Unit 3

Growing of Annuals

The landscape design, lawns, flowering annuals, foliage plants, shrubs, trees, and other plants and features are of fundamental importance in a garden. No garden seems to be complete until it has beds of ornamental annual flowering plants. Introduction of annual flowering plants adds immensely to the decorative value of the garden whether it is large, small, public, or a private garden.

Annuals are defined as those monocarpic plants that complete their life cycle within a season or year from seed to seed. They complete the process of their life cycle such as germination, growth, flowering, seed formation, and natural death in a season or a year. They need fresh planting or sowing in every season or year. They are generally herbaceous and hardy to semi-hardy, for example antirrhinum, China aster, gomphrena, marigold, petunia, verbena, zinnia, etc.

Annuals provide a beautiful look of various colours in the garden. These plants mostly have a long flowering duration, sizeable height coupled with a wide colour range, ease of cultivation, attractive shape, and general adaptability. In addition, many annuals such

as acroclinium, ammobium, antirrhinum, calendula, carnation, China aster, helichrysum, larkspur, etc., produce excellent cut flowers, some such as acroclinium, helichrysum, nigella, statice, etc. are used as dry flowers, while annual chrysanthemum, gaillardia, marigold, etc., are used as loose flowers.

Selection of flowering annuals and their varieties for commercial cultivation should be proper as per the soils, climatic conditions, available resources, consumer choice, market demand, and availability. Raising of healthy seedlings of annuals in pro-tray, polythene bags, and small seed packets has good commercial scope.

The important annuals are *Amberboa moschata* (*Centaurea moschata*; Sweet Sultan), *Antirrhinum majus* (dog flower/snapdragon), *Arctotis breviscapa* (African daisy/blue-eyed daisy/Transvaal daisy), *Bassia scoparia* (*Kochia scoparia*; burning bush/summer cypress), *Bracteantha bracteatum* (*Helichrysum bracteatum*; everlasting flower/immortelle/straw flower), *Calendula officinalis* (*Calendula*/scotch marigold), *Callistephus chinensis* (China aster), *Celosia argentea* (Cock's comb/wool flower), *Centaurea cyanus* (Cornflower/blue bottle), *Chrysanthemum carinatum* (Annual chrysanthemum), *C. coronarium* (Crown daisy), *Coreopsis tinctoria* (Tickseed), *Dianthus barbatus* (Sweet William), *Dimorphotheca pluvialis* (*D. annua*; sun marigold/weather prophet), *Eschscholzia caespitosa* (Tufted California poppy), *E. californica* (California poppy), *Gaillardia pulchella* (Blanket flower/fire wheels/Indian blanket), *Gomphrena globosa* (Batchelor's buttons/globe amaranth), *Gypsophila elegans* (Baby's breath), *Iberis amara* (Candytuft), *Impatiens balsamina* (Balsam), *Lathyrus odoratus* (Sweet pea), *Limonium sinuatum* (Statice), *Linum grandiflorum* (Flowering flax), *Salvia splendens* (Scarlet sage), *Phlox drummondii* (Phlox), *Lobularia maritima* (*Alyssum maritimum;* Sweet alyssum), *Lupinus subcarnosus* (Texas bluebonnet), *Petunia hybrida* (Petunia), *Matthiola incana* (Brompton stock/gillyflower), *Papaver commutatum* (Poppy), *P. rhoeas* (Corn poppy/field poppy/flanders poppy), *P. somniferum* (Opium poppy), *Tagetes erecta* (African marigold), *T.*

patula (French marigold), *Tropaeolum majus* (Indian cress/nasturtium), *Verbena hybrida* (Verbain), *Viola wittrockiana* (Pansy), *Dianthus chinensis* (Indian pink), *Eschscholtzia californica* (Californian poppy) and *Zinnia elegans* (Zinnia).

Importance of Annuals

- They are used as instant landscaping for decoration on various occasions.
- They can be grown individually or with plants in borders or in beds.
- They can be trained on walls and trellises.
- They can be planted in the form of edges, borders, or ground covers.
- They can be grown for cut flowers, loose flowers, and dried flowers.
- They can be planted in hanging baskets and pots.
- They are also suitable for planting in rock gardens.

Classification of Annuals

Based on Season

Winter season annuals

These are grown in the winter season, and can withstand low temperature and low humidity. The seeds of these annuals are sown in September and transplanted in October, for example *Amberboa moschata* (Sweet sultan), *Antirrhinum majus* (Snapdragon), *Consolida ajacis* (Larkspur), *Iberis amara* (Candytuft), *Petunia hybrida*, *Phlox drummondii*, *Tropaeolum majus* (Nasturtium), *Verbena hybrida*, *Viola wittrockiana* (Pansy), etc.

Summer season annuals

These annual plants are grown in the summer season. These can tolerate high temperature and dry weather to produce flowers. The seeds are sown in the end of February or beginning of March, and seedlings are transplanted after 25–30 days. These are *Bassia scoparia* (Kochia), *Cosmos bipinnatus* (Cosmos), *Gaillardia pulchella* (Blanket flower), *Gomphrena globosa* (Globe

amaranth), *Helianthus annuus* (Sunflower), *Portulaca grandiflora* (Moss rose/purslane), *Tithonia rotundifolia* (Mexican sunflower), *Zinnia elegans*, etc.

Rainy season annuals

These are grown in rainy season, and can produce flowers under high humidity and rainfall as compared to other annuals. Seeds are sown in June and seedlings are transplanted in July. Such annuals are *Amaranthus caudatus* (Love-lies-bleeding/rassel flower/Velvet flower), *Gaillardia pulchella* (Blanket flower), *Impatiens balsamina* (Balsam/busy lizzie/patience plant), *Celosia argentea* (Cock's comb/wool flower), etc.

Based on purpose and/or place

Purpose	Annuals
Rockery	Ageratum, Alyssum, Brachycome, Gamolepis, Linum, Nemesia, Phlox, Portulaca, Saponaria, etc.
Hanging basket	Impatiens, Petunia, Phlox, etc.
Foliage plants	Amaranthus, Kochia, etc.
Edge plants	Dwarf Ageratum, Alyssum, Brachycome, Dianthus, Nigella, Pansy, Portulaca, etc.
Fragrant flowers	Carnation, Stock, Sweet pea, Viola, etc.
Bedding plants	Balsam, Candytuft, Carnation, Ice Plant, Marigold, Pansy, Petunia, Phlox, Verbena, etc.
Dry flowers	Acroclinum, Annual Chrysanthemum, Helichrysum, Limonium, Nigella, etc.
Pot plants	Antirrhinum, Carnation, China aster, Linum, Petunia, etc.
For shady situation	Cineraria, Salvia, Torenia, etc.
For screening	Hollyhock, Quamoclit, Sweet pea, etc.
Cut flowers	Antirrhinum, Calendula, Carnation, Celosia, China aster, Cornflower, Gypsophila, Larkspur, Stock, etc.
Loose flowers	Annual chrysanthemum, Gaillardia, Gomphrena, Marigold, Zinnia, etc.

Fig. 3.1: Pot marigold (Calendula officinalis)

Fig. 3.2: Carnation (Dianthus Caryophyllus)

Fig. 3.3: Indian pink (Dianthus chinensis)

Fig. 3.4: Californian poppy (Eschscholtzia californica)

Fig. 3.5: Ice plant (Mesembryanthemum crystallinum)

Fig. 3.6: Petunia (Petunia hybrida)

Fig. 3.7: Phlox (Phlox drummondii)

Fig. 3.8: Sweet pea (Lathyrus odoratus)

Fig. 3.9: Verbena (Verbena officinalis)

Fig. 3.10: Hollyhock (Rosea)

Fig. 3.11: Antirrhinum (Antirrhinum majus)

Fig. 3.12: Gomphrena (Gomphrena globosa)

Fig. 3.13: Zinnia (Zinnia elegans)

Fig. 3.14: Larkspur (Delphinium ajacis L.)

Herbaceous Border

The planting of annuals in the border of a bed in a definite pattern is known as herbaceous border. Its length is much more than the width and maybe made against a wall, fence, shrubbery, hedge, or a path. It maybe single or double-faced. Single faced border is viewed from the front side whereas double-faced is created in the centre of the garden so that it can be viewed from both the sides.

The ideal site for making a herbaceous border should be sunny and facing South so that the annuals get sunlight for the maximum duration in a day. If that direction is not available, it should be made facing the East direction. Here, tall annuals are planted in the back, the intermediate types in the centre, and the smallest ones in the front in single-faced border; while in the double-faced border, the tallest ones are kept in the centre, then the intermediate types at both the sides, and in front of both the sides the smallest ones are kept. The width of single-faced border is about 2.5 metres while that of the double-faced ones is roughly 4.5 metres.

Cultivation of Common Annuals

Preparation of seedbed

- Seeds of annuals are sown on a raised seedbed.
- The soil should be sandy loam, rich in organic matter, and well-drained.
- Soil pH should range between 6.0 and 7.5.

- The soil of the seedbed should be deeply cultivated to bring it to a fine tilth and all the stumps, weeds, stones, brick, tile pieces, and wood pieces, etc., should be removed from the field, and land should be levelled.
- Soil of the bed should be sterilised before sowing, to prevent diseases such as damping off.
- The sterilisation may be done after mixing 5–10 kg of FYM/m^2, with 2% formalin through soil drenching, to kill the pathogenic spores and nematodes in the soil, covered with polythene at least for 48 hours, then the soil is exposed for about a week, and then the sowing is carried out after levelling the bed.
- Nursery beds of any convenient length, but of 1.5 metre width and 15–20 cm raised are prepared.
- In between two beds, a space of 30–40 cm is left for performing various operations.

Seed sowing in beds

Seeds of the annuals are sown in nursery beds or in plug trays. However, annuals, which have bold seeds like sweet pea, nasturtium, lupin, etc., or seeds, which are difficult to transplant like linaria and eschscholzia, are sown directly. Seeds should be sown 2–3 cm apart in rows that are spaced 5–10 cm apart, which facilitates easy weeding, drenching, and removal of disease-infected seedlings.

- The surface of the bed is levelled using a fork or wooden plank.
- Straight lines are made across the bed at a spacing of 5 cm and 0.5–1.0 cm deep. Time of the seed emergence depends on the depth to which the seeds have been sown. If it is too shallow, the seeds come up and dry out early but if it is too deep, the emergence of seedling takes more time. Seeds are sown approximately at a depth of 2–3 times the diameter of the seed.
- Small seeds are mixed with bulk material like ash or sand for an even distribution.
- The seeds are then covered with a mixture of 0.5 cm of fine soil, sand, well rotten and sieved FYM in the ratio of 2:1:1.

- Spraying the seed covering mixture with 0.25% Captan protects the seedlings from damping off disease.
- Mulching seedbeds by polyethylene sheet or paddy straw helps in the quick and uniform germination of seeds.
- When seedlings initiate emerging, the mulch should immediately be removed carefully in the evening hours.
- The beds require light irrigation from sowing up to transplanting by the means of a rose can daily by the evening.

Seed sowing in plug trays

These days, high value annual seeds are preferred to be sown in plug trays, commonly called as pro-trays instead of nursery beds. Pro-trays have shallow plugs. In these trays, used germination media remain warm and provide better aeration especially during germination. Seeds can be sown directly into these plugs trays. Weeding and thinning operations are also easily carried out in these pro-trays. Seedlings are removed easily without any damage to its roots. The steps involved are as follows:

- annual seeds are now commonly sown in a pro-tray with cocopeat, vermiculite or sand;
- the pro-trays are filled with medium and one seed is sown per cell. Small depressions (0.5 cm) are made at the centre of the plugs with finger tips for sowing of seed;
- the seed is then covered with medium;
- ten pro-trays are arranged one by one and covered by a polythene sheet, and kept as such for four to five days or till germination starts;
- after five or six days, the polythene cover is taken out and fertigation is sprinkled by a rose can.

Transplanting of seedlings

Transplanting is a process in which seedlings or rooted cuttings are planted from one open place, that is,

nursery beds, pro-trays, pots, etc., to their permanent site for further growth and flowering.

- Seedlings should have attained proper age and stage of transplanting.
- They should be sturdy.
- They should have a well-developed root system.
- They must be vigorous and healthy.

Method of transplanting

- Transplanting should be done when the seedlings are about four weeks old or have formed about three to four true leaves.
- The nursery bed is watered 24–48 hours before transplanting and then the water should be withheld to harden the seedlings.
- Transplanting should be performed in the evening so that the plants may establish themselves in the night.
- From the nursery, the seedlings should be lifted by digging them up gently and not being pulled up.
- Immediately after transplanting, the transplants are watered so that they do not have transplanting shock and recover fully.
- Tall grown seedlings should not be transplanted as they are weak and may start flowering very early.
- Transplanting is done on a land which should be well prepared by ploughing and incorporating 5 kg well rotten FYM along with 10g each of N, P_2O_5, and K_2O per square metre.
- Frequent sprinkling of water on the newly transplanted seedling may cause wilting.
- The soil near the root zone should be pressed properly after transplanting.
- Depth of transplanting should accommodate the complete root system.

Annuals are planted as follows

Height	Spacing (cm)
Tall annuals	60×60
Medium annuals	45×45
Dwarf annuals	30×30

Application of manures and fertilisers

- Supply of nutrients along with organic manure greatly improves the physical condition of the soil.
- FYM and compost are easily available organic manures.
- In the field, wellrotten manure must be applied well before planting of seedlings.
- In new transplanted seedlings, chemical fertilisers should be used in small amounts.
- A mixture of both chemical fertilisers and organic manure in low concentration must be used in the form of solution during the vegetative phase of the plants to get good vegetative growth along with increased quality and quantity of flowers.
- Before laying out the plan, land should be well prepared by ploughing and mixing 5 kg wellrotten FYM and 10 g each of N, P_2O_5, and K_2O per sq. m. through 40 g calcium ammonium nitrate, 62 g single superphosphate and 16 g of muriate of potash.
- Vermicompost is an emerging manure, which is effective in much smaller quantity than that of FYM and compost.

Irrigation method

Prevailing weather conditions, water infiltration rate in the soil, age and vigour of the plant are the main factors which decide the amount of water required by the plants at any given time. At the time of germination, frequent light watering is required to keep the seedbeds moist, to facilitate germination. As plants become large, the total quantity of water required is increased and the frequency of application is reduced. During summer, watering is done weekly but during the winter season at an internal of 10–12 days interval.

Irrigation is required to

- increase the absorption of nutrients from the soil,
- replace loss of water caused due to transpiration,
- maintain turgor pressure in the plants,
- increase the photosynthesis rate.

Method of watering in nurseries

- Watering is done either by hand or through the micro-irrigation system. In small area and/or nurseries, hand watering by rose cans, hose pipes fitted with spray-nozzles, or knapsack sprayers are commonly used.
- In watering of seedbeds, a fine droplet size is very essential, otherwise, the seeds may be washed out or the seed covering material maybe washed away.

General rules for irrigation

- Irrigation should be done before the water stress symptoms occur.
- Irrigation should be done under cooler conditions.
- Water should be applied on the soil surface and not on the plants. This helps to reduce the risk of many diseases.
- Water must be given according to the seasonal requirement of the plant.

Cultural operations

Weeding

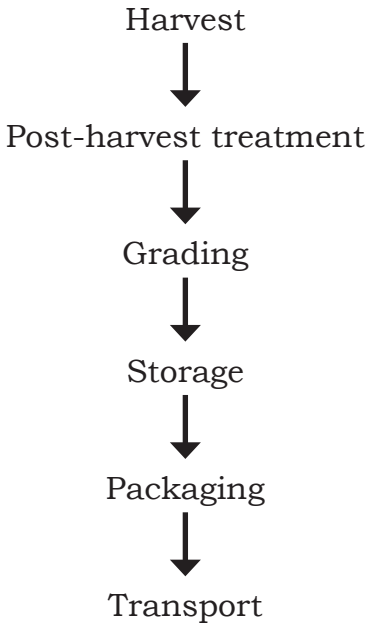
Regular weeding and hoeing are essential for developing healthy plants. Weeding is carried out physically with the help of a *khurpi* or hand hoe.

Irrigating annuals

- Little amount of water is needed everyday for up to 7–10 days, starting just after transplantation.
- When the seedlings start new growth, the beds should be watered once or twice a week, profusely.
- Irrigation in beds during summer should be carried out at 5–7 days' intervals.
- In the winter, irrigation is done at 10–12 days intervals.
- In the rainy season, it solely depends on the weather conditions.
- Potted plants require daily but little watering during the summer, whereas on alternate days in winters.
- Over-irrigation should never be done.

Harvesting and post-harvest operations

Cut flower annuals require proper post-harvest management for prolonging their vase-life. The stages after cultivation of annuals involve:



Harvesting

- Though annuals are grown in gardens or pots for instant display, but these are also grown for plucking flowers or for cutting for sale.
- Harvesting is normally done by hand using shears or a sharp knife.
- In general, the flowers are cut either late in the afternoon or very early in the morning. Flowers should always be harvested at the right maturity stage.
- Prematurely harvested flowers will never come to a full bloom.
- Most of the flowers are harvested when they are fully open, for sale in the local markets.

Post-harvest handling

- Immediately after harvesting, flowers should be kept in a bucket having demineralised water up to one-fourth the volume of the bucket as it helps in their recovery from the shock inflicted through the cutting from the parent plant.

- Flowers are placed as quickly as possible in the post-harvest treatment solutions like aluminium sulphate and a special wetting agent.
- For most flowers, the time between cutting and placing on the solution should be no longer than half an hour.
- As most flowers are susceptible to Botrytis infection, so great care has to be taken to prevent its infection.
- By using clean buckets, clean water, and the right post-harvest treatment, the chance of infection can be minimised.

Storage

- If flowers are not sold the day they are harvested, they have to be stored in cold storage for a specific duration until their packing and transportation.
- The flowers have to be cooled down to their optimum storage temperature.

Storage temperature recommendations and approximate storage life of some annuals are given as under:

Annuals	Storage temperature (°C)	Storage life (approx.)	Vase life
China Aster	0 to 4	1 to 3 weeks	5 to 10 days
Clarkia	4	3 days	5 to 10 days
Cornflower	4	3 days	6 to 10 days
Cosmos	4	3 to 4 days	4 to 6 days
Dahlia (bedding type)	4	3 to 5 days	7 to 14 days
Delphinium	4	1 to 2 days	4 to 12 days
Gypsophila	4	1 to 3 weeks	5 to 10 days
Phlox	4	1 to 3 days	2 to 7 days
Snapdragon	4	1 to 2 weeks	5 to 7 days
Statice	2 to 4	3 to 4 weeks	4 to 8 days
Stock	4	3 to 5 days	5 to 8 days
Sweet pea	0.5 to 0	2 weeks	3 to 7 days
Sweet William	7	3 to 4 days	5 to 9 days

Packaging

- Proper packaging is essential to check the spoilage of flowers.

- The packing material should be economical but sturdy, and able to protect the flowers during transportation. The materials that are generally used in India for construction of a package are bamboo, wood, gunny bags, plastic films, corrugated fibre boards, and newspaper for precision harvest.

Insect-pests and disease management

Sucking pests

Thrips, aphids, and hoppers infest the annuals in nursery and field. These can be effectively controlled by spraying insecticides like dimethoate 2 ml/litre.

Caterpillars

These infest the annuals at flowering and the seed formation stage. These are effectively controlled by spraying spinosad at 0.5 ml/litre.

Damping off

This malady occurs usually at the nursery stage when the seed is sown too densely. The rot occurs at the collar stage of the seedlings. It can be controlled by spraying copper oxychloride at 2–3 g/litre.

Safety precautions

1. Wearing of an apron, gloves, face mask, boots, etc., while handling the seeds, insecticides, fungicides, and weedicides.
2. Seeds, pesticides, and equipment should be kept away from the reach of children.
3. In case of any accidental hazard, a doctor should be consulted immediately.

Practical Exercise

Activity 1

Raising of annuals' seedlings

Material required

Seeds of annuals, watering can, measuring tape, *khurpi*, sand, notebook, small size demarcation board, etc.

Procedure

- Prepare raised nursery bed in a protected place, keeping the upper 5 cm surface fine with adding of well decomposed FYM or vermicompost.

- Select the annuals as per the purpose for which they are being grown.
- Calculate the quantity of seeds as per the required plant population.
- Treat the seeds with carbendazim at 2 g/kg followed by chlorpyriphos at 5 ml/kg of seed before sowing.
- Sow the seeds in prepared raised beds and cover the seeds with fine soil, sand, or leaf mould. When the seeds are sown in a seed pan, a pot mixture consisting of two parts of soil, two parts of well rotted leaf mould, and one part of sand should be used.
- Fine seeds may be mixed with three to four parts of sand before sowing.
- Watering the nursery maybe done with a rose can. After complete seed germination, crowded seedlings are thinned out.
- Recommended fungicide or insecticide is sprayed on seven days old seedlings. Nursery beds should be kept moist by regular sprinkling of water.
- One month after planting, when the seedlings have produced six to eight leaves, they can be lifted safely with the help of a *khurpi* and kept in moist jute bag or polyethylene bags at a shaded place, and then transplanted into the main bed.

Check Your Progress

A. Fill in the Blanks

1. Plants that complete their life cycle within a season or in a year are _____.
2. Low temperature can be withstood by _____ annuals.
3. Winter annuals can be sown in _____.
4. High temperature and dry weather can be tolerated by the_____ annuals.
5. High humidity is required for the flowering of _____ annuals.
6. Rainy season annuals can be sown in _____.
7. The planting of annuals at the border of a bed in a definite pattern is known as _____.
8. Artificial application of water to the crop is known as _____.
9. A serious disease of nursery is _____.
10. Plug trays are commonly known as _____.

B. Multiple Choice Questions

1. The width of single-faced border is kept at about _____.
   (a) 2.5 m
   (b) 4.5 m
   (c) 5.5 m
   (d) 6.5 m

2. The width of double-faced border is kept at about _____.
   (a) 2.5 m
   (b) 4.5 m
   (c) 5.5 m
   (d) 6.5 m
3. Which of the following is not a winter season annual?
   (a) Candytuft
   (b) Pansy
   (c) Zinnia
   (d) Sweet sultan
4. Tall annuals are generally planted at a spacing of _____.
   (a) 20 × 20 cm
   (b) 30 × 30 cm
   (c) 40 × 40 cm
   (d) 60 × 60 cm
5. Storage temperature of dahlia flower is about?
   (a) $0^{\circ}C$
   (b) $2^{\circ}C$
   (c) $4^{\circ}C$
   (d) $46^{\circ}C$
6. Which of the following is a rainy season foliage annual?
   (a) Gaillardia
   (b) Petunia
   (c) Larkspur
   (d) Kochia

C. Subjective Questions

1. Write about annuals and their importance.

   _____
   _____
   _____

2. Give the important characteristics of annuals.

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   _____
   _____

3. Describe herbaceous border.

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   _____
   _____

4. How is a seed bed prepared for raising annuals?

   _____
   _____
   _____

NOTES

5. How are annuals sown?

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6. Write the method of transplanting the seedlings of annuals.

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7. What are the general rules for irrigating the annuals?

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8. Discuss the classification of annuals.

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_____

9. Write about the harvesting and post-harvest handling of annuals.

_____

_____

_____

10. Give any two examples of annuals suitable for planting on or as:
    (a) hanging basket
    (b) edge plants
    (c) pot plants
    (d) cut flowers

D. Match the Columns

A	B
1. Fragrant flowers	(a) Cineraria, Salvia
2. Bedding plants	(b) Antirrhinum, Carnation
3. Dry flowers	(c) Acroclinum, Helichrysum
4. Pot plants	(d) Balsam, Ice Plant
5. For shady situation	(e) Carnation, Stock