss, availability of food, pollution, pesticides, alien invasive species, diseases and possibly other influences.

Apple blossom

Production standards worldwide

GlobalGAP is a European-based private sector body that sets voluntary standards for the establishment of a single standard for Good Agricultural Practice (GAP) during production and postharvest of fruit and vegetables.

The scheme started as EUREPGAP in 1997 largely as a reaction to consumers having increasing concerns about product safety, environmental issues and labour standards.

At the time, producers supplying to multiple retailers had to undergo multiple audits every year against different criteria to meet the market standards.

Early steps highlighted the importance of Integrated Crop Management (inclusive of IPM and IFP) and a responsible approach to worker welfare.

Over the next ten years and with the emerging pattern of globalised trading, EUREPGAP gained in global significance. To prevent confusion, in 2007 EUREPGAP was re-branded to become GlobalGAP.

The scheme now has over 93,000 certified producers in more than 100 countries, including all of North America, all of continental Europe and Scandinavia, most of South America, a number of African countries, major producing countries within Asia and South-East Asia (including Japan, China, India, Indonesia and others) and Oceania. As an interim step some countries develop localized GAP programmes.

The scheme is controlled by more than 1,400 inspectors/auditors of the 130 GlobalGAP approved Certification Bodies.

GlobalGAP provides a pre-farm-gate standard for certification of farm inputs and covers all activities until the product leaves the farm. It is a business-to-business label and is therefore not directly visible to consumers. It incorporates different product applications capable of fitting to the whole of global agriculture.

GlobalGAP benefits include the promotion of sustainable production, on-farm management improvement, value addition of products, a global accreditation system that has integrity, market access qualification for small holders, and harmonized buyer requirements.

Beyond the farm, the scheme provides other benefits such as increased export yields and prices.

A 2005 case study by USAid in Kenya attributed GlobalGAP as enabling farmers to achieve their highest ever income recorded for smallholders and up to 40% savings on pesticide costs.