

Landscape Garden

There are many people who think that landscape gardening relates to only gardening in large public parks or palaces of the rich. Landscaping as it is done for larger estates or public parks can also be implemented in a tasteful and artistic way for a small home ground, though on a smaller scale.

There are some basic guidelines for a home landscape. But personal preference plays a considerable role in developing a home garden. The home including its surroundings should be an outward expression of the inner personality and individuality of the owner. Often a common mistake is made by many to copy a successful competitor of a garden competition or a neighbour. This may not suit your own home for various reasons. For example, location aspect of your own garden may be quite different compared to the one which you want to copy. It is advisable to think a lot before even a single digging work starts. It is a matter of great regret that in our country sometimes we spend a fortune in decorating the interior of the house to make it attractive but ignore the outside compound.

Before any actual garden work is undertaken a master plan has to be prepared according to a scale (1: 15 or 1: 20) in which all the features such as house wall, drive-way, paths, flower beds, shrubbery, etc., are plotted. The shaded areas due to large tree canopy or the building itself has to be marked on the plan. A plan prepared on a printed graph paper is of great help. The plan thus prepared should be studied again and again keeping in view what shape a plant will take in the long run. It is frequently observed that people attracted by the graceful form of a young Araucaria cookii, plant this in the centre of a lawn or near the house possess the gigantic form and height it will attain after some years. Big trees, if space permits, can go in the backyard but should not be overcrowded in the front. But a few low-growing trees can be accommodated at the appropriate places as next to entrance, if space is available or somewhere in the front lawn. An open spacious lawn with some annuals (cut-and-come again zinnias, salvias, and petunias) or herbaceous perennials (chrysanthemum, Canna, and Impatiens in shade) can be planned in addition to the foundation plantings.

Work or Service Area: The work or service area can be convenient, orderly and attractive. Wherever feasible this and the living area should be situated at the back of the house as these need seclusion or privacy. This area includes the kitchen garden, compost bin, nursery, tool shed, and garage. Some people like to include the child-ren's swings and the slide in this portion as the children can be kept under surveillance from the kitchen. This should be separated from view by planting a thick hedge or a row of bushy shrubs, as this is considered as the shabbiest part in any garden.

Private Garden Area or Living Area: This is generally termed as the outdoor living area, where people sit out in the winter to enjoy the sun or rest in the summer under an arbour or shade of tree. This area should be easily approachable and visible from the living (drawing-room) or dining-room, screened from unsightly objects and for privacy. In the western countries people prefer a terrace and this is the place where it should come. There should be some shaded sitting spot such as a tree or arbour with garden benches.

Landscaping can help you effectively cover your outdoors thereby helping you block unpleasant views from outsiders or your own neighbors. Building huge walls to achieve this would be undesirable when the same can be achieved beautifully through landscaping.

Garden benches offer a real opportunity to add utility, color and beauty to the landscape. Comfortable and attractive items are now available in a wide variety of low maintenance outdoor furniture. Outdoor furniture must be large enough to be practical and must be in scale with its surroundings. Built-in furniture has the added value of being permanently in place and enhancing the overall design. Occasionally the surface of a retaining wall or raised planter can serve as a seating area. The living terrace is the most usual place for outdoor furniture.

A wide stretch of lawn with shrub border or few annual beds or a rose garden can also be included in this section. A tennis court or a play area has to be included here, if there is enough room.

But before actual planning one has to first decide what one wants for one's house. A choice has to be made from the following. Whether the garden is needed (a) as an outdoor living room with a long stretch of lawn and terrace (b) as a fenced-in playground (c) as a show piece with collection of exotic and rare plants or (d) a yielder of vegetables and fruits or cut flowers for the house is to be determined first. Some may like to add to the list a large tree for shade or trees to attract birds. It is to be considered first what should be the major theme of the garden.

Many people advise not to include any pool or formal rock garden or the kind in a home garden. But there is no harm if a formal or informal tiny pool can fit in with the overall design, with or without a fountain or a rock garden. A statue or sun dial can also be well fitted in some spacious compounds.



Roof garden

Garden is an embellished area with plants. The importance of gardening has been well understood by every individual. The gardens not only serve as a place of recreation, it also serves as a place for education by the way of establishing a home garden or botanical gardens.

The art of creating the greenery and maintaining the greenery is known as "Roof Gardening". This is also known as Terrace gardening. The existing roof top can be effectively utilized for growing fruit plants, vegetables, spices, homestead medicinal plants, flower plants and ornamental plants. The population explosion occurs every day resulted in the migration of peoples from rural areas to urban areas for income generation. Due to migration of peoples most of the agriculture lands are converted into residential areas, resulted with decreased production of fruits and vegetables. This can be circumvented by kitchen gardening and roof gardening.

In urban areas, due to escalating population, more land area is brought under the construction of houses; therefore there is hardly any space for growing vegetables. Especially in multistoried buildings, roof gardening is the only way to grow fruits and vegetables by using the pots and containers. This practice is known as container gardening. Psychiatrist recommends that working in garden refresh the body and mind by reliving harsh stresses. Gardens become the integral part of the family life benefited by the supply of toxic free fresh fruits and vegetables.

Dietitians recommend 85 grams of fruits/day, 300 grams of vegetables/day, whereas the present day consumption of fruit is only 30 grams/day and vegetables is 120 grams/day. The consequences of nutritional and vitamin deficiency are given as follows.

Aims of roof gardening

Year round supply of fresh fruits and vegetables

Reduces expenditure on purchase of fruits and vegetables

Effective utilization of space available at the roof top

Supply of toxic free fruits and vegetables

To grow our own favourite vegetables

Rare and unavailable vegetables can be grown in roof garden

Apart from the above, working in a roof garden will relieve stress and strains.

Maintaining the greenery through roof garden reduces the pollution

Increases the monetary value of land / apartment

Location of garden

Roof top/ verandah / window sills

Preferably open areas with plenty of sunlight and water supply

Roof gardening can be established in a best manner with the availability of sun light and water. Plants produce quality fruits and vegetables by using sunlight and water. Since there is not enough place in the flats these days, this garden can be laid on roof tops, there by effectively utilizing the

available space on the roof tops. In multistoried buildings, not all the apartments have a roof. Thus the pots can be placed in the verandah and window sills.

For efficient utilization of roof spaces, an inward trough is formed in the unutilized spaces of roof top i.e., like sunkened trough. The length and depth of trough may be designed as per the requirement. The available area is properly coated with water-proofing materials to avoid the seepage of water into the roof area. The inner side is designed with a gradual slope to facilitate the drainage. The drainage hole is covered with wire mesh and gravel for ensured drainage. Finally the entire area is laid with geo-textile material and finally filled up with the soil mixture for raising fruits and vegetable.



pots

Earthen pots made of burnt porous clay in various sizes to hold enough quantity of soil and roof space for cultivating different kinds of plants. They have straight sides and are made wider at the top than at the bottom to hold the greatest bulk of compost and also to facilitate easy removal of soil, intact with roots (ball of earth) at the time of planting or repotting.

In our country, pots of varying sizes viz., tube pots, $\frac{1}{4}$ size, $\frac{1}{2}$ size, $\frac{3}{4}$ size and 'thali' are used commonly. Tube pots are used to raise the rootstocks of mango and sapota for grafting purposes. $\frac{1}{4}$ size pots are used for potting singly very small seedlings during first transplanting and also for layering in plants like West Indian Cherry and Guava. $\frac{1}{2}$ size pots are extensively employed for growing well rooted cuttings of several kinds of plants and small plants of all kinds. $\frac{3}{4}$ size pots are preferred for growing Dahlia, Cannas, Palms, Shrubs, Roses etc. In addition to the above, the earthen pots were filled with soil mixture and used for raising vegetable crops. Apart from the above, the soil mixture is filled in polythene covers and used for the cultivation of vegetables like tomato, brinjal, chilli, turmeric, coriander, amaranthus etc.,

Polythene bags

Small polythene bags with punched holes at the bottom for drainage and filled with a porous rooting medium are used for propagation of cuttings like jasmine, duranta, crotons etc., in the mist chamber. Some times, young seedlings which are raised in the nursery are subsequently transplanted in these polythene bags are kept there till they attain required growth for transplanting them to the main field (e.g., papaya, curry leaf etc).

Plastic pots: Plastic pots, round and square are used to keep mostly indoor plants. They are reusable, light weight, non-porous and they require only little storage space.

Fibre pots: These are available in small size varying from 5-10 cm width and are either round or square in shape. They are bio non-degradable and last longer periods with the soil and plants inside.

Paraffined paper or Styrofoam cups

They look like ice-cream cups with drainage holes. They serve satisfactory as temporary containers for growing and transferring young plants on a large seed bed. They are light, cheap and require little space. Recently, thermocole molded pots have been gaining popularity as they are light weight and attractive.

Tools

Hand hoe

Spade / showel

Rose can

Hand sprayer

Gardening hose with sprinkler

Bamboo stakes and jute strings

Other inputs

Quality seeds from reliable sources like Agricultural University and Research Stations and National Seed Corporation. Good soil free from stones, weeds and other undecomposable materials Well decomposed organic manure (compost / FYM / leaf compost / digested coir compost)

River bed sand, Chemical fertilizers, Insecticides, Fungicide, Organic inputs (Neem oil, Neem seed kernel extract, Panchakavya)

How to start

Wash the container thoroughly and make drainage holes at the bottom. Mix soil, compost and sand with the help of hand hoe and shovel. Fill the containers loosely with a gentle tap. The soil should settle, bearing one inch head space at the top for irrigation.

a). For the transplanted vegetables, where nursery has to be raised, shallow pans and troughs can be filled with the fine mixture of soil, sand and compost (1:1:1) and the seeds should be sown. The container should be irrigated immediately after sowing. A layer of dry grass or straw is spread on top of the soil till the seedlings emerge, and thereafter it is removed. Most of the seedlings are ready for transplanting with one month of sowing. Recently, protrays are employed for raising vegetable seedlings. Protrays are the plug trays of 2-3" depth with a drainage hole. Initially ¼ portion of plug are filled with compost and one seed is sown in each plug and cover the remaining portion with compost or sand mixed compost. The watering and other operations are similarly to the above method.

b)The seeds of certain vegetable crops which can be sown directly, should be sown in the selected pots/ polythene bags etc., The depth of the seed sowing should be about two and a half times of the seed size. Most of the vegetables are raised by sowing their seeds directly in containers. The seedlings of brinjal, chilli, tomato, capsicum and onion are transplanted in containers / pots after 30-40 days of germination. Their seedlings can also be raised in earthen pot or pans. A single healthy seedling may be transplanted in each container. Several seedlings, each of onion and knolkhol, and can be transplanted in a container of the same size. Two or three seeds are sown directly in such containers and later thinned out retaining healthy seedlings. The number of plants per pot may be varied with shape and size.

Plants in pots and containers need a lot of care and attention. It is essential to water the plants judiciously depending upon the season, kind of crop, size of the plant and size of the container. Plants need extra water during summer season and hence the plants should preferably be irrigated twice a day. Too much watering will also lead to problems; hence we should strike a intelligent balance. The thumb rule for irrigation is that the top soil should be scratch about one inch and seen, if the lower soil is damp, there is no need of immediate irrigation. Due to evaporation, the top soil generally dries even though the soil may have enough moisture to sustain the plant. In general, watering can be done as and when required.

Fertilizer application

For maximum growth and yield of crops can be achieved not only through organic manures and can be improved better by the application of inorganic fertilizers. Top dressing with nitrogenous fertilizers improves plant growth and yield of vegetables. This can be done by applying urea or DAP or ammonium sulphate in small quantities. In general, 5-10 g of urea may be applied in moist soil once in a week or 10 days starting from 3 weeks after sowing or 2 weeks after transplanting. In general, 5 to 10 grammes of complex fertilizers (17:17:17 / 20:20:20) containing NPK mixture is applied in three stages as follows:

30 days after planting (i.e) on set of vegetative phase = 5 to 10 grammes/plant

60 days after planting (i.e) on set of flowering phase = 15 to 20 grammes/plant

90 days after planting (i.e) on set of fruiting phase = 15 to 20 grammes/plant

In addition to the above, vermicompost 100 grammes/plant should be applied at monthly intervals. Care must be taken that vermicompost should not mix with any inorganic fertilizers. Hence the application of vermicompost and inorganic fertilizers should not be practiced simultaneously. Heavy doses of fertilizer are very harmful. Immediately after fertilizer application, the plant should be watered.



Rock Garden

A rock garden, also known as a rockery or an alpine garden, is a small field or plot of ground designed to feature and emphasize a variety of rocks, stones, and boulders.

The standard layout for a rock garden consists of a pile of aesthetically arranged rocks in different sizes, with small gaps between in which plants are rooted. Typically, plants found in rock gardens are small and do not grow larger than 1 meter in height, though small trees and shrubs up to 6 meters may be used to create a shaded area for a woodland rock garden. If used, they are often grown in troughs or low to the ground to avoid obscuring the eponymous rocks. The plants found in rock gardens are usually species that flourish in well-drained, poorly irrigated soil.

Some rock gardens are designed and built to look like natural outcrops of bedrock. Stones are aligned to suggest a bedding plane, and plants are often used to conceal the joints between said stones. This type of rockery was popular in Victorian times and usually created by professional landscape architects. The same approach is sometimes used in commercial or modern-campus landscaping but can also be applied in smaller private gardens.

The Japanese rock garden, often referred to as a "Zen garden", is a special kind of rock garden with water features, moss, pruned trees and bushes, and very few plants.

Rock gardens have become increasingly popular as landscape features in tropical countries such as Thailand. The combination of wet weather and heavy shade trees, along with the use of heavy plastic liners to stop unwanted plant growth, has made this type of arrangement ideal for both residential and commercial gardens due to its easier maintenance and drainage. They have also made an international debut. In Canada, residents find that they help in yard cooling during the hot summer months.

History

Although the use of rocks as decorative and symbolic elements in gardens can be traced back to early Chinese and Japanese gardens, rock gardens dedicated to growing alpine plants have a shorter history.

During the Golden Age of Botany (early 1700s – mid-1800s), there was widespread interest in exotic articles imported to England. Although others had previously written about growing alpine plants, it was Reginald Farrer that started this tradition with the 1919 publication of his two-volume book, *The English Rock Garden*.

Japanese rock garden, A mountain, waterfall, and gravel "river" at Daisen-in (1509–1513)



Bonsai

Bonsai ('tray planting' ,) is a Japanese art form which utilizes cultivation techniques to produce, in containers, small trees that mimic the shape and scale of full size trees. Similar practices exist in other cultures, including the Chinese tradition of penzai or penjing from which the art originated, and the miniature living landscapes of Vietnamese . The Japanese tradition dates back over a thousand years.

The loanword "bonsai" (a Japanese pronunciation of the earlier Chinese term penzai) has become an umbrella term in English, attached to many forms of potted or other plants, and also on occasion to other living and non-living things. According to Stephen Orr in The New York Times, "the term should be reserved for plants that are grown in shallow containers following the precise tenets of bonsai pruning and training, resulting in an artful miniature replica of a full-grown tree in nature." In the most restrictive sense, "bonsai" refers to miniaturized, container-grown trees adhering to Japanese tradition and principles.

Purposes of bonsai are primarily contemplation for the viewer, and the pleasant exercise of effort and ingenuity for the grower. By contrast with other plant cultivation practices, bonsai is not intended for production of food or for medicine. Instead, bonsai practice focuses on long-term cultivation and shaping of one or more small trees growing in a container.

A bonsai is created beginning with a specimen of source material. This may be a cutting, seedling, or small tree of a species suitable for bonsai development. Bonsai can be created from nearly any perennial woody-stemmed tree or shrub species that produces true branches and can be cultivated to remain small through pot confinement with crown and root pruning. Some species are popular as bonsai material because they have characteristics, such as small leaves or needles, that make them appropriate for the compact visual scope of bonsai.

The source specimen is shaped to be relatively small and to meet the aesthetic standards of bonsai. When the candidate bonsai nears its planned final size it is planted in a display pot, usually one designed for bonsai display in one of a few accepted shapes and proportions. From that point forward, its growth is restricted by the pot environment. Throughout the year, the bonsai is shaped to limit growth, redistribute foliar vigor to areas requiring further development, and meet the artist's detailed design.

Bonsai uses cultivation techniques like pruning, root reduction, potting, defoliation, and grafting to produce small trees that mimic the shape and style of mature, full-size trees.

The Japanese art of bonsai originated from the Chinese practice of penjing. From the 6th century onward, Imperial embassy personnel and Buddhist students from Japan visited and returned from mainland China. They brought back many Chinese ideas and goods, including container plantings. Over time, these container plantings began to appear in Japanese writings and representative art.

In the medieval period, recognizable bonsai were portrayed in handscroll paintings like the Ippen shonin eden (1299). The 1195 scroll Saigyō Monogatari Emaki was the earliest known to depict dwarfed potted trees in Japan. Wooden tray and dish-like pots with dwarf landscapes on modern-looking wooden shelves also appear in the 1309 Kasuga-gongen-genki scroll. In 1351, dwarf trees displayed on short poles were portrayed in the Boki Ekotoba scroll. Several other scrolls and paintings also included depictions of these kinds of trees.

A close relationship between Japan's Zen Buddhism and the potted trees began to shape bonsai reputation and aesthetics. In this period, Chinese Chan (pronounced "Zen" in Japanese) Buddhist monks taught at Japan's monasteries. One of the monks' activities was to introduce political leaders to various arts of miniature landscapes as admirable accomplishments for men of taste and learning. Potted landscape arrangements up to this period included miniature figurines after the Chinese fashion. Japanese artists eventually adopted a simpler style for bonsai, increasing focus on the tree by removing miniatures and other decorations, and using smaller, plainer pots.

The final trend supporting world involvement in bonsai is the widening availability of specialized bonsai plant stock, soil components, tools, pots, and other accessory items. Bonsai nurseries in Japan advertise and ship specimen bonsai worldwide. Most countries have local nurseries providing plant stock as well. Japanese bonsai soil components, such as Akadama clay, are available worldwide, and suppliers also provide similar local materials in many locations. Specialized bonsai tools are widely available from Japanese and Chinese sources. Potters around the globe provide material to hobbyists and specialists in many countries.

Cultivation and care

Bonsai cultivation and care requires techniques and tools that are specialized to support the growth and long-term maintenance of trees in small containers.

Propagation from a source tree through cuttings or layering. Nursery stock directly from a nursery, or from a garden centre or similar resale establishment. Commercial bonsai growers, which, in general, sell mature specimens that display bonsai aesthetic qualities already. Collecting suitable bonsai material in its original wild situation, successfully moving it, and replanting it in a container for development as bonsai. These trees are called yamadori and are often the most expensive and prized of all Bonsai.

Techniques

Leaf trimming, the selective removal of leaves (for most varieties of deciduous tree) or needles (for coniferous trees and some others) from a bonsai's trunk and branches. Pruning the trunk, branches, and roots of the candidate tree. Wiring branches and trunks allows the bonsai designer to create the desired general form and make detailed branch and leaf placements. Clamping using mechanical devices for shaping trunks and branches. Grafting new growing material (typically a bud, branch, or root) into a prepared area on the trunk or under the bark of the tree. Defoliation, which can provide short-term dwarfing of foliage for certain deciduous species. Deadwood bonsai techniques such as jin and shari simulate age and maturity in a bonsai.

Care

Small trees grown in containers, like bonsai, require specialized care. Unlike houseplants and other subjects of container gardening, tree species in the wild, in general, grow roots up to several meters long and root structures encompassing several thousand liters of soil. In contrast, a typical bonsai container is under 25 centimeters in its largest dimension and 2 to 10 liters in volume. Branch and leaf (or needle) growth in trees is also of a larger scale in nature. Wild trees typically grow 5 meters or taller when mature, whereas the largest bonsai rarely exceed 1 meter and most specimens are significantly smaller. These size differences affect maturation, transpiration, nutrition, pest resistance, and many other aspects of tree biology. Maintaining the long-term health of a tree in a container requires some specialized care techniques:

Watering must be regular and must relate to the bonsai species' requirement for dry, moist, or wet soil. Repotting must occur at intervals dictated by the vigor and age of each tree. Tools have been developed for the specialized requirements of maintaining bonsai. Soil composition and fertilization must be specialized to the needs of each bonsai tree, although bonsai soil is almost always a loose, fast-draining mix of components. Location and overwintering are species-dependent when the bonsai is kept outdoors as different species require different light conditions. Few of the traditional bonsai species can survive inside a typical house, due to the usually dry indoor climate.



Water garden

Water gardens, also known as aquatic gardens, are a type of water feature. They can be defined as any interior or exterior landscape or architectural element whose primary purpose is to house, display, or propagate a particular species or variety of aquatic plant. The primary focus is on plants, but they will sometimes also house ornamental fish, in which case the feature will be a fish pond.

Water gardening is gardening that is concerned with growing plants adapted to pools and ponds. Although water gardens can be almost any size or depth, they are typically small and relatively shallow, generally less than twenty inches (50 cm) in depth. This is because most aquatic plants are depth sensitive and require a specific water depth in order to thrive. The particular species inhabiting each water garden will ultimately determine the actual surface area and depth required.

Water gardens, and water features in general, have been a part of public and private gardens since ancient Persian gardens and Chinese gardens. For instance, the (c. 304) Nanfang Caomu Zhuang records cultivating Chinese spinach on floating gardens. Water features have been present and well represented in every era and in every culture that has included gardens in their landscape and architectural environments. Up until the rise of the industrial age, when the modern water pump was introduced, water was not recirculated but was diverted from rivers and springs into the water garden, from which it exited into agricultural fields or natural watercourses. Historically, water features were used to enable plant and fish production both for food purposes and for ornamental aesthetics.

When the aquatic flora and fauna are balanced, an aquatic ecosystem is created that will support sustainable water quality and clarity. Elements such as fountains, statues, artificial waterfalls, boulders, underwater lighting, lining treatments, edging details, watercourses, and in-water and bankside planting can add visual interest and help to integrate the water garden with the local landscape and environment.

Water garden plants are divided into three main categories: submerged, marginal, and floating.

Submerged plants are those that live almost completely under the water, sometimes with leaves or flowers that grow to the surface such as with the water lily. These plants are placed in a pond or container usually 1–2 ft (0.30–0.61 m) below the water surface. Some of these plants are called oxygenators because they create oxygen for the fish that live in a pond. Examples of submerged plants are:

Water lily (Hardy and Tropical)

Hornwort (*Ceratophyllum demersum*)

Featherfoil (*Hottonia palustris*)

Eurasian water milfoil (*Myriophyllum spicatum*)

Shining pondweed (*Potamogeton lucens*)

Marginal plants are those that live with their roots under the water but the rest of the plant above the surface. These are usually placed so that the top of the pot is at or barely below the water level. Examples of these are:

Iris or Flag (*Iris* spp.), Water-crowfoot (*Ranunculus fluitans*), Bulrush (*Scirpus lacustris*), Cattail (*Typha latifolia*), Taro (*Colocasia esculenta*), Arrowhead (*Sagittaria latifolia*), Lotus (*Nelumbo* spp.), Pickerelweed (*Pontederia cordata*)

Floating plants are those that are not anchored to the soil at all, but are free-floating on the surface. In water gardening, these are often used as a provider of shade to reduce algae growth in a pond. These are often extremely fast growing/multiplying. Examples of these are:

Mosquito ferns (*Azolla* spp.), Water-spangle (*Salvinia* spp.), Water-clover (*Marsilea vestita*)

Water Lettuce (*Pistia stratiotes*), Water Hyacinth (*Eichhornia crassipes*)

Often the reason for having a pond in a garden is to keep fish, often koi, though many people keep goldfish. Both are hardy, colorful fish which require no special heating, provided the pond is located in an area which does not have extremes of temperature that would affect the fish. If fish are kept, pumps and filtration devices are usually needed in order to keep enough oxygen in the water to support them.



Hydroponics

Plants grow through a process called photosynthesis, in which they use sunlight and a chemical inside their leaves called chlorophyll to convert carbon dioxide (a gas in the air) and water into glucose (a type of sugar) and oxygen.

There's no mention of "soil" anywhere in there—and that's all the proof you need that plants can grow without it. What they do need is water and nutrients, both easily obtained from soil. But if they can get these things somewhere else—say, by standing with their roots in a nutrient-rich solution—they can do without soil altogether. That's the basic principle behind hydroponics. In theory, the word "hydroponics" means growing plants in water (from two Greek words meaning "water" and "toil"), but because you can grow plants without actually standing them in water, most people define the word to mean growing plants without using soil

The white surface of hydroponic containers like these helps to reflect light evenly onto the plant leaves, improving growth. Photo by courtesy of NASA Kennedy Space Center

Although the benefits of hydroponics have sometimes been questioned, there seem to be many advantages in growing without soil. Some hydroponic growers have found they get yields many times greater when they switch from conventional methods. Because hydroponically grown plants dip their roots directly into nutrient-rich solutions, they get what they need much more easily than plants growing in soil, so they need much smaller root systems and can divert more energy into leaf and stem growth. With smaller roots, you can grow more plants in the same area and get more yield from the same amount of ground (which is particularly good news if you're growing in a limited area like a greenhouse or on a balcony or window-ledge inside). Hydroponic plants also grow faster. Many pests are carried in soil, so doing without it generally gives you a more hygienic growing system with fewer problems of disease. Since hydroponics is ideal for indoor growing, you can use it to grow plants all year round. Automated systems controlled by timers and computers make the whole thing a breeze

One is the cost of all the equipment you need—containers, pumps, lights, nutrients, and so on. Another drawback is the ponics part of hydroponics: there's a certain amount of toil involved. But hydroponics is more scientific and the plants are much more under your control. You need to check them constantly to make sure they're growing in exactly the conditions they need (though automated systems, such as lighting timers, make things quite a bit easier). Another difference is that, because hydroponic plants have much smaller root systems, they can't always support themselves very well. Heavy fruiting plants may need quite elaborate forms of support.

In the nutrient-film technique, nutrient constantly drips past the roots of the plants, which grow out from an inclined tray. The nutrient is pumped back up to the tray and a second pump adds oxygen through an air stone (a piece of porous rock that lets air bubble through it—just like in a fish tank).

There are various different ways of growing things hydroponically. In one popular method, you stand your plants in a plastic trough and let a nutrient solution trickle past their roots (with the help of gravity and a pump). That's called the nutrient-film technique: the nutrient is like a kind of liquid conveyor belt—it's constantly sliding past the roots delivering to them the goodness they need. Alternatively, you can grow plants with their roots supported by a nutrient-enriched medium such as rockwool, sand, or vermiculite, which acts as a sterile substitute for soil. Another method is called aeroponics and it's typified by a popular product called the AeroGarden. Although the name

suggests you're growing plants in air, the roots are actually suspended inside a container full of extremely humid air. Effectively, the roots grow in a nutrient-rich aerosol a bit like a cloud packed full of minerals.



Cut flowers

Cut flowers are flowers or flower buds (often with some stem and leaf) that have been cut from the plant bearing it. It is usually removed from the plant for decorative use. Typical uses are in vase displays, wreaths and garlands. Many gardeners harvest their own cut flowers from domestic gardens, but there is a significant floral industry for cut flowers in most countries. The plants cropped vary by climate, culture and the level of wealth locally. Often the plants are raised specifically for the purpose, in field or glasshouse growing conditions. Cut flowers can also be harvested from the wild. The cultivation and trade of flowers is a specialization in horticulture, specifically floriculture.

Cultivation

Cut flower cultivation is intensive, usually on the basis of greenhouse monocultures, and requires large amounts of highly toxic pesticides, residues of which can often still be found in flower shops on imported flowers. These facts have spurred the development of movements like "Slow Flowers", which propagates sustainable floriculture in the consumer country.

Uses

A common use is for floristry, usually for decoration inside a house or building. Typically the cut flowers are placed in a vase. A number of similar types of decorations are used, especially in larger buildings and at events such as weddings. These are often decorated with additional foliage. In some cultures, a major use of cut flowers is for worship; this can be seen especially in south and southeast Asia.

Sometimes the flowers are picked rather than cut, without any significant leaf or stem. Such flowers may be used for wearing in hair, or in a button-hole. Masses of flowers may be used for sprinkling, in a similar way to confetti. Garlands, wreaths and bouquets are major derived and value added products.

Popular genera

Among the most popular species and genera in the worldwide cut flower trade are the following:

Alstroemeria, Aster, Banksias, Begonias, Bellflower Campanula, Bird of Paradise (Strelitzia reginae)

Bulb flowers, mostly available in spring, Daffodils, Freesia, Tulips, Busy lizzies, Carnations (Dianthus caryophyllus), Chinese lantern (Physalis alkekengi), Chrysanthemum, Clematis, Cyclamen, Daisies, Delphiniums, Epacris impressa, Fuchsia, Gardenia, Geraniums, Gerberas, Gladioli, Gladiolus, Gumamela, Gypsophila, Heather (Calluna vulgaris), Hydrangeas, Iris, Lavender (Lavendula)

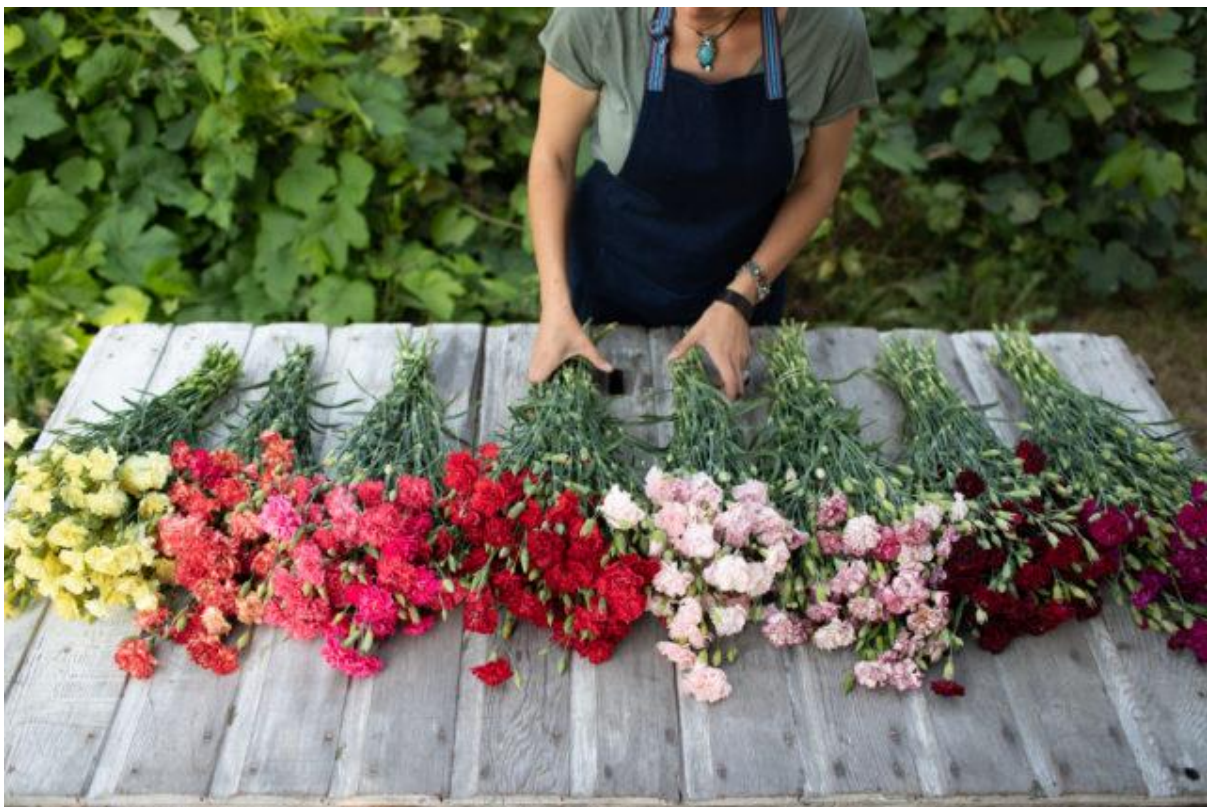
Leucadendron, Lilac, Lilies (Lilium), Stargazer Lily, Lobelias, Love Lies Bleeding (Amaranthus caudatus)

Oleander, Orchids, Cooktown Orchid

Once flowers are removed from the plant they continue to grow slowly, but have a diminished capability of receiving the nutrients that are vital for their survival. In most countries, cut flowers are a local crop because of their perishable nature. In India, much of the product has a shelf life of only a day. Among these are marigold flowers for garlands and temples, which are typically harvested before dawn, and discarded after use the same day.

The majority of cut flowers can be expected to last several days with proper care. This generally requires standing them in water in shade. They can be treated in various ways to increase their life. According to James C. Schmidt, a horticulturist at the University of Illinois, originally putting cut flowers in a sterilized vase is important to extending the life of the flowers. Vases can be cleaned using a household dish detergent or a combination of water and bleach. Using these disinfectants ensures that there will be less bacteria growing within the vase that could potentially cause the plant to wilt and die at a faster rate. Schmidt also claims that cutting the flowers diagonally with a sharp knife under running water ensures that they can immediately take up fresh and clean water. Re-cutting the stems periodically will ensure that there is a fresh surface from which the stems can take up water. This will allow the flowers to last even longer. Other ways to care for vase flowers includes keeping flowers away from ceiling fans and air-conditioning vents as this can lead to dehydration, keeping flowers away from fresh fruit or vegetables, using filtered water rather than tap water so as to avoid both chlorine and fluoride, and keeping flowers away from your television.

There is also a market for 'everlasting' or dried flowers, which include species such as *Xerochrysum bracteatum*. These can have a very long shelf life.



Ikebana

Ikebana "arranging flowers" or "making flowers alive") is the Japanese art of flower arrangement. It is also known as Kadō "way of flowers" The tradition dates back to Heian period, when floral offerings were made at altars. Later, flower arrangements were instead used to adorn the tokonoma (alcove) of a traditional Japanese home.

Ikebana reached its first zenith in the 16th century under the influence of Buddhist tea masters and has grown over the centuries, with numerous distinct schools extant today.

Ikebana is counted as one of the three classical Japanese arts of refinement, along with kōdō for incense appreciation and chadō for tea and the tea ceremony.

Etymology

"Ikebana" is from the Japanese ikeru "to arrange (flowers), have life, be living") and hana "flower"). Possible translations include "giving life to flowers" and "arranging flowers".

History

Ikebana arrangement with cart, at the Kyoto State Guest House

The pastime of viewing plants and appreciating flowers throughout the four seasons was established in Japan early on through the aristocracy. Waka poetry anthologies such as the Man'yōshū and Kokin Wakashū from the Heian period (794–1185) included many poems on the topic of flowers. With the introduction of Buddhism, offering flowers at Buddhist altars became common. Although the lotus is widely used in India where Buddhism originated, in Japan other native flowers for each season were selected for this purpose.[4] While in China the Buddhist priests were the first instructors of flower arrangement, in Japan they only introduced its crudest elements. For a long time the art had no meaning and was merely the placing in vases, without system, of the flowers to be used as temple offerings and before ancestral shrines. The first flower arrangements worked out with a system were known as shin-no-hana, meaning "central flower arrangement". A huge branch of pine or cryptomeria stood in the middle, and around the tree were placed three or five seasonable flowers. These branches and stems were put in vases in upright positions without attempt at artificial curves.

Generally symmetrical in form, the arrangements appeared in Japanese religious pictures of the 14th century. It was the first attempt to represent natural scenery. The large tree in the center represented distant scenery, plum or cherry blossoms middle distance, and little flowering plants the foreground. The lines of these arrangements were known as centre and sub-centre. Later on, among other types of Buddhist offering, placing mitsu-gusoku became popular in the Kamakura (1185–1333) and Nanboku-chō periods (1336–1392). Various Buddhist scriptures have been named after flowers such as the Kegon-kyo (Flower Garland Sutra) and Hokke-kyo (Lotus Sutra). The Chōjū-jinbutsu-giga (Scroll of Frolicking Animals and Humans) depicts lotus being offered by a monk(ey) in front of a frog mimicking the Buddha.

With the development of the shoin-zukuri architectural style starting in the Muromachi period (1336–1573), kakemono (scroll pictures) and containers could be suitably displayed as art objects in the oshiita, a precursor to the tokonoma alcove, and the chigaidana, two-leveled shelves. Also displayed in these spaces were flower arrangements in vases that influenced the interior decorations, which became simpler and more exquisite. This style of decoration was called zashiki kazari The set of three ceremonial objects at the Buddhist altar called mitsugusoku consisted of candles lit in holders, a censer, and flowers in a vase. The flowers in the vase were arranged in the

earliest style called tatebana or tatehana ("standing flowers"), and were composed of shin (motoki) and shitakusa.[8] Recent historical research now indicates that the practice of tatebana[9] derived from a combination of belief systems, including Buddhist, and the Shinto yorishiro belief is most likely the origin of the Japanese practice of ikebana that we know today. Together they form the basis for the original purely Japanese derivation of the practice of ikebana.

The art developed very slowly, and the many schools did not come into existence until the end of the 15th century following the period of the civil war. The eighth shōgun Ashikaga Yoshimasa (1436–1490), was a patron of the arts and the greatest promoter of cha-no-yu, the ceremonial tea, and ikebana flower arrangement. Yoshimasa finally abdicated the office in order to devote his time to the fine arts. It was he who said that flowers offered on all ceremonial occasions and placed as offerings before the gods should not be offered loosely, but should represent time and thought. Rules then commenced to be formulated.

Ikebana has always been considered a dignified accomplishment. All of Japan's most celebrated generals have been masters of this art, finding that it calmed their minds and made clear their decisions for the field of action. That warriors like Hideyoshi and Yoshimasa, two of Japan's most famous generals, found benefit in the practise of ikebana shows that it is valuable training, even for the masculine mind. Rikka reached its greatest popularity during the Genroku era.

Since flower arrangement arrived in Japan from China together with Buddhism, it was naturally imbued with Chinese and Buddhist philosophy. The Buddhist desire to preserve life lies at the root of the whole subject and has created most of the rules of flower arrangement, controlling also the shapes of the flower vases, which are so formed as to help to prolong the life of the flowers. So much thought and time would never have been given to preservatives had not this desire predominated in all their floral offerings.

More than simply putting flowers in a container, ikebana is a disciplined art form in which nature and humanity are brought together. Contrary to the idea of a particolored or multicolored arrangement of blossoms, ikebana often emphasizes other areas of the plant, such as its stems and leaves, and puts emphasis on shape, line, and form. Though ikebana is an expression of creativity, certain rules govern its form. The artist's intention behind each arrangement is shown through a piece's color combinations, natural shapes, graceful lines, and the implied meaning of the arrangement.

Consideration of the vase as being something more than a mere holder of the flowers is purely Japanese. They think of the surface of the water, which they always expose, as the surface of earth from which the group springs. This aids in creating the effect of representing a complete plant growing as nearly as possible in its natural conditions.

The Japanese express the seasons in their floral arrangements, grouping the flowers differently according to the time of the year. For example, in the month of March, when high winds prevail, the unusual curves of the branches convey at once the impression of strong winds. In summer the Japanese rejoice in the low, broad receptacles, where the visually predominating water produces a cooler and more refreshing arrangement than those in upright vases.

For a house-warming, white flowers are used, as they suggest water to quench a fire, fire being their constant dread, as in the construction of many houses everything but the roof is flammable. Red flowers suggest fire, so are avoided on such occasions. To celebrate an inheritance all kinds of evergreens or chrysanthemums may be used, or any flowers which are long-lived, to convey the idea that the wealth or possessions may remain forever.



Topiary

Topiary is the horticultural practice of training perennial plants by clipping the foliage and twigs of trees, shrubs and subshrubs to develop and maintain clearly defined shapes, whether geometric or fanciful. The term also refers to plants which have been shaped in this way. As an art form it is a type of living sculpture. The word derives from the Latin word for an ornamental landscape gardener, *topiarius*, a creator of *topia* or "places", a Greek word that Romans also applied to fictive indoor landscapes executed in fresco.

The plants used in topiary are evergreen, mostly woody, have small leaves or needles, produce dense foliage, and have compact and/or columnar (e.g., *fastigiata*) growth habits. Common species chosen for topiary include cultivars of European box (*Buxus sempervirens*), arborvitae (*Thuja* species), bay laurel (*Laurus nobilis*), holly (*Ilex* species), myrtle (*Eugenia* or *Myrtus* species), yew (*Taxus* species), and privet (*Ligustrum* species). Shaped wire cages are sometimes employed in modern topiary to guide untutored shears, but traditional topiary depends on patience and a steady hand; small-leaved ivy can be used to cover a cage and give the look of topiary in a few months. The hedge is a simple form of topiary used to create boundaries, walls or screens.

Traditional topiary forms use foliage pruned and/or trained into geometric shapes such as balls or cubes, obelisks, pyramids, cones, or tiered plates and tapering spirals. Representational forms depicting people, animals, and man-made objects have also been popular. The royal botanist John Parkinson found privet "so apt that no other can be like unto it, to be cut, lead, and drawn into what forme one will, either of beasts, birds, or men armed or otherwise." Evergreens have usually been the first choice for Early Modern topiary, however, with yew and boxwood leading other plants.

Topiary at Versailles and its imitators was never complicated: low hedges punctuated by potted trees trimmed as balls on standards, interrupted by obelisks at corners, provided the vertical features of flat-patterned parterre gardens. Sculptural forms were provided by stone and lead sculptures

American portable style topiary was introduced to Disneyland around 1962. Walt Disney helped bring this new medium into being - wishing to recreate his cartoon characters throughout his theme park in the form of landscape shrubbery. This style of topiary is based on a suitably shaped steel wire frame through which the plants eventually extend as they grow. The frame, which remains as a permanent trimming guide, may be either stuffed with sphagnum moss and then planted, or placed around shrubbery. The sculpture slowly transforms into a permanent topiary as the plants fill in the frame. This style has led to imaginative displays and festivals throughout the Disney resorts and parks, and mosaiculture (multiple types and styles of plants creating a mosaic, living sculpture) worldwide includes the impressive display at the 2008 Summer Olympics in China. Living corporate logos along roadsides, green roof softscapes and living walls that biofilter air are offshoots of this technology.

Artificial topiary is another offshoot similar to the concept of artificial Christmas trees. This topiary mimics the style of living versions and is often used to supply indoor greenery for home or office decoration. Patents are issued for the style, design, and construction methodology of different types of topiary trees



Nursery layout

The nursery is the place where young plants are raised and taken care of until they reach the right size for outplanting.

OBJECTIVES OF THE NURSERY

- To raise healthy and disease free stocks.
- To distribute plant material in masses who have little knowledge about the techniques of raising plants.
- To introduce exotic species.
- Planting of nursery grown is the surest method of artificially regenerating poor and barren sites.
- Replacement of casualties.

3. SITE SELECTION The following are the factors in selecting an ideal nursery site:

- Water should be available throughout the year
- Area should be large enough to accommodate the required seedlings and facilities
- Area could be flat or slightly inclined to allow sufficient drainage
- Area must be accessible or close to the road
- Area must have good soil condition, i.e. dry sandy loam or loam, topsoil of about 30 cm, with 5.5 to 6.5 pH and high quantity of organic matter
- Area must have good exposure to sunlight
- Area must be protected from strong winds with temporary windbreakers • using local materials. For permanent windbreakers, establish a green belt (trees that can withstand strong winds) around the nursery.

4. NURSERY LAYOUT A perfect master plan is required otherwise improper layout plan will cause considerable anxiety to nursery manager in future. ☐ The nursery lay out should be compact and as far as possible, it should be in rectangular or square shape to minimize the length of boundary for fencing and watch and ward point of view. ☐ For setting up of a commercial nursery provision of wind break/ shelter break must be done all along the boundary not only to protect against hot wind and wild life but also to modify the micro-climatic situations.

5. ☐The nursery should be connected by main road for better approach and disposal of produce. ☐There should be proper provision for road and path, irrigation and drainage channels, mother block, nursery beds, growing structure, store, compost pit, display site-cum-sale counter etc. ☐. A nursery is usually arranged in a series of beds with pathway between them. ☐ An open area is needed at one end, where work such as sieving of soil and filling of containers can be done. ☐Usually a room/shelter is required for staff and the watchman, and where equipment can be securely stored. ☐ Layout should be in a way that enables operations to flow logically through the nursery so as to save labor and time. ☐Roads and paths within the nursery should be carefully planned. The nursery facilities should be kept

6. MAJOR STEPS IN NURSERY LAYOUT

7. 1. Mother block ☐Once an superior type of material has been identified, it should be multiplied and maintained under conditions that prevent recontamination and allow detection of any significant change from the original source. ☐ The planting stock that maintained as a source for commercial propagation is referred to as a mother block.

8. ☐Therefore, for preservation of pathogen free planting stock; proper isolation, sanitation, periodical inspection and testing and maintenance are very important. ☐ As far as possible mother block should be in the close proximity of the nursery site. The scion shoots should be taken only from bearing plants. ☐There should be proper record and certification of planting stock.

9. 2. Seed beds Seed beds can be accommodated in a comparatively smaller area. They should be nearer to a source of water supply and to the office so that they can be kept under proper vigilance.

The beds should be raised enough to avoid water stagnation due to rain and excess watering. Seed beds should be located in an open situation for better germination of seeds and to avoid infestation of 'damping off' disease.

10. 3-Pot yard The pot yard is generally used for tender plants, which require shade as compared to hardy plants. Therefore, pot yards should be in shade and near to water source for frequent watering. Trenches can be provided for keeping the potted plants closely packed together. 4Packing yard and working shed - The packing yard is used for packing the plants before sale or dispatch to out stations. The yard can be combined with working shed. In packing yard, there should be plenty of space to enable a number of workers for sorting out and packing the plants with ease.

11. 5-Compost pit Nursery production of horticultural and forestry plants require huge amount of organic manures, like F.Y.M, compost, leaf mould etc. for different purposes. Therefore, arrangements should be made at nursery level to produce enough quantity of compost etc. for own purpose. One compost pit of permissible size should be located at any corner of nursery layout. At the same time several waste products of nursery can also be utilized for the same and extra effort to dispose off waste material is not required

12. 6-IRRIGATION SYSTEM Design and installation of an irrigation system includes several stages or phases, each of which requires different kind of expertise . Ist phase - planning and development. handled by nursery staff , irrigations specialist 2nd phase - it require the services of specialist . The agricultural extension services at many land grant universities has who can help plan irrigation systems, MAIN IRRIGATION LINE The main lines from the source to seed beds are generally located along the road between blocks and should be buried 30 to 36 inch deep sub lines extend under the roads. LATERAL IRRIGATION CHANNEL The first lateral lines in a block may be placed at the edge of the block or about 24 feet inside . The first sprinkler on a lateral line may be placed at the edge of the block adjacent to the roads or 20 feet down the alley . Better water coverage is obtained when the first and last lateral lines are on the outside edge of the block and sprinkler are located at the beginning and the end of the lateral lines

13. 7-ROADS AND DRAINAGE An adequate road and drainage system carefully planned and constantly maintained ,is essential to the efficient operations of the operation of the nursery . An all weather , hard surface road should connect the administrative site to a paved highway. Exterior and interior road should be permanent and stable . Frequently , roads within seedbed area also serve as drainage channels . Therefore, they should 1) Provide access to seedbed s for equipment 2) Drain the surface water rapidly, but at a low velocity by spreading it over a large drainage area, in contrast to the conventional road ditch and culvert system . Roads or channels at ends of the beds should be 50 feet wide or wider to enable tractor and attached equipments to turn without damaging seed beds .

14. General layout of nursery 1:Main road 13:Shade net house 2:Gate 14:Poly 3:Nursery road 15:Seedling/beds 4:Path 16:Mother beds 5:Office 17:Well water source 6Labor shed 18:Water pipeline 7:Store room 19:Soil dumping 8:Vehicle shed 20:Compost area 9:Potted plants 21:Mother plant 10:Saplings 22:Fencing 11:Seedlings 23:Plant library 12:Propagation 24:Generator

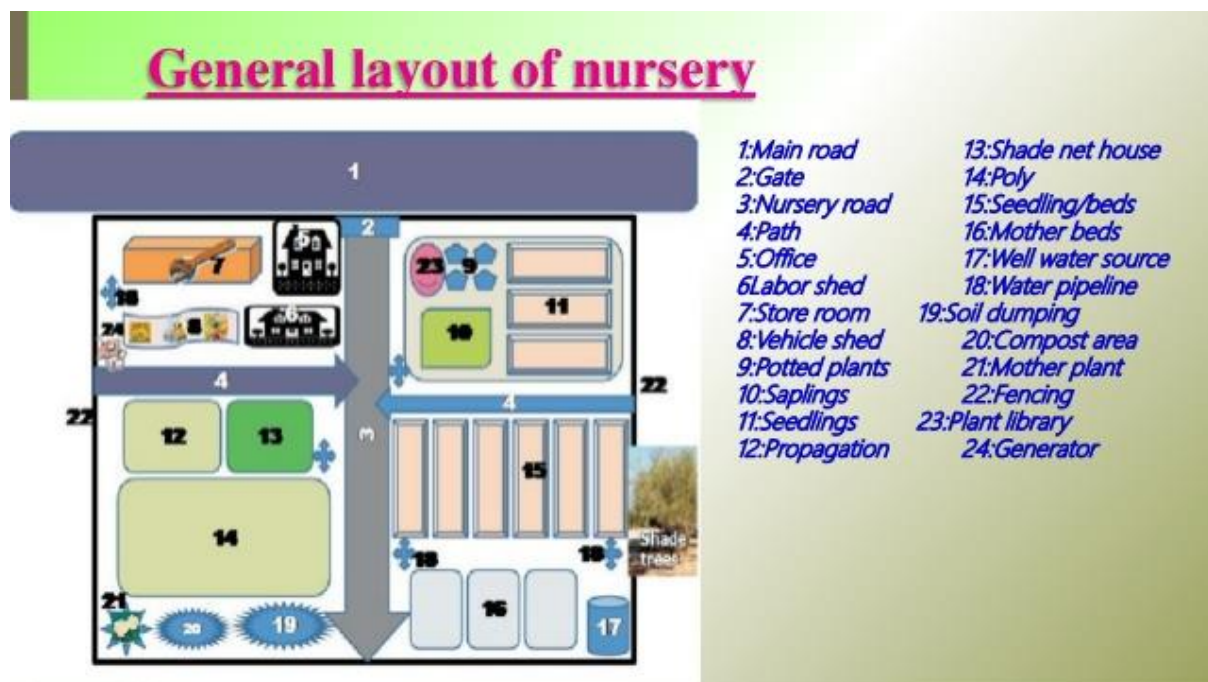
15. 8-ADMINISTRATION AND OPERATIONAL OPERATION Office ,lab and working space ☐ One or more offices are needed for the nursery manager assistants , secreteries and for records and files . ☐ . A large space is needed for the storage of packing or balling material and for grading and balling of seedling if this operation is not handled in this field. ☐ A lunch room ,a break room and rest room are needed for the crew . A building with 3000 to 6000 square feet of floor space is adequate for this

complex OTHER FACILITIES Fertilizers and chemical require careful storage and should be stored in a separate building . Pesticide require special security and protection from freezing .Usually two or more kind of fuel are used at a nursery and each of these requires special storage facilities . Well designed pumphouse are usually needed to protect pumping equipment .They must be protected from freezing in winter and overheating in the summer . The domestic watersupply may come from the main water source if deep wells are used .

16. FENCES ☐ Nurseries should be fenced if there is potential damage from cattle ,hogs, sheep, dogs or people. ☐ Fences around administrative sites may be needed to protect equipment and building from theft or vandalism WINDBREAKS ☐ Exterior and interior windbreaks often needed to reduce the erosion and drying effects of strong winds ☐ They should be located on the wind ward sides of fields and parallel to seed beds It can either consist of a single line of trees with a spacing of 1.5-2.0 m, or two lines with a spacing of 4-5 m within the line and 2-4 m between the lines.

17. IMPORTANCE OF WIND BREAK ☐ Reduced wind and increased retention of moisture ☐ Protect houses and crops against strong wind ☐ The leaves shed by trees return organic matter to the soil, increasing its structural stability, erosion resistance and capacity to store water COMMON WIND BREAK SPP. Nitrogen fixing by leguminous trees – Mexican lilac Create strong and impenetrable fences - Jatropha tree Provide oil that can be used for biofuels or turned into soap – Jatropha tree Provide food (fruit trees) Medicinal benefits– Neem tree Provide sustainable fire wood – Neem tree

18. Illustrations Trees planted around a crop field Windbreaks must be planted at right angles to the prevailing wind



Green wall/ Vertical Wall

A green wall is a vertical greening typology, where a vertical built structure is intentionally covered by vegetation. Green walls include a vertically applied growth medium such as soil, substitute substrate, or hydroculture felt; as well as an integrated hydration and fertigation delivery system. They are also referred to as living walls or vertical gardens, and widely associated with the delivery of many beneficial ecosystem services.

Green walls differ from the more established vertical greening typology of 'green facades' as they have the growth medium supported on the vertical face of the host wall (as described below), while green facades have the growth medium only at the base (either in a container or as a ground bed). Green facades typically support climbing plants that climb up the vertical face of the host wall, while green walls can accommodate a variety of plant species.[3] Green walls may be implanted indoors or outdoors; as freestanding installations or attached to existing host walls; and applied in a variety of sizes.

Green walls have seen a surge in popularity in recent times. An online database provided by greenroof.com for example had reported 80% of the 61 large-scale outdoor green walls listed as constructed after 2009, with 93% after 2007. Many notable green walls have been installed at institutional buildings and public places, with both outdoor and indoor installations gaining significant attention. As of 2015, the largest green wall is said to cover 2,700 square meters (29,063 square feet) and is located at the Los Cabos International Convention Centre designed by Mexican architect Fernando Romero.

Green walls are often constructed of modular panels that hold a growing medium and can be categorized according to the type of growth media used: loose media, mat media, and structural media.

Freestanding media

Freestanding media are portable living walls that are flexible for interior landscaping. Zauben living walls are designed with hydroponic technology that conserves 75% less water than plants grown in soil, self-irrigates, and includes moisture sensors.

Loose media

Loose medium walls tend to be "soil-on-a-shelf" or "soil-in-a-bag" type systems. Loose medium systems have their soil packed into a shelf or bag and are then installed onto the wall. These systems require their media to be replaced at least once a year on exteriors and approximately every two years on interiors.[citation needed] Loose soil systems are not well suited for areas with any seismic activity. Most importantly, because these systems can easily have their medium blown away by wind-driven rain or heavy winds, these should not be used in applications over 2.5 m high. There are some systems in Asia that have solved the loose media erosion problem by use of shielding systems to hold the media within the green wall system even when soil liquefaction occurs under seismic load. In these systems, the plants can still up-root themselves in the liquified soil under seismic load, and therefore it is required that the plants be secured to the system to prevent them from falling from the wall. Loose-soil systems without physical media erosion systems are best suited for the home gardener where occasional replanting is desired from season to season or year to year. Loose-soil systems with physical media erosion systems are well suited for all green wall applications.

Mat media

Mat type systems tend to be either coir fiber or felt mats. Mat media are quite thin, even in multiple layers, and as such cannot support vibrant root systems of mature plants for more than three to five years before the roots overtake the mat and water is not able to adequately wick through the mats. The method of reparation of these systems is to replace large sections of the system at a time by cutting the mat out of the wall and replacing it with new mat. This process compromises the root structures of the neighboring plants on the wall and often kills many surrounding plants in the reparation process. These systems are best used on the interior of a building and are a good choice in areas with low seismic activity and small plants that will not grow to a weight that could rip the mat apart under their own weight over time. It is important to note that mat systems are particularly water inefficient and often require constant irrigation due to the thin nature of the medium and its inability to hold water and provide a buffer for the plant roots. This inefficiency often requires that these systems have a water re-circulation system put into place at an additional cost. Mat media are better suited for small installations no more than eight feet in height where repairs are easily completed.

Sheet media

Semi-open cell polyurethane sheet media utilising an egg crate pattern has successfully been used in recent years for both outdoor roof gardens and vertical walls. The water holding capacity of these engineered polyurethanes vastly exceeds that of coir and felt based systems. Polyurethanes do not biodegrade, and hence stay viable as an active substrate for 20+ years. Vertical wall systems utilising polyurethane sheeting typically employ a sandwich construction where a water proof membrane is applied to the back, the polyurethane sheeting (typically two sheets with irrigation lines in between) is laid and then a mesh or anchor braces/bars secure the assembly to the wall. Pockets are cut into the face of the first urethane sheet into which plants are inserted. Soil is typically removed from the roots of any plants prior to insertion into the urethane mattress substrate. A flaked or chopped noodle version of the same polyurethane material can also be added to existing structural media mixes to boost water retention.

Structural media

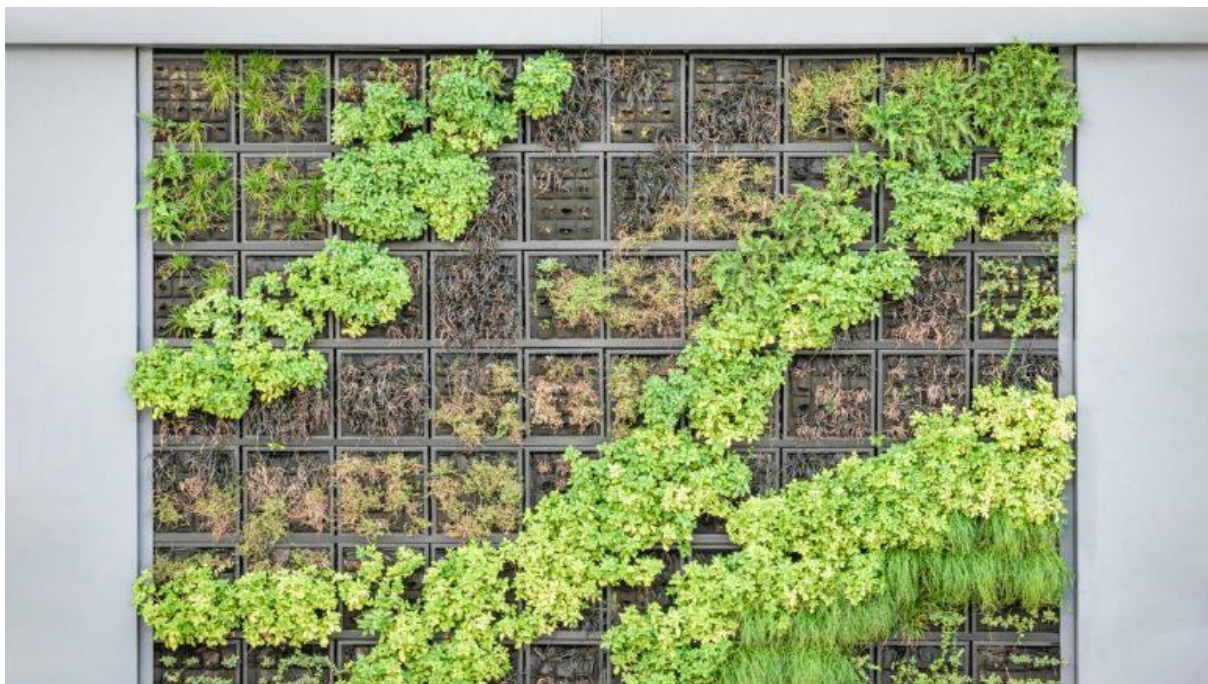
Structural media are growth medium "blocks" that are not loose, nor mats, but which incorporate the best features of both into a block that can be manufactured into various sizes, shapes and thicknesses. These media have the advantage that they do not break down for 10 to 15 years, can be made to have a higher or lower water holding capacity depending on the plant selection for the wall, can have their pH and EC's customized to suit the plants, and are easily handled for maintenance and replacement.

Green walls are found most often in urban environments where the plants reduce overall temperatures of the building. "The primary cause of heat build-up in cities is insolation, the absorption of solar radiation by roads and buildings in the city and the storage of this heat in the building material and its subsequent re-radiation. Plant surfaces however, as a result of transpiration, do not rise more than 4–5 °C above the ambient and are sometimes cooler."

Living walls may also be a means for water reuse. The plants may purify slightly polluted water (such as greywater) by absorbing the dissolved nutrients. Bacteria mineralize the organic components to make them available to the plants.

The living wall could also function for urban agriculture, urban gardening, or for its beauty as art. It is sometimes built indoors to help alleviate sick building syndrome.

Green walls provide an additional layer of insulation that can protect buildings from heavy rainwater which leads to management of heavy storm water and provides thermal mass. They also help reduce the temperature of a building because vegetation absorbs large amounts of solar radiation. This can reduce energy demands and cleanse the air from VOC's (Volatile Organic Compounds) released by paints, furniture, and adhesives. Off-gassing from VOCs can cause headaches, eye irritation, and airway irritation and internal air pollution. Green walls can also purify the air from mould growth in building interiors that can cause asthma and allergies. Vegetation in green walls can help with the mitigation of the heat island effect and contribute to urban biodiversity.



Kitchen garden

The traditional kitchen garden, also known as a potager (from the French *jardin potager*) or in Scotland a *kailyaird*,^[1] is a space separate from the rest of the residential garden – the ornamental plants and lawn areas. Most vegetable gardens are still miniature versions of old family farm plots, but the kitchen garden is different not only in its history, but also its design.

The kitchen garden may serve as the central feature of an ornamental, all-season landscape, or it may be little more than a humble vegetable plot. It is a source of herbs, vegetables and fruits, but it is often also a structured garden space with a design based on repetitive geometric patterns.

The kitchen garden has year-round visual appeal and can incorporate permanent perennials or woody shrub plantings around (or among) the annuals.

Of the planted crops, turnips required the most room, and planted next to these were coleworts, and a path leading to plots of sorrel, arugula, parsley, spinach, beets, and orach, then separated from the greens another path to the root vegetables, leeks, onions, garlic, carrots, and scallions, and so on for edible flowers and winter potherbs like thyme, sage, lavender, rosemary, hyssop, southern wormwood, savoury, lemon balm, basil, costmary, spikenard, chamomile, and pennyroyal.

Marigolds could grow perennially in untilled fields, and their juice and flowers were reputed to have many benefits from soothing eye irritation to relieving tooth pain. Strawberry juice and wine were rumored to have similar benefits for the eyes, and, according to Estienne, the berries themselves had "no neede of greate toile or tilling". Modern researchers continue to study whether reduced tillage improves weed control and yield for strawberry plants.

Other plants found in the kitchen garden: asparagus, artichoke, sow thistle, endive, chicory, watercress, scallions, chives, parsnips, purslane, smallage, tarragon, borage, bugloss, radishes, rapeseed, skirret, poppy, mustard, cucumbers and gourds. Citrus and melons could be part of the kitchen garden also, if the conditions of soil and climate were such as to support their growth.

A potager is a French term for an ornamental vegetable or kitchen garden. The historical design precedent is from the Gardens of the French Renaissance and Baroque Garden à la française eras. Often flowers (edible and non-edible) and herbs are planted with the vegetables to enhance the garden's beauty. The goal is to make the function of providing food aesthetically pleasing.

Plants are chosen as much for their functionality as for their color and form. Many are trained to grow upward. A well-designed potager can provide food as well as cut flowers and herbs for the home with very little maintenance. Potagers can disguise their function of providing for a home in a wide array of forms—from the carefree style of the cottage garden to the formality of a knot garden.

A vegetable garden (also known as a vegetable patch or vegetable plot) is a garden that exists to grow vegetables and other plants useful for human consumption, in contrast to a flower garden that exists for aesthetic purposes. It is a small-scale form of vegetable growing. A vegetable garden typically includes a compost heap, and several plots or divided areas of land, intended to grow one or two types of plant in each plot. Plots may also be divided into rows with an assortment of vegetables grown in the different rows. It is usually located to the rear of a property in the back garden or back yard. About a third of adults in the UK and America grow food in private or community kitchen or vegetable gardens.^[7]^[8] In World War II, many people had a "victory garden" which provided food and thus freed resources for the war effort.

With worsening economic conditions and increased interest in organic and sustainable living, many people are turning to vegetable gardening as a supplement to their family's diet. Food grown in the back yard consumes little if any fuel for shipping or maintenance, and the grower can be sure of what exactly was used to grow it. Organic horticulture, or organic gardening, has become increasingly popular for the modern home gardener.

The herb garden is often a separate space in the garden, devoted to growing a specific group of plants known as herbs. These gardens may be informal patches of plants, or they may be carefully designed, even to the point of arranging and clipping the plants to form specific patterns, as in a knot garden. Herb gardens may be purely functional or they may include a blend of functional and ornamental plants. The herbs are usually used to flavour food in cooking, though they may also be used in other ways, such as discouraging pests, providing pleasant scents, or serving medicinal purposes (such as a physic garden), among others.

A kitchen garden can be created by planting different herbs in pots or containers, with the added benefit of mobility. Although not all herbs thrive in pots or containers, some herbs do better than others. Mint, a fragrant yet invasive herb, is an example of an herb that is advisable to keep in a container or it will take over the whole garden.

