18BBO6EL NON-MAJOR ELECTIVE PAPER- PLANTS AND HUMAN WELFARE
UNIT-IV
Green house, shade house, Indoor gardening – Bonsai – flower arrangements- fresh and dry
flower – Ikebana. Nursery management and maintenance.

A **greenhouse** (also called a **glasshouse**, or, if with sufficient heating, a **hothouse**) is a structure with walls and roof made chiefly of transparent material, such as glass, in which plants requiring regulated climatic conditions are grown.[1] These structures range in size from small sheds to industrial-sized buildings. A miniature greenhouse is known as a cold frame. The interior of a greenhouse exposed to sunlight becomes significantly warmer than the external temperature, protecting its contents in cold weather.[2]

Many commercial glass greenhouses or hothouses are high tech production facilities for vegetables, flowers or fruits. The glass greenhouses are filled with equipment including screening installations, heating, cooling, lighting, and may be controlled by a computer to optimize conditions for plant growth. Different techniques are then used to evaluate optimality degrees and comfort ratio of greenhouses, such as air temperature, relative humidity and vapour-pressure deficit, in order to reduce production risk prior to cultivation of a specific crop.

The idea of growing plants in environmentally controlled areas has existed since Roman times. The Roman emperor Tiberius ate a cucumber-like vegetable daily.[3] The Roman gardeners used artificial methods (similar to the greenhouse system) of growing to have it available for his table every day of the year. Cucumbers were planted in wheeled carts which were put in the sun daily, then taken inside to keep them warm at night. The cucumbers were stored under frames or in cucumber houses glazed with either oiled cloth known as *specularia* or with sheets of selenite (a.k.a. *lapis specularis*), according to the description by Pliny the Elder.[4][5]

The first description of a heated greenhouse is from the *Sanga Yorok*, a treatise on husbandry compiled by a royal physician of the Joseon dynasty of Korea during the 1450s, in its chapter on cultivating vegetables during winter. The treatise contains detailed instructions on constructing a greenhouse that is capable of cultivating vegetables, forcing flowers, and ripening fruit within an artificially heated environment, by utilizing *ondol*, the traditional Korean underfloor heating system, to maintain heat and humidity; cob walls to insulate heat; and semi-transparent oiled *hanji* windows to permit light penetration for plant growth and provide protection from the outside environment. The Annals of the Joseon Dynasty confirm that greenhouse-like structures incorporating *ondol* were constructed to provide heat for mandarin orange trees during the winter of 1438.[6]

The concept of greenhouses also appeared in the Netherlands and then England in the 17th century, along with the plants. Some of these early attempts required enormous amounts of work to close up at night or to winterize. There were serious problems with providing adequate and balanced heat in these early greenhouses. The first 'stove' (heated) greenhouse in the UK was completed at Chelsea Physic Garden by 1681.[7] Today, the Netherlands has many of the largest greenhouses in the world, some of them so vast that they are able to produce millions of vegetables every year.

Experimentation with greenhouse design continued during the 17th century in Europe, as technology produced better glass and construction techniques improved. The greenhouse at

the Palace of Versailles was an example of their size and elaborateness; it was more than 150 metres (490 ft) long, 13 metres (43 ft) wide, and 14 metres (46 ft) high.

A heated greenhouse, or "hothouse", In Macon, Georgia c. 1877

The French botanist Charles Lucien Bonaparte is often credited with building the first practical modern greenhouse in Leiden, Holland, during the 1800s to grow medicinal tropical plants.[8] Originally only on the estates of the rich, the growth of the science of botany caused greenhouses to spread to the universities. The French called their first greenhouses *orangeries*, since they were used to protect orange trees from freezing. As pineapples became popular, *pineries*, or pineapple pits, were built.

The golden era of the greenhouse was in England during the Victorian era, where the largest glasshouses yet conceived were constructed, as the wealthy upper class and aspiring botanists competed to build the most elaborate buildings. A good example of this trend is the pioneering Kew Gardens. Joseph Paxton, who had experimented with glass and iron in the creation of large greenhouses as the head gardener at Chatsworth, in Derbyshire, working for the Duke of Devonshire, designed and built The Crystal Palace in London, (although the latter was constructed for both horticultural and non-horticultural exhibition).

Other large greenhouses built in the 19th century included the New York Crystal Palace, Munich's Glaspalast and the Royal Greenhouses of Laeken (1874–1895) for King Leopold II of Belgium.

In Japan, the first greenhouse was built in 1880 by Samuel Cocking, a British merchant who exported herbs.

In the 20th century, the geodesic dome was added to the many types of greenhouses. Notable examples are the Eden Project, in Cornwall, The Rodale Institute[9] in Pennsylvania, the Climatron at the Missouri Botanical Garden in St. Louis, Missouri, and Toyota Motor Manufacturing Kentucky.[10]

Greenhouse structures adapted in the 1960s when wider sheets of polyethylene (polythene) film became widely available. Hoop houses were made by several companies and were also frequently made by the growers themselves. Constructed of aluminum extrusions, special galvanized steel tubing, or even just lengths of steel or PVC water pipe, construction costs were greatly reduced. This resulted in many more greenhouses being constructed on smaller farms and garden centers. Polyethylene film durability increased greatly when more effective UV-inhibitors were developed and added in the 1970s; these extended the usable life of the film from one or two years up to 3 and eventually 4 or more years.

Gutter-connected greenhouses became more prevalent in the 1980s and 1990s. These greenhouses have two or more bays connected by a common wall, or row of support posts. Heating inputs were reduced as the ratio of floor area to exterior wall area was increased substantially. Gutter-connected greenhouses are now commonly used both in production and in situations where plants are grown and sold to the public as well. Gutter-connected greenhouses are commonly covered with structured polycarbonate materials, or a double layer of polyethylene film with air blown between to provide increased heating efficiencies.

The Eden Project, in Cornwall, England.

The Royal Greenhouses of Laeken, Brussels, Belgium. An example of 19th-century greenhouse architecture

The warmer temperature in a greenhouse occurs because incident solar radiation passes through the transparent roof and walls and is absorbed by the floor, earth, and contents, which become warmer. As the structure is not open to the atmosphere, the warmed air cannot escape via convection, so the temperature inside the greenhouse rises. This differs from the earth-oriented theory known as the "greenhouse effect".[11][12][13][14]

Quantitative studies suggest that the effect of infrared radiative cooling is not negligibly small, and may have economic implications in a heated greenhouse. Analysis of issues of near-infrared radiation in a greenhouse with screens of a high coefficient of reflection concluded that installation of such screens reduced heat demand by about 8%, and application of dyes to transparent surfaces was suggested. Composite less-reflective glass, or less effective but cheaper anti-reflective coated simple glass, also produced savings.[15]

Ventilation

Ventilation is one of the most important components in a successful greenhouse. If there is no proper ventilation, greenhouses and their growing plants can become prone to problems. The main purposes of ventilation is to regulate the temperature and humidity to the optimal level, and to ensure movement of air and thus prevent the build-up of plant pathogens (such as *Botrytis cinerea*) that prefer still air conditions. Ventilation also ensures a supply of fresh air for photosynthesis and plant respiration, and may enable important pollinators to access the greenhouse crop.

Ventilation can be achieved via the use of vents - often controlled automatically via a computer - and recirculation fans.

Heating

Heating or electricity is one of the most considerable costs in the operation of greenhouses across the globe, especially in colder climates. The main problem with heating a greenhouse as opposed to a building that has solid opaque walls is the amount of heat lost through the greenhouse covering. Since the coverings need to allow light to filter into the structure, they conversely cannot insulate very well. With traditional plastic greenhouse coverings having

an R-value of around 2, a great amount of money is therefore spent to continually replace the heat lost. Most greenhouses, when supplemental heat is needed use natural gas or electric furnaces.

Passive heating methods exist which seek heat using low energy input. Solar energy can be captured from periods of relative abundance (day time/summer), and released to boost the temperature during cooler periods (night time/winter). Waste heat from livestock can also be used to heat greenhouses, e.g., placing a chicken coop inside a greenhouse recovers the heat generated by the chickens, which would otherwise be wasted.[*citation needed*] Some greenhouses also rely on geothermal heating.[16]

Cooling

Cooling is typically done by opening windows in the greenhouse when it gets too warm for the plants inside it. This can be done manually, or in an automated manner. Window actuators can open windows due to temperature difference[17] or can be opened by electronic controllers. Electronic controllers are often used to monitor the temperature and adjusts the furnace operation to the conditions. This can be as simple as a basic thermostat, but can be more complicated in larger greenhouse operations.

Lighting[

During the day, light enters the greenhouse via the windows and is used by the plants. Some greenhouses are also equipped with grow lights (often LED lights) which are switched on at night to increase the amount of light the plants get, hereby increasing the yield with certain crops.[18]

Carbon dioxide enrichment

The benefits of carbon dioxide enrichment to about 1100 parts per million in greenhouse cultivation to enhance plant growth has been known for nearly 100 years.[19][20][21] After the development of equipment for the controlled serial enrichment of carbon dioxide, the technique was established on a broad scale in the Netherlands.[22] Secondary metabolites, e.g., cardiac glycosides in *Digitalis lanata*, are produced in higher amounts by greenhouse cultivation at enhanced temperature and at enhanced carbon dioxide concentration.[23] Carbon dioxide enrichment can also reduce greenhouse water usage by a significant fraction by mitigating the total air-flow needed to supply adequate carbon for plant growth and thereby reducing the quantity of water lost to evaporation.[24] Commercial greenhouses are now frequently located near appropriate industrial facilities for mutual benefit. For example, Cornerways Nursery in the UK is strategically placed near a major sugar refinery,[25] consuming both waste heat and CO_2 from the refinery which would otherwise be vented to atmosphere. The refinery reduces its carbon emissions, whilst the nursery enjoys boosted tomato yields and does not need to provide its own greenhouse heating.

Enrichment only becomes effective where, by Liebig's law, carbon dioxide has become the limiting factor. In a controlled greenhouse, irrigation may be trivial, and soils may be fertile by default. In less-controlled gardens and open fields, rising CO_2 levels only increase primary production to the point of soil depletion (assuming no droughts,[26][27][28] flooding,[29] or both[30][31][32][33][34]), as demonstrated *prima facie* by CO_2 levels continuing to rise. In addition, laboratory experiments, free air carbon enrichment (FACE) test plots,[35][36] and field measurements provide replicability.[37][38][39]

Types

Recreational Greenhouse at Palazzo Parisio, Malta.

In domestic greenhouses, the glass used is typically 3mm (or ⅛″) 'horticultural glass' grade, which is good quality glass that should not contain air bubbles (which can produce scorching on leaves by acting like lenses).[40]

Plastics mostly used are polyethylene film and multiwall sheets of polycarbonate material, or PMMA acrylic glass.[41]

Commercial glass greenhouses are often high-tech production facilities for vegetables or flowers. The glass greenhouses are filled with equipment such as screening installations, heating, cooling and lighting, and may be automatically controlled by a computer.

Dutch Light

In the UK and other Northern European countries a pane of horticultural glass referred to as "Dutch Light" was historically used as a standard unit of construction, having dimensions of 28¾″ x 56″ (approx. 730mm x 1422 mm). This size gives a larger glazed area when compared with using smaller panes such as the 600mm width typically used in modern domestic designs which then require more supporting framework for a given overall greenhouse size. A style of greenhouse having sloped sides (resulting in a wider base than at eaves height) and using these panes uncut is also often referred to as of "Dutch Light design", and a cold frame using a full- or half-pane as being of "Dutch" or "half-Dutch" size.

Uses

Greenhouses allow for greater control over the growing environment of plants. Depending upon the technical specification of a greenhouse, key factors which may be controlled include temperature, levels of light and shade, irrigation, fertilizer application, and atmospheric humidity. Greenhouses may be used to overcome shortcomings in the growing qualities of a piece of land, such as a short growing season or poor light levels, and they can thereby improve food production in marginal environments. Shade houses are used specifically to provide shade in hot, dry climates.[42][43]

Greenhouses in Almería as seen from space

As they may enable certain crops to be grown throughout the year, greenhouses are increasingly important in the food supply of high-latitude countries. One of the largest complexes in the world is in Almería, Andalucía, Spain, where greenhouses cover almost 200 km^2 (49,000 acres).[44]

Greenhouses are often used for growing flowers, vegetables, fruits, and transplants. Special greenhouse varieties of certain crops, such as tomatoes, are generally used for commercial production.

YPJ members in a greenhouse farm, for ecological cooperative farming in Rojava

Many vegetables and flowers can be grown in greenhouses in late winter and early spring, and then transplanted outside as the weather warms. Seed tray racks can also be used to stack seed trays inside the greenhouse for later transplanting outside. Hydroponics (especially hydroponic A-frames) can be used to make the most use of the interior space when growing crops to mature size inside the greenhouse.

Bumblebees can be used as pollinators for pollination, but other types of bees have also been used, as well as artificial pollination.

The relatively closed environment of a greenhouse has its own unique management requirements, compared with outdoor production. Pests and diseases, and extremes of temperature and humidity, have to be controlled, and irrigation is necessary to provide water. Most greenhouses use sprinklers or drip lines. Significant inputs of heat and light may be required, particularly with winter production of warm-weather vegetables.

Greenhouses also have applications outside of the agriculture industry. GlassPoint Solar, located in Fremont, California, encloses solar fields in greenhouses to produce steam for solar-enhanced oil recovery. For example, in November 2017 GlassPoint announced that it is developing a solar enhanced oil recovery facility near Bakersfield, CA that uses greenhouses to enclose its parabolic troughs.[45]

An "alpine house" is a specialized greenhouse used for growing alpine plants. The purpose of an alpine house is to mimic the conditions in which alpine plants grow; particularly to provide protection from wet conditions in winter. Alpine houses are often unheated, since the plants grown there are hardy, or require at most protection from hard frost in the winter. They are designed to have excellent ventilation.[46]

Adoption

Worldwide, there are an estimated 9 million acres of greenhouses.[47]

Netherlands

Young tomato plants for transplanting in an industrial-sized greenhouse in the Netherlands

The Netherlands has some of the largest greenhouses in the world. Such is the scale of food production in the country that in 2000, greenhouses occupied 10,526 hectares, or 0.25% of the total land area.[citation needed]

Greenhouses in the Westland region.

Greenhouses began to be built in the Westland region of the Netherlands in the mid-19th century. The addition of sand to bogs and clay soil created fertile soil for agriculture, and around 1850, grapes were grown in the first greenhouses, simple glass constructions with one of the sides consisting of a solid wall. By the early 20th century, greenhouses began to be constructed with all sides built using glass, and they began to be heated. This also allowed for the production of fruits and vegetables that did not ordinarily grow in the area. Today, the Westland and the area around Aalsmeer have the highest concentration of greenhouse agriculture in the world.[citation needed] The Westland produces mostly vegetables, besides plants and flowers; Aalsmeer is noted mainly for the production of flowers and potted plants. Since the 20th century, the area around Venlo and parts of Drenthe have also become important regions for greenhouse agriculture.

Since 2000, technical innovations include the "closed greenhouse", a completely closed system allowing the grower complete control over the growing process while using less energy. Floating greenhouses[clarification needed] are used in watery areas of the country.

The Netherlands has around 4,000 greenhouse enterprises that operate over 9,000 hectares[48] of greenhouses and employ some 150,000 workers, producing €7.2 billion[49] worth of vegetables, fruit, plants, and flowers, some 80% of which is exported.

FRESH FLOWER ARRANGEMENT

Flower arrangement is a tribute to nature and her profound creation – an attempt to establish a communion with nature, by capturing some of splendor and framing it in an individually conceived design. As such, it may also be considered an art, as it invokes the aesthetic faculties of the mind. But most of all, it is pastime that is rewarding and involving.

One of the greatest advantages of flower arranging is that you can produce as attractive effects with the humblest of materials, like a twisted branch picked up during your morning walk, and just a few blooms gathered from your garden as you can with a luxurious variety of flowers. Conventionally, there have been two different approaches to floral designs: **western styles**,

employing a ‘mass’ concept of arranging flowers in an even symmetry, and **the eastern or Japanese or Ikebana styles**, which are based on specific rules and angles, using less material.

Some of the basic differences between eastern and western arrangements are

- Primarily western style is symmetrical arrangement, but eastern style is asymmetrical one.
- Western arrangements employ more flowers to create mass effect, but eastern styles impress more by the beauty of individual material.
- Contrary to western arrangements the materials in Japanese never touch the rim of the vase.
- Accessories are never used in western arrangements. But in Ikebana interesting branches, drift wood, pieces of bark, shells etc., are used to imitate the nature. Here the more emphasis is given on western arrangements.

Western styles of flower arrangement

Western style flower arrangements are associated with ‘mass’ or a number of flowers and foliage arranged together in a graceful manner.

In England and Europe, this style was first used to decorate palaces, mansions and churches. Traditionally, triangular, round or oval shapes were created, but after the Second World War, more designs like the L-Shape, Crescent and S-Shape were introduced. These are said to be more American in their influence.

Western designs may be scaled to large proportions and with their symmetrical patterns; they can give a touch of grandeur to a formal occasion. Small compositions look equally pretty, but whatever the size may be, it is better to go in for these styles when there is a generous availability of material. A few typical nuances of such styles can be mentioned as guidelines. These are:

- The outline of the design is normally created first with finer, lighter ‘lines’ so that the shape of the style is defined.
- There is not much emphasis on individual plant material due to the mass effect, but in the more recent western styles, ‘points’ are woven through the ‘fillers’ so that a certain planning is evident within the mass effect and the design looks more attractive. Colours are also used in the same manner.
  The arrangement gives a flowing, radiating effect originating as it were, from the rim of the vase, where the focus has been created with heavier points.

A vase for a western arrangement requires to be fitted with a pin holder as well as a wire-netting. It also make use of an ‘ oasis’ or a block of plastic foam which is very light but becomes solid and heavy when it is immersed in water for approximately twenty minutes. The block can be conveniently cut with a knife and is fitted to fill the entire diameter of the vase. It is easy to simply push in the flowers in this sponge-like substance, but being damp, once the

stems are fixed, it is advisable not to remove them as the oasis starts to crumble. As it retains water, flowers last in an oasis just as they would in a vase, but a fresh oasis has to be used each time for an arrangement.

Different models

- The triangular model
- The Round bowl model
- The Oval bowl model
- The L-Shape model
- The S-Shape model
- The Crescent shape model

1. The triangular shape

Begin by first fixing the central line (A), keeping it in proportion to the vase and fixing it upright at ninety degrees. Next, insert lines (B), each about three-fourths the length of the main line, so that they lie horizontally over the rim of the vase on either side of an imaginary triangle. Insert two more lines, (C) and (D), this time short, and of unequal lengths. Place these horizontally and forward over the rim of the

vase, in line with (A). These establish the width of the arrangement.

Now you can proceed with filling up the distance between (A) and (B) on either side in a symmetrically graded manner. As you make your material descend, fix it outward, the slant being more distinct with each line. Also ensure that the material is kept short, about half-way down the vase and again increases in length as you approach the rim, so that it finally merges with the outer arms (B). Compose the rest of the arrangement with graded tiers of fillers, at the same time adding points in the manner desired, working towards the focus.

Choice of the pots: A brass vase
Choice of the plants:
Nine double tuberoses – A – central line
Six yellow gladioli – B

Eighteen pink roses – C & D
Nine money plant leaves – to fill the gap
Four variegated spider lily leaves – to balance the rose
One bunch of Thuja leaves – to cover the wire netting

2. The round bowl model

For setting the main lines of an all-round arrangement, you will need at least eight flowers for the periphery. Wedge four flowers of equal length (A) through the grill diagonally across each other. Along the same lines, insert four slightly shorter flowers (B). These long and short pairs serve to give you guidance for creating 'movement' in the arrangement. Now, take an erect flower (C) and fix it in the centre of the pin holder. This defines the height of the arrangement. If it is for a sit-down dining table, the central line should not be more than nine inches high so that is does not obstruct the vision of those sitting across the table. Fix four slightly shorter flowers (D), around (G).

From this central group, you will find it easy to proceed with the rest of the arrangement. Keep turning the vase, working on all four sides simultaneously. Begin by fixing the first pair of flowers between the gaps in the central group and grade the flowers outwards, filling in the alternate spaces to merge with the outer points of the circumference. Use heavier flowers or full blown blooms for the depth or short

lengths , and buds or feathery material for the longer lengths, working within the framework of the symmetrical round. Fillers can be worked in similarly.

The longer the lengths of your peripheral lines and central line, the more flowers you will require for the arrangement. No foliage is used as the buds at the tip of the antirrhinums are contrast enough to intersperse the round forms of the roses.

Choice of the pots: A round bowl
Choice of the plants:
Two dozen double coloured orange and yellow roses – A,B &C
One-and-half dozen antirrhinums – D & fillers

3. The oval bowl

For this, an image of a rectangle must be kept in mind. The lines at the sides (A) are therefore kept long. Grouped along these main lines are (B) and (C), of different lengths, corresponding with each other in perfect symmetry on both sides. The width is determined by two short lines, (D) which are on both sides and in front of the vase, being roughly one-fourth the length of (A). Like in the round bowl,

take an erect  flower for the central line (E). This must necessarily be kept low as oval bowls are usually placed on conference tables/dining tables or mantelpieces.

From the central line, on either side, grade the flowers down in the manner of fan so that the lengths of the material will slant and increase as it is arranged to merge with the outer points at the sides. Now you can proceed with filling in the vase. Remember to maintain the ‘movement’ with short and long stems, within the oval framework. Turn the vase around and work similarly on the other side.

Choice of the pots: Rectangular and boat shaped containers vase
Choice of the plants:
Twenty-one yellow roses – A,B,C,D,E
Two dozen sweet Williams as fillers
Two bunches of gypsophila as fillers

4. The L – shape

This design is easy to make if you conform strictly to the L-Shape. If you are using a rectangular container, place the pin holder in one corner of the vase, depending on which may you would like to face your L.

Fix two main lines (A) of equal length at a right angle. While the perpendicular line will be fixed in the pin holder, the horizontal line will have to be wedged through the wire mesh so that it lies parallel to the bowl. On either side of the vertical arm, fix two shorter lengths, (B) and (C) and repeat the same f

or the horizontal line will have to be wedged through the wire mesh so that it lies parallel to the bowl. On either side of the vertical arm, fix two shorter lengths, (B) and (C) and repeat the same for the horizontal arm. As in the triangular style, a width is established with two short lines (D) and (E) inclining over the vase at the rim, in front of the main line.

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Fill in the next tier of material between the spaces of the vertical arm, grading it down narrowly and increasing it from the vortex of the L to follow the horizontal line sideways. You can arrange the points according to your own discretion, but make sure to concentrate the focus at the vortex of the right angle.

Choice of the pots: Rectangular container

Choice of the plants:

Six white gladioli – A, D
One-and-a-half dozen larkspurs – B
Two dozen sweet sultans – C
One dozen pink roses – E
Small bunch of Gypsophila – fillers
Three aspidistra leaves – curving outwards

5. The S-shape

The outline of this style must be made with curved material or with pliable branches that can be manipulated to take the form of the S. The placement of lines is in groups of three, just like in the L. Take two main curved lines (A), one facing up and the other down to form the S. Fix lines (B) and (C) on either side of (A) corresponding to each other on opposite sides. Concentrate the density of the flowers and foliage towards the rime of the vase, where the inward facing curves meet the outward

S-

curves facing down. In this way, the outline of the S will show up better.

Choice of the pots: Vase with a stem (or) a tall vase
Choice of the plants:
One dozen larkspurs – C
Five marigolds
Seven tuberoses – B
Five white sweet sultans
Three asparagus ferns
Four areca palm leaves – A

6. The crescent shape

This half-moon shaped arrangement also needs curved material to form the image of the crescent in which the two arms of the arrangement look inwards at each other. Take an inward curving line (A) and fix at one side of the pin holder. Take another curving line (B), two-thirds the length of (A). As in the previous styles, fix two different curving lengths on either side of (A), corresponding them to the lines on either side of (B). Fill in the space between the crescent by arranging the material in a manner in which the flowers are shorter and heavier towards the base of the vase and lengths increase again to face inwards as they rise to go along the curve (B).

Choice of the pots: A vase with stem

Choice of the plants:

Three Royal lilies -

B

Six fishbone ferns

Three Cycas (Sago) palm leaves - A

Twelve red carnations - C

Three red carnations - C

The above mentioned styles, pots and plants are just to create basic idea of western flower arrangements. By using these basic principles one can create his own styles with available pots and plants.

Eastern or Japanese or Ikebana styles

Ikebana is the Japanese art of flower arrangement, also known as *kado*, the "way of flowers". 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 floral arrangement as a collection of particolored or multicolored arrangement of blooms, ikebana often emphasizes other areas of the plant, such as its stems and leaves, and draws emphasis towards shape, line, form. Though ikebana is a creative expression, it has certain rules governing its form. The main rule is that all the elements used in construction must be organic, be they branches, leaves, grasses, or flowers. The artist's intention behind each arrangement is shown through a piece's color combinations, natural shapes, graceful lines, and the usually implied meaning of the

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arrangement.

Another aspect present in ikebana is its employment of minimalism. That is, an arrangement may consist of only a minimal number of blooms interspersed among stalks and leaves. The structure of a Japanese flower arrangement is based on a scalene triangle delineated by three main points, usually twigs, considered in some schools to symbolize heaven, earth, and man and in others sun, moon, love and earth. The container is also a key element of the composition, and various styles of pottery may be used in their construction.

Irrespective of the styles each flower arrangement contains the following three components.

- **Containers:** The containers or vases for flower arrangement differ in size, shape and material. it may be of porcelain, ceramic, brass, bell metals, bamboo, drift wood etc. Glass containers are not generally preferred as vases. The size of the containers varies from tall vases to flat saucers. Symmetrically or asymmetrically shaped containers are preferred depending upon the type of flower arrangement. The colour of the containers should not be bright; as such containers will detract the beauty of the blossoms. Besides the above containers, split bamboos or pieces of bamboo with two or three in internodes having holes can be also employed as natural containers especially for line arrangement.

Sometimes drift wood (pieces of any lignified woody stem) with a depression on its top portion may be also used as containers for line arrangement.

- **Mechanism:** It refers to the physical mechanism by which flowers are held in oisition in containers. Pin-holders, clay balls or a crushed wire mesh are all commonly used in containers to hold the flowers in position. Deep containers generally do not require a mechanism. However, it is a must for flat and shalloe containers. In some cases, the flowers have long and weak stalks. In such cases, the mechanism alone will not suffice to keep the flowers din position where a thin GI wire can be pushed inside the stalks to retain in position. Mechanism of flower arrangement should be such that all the stalks of the cut flowers must originate from a point. The exposed stalk of the cut flowers as far as possible must be 11/2 times the height of the containers.

- **Flowers:** The term 'flowers' in flower arrangement include real flowers, foliage, dried twigs. fruits (fresh or dry). Dry and fresh flowers may be combined or arranged separately. Colour combination adopted in a flower arrangement is highly based on individual taste and preferences.

In massing or grouping of flowers, care must be taken to have proper balance and proportion between the container and the flowers. When different flowers are combined orange coloured flowers may be combined with red flowers or blue flowers with violet coloured flowers. It is always attractive to combine all light colours or all bright colours in a vase.

Prolonging the vase life of flowers

How long the flowers kept in the containers remain fresh is referred to as vase life of flowers. This is dependent upon many factors like temperature, relative humidity, light, air velocity, composition of the holding water etc. The vase life can be extended by the following methods.

- **Prevention of pollination:** Flowers begin to fade after fertilization. Therfore main purpose is to delay this natural process. This explains why double flowers keep longer than single flowers. To prevent pollination, the easiest way is to remove the stamens from the flowers when they open. By this method, the vase life of Lily flowers could be extended by 10 days.

- **Prevention of blocking of the conducting vessels of the flower stalks:** Air pockets sometime block the conducting vessels, thereby causing the flowers to fade quickly. Blocking can be prevented by the following methods.
    - By dipping the stems of cut flowers in boiling water for 20 -30 seconds. (e.g. Rose, Iceland poppy, Dahlia, Zinnia, Chrysanthemum, etc.)
    - By burning the stems of the cut flowers for 15 seconds (e.g. poppy)
    - By dipping in dilute acids like N/500 nitric acid.
    - Splitting the stems in woody flowers like hydrangea, Rhododendron before placing them in cold water.

- Sometimes blocking is also due to bacterial growth at the cut end.

This can be prevented by any copper fungicide treatment or by dropping a coppercoin into the vessel.

Use of preservative solutions has been known for many years in lengthening the vase life of cut flowers. Preservatives normally include sugars, biocide, anti-ethylene compound and hydrated compound. Silver thio sulphate is an anti-ethylene compound in the preservative solution while quinoline compound is a biocide.

DRY FLOWER ARRANGEMENT

The art of making arrangements with dried flowers and leaves was a flourishing craft as early as the seventeenth century in England and America. But now it has passed from the hobby stage to big business in many countries. In recent years, there has developed a trend to fragrance a mixture of flowers for keeping in rooms, kitchens, toilets etc. This is known as 'Potpourri', wherein our living environment is made fragrant with natural items.

Advantages of dried arrangement over fresh flowers

- It is not dependent on season or weather if once good materials are collected.
- It lasts almost indefinitely.
- It helps the individuals to improve their skill in design by affording time to study composition and to correct mistakes.
- Dried arrangements are certainly time savers as they can be made by conveniently in advance

and then enjoyed as needed.

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Materials for dried arrangement

The materials usually employed for dried arrangement can be grouped into three categories as follows.

- Cultivated flowers and vegetable including seed, pods, vines and grains.

- Naturally available materials like flowers, seed pods, fern leaves, certain weeds and grasses.
- Pods, cones, capsules, fruits, branches, leaves, berries and flowers of broadleaved evergreen trees and shrubs.

Dried pods

Dried flowers

Preservation of plant materials

There are a few methods of preserving flowers and foliage.

- **Hanging upside-down:** Many flowers dry best by this method. It is the easiest method and is preferable to those materials which keep their shape and do not fall

apart while drying. Materials intended for drying are tied and allowed to hang upside down from string without touching each other.

Hanging upside-down

- **Burying in sand or borax:** Fine and dry sand are poured to a depth of 10 cm into a box or pan. Th which should be dry are stripped of all foliage and may be kept upside down on the sand and then cov a layer of sand over them. After two weeks of time, the sand may be poured off carefully and the flo be taken out after gently wiping them free of sand with a soft brush. They are then ready for arrangeme may be used in almost the same way as sand and is a good medium for preserving materials when limited. Alum and silica gel are also used in the place of borax. The form of flowers are also well pre borax method. Candytuft, daisies, marigold, narcissus, chrysanthemum, snapdragons, sunflowers, tit roses and coleus leaves dry well in sand or borax.

- **Glycerin method:** This method is used for foliage only. The clean foliage materials are kept inside a jar containing a solution made up of 2/3 of water and 1/3 glycerin. The material has to be kept there till full absorption has taken place. It takes atleast two weeks for most materials to do so. Materials so preserved keep well for 5 to 10 years

Glycerin method

- **Pressing:** Leaves and flowers can also be preserved by pressing between several thickness of newspapers and some heavy object is kept over them. It takes about three weeks for complete drying.

Pressing between papers

Design for dried arrangement

The same basic principles of design apply both to dried as well as fresh arrangement. Here beauty is lacking as against in some fresh flowers, design is given much important in dried arrangement. Before deciding on a design, one has to consider the composition to be a line or mass arrangement. In line arrangement, the main emphasis is a definite outline with restrained use of interesting forms of leaves, stems, buds or seed pods. On the other hand, in mass effect in colour and form.

The pattern most frequently used are the crescent, S-curve, Triangle, fan, Round, Oval, Pyramid, L-Vertical and horizontal. The other considerations viz, balance, harmony, scale, repetition, focal point, rhythum and unity are also important in dried arrangement. The focal point or center of interest, where all important lines meet is the spot where the eyes come to rest. This is a natural place for the largest flowers, the key note of the whole composition. The focal point should be in proper scale to the rest of the composition. Hydrangeas, Celosia, Magnolia blossoms make good focal points.

Colour in dried arrangement

Flowers and foliage properly dried retain much of their colour and variety in colour may be brought out by choosing correct materials. The commonly used colour blends are monochromatic, analogous, complementary and triad. When on hue with its light and dark values or tones are brought in an arrangement, it is 'monochromatic'. When neighbouring and closely related colours, those adjacent on the colour wheel say blue and green, yellow and orange are combined it is called 'analogous'. On the other hand, contrasted opposite on colour wheel, as green and red are combined, it is known as 'complementary'. Three colours equidistant on the colour wheel, as yellow, blue and red are combined it is a 'triad'. Containers made up of dull metals like copper, brass or earthern pots and wooden vessels, old lamps and three caddies also make excellent containers.

Triad

Bases: Dried arrangements are made 'distinctive' by keeping them over a proper base. A commercial base of round, oval or rectangular blocks of any good wood is preferred. Bases give formality and dignity. A well-proportioned base is essential for any dried arrangement. The surfaces of the base blocks may be polished to make them shining.

The kinds of mechanism to hold the materials in fresh arrangements may also be used for dried arrangement. The dust noticed on the arrangements may be cleaned gently with a small water colour brush or wiped with a slightly moistened cloth or brush.

NURSERY MANAGEMENT AND MAINTANANCE

Nursery is a place where seedlings, cuttings and grafts are raised with care before transplanting.

Advantage of raising seedlings in nursery

1. It is very convenient to look after the tender seedlings
2. It is easy to protect the seedlings from pests and diseases
3. Economy of land usage (duration in the main field is reduced)
4. Valuable and very small seeds can be raised effectively without any wastage

5. Uniform crop stand in the main field can be maintained by selecting healthy, uniform and vigorous seedlings in the nursery itself.

Preparation of nursery
Selection of site

1. The nursery area should be nearer to the water source
2. Generally, the location should be partially shaded i.e. under the trees. If not, artificial shade is to be provided
3. It should be well protected from animals
4. Proper drainage facilities should be provided.

Selection of soil
A medium textured, loam (or) sand loam soil is preferred. Soil should be rich in organic matter. Soil depth should be preferably by 15-25 cm.

Types of nursery bed
a) Flat bed b) Raised nursery bed

Preparation of raised nursery bed
Selected soil should be worked well to break the clods. Weeds, stones and stubbles should be removed. Height of the raised bed should be 10-15 cm with a width of 1m and length may be according to the requirement and conveniences. Two parts of fine red earth, one part of sand and one part of FYM can be incorporated to each bed to improve aeration and fertility of the soil. Before preparing the bed, the soil should be drenched with 4 % formaldehyde or 0.3 % copper oxy chloride to kill the pathogenic spores in the soil.

Advantage of raised nursery bed

1. Water movement will be uniform and drainage of excess water is possible (In the case of flat bed water moves from one end to the other and there is possibility of washing away of seeds).
2. Germination percentage of seeds is normally high. Operations like weeding and plant protection measures are easy.

Media for propagating nursery plants
Several materials and combination of different materials are available are media for germinating seeds and rooting cuttings. A good propagating medium should possess the following characters.

1. It must be firm and dense to hold the cuttings or seeds in place during rooting or germination.
2. It must possess sufficient moisture retaining capacity
3. It must be sufficiently porous to permit excess water to drain away and to admit proper aeration
4. It must be free from weed seeds, nematodes and pathogens.

1. Soil mixture
This is the most commonly employed medium for pot plants. It usually consists of red earth, well decomposed

cattle manure, leaf mold, river sand and also charcoal in some cases. Soil mixture commonly used for propagation is

Red earth - 2 parts
FYM - 1 part
Sand - 1 part

2. Sand

It is the most satisfactory medium for rooting of cuttings.

3. Peat

It consists of the remains of aquatic marsh, bog or swamp vegetation which has been preserved under water in a partially decomposed state. When such peat is derived from sphagnum, hypnum or other mosses, it is known as peat moss. it is used in mixture after breaking them and moistened.

4. Sphagnum moss

Commercial sphagnum moss is the dehydrated young residue or living portion of acid-bog plants in the genus Sphagnum such as *S. papilliosum*, *S. capillacem* and *S. palustre*. it is generally collected from the tree trunks of the forest species in south Indian hills above 1500m above M.S.L. during rainy period. It is relatively sterile, light in weith and has a very high water-holding capacity. It is the commonly used medium in air layering.

5. Vermiculite

It is very light in weight and able to absorb large quantities of water. This can be used as a rooting medium for air layering and also in pots for raising certain plants.

Container for propagation and growing young plants

1. Earthen pots

They are made of burnt porous clay in various sizes to provide requisite amount of soil and root space to different kinds and sizes of plants. They have straight sides and are made wider at the top than at the bottom to hold the greatest bulk of compost where the feeding roots are and also to facilitate easy removal of soil, intact with roots (ball of earth) at the time of planting or repotting. In our county, tube pots of varying sizes are used as follows.

Tube pot sizes	Height (cm)	Diameter (cm)	Cost per pot (Rs.)
Tube pot	20	13	15.00
¼ size pot	18	22	15.00
½ size pot	20	27	30.00
¾ size pot	25	32	50.00
Full size pot	35	35	65.00
Tub size pots	35	50	90.00

2. Seed pan and seed boxes

Seeds pans are shallow earthen pots about 10 cm high and 35 cm in diameter at the top. They have one large

hole for drainage in the centre or 3 holes at equidistant from each other. Seed boxes are made of wood, 40 cm wide and 60 cm long and 10 cm deep, with 6-8 properly spaced holes drilled in the bottom.

Against each of the holes is placed a crock with its concave side down. Some large pieces of crock are put over it and also by the side of this crock, some coarse sand 2 or 3 handfuls are sprinkled on the crock pieces forming a thin layer to prevent fine soil from clogging the drainage. Over this, required soil mixture is added. Very delicate kinds of seeds like Cineraria, Begonia, etc. are best sown in these containers.

3. Polythene bags

Small polythene bags with holes punched in the bottom for drainage and filled with a porous rooting medium are used for propagation of cuttings like Jasmines, Duranta, Crotons etc. in the mist chamber. Sometimes, young seedlings which are raised in the nursery are subsequently transplanted in these polythene bags and kept there till they attain required growth for transplanting them to the main field (Papaya, Curry leaf etc.).

4. 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

Tools and implements for nursery work

Rose can/water can	:	This is used for watering the nursery. Fine spray of water should be used for watering nursery of small sized seeds
Digging fork	:	This has prongs of 20 cm long fitted to a wooden handle. This is used for uprooting plants, rooted cuttings, harvesting of tubers etc., without damaging the root system or tubers.
Shovel	:	This is a curved steel plate attached to a wooden handle and used for transferring soil, manure etc.
Garden rake	:	This is used for leveling lands and collecting weeds. The rake consists of a number of nail like projections from a crow bar provided with long handle
Hand trowel	:	This is used as a small tool for making holes for planting seedlings and small plants. This is also useful for removing surface weeds in nursery beds
Secateur	:	This is used for cutting small shoots to regulate shoot growth in fruit trees
Budding or Grafting knife	:	This knife is used for budding and grafting. This has two blades in which one is with ivory edge used for lifting the bark in budding operation.

Potting

Purposes for which plants are potted are

1. Preparing plants for sale such as rooted cuttings of grapes
2. Growing plants for decoration like crotons
3. Growing plants for experimental studies like pot -culture studies
4. For using plants as rootstocks in certain grafting methods as in inarching of mango.

Pot mixture or potting compost

It is essential for potting of plants. The pot mixture is prepared by suing various ingredients. The proportion of pot mixtures will vary with different kinds of plants.

1. An ideal pot mixture should have an open structure, which allows good drainage and holds sufficient moisture for plant growth and permits excess waster to drain away.
2. Should supply adequate nutrient to the plants during all stages of growth
3. Should be free from all harmful organisms and toxic minerals and
4. Should be light in weight

Potting procedure

1. Wet the seedbed before lifting plants. Life with a ball of earth with as much of the root system intact, as possible. Do not pullout seedlings in the hot sun. Do not allow roots or the soil around the roots to dry.
2. Fill up pots by putting some crocks first, then a layer of sand (5-8 cm) and finally pot mixture (8-10 cm).
3. Place the plant with the ball of earth in the centre upon the layer of pot mixture (Place on one side of pots in the case of root stock plants used in inarching)
4. Put pot mixture around the ball of earth, press as you fill up and level off, leaving one inch head space at top. Do not press over the ball of earth. It will break and damage the roots.
5. Set the stem of plant at the same height as it was in the seed bed
6. Immerse pot with plant in a tub of water gently and keep inside water till air bubbles cease to come out. Remove and place the pot under shade of trees.

Repotting

Repotting is done for changing the soil medium for pot bound plants.

Pot bound condition

When the potted plants are grown for more than one season or one year in pot, the root very soon become a tangled mass and exhaust all the nutrient in the limited soil, besides being circumscribed in the limited place. This stage is known as pot bound condition.

Repotting procedure

1. It is better to west the potted plant 24 hours earlier to facilitate repotting (removal of plant from pot)
2. The technique to remove the plant with a ball')f each intact is to keep the right hand palm over the soil, allowing the stem of the plant in between the first fingers and turn the pot upside down holding the pot at the bottom with the left hand and gently knocking the rim of the pot on the edge of table or any other hard

surface or even on the bottom edge of another inverted pot. The ball of earth comes out of the pot. If for any reason, it fails to come out, break the pot knocking the sides with a stone or fork and free the soil from it.

3. Examine the roots, cut neatly with a secateur, the decayed, dead and dried or twisted roots. Reduce the size of the ball of earth around the roots.
4. Place the plant in the new pot at the same height at which it was in the old pot. Fill up pot with fresh pot mixture and immerse in water.

General

1. The initial reaction after potting and repotting is wilting. The transpiration loss has to be checked to help plants revive. Hence keep freshly potted plants under shade and "pot water daily".
2. After about ten days under shade, the plants should be gradually exposed to sun by keeping them for some hours under sun and then putting them under shade. The period of exposure can be increased every week until finally the plants can be kept in the open. This process is called "hardening".