UNIT 3 WINTER BEDDING FLOWERS-III

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3.0 OBJECTIVES

After going through this unit, you will be in a position to know:

- background information about some new bedding plants,
- specific uses of these bedding plants,
- variability related to flower type and colour in crop,
- important varieties in different crops,
- nursery raising - crop specific requirements,
- essential cultivation practices including soil and climate, planting, manuring and fertilization, growth and flowering requirements, aftercare and irrigation,
- harvesting and post-harvest management including extraction, curing and storage of seeds.

3.1 INTRODUCTION

Background information about these bedding plants will enrich your knowledge about the status of the crop along with a brief description and their specific uses. All these flowering plants are used in garden for bedding plantation in winter.

3.2 WINTER BEDDING FLOWER CROPS

Let us know about all these bedding flowers crops one by one :

3.2.1 Dimorphotheca (*Dimorphotheca Sinuata Syn. D. Aurantiaca, D. Calendulacea*)

Dimorphotheca, a member of the family Asteraceae, is known by different names like; Cape Marigold, Star of the Veldt, Namaqualand Daisy, African Daisy, and Cape Daisy. It is native to South Africa. Dimorphotheca (Di = two, morphos = form, theca = box or seed vessel) means the plant producing two different types of fruits or achenes. It is surprising that disc florets produce common flattened fruit, whereas the ray florets produce rod - like undulated fruits or seeds quite

different from the former but producing identical plants. The plants are about 30-60 cm tall, branching and bearing daisy like large flowers of various shades of colour such as white, bluish-white, yellow, salmon, rose and reddish - purple, etc. The flowers are up to 80 mm across and are borne singularly at the tip of each branch. The leaves are light green when mature with shallowly lobed margins. They are slender, spoon-shaped, reaching up to 80 mm long. The stems are reddish in colour and are often covered by the masses of leaves around them. The plants are free - flowering and flowers remain open during day - time only. Even on cloudy days, flowers remain closed. It can grown in beds border and pot etc.

Dimorphotheca

3.2.2 Poppy (*Papaver rhoeas*)

Poppy, also called Garden poppy, belongs to the family Papaveraceae. **Shirley poppy (*Papaver rhoeas*)** is 50 to 60 cm tall with large cup shaped, single or double flowers with crinkled silken petals borne on long slender stems. The flower colours are white, pink, rose, slaty blue, apricot, terracotta, salmon, scarlet, pale mauve, blue or dark maroon with a white base and in many the edges have a contrasting colour (picotee-edged). Some of its varieties are double flowered. The other commonly grown poppies are:

i) **Tulip Poppy (*P. glaucum*) :** An annual from Asia Minor, with a spreading habit having blue-green leaves and bright red flowers.

ii) **Opium Poppy (*P. somniferum*) :** It is from Greece and the Orient, 60-90 cm tall with blue-green leaves and very showy large double white, salmon - pink, scarlet and white, carnation or paeony - like flowers.

iii) **Iceland Poppy (*P. nudicaule*) :** It is 30-45 cm tall with bright green foliage and brilliantly - coloured flowers borne on wiry stems, and

iv) **Oriental Poppy (*P. orientale*) :** It is 60-90 cm high, with large fiery red, scarlet, crimson, orange - scarlet and pink flowers.

Poppy

3.2.3 Sweet William (*Dianthus barbatus*)

Sweet William is closely related to carnation and pinks and belongs to the same family Caryophyllaceae. It is a herbaceous plant with erect stems, but spreading well at the top. It is considered as a biennial but grows in the plains as an annual. Its plants are medium tall (30 - 45 cm) in height. It has angular stems, short, pointed – broad leaves and the flowers grow up on top of the branches, many a time, forming a compact attractive, colourful clusters. The individual flowers having one or many colours, may be single or double with very finely cut petals. Its flowers may be of various pleasing colours ranging from white to red, scarlet, pink, lilac, violet, maroon, black and mauve. The flowers may be self coloured, zoned, starred, mottled or with clear white eyes.

Sweet William Flowers

3.2.4 Helichrysum (*Helichrysum bracteatum*)

Helichrysum is popular by other names like; Paper Flower, Straw Flower and Everlasting Flower. It is a member of the family Asteraceae. The plants are about 75- 90 cm tall with oblong pointed foliage and cut flowers, about 7 cm and more across, with petals clustered and incurved towards the centre disc, when these are half open. The flower colour may be crimson, rose, yellow, mauve, salmon - pink, dark red or white. The flowers are papery in texture when mature and last long when dried. The plants are free - flowering.

Helichrysum

3.2.5 Sweet Sultan (*Centaurea moschata*)

It is an annual herb of the family Asteraceae with straight growth and less branching habit. It is a sweet scented annual. Sweet sultan is tall growing (90 cm), with toothed leaves and fragrant flowers of white, mauve, violet pink, bright red, reddish - violet, purple and yellow. The yellow flowered variety produces small - sized flowers. The flowers are born on long stems. There is another species, *C. americana* which is about 90 cm tall and produces large thistle - like blooms that are about 10.2 cm across and of a lilac-blue colour.

Sweet Sultan

3.2.6 Sweet Pea (*Lathyrus odoratus*)

Sweet pea is one of the most handsome and popular garden annual grown for its very attractive and fragrant flowers. It belongs to family Papilionaceae. It is an annual herb with trailing habit attaining a height of from 30 cm to almost 245 cm. The flat rough stem is slightly hairy. It produces very thin long leaves with stipules and a pair of long narrow pointed leaflets ending in tendrils. It produces flowers of different colours like; white, rose, pink, scarlet, crimson, cream, salmon, lavender, bluish and mauve to orange and exhaustive combinations of these hues. At present, there are 6 distinct strains of sweet peas:

i) The Giant Frilled or Spencer

ii) The Early-flowering (winter), frilled

iii) The Cuthbertson (spring flowering) frilled

iv) The Multiflora

v) The Dwarf Cupid

vi) The Dwarf Cupid Giant Frilled.

In the plains of India, only the early flowering strains do well while the others adapt and perform well on the hills.

Sweet Pea

3.2.7 Dahlia (*Dahlia variabilis*)

Dahlia is one among the most important garden plants. Large variations in colour, sizes, shapes and forms of its flowers coupled with profusion of flowering and easy cultivation has made them immensely popular. Dahlias are half hardy herbaceous perennial with tuberous roots as its storage organ. It belongs to the family Asteraceae. Stems of dahlia are mostly erect, branched and glabrous. The leaves, with slightly serrated margins, are produced opposite at each node on the stem. They bear flowers on a long, stiff stem well above the foliage. Ray - florets are neutral or pistillate and disc florets perfect. Based on the arrangement of disc and ray florets, dahlia has been classified into following main types:

i) Single flowered

ii) Star flowered

iii) Anemone flowered

iv) Paeony flowered

v) Decorative

vi) Cactus

vii) Double show and Fancy

viii) Pompon

ix) Miscellaneous

x) Dwarf bedding

The height of dahlia plants vary greatly from 30 to 180 cm but the formation of flower may belong to any of the above groups.

Dahlia

3.3 SPECIFIC USES OF THESE BEDDING FLOWER CROPS

The use of these flower crops the uses are described one by one below:

3.3.1 Dimorphotheca

It is beautiful cut flowers are used for daytime decorations as the flowers remain closed during nights. Plants are valued for low edging along pathways, in beds, borders, rockeries, dry banks and pots.

3.3.2 Poppy

It is useful for growing in beds and borders. Cut stems are also useful in short-lived flower decorations.

3.3.3 Sweet William

It is excellent for cut flowers, beds, borders and pots. Dwarf varieties can be used in rock gardens or window boxes.

3.3.4 Helichrysum

It can be used to grow in beds and borders. Dried flowers are used for dry flower arrangements. Both dried and fresh flowers are used for table decoration. This versatile plant provides the perfect backdrop for just about any colourful flower in hanging baskets and combination pots and baskets.

3.3.5 Sweet Sultan

Sweet sultan is planted in herbaceous borders for mass effect. Flowers are excellent for cutting and are ideal for making bouquets and flower arrangements. It is excellent to grow in beds, border and pots etc.

3.3.6 Sweet Pea

Sweet pea can be grown as a tall hedge or temporary screen, particularly alongside a path or in a kitchen garden. They are good for growing on trellises. They are also grown in clumps of 5 or 6 plants or groups in an annual mixed border. The dwarf cupid cultivars are useful for edging. Sweet pea can also be grown thickly in window boxes and are allowed to droop. They can also be grown in pots. Sweet scent and long duration vase-life make sweet pea suitable as a cut-flower.

3.3.7 Dahlia

Dahlia is used in beds, borders and is also suitable for planting in front of shrubberies, as a pot plant and for indoor decoration and exhibitions. It is also grown as a cut flower. For exhibitions and garden display, all types of dahlias are used. Dwarf growing types are suitable for borders, beds or even in mixed borders. Large flowering dahlias in pots are popular for terrace garden or verandah display. The long - stemmed flowers of various forms and colour are used in flower arrangement. Cut flowers of pompon and miniature types stay fresh in flower vases for many days and also make moderately good garlands.

3.4 IMPORTANT VARIETIES OF THESE BEDDING FLOWER CROPS

Important variety of these crops you will learn one by one:

3.4.1 Dimorphotheca

Orange Glory, Orange Improved, Salmon Beauty, Buff Beauty, White Beauty and Goliath.

3.4.2 Poppy

Shirley, Sweet Briar, Allegro, Beauty of Livermore, Brilliant, Oriental Mix, Princess Victoria Louise, Champagne Bubbles and American Legion.

3.4.3 Sweet William

Double Mix, Indian Carpet Mix, Wee Willie Mix, Cinderella Mix, Albus, Copper Red, Crimson Beauty, Diadem, Nigrescens, Oculatus Marginatus, Black Beauty, Giant White, Pink Beauty, Scented Beauty, Drea Holborn Glory, Scarlet Glory, Homeland, and White Giant.

3.4.4 Helichrysum

'Chico' series, Outback Plants, Florabella, Blushing Beauty, Golden Beauty, Yellow Beauty, Dreamtime Cream, Dreamtime Antique Shades and Fire Ball, Luteum, Ferrugineum Monstrosum, Borussorum Rex, Purpureum, Roseum, Tall Double Mixed and Dwarf Double Mixed, Licorice, Petite, Minus and Limelight.

3.4.5 Sweet Sultan

'Florence' series, Blue Boy Emperor Alba, Favourita, Graceosa, Splendens, Suaveolens and Odorata.

3.4.6 Sweet Pea

Grandiflora, Countess Spencer, Giant Frilled, Late Flowering Spencer, Early Flowering Frilled, Cuthbertson Frilled, Multiflora, Dwarf Cupid and Dwarf Cupid Giant Frilled, Knee High Mix, Winter Elegance Mix and Mammoth Mix.

3.4.7 Dahlia

Figaro, Hello Nearest Blue, Silver City, Arthur Hambly, April Dawn, Cabaret, Senior Ball, Snow Drop, Scarlet Comet and Golden Star.

3.5 NURSERY RAISING

Now you will study the methods to raise the nursery of these flower crops one by one :

3.5.1 Dimorphotheca

The African daisy is easily grown from seeds. Seeds are sown in September - October and even earlier in July where rainfall is low. In Bangalore, it can be grown for a greater part of the year. In hills, sowing of seeds should be done in March - April. They can be sown directly in prepared beds on a calm day when the wind will not blow the papery seeds away. For best results, prepare the beds with compost and remove clods and stones to make a fine bed. Sow thickly and rake lightly to cover the seeds to prevent them being blown or washed away. Keep beds moist to trigger germination. Allow the media to dry down some what when radicles have emerged. Seeds take four to ten days to germinate. Seedlings can be thinned or pricked out when they are about 5 cm tall. Seedlings are ready for transplanting in one month.

3.5.2 Poppy

Seeds are directly sown in permanent beds where the plants are to flower. The seedlings are later thinned out to maintain proper distance. Seeds are sown in September - October in the plains and from August - October and March - April in the hills. Oriental poppies may also be propagated by root cuttings taken in the spring or by division when plants are dormant.

3.5.3 Sweet William

In plains, the seeds are sown in nursery beds or seed - pans in September - October and the seedlings transplanted into beds after about a month of sowing. In the hills, seeds are sown from August to October and in February to March. Seeds germinate in 7 to 10 days. For production of quality seedlings, pH of the medium should be 5.5-6.0 and the medium temperature 21-24°C. The nursery beds should be kept evenly moist.

3.5.4 Helichrysum

The seeds are sown in September - October in plains and seedlings are transplanted later into beds after about a month of sowing. In the hills, sowing can be done in March - April. Sowing of seeds should be done in well drained, disease - free germination medium having a pH of 5.8-6.2. The optimum temperature for seed germination is 21-22°C.

3.5.5 Sweet Sultan

The seeds are sown either in nursery beds for transplanting seedlings later or *in situ*. The sowing is done during September - October in the plains and during March - April or August - October in the hills.

3.5.6 Sweet Pea

Seeds are bold resembling that of pea seeds. About 12 to 15 seeds make one gram. Seeds are dibbled directly into well prepared field. The best time of sowing is during September to October in the hills and February - March in the plains. Though, spacing depends upon the type or variety, 15 to 30 cm spacing would be adequate for almost all varieties. The ideal depth of sowing is about 3 cm. When grown in clumps, the seeds should be sown in circles at a distance of 15-22 cm and not more than 5-6 plants should be grown at each clump. Seeds take about 7-10 days for germination.

3.5.7 Dahlia

Dahlias are propagated by seeds, tuberous roots, and cuttings. Dwarf bedding dahlia is generally propagated by seeds. But, seed raised plants generally do not come out to be true to type. Therefore, plants are raised by cuttings. The cuttings are taken from the young green shoots produced from the crown of the tubers, when they are about 7.5 to 10 cm in length. The shoots should be cut as close to the crown as possible. The lower leaves in the cuttings may be removed by clipping and the cut end is rooted with the help of growth regulators. The cuttings are placed 5 cm apart in shallow boxes or pans containing a porous mixture of coarse soil and leaf mould. Cuttings take about 6 weeks to root. Another method of raising true to type dahlia is by division of old tuberous roots. But it should be kept in mind that each tuberous root should contain a small portion of the crown. In the hills, tuberous roots/cuttings are transplanted in the final beds in March - April and in plains during June - July.

Sowing of seeds should be done thinly in shallow boxes or seed - pans containing porous soil, covered with a layer of leaf mould and watered through a fine rose. Germination of seeds takes about ten days and the favourable temperature is from 18 - 28°C. Seedlings are ready for transplanting in three to four weeks.

Check Your Progress Exercise 1

Note : a) Space is given below for answers.

b) Compare your answer with that given at the end of the unit.

1) Write common as well as scientific names of commonly grown poppies.

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2) What are the important types of sweet pea?

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3) Write common names and families of the following:

Botanical Name	**Common Name**	**Family**
i) *Dimorphotheca sinuata*	_____	_____
ii) Dianthus barbatus	_____	_____
iii) Centaurea	_____	_____
iv) Lathyrus odoratus	_____	_____

4. List different types of dahlia on the basis of arrangement of ray and disc florets.

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5. How will you propagate dahlia from seeds ?

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3.6 CULTIVATION PRACTICES FOR THESE ANNUAL FLOWER CROPS

The essential cultural operation of these crops you will study one by one:

3.6.1 Soil and Climate

3.6.1.1 Dimorphotheca

Dimorphotheca grows well in winter. The plants require a sunny situation. The plants are hardy and grow well in any type of soil from medium clay to light sandy. But it should be well drained and rich in plant food.

3.6.1.2 Poppy

Poppies are very easy to grow and are very hardy. They can withstand sever frost. An open situation and rich well drained loamy soils with good water holding capacity are best suited for their growth.

3.6.1.3 Sweet William

A well fertilized, medium textured, well drained soils in open sunny situations are preferable for the cultivation of Sweet William. It requires cool weather for its optimum growth and flowering. It has been found that, Sweet William require cold treatment for flower initiation.

3.6.1.4 Helichrysum

It can be grown almost in all types of soil and does not need any special attention. However, a disease – free and well drained soils are considered better. For profuse flowering, helichrysum should be grown under bright sunny situations. It likes cooler nights (13-16^{o}C) for compact growth and flowering.

3.6.1.5 Sweet Sultan

Sweet Sultan can be cultivated in poor soils however, for satisfactory performance; it must be planted in a well drained soil which has been cultivated to a fine tilth. It requires full sun for optimum growth and flowering but, can tolerate shade and semi-shade conditions also.

3.6.1.6 Sweet Pea

Garden soil that is well drained and well aerated is suitable for the cultivation of sweet pea. Too sandy or clayey soils will have to be corrected before use. The optimum pH range is 6.0 - 6.5. Sweet pea is a deep rooted crop and the success of its culture will depend largely on the soil preparation. The soil is dug to a depth of about 60-75 cm and some sand is added if the soil is heavy. Sweet pea is a winter season annual. During the period of its growth, it needs continuous cool weather. If the seeds are sown in October in the hills, the young plants will need protection from frost. The location for growing sweet pea should be open and sunny. Plants grown in excessive shade become weak and spindly and produce few flowers.

3.6.1.7 Dahlia

Dahlia can be grown on any type of soil which is porous and rich in humus. They generally prefer well drained, deep, fertile and moist soil with pH 6.5. An open and sunny place but sheltered from exposure of strong wind is ideal. Dahlia is grown under wide range of climates. For best growth it requires ample of sunlight. Although it can withstand low temperature to a certain extent, its growth is slowed down. A cool atmosphere free from frost is also necessary. For pot plant production dahlia is planted in a mixture consisting of 1 part garden soil, 1 part sand, 1 part leaf - mould, 1 part manure and ¼ part broken pieces of charcoal.

3.6.2 Planting

In general, transplant seedlings at 4-leaf stage. Before transplanting, seedlings are hardened off by with holding water for 1 or 2 days or by exposing them gradually to sunlight. Transplanting is generally done either on a cloudy day or in the evening. Transplanting in evening is good as night cool temperature is beneficial for the establishment. Light watering every day in early morning or late in the afternoon is required for about a week for proper establishment of the seedlings.

The seedlings of dimorphotheca are planted at a spacing of 25-40 cm. In and around Calcutta, plants tend to spread more and hence need a little more spacing. The plants start blooming in about 6 to 8 weeks. Poppy seedlings are thinned out about 20-25 cm apart. A spacing of 15- 25 cm is sufficient for Sweet William. Helichrysum seedlings should be planted at a spacing of 30-40 cm. Sweet Sultan requires a spacing of 30 cm from plant to plant and row to row. In case of sweet pea, as the seeds are sown directly in permanent beds, seedlings should later be thinned out 15-20 cm apart. As the plants flower best in full sunshine, the rows should be arranged from north to south, so that both sides of the row should get full sun. The seedlings of dahlia are planted at a spacing of 45-90 cm apart.

3.6.3 Manuring and Fertilization

In general, mix farmyard manure or compost at the rate of 3 kg/m^2 in the soil. Chemical fertilizers like; 20 gram urea, 60-120 gram super phosphate and 30-60 gram muriate of potash/m^2 should be added. Half quantity of urea, full of super phosphate and muriate of potash should be applied at the time of bed preparation. The remaining quantity of urea must be applied one month after transplantation. Apply fertilizers in such a way so that they do not come in direct contact of the foliage since it cause scorching. Fertilizers should never be applied in pot grown annual flowers. However, some readymade pot-mixtures can be used. The pot mixture should consist of 2 parts of garden soil and 1 part each of coarse sand and farmyard manure. Instead of fertilizers, it is better if pot-grown plants are given liquid feeding. The liquid manure is prepared by fermenting 1-2 kg each of fresh cow dung and oil cake in 10 liters of water in a drum for one week. It is diluted to tea colour and sieved with the help of a muslin cloth. It is then applied at the rate of 500-1000 ml/pot at 7-10 days intervals. In addition, in case of dimorphotheca, helichrysum, poppy, Sweet William and Sweet Sultan, well decayed farm yard manure should be added at the time of planting. Sweet pea also requires manure in ample quanties. At the time of soil preparation, add one part of well rotten cow dung manure to two parts of soil. A little quantity of bone meal should also be incorporated in the soil. The application of 2 kg super

phosphate, 2 kg of bone meal and 250 gram of sulphate of potash for each 20 running meter of trench have also been advised. At bud appearing stage, liquid fertilizers by dissolving 30 gram of ammonium sulphate, 30 gram of super phosphate, and 15 gram of sulphate of potash in 20 liter of water and about 250 ml/plant of this solution is applied once a week. Alternatively, an application of well diluted liquid manure, once a week or a fortnight after the buds appear, is also beneficial.

3.6.4 Growth and Flowering

The plants of dimorphotheca take 6-8 weeks for flowering after sowing. Though, its plants continues to bloom for a long time and the flowers last long on the plant, commencement of the hot weather retards its progress. Poppy flowers after 6-12 weeks. Annual varieties of Sweet William flower in about 13-15 weeks after sowing while, biennial varieties take about 26-32 weeks. Its annual varieties do well almost everywhere in India whereas, biennials grow best only in those areas experiencing cool winter. Helichrysum flowers in 14-17 weeks after sowing when grown in sunny locations. Sweet Sultan flowers in 12-14 weeks. It requires full sun for optimum growth and flowering. Sweet pea requires regular watering, weeding, hoeing, and removal of 'off' type plants. Since the plants have trailing habit, they need supports, mostly bamboo sticks to keep them erect. Staking should be done when the seedlings are about 20-25 cm tall. In certain varieties, pinching may also be necessary to encourage branching. It is done when the seedlings are about 6-7 pairs of leaves. The flowers start occurring from 8-10 weeks after sowing and continue for about a month or more. Dahlia should be grown under light levels as high as possible while maintaining moderate production temperatures of 18-21°C day and 16-18°C night. A soft pinch after 2 weeks of transplanting by removing topmost leaf pair is beneficial to bulk up plant size. Support should be given to each plant immediately after they have started growth, as new growth is somewhat soft and liable to be affected by strong winds. The stakes may be painted green and the base tarred. Supporting stake helps the vertical growth of the plant. Mulching is another important operation in dahlia cultivation. This can be done with grass clippings, old hay and sawdust showing several beneficial effects. It helps to maintain an even soil temperature and causes earlier and better bloom. Mulch slows down water evaporation and reduces the irrigation requirement. It also keeps the weeds under control.

3.6.5 Aftercare and Irrigation

Do not water the established seedlings daily. This is extremely harmful. Daily light watering is needed only for about a week after transplanting. Thereafter, the correct method is to flood the beds first, and then weeding and hoeing are done after a couple of days when the soil is just moist. The soil is then allowed to dry before the next watering. Later, frequency and quantity of watering depends upon soil and season. In lighter soils, more frequent irrigation is needed than that in heavy soils. Potted plants require daily watering during summer, whereas on alternate days in winter. The requirement for irrigation also depends upon the crop. Do not over water Sweet William. Allow pots or beds to dry between irrigations. In case of sweet pea it is better to make slightly raised ridges, when the plants grow, to prevent rotting by over watering. Excess watering is also harmful to sweet sultan. Grow helichrysum plants as dry as possible without risking permanent wilting. Plants may collapse if the medium is wet for extended

period of time. Do not allow mature plants to dry out. Water early enough in the day so that foliage is entirely dry by nightfall to prevent foliar diseases. Dahlia require abundance of water. However, over watering causes a rapid but soft growth, as a consequence, roots become feeble, few buds are formed and they generally blast before developing into flowers. Plants in beds should be watered thoroughly only when they need it. The amount of water in ground should be such that it moistens the full depth of 40 cm and the whole bed remains moist for few days.

3.6.6 Enemies of these Bedding Flower Crops

Insect - pests and diseases are the enemies of these flowers crops. We will discuss them one by one with their control methods.

3.6.6.1 Insect-pests

i) **Aphids :** These are small sucking type of insect which attack these flower crops and harm the crops. These can be control by spraying or dusting the plants with Malathion, Basudin etc.

ii) **Thrips :** These small pests attack the foliage of some of the crops specially Dahlia, Sweet William and harm the crops. Thrips can be controlled by spraying with Malathion, or Rogor etc.

iii) **Caterpillar :** These are commonly seen in Dahlia, Sweet Pea, Helichrysum and other crops also. To control them dust or spray the infected plants with Rogor etc.

3.6.6.2 Diseases

i) **Damping off :** This disease in noticed in nursery and the very young seedling of these crops. Collapse and die, as a result of fungal attack in the roots or at the base of the stem.

Control : a) Avoid thick seed sowing in Nursery beds.

b) Treat the seed with fungicide like captan or Bavistin before sowing in Nursery beds.

c) Avoid over watering of seed beds.

d) Sterilize the soil before seed sowing.

ii) **Stem Rot (*Scberotinia clerotiorum*) :** It is found specially in Dahlia, Poppy and in other crops also. It causes basal rot, as a result of which the plant dies up.

Control : a) Soil sterilization before sowing of seed in necessary to control the disease.

b) Remove diseased twinges or plants should be burn or destroyed.

iii) **Leaf Smut Disease (*Entyloma dahlia*) :** It is found in Dahlia. The spores are produced on the leaves which later die up.

Control : a) Diseased leaves should be burn as they are source of further infection. Spray the diseased plants / crops with Bordeaux mixture or Fytolan.

iv) **Powdery Mildew :** The disease is caused by a group of fungus which produced a white powdery coating on the foliage and harm the plant growth etc.

Control : a) Spraying with sulphur or dusting is effective to control.

b) A spraying with Karathane also help to control the disease.

v) **Downy Mildew (*Peronospora arborescens*) :** This disease is very common in Poppy. It attack during Late February or early March. Some time attack other crops also.

Control : a) The disease leaves should be burnt.

b) Use - disease - free seeds and spray the plants with Fytolan to control the disease.

vi) **Virus :** These disease are also found some time in these crops, specially in Dahlia.

Control : The diseased plants should be up rooted and burn.

vii) **Wilt :** It is caused by several kind of soil fungus or bacteria, in these crops.

Control : Sterilization of soil fungi and pretreatment of seeds before sowing are quite beneficial in controlling the disease.

3.7 HARVESTING AND POST-HARVEST MANAGEMENT

Dimorphotheca sinuata produces dimorphic fruits (two different achenes/seeds). These achenes / seeds are morphologically and anatomically different, with each having different responses to environmental conditions, ensuring species survival in stressful climates. As seeds tend to drop from the plant as soon as they are mature, hence heads should be collected before dispersal of seeds. Achenes of the disc flowers are winged, having better dispersal mechanisms than achenes of the ray flowers, which are non-winged. Seeds should be stored at 5°C and 40 per cent relative humidity. The flowers should be harvested at fully open stage for day time floral decorations.

The seed pods of **poppy** are harvested when they are just about to open after drying. Poppy flowers should be harvested at coloured bud stage. Its cut stems excrete milky latex. They may be seared with flame or dipped in hot water to stop the flow of fluid and prevent rapid wilting. Cut stems can be stored wet at 4°C for 3-5 days in water.

The seeds of **Sweet William** may shatter if the pods are allowed to dry too much on the plant. Therefore, individual heads are collected as they begin to dry. Its cut flowers of are harvested when at least 50 % of flowers in the cyme are open. Sweet William flowers are sensitive to ethylene and benefit from silver thiosulphate (STS) treatment.

Helichrysum flower heads are collected individually at a stage when they become fuzzy. Harvest flowers before they are fully open, just as centers are showing. For drying, remove all foliage, bunch and tie stems, and hang upside down in a warm, dry, and well ventilated room.

Allow **Sweet Sultan** flower heads to dry on the plants before harvesting. Its cut flowers are harvested when they are fully open.

The seeds of **Sweet Pea** would be ready for harvesting, when the lower most pods on the plant are completely dry. At this stage, whole plant is cut and dried in shade before threshing to separate seeds. The seeds are then cleaned, graded and stored in air tight containers. Its flowers are easily damaged during post- harvest. Harvest flowers when the first flower is showing colour and other flowers are in a bud stage. Flowers are highly sensitive to ethylene and should be placed in silver thiosulphate (STS) solution to extend the vase life. Flowers can be stored dry at -0.5 - 0°C for 2 weeks in moisture retentive boxes or wet at 4°C for 3-4 days in water.

In case of **Dahlia**, seed heads are harvested when they turn yellow, after which they are dried on canvas. Seeds can be extracted by threshing or rolling. After cleaning the seeds are stored in air tight containers. Tubers are taken out with the help of a forked hoe when plant is almost dry and the colour of the stem turns yellow. These are allowed to dry in shade for 3-4 days. Before storing, tubers are treated with 0.2 % captan for 30 minutes. They can be stored on sand floor in a cool dry place. The ideal storage temperature is 4-7°C. In storage these are covered with peat moss or sand to prevent shriveling. Its flowers are harvested at fully open stage. After harvesting, stems must be immersed in warm (50°C) water. Flowers can be stored wet at 4°C for 3-5 days in water.

Check Your Progress Exercise 2

Note : a) Space is given below for answers.

b) Compare your answer with that given at the end of the unit.

1) What type of soil and climatic conditions are suitable for growing sweet pea ?

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2) Write the post harvest management of dahlia seeds and tubers.

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3) What is the planting distance for the followings when grown as bedding plant ?

i) Dimorphotheca _____

ii) Poppy _____

iii) Helichrysum _____

iv) Sweet William _____

3.8 LET US SUM UP

In this unit, we have studied about importance of different types of bedding annual flowers, uses of these annuals, variability related to flower type and colour in crop, important varieties in different crops, nursery raising - crop specific requirements, essential cultivation practices including soil and climate, planting, manuring and fertilization, growth and flowering requirements, aftercare and irrigation, crop enemies and there control, harvesting and post - harvest management, and extraction, curing and storage of seeds. The successful cultivation of any annual depends upon quality planting material, knowledge about inter cultural operation and post - harvest management. The selection of site is of vital importance.

3.9 KEY WORDS

Pinching : Removal of apical portion of the plant is called pinching.

Foot candles : Unit of light.

Transplanting : Replanting of seedlings (nursery raised) in the field / pot / outdoor conditions in a given spacing.

Cyme : Usually a flat-topped inflorescence.

Achene : A type of fruit.

3.10 FURTHER REFERENCES

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3.11 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) i) Shirley poppy (*Papaver rhoeas*)
   ii) Tulip Poppy (*P. glaucum*)
   iii) Opium Poppy (*P. somniferum*)
   iv) Iceland Poppy (*P. nudicaule*)
   v) Oriental Poppy (P. orientale)

2) i) The Giant Frilled or Spencer
   ii) The Early-flowering (winter), frilled
   iii) The Cuthbertson (spring flowering) frilled
   iv) The Multiflora
   v) The Dwarf Cupid
   vi) The Dwarf Cupid Giant Frilled.

3)

	Botanical Name	**Common Name**	**Family**
i)	*Dimorphotheca sinuata*	Cape Marigold	Asteraceae
ii)	*Dianthus barbatus*	Sweet william	Caryophyllaceae
iii)	*Centaurea moschata*	Sweet sultan	Compositae
iv)	*Lathyrus odoratus*	Sweet pea	Papilionaceae

4) i) Single flowered
   ii) Star flowered
   iii) Anemone flowered
   iv) Paeony flowered
   v) Decorative
   vi) Cactus
   vii) Double show and Fancy
   viii) Pompon
   ix) Miscellaneous
   x) Dwarf bedding

5) Sowing of seeds should be done thinly in shallow boxes or seed - pans containing porous soil, covered with a layer of leaf mould and watered through a fine nose. Germination of seeds takes about ten days and the favourable temperature is from 18-28°C. Seedlings are ready for transplanting in three to four weeks.

Check Your Progress Exercise 2

1) Garden soil that is well drained and well aerated is suitable for the cultivation of sweet pea. Too sandy or clayey soils will have to be corrected before use. The optimum pH range is 6.0 - 6.5. Sweet pea is a deep rooted crop and the

success of its culture will depend largely on the soil preparation. The soil is dug to a depth of about 60-75 cm and some sand is added if the soil is heavy. Sweet pea is a winter season annual. During the period of its growth, it needs continuous cool weather. If the seeds are sown in October in the hills, the young plants will need protection from frost. The location for growing sweet pea should be open and sunny. Plants grown in Excessive shade become weak and spindly and produce few flowers.

2) The seed heads are harvested when they turn yellow, after which they are dried on canvas. Seeds can be extracted by threshing or rolling. After cleaning the seeds are stored in air tight containers. Tubers are taken out with the help of a forked hoe when plant is almost dry and the colour of the stem turns yellow. These are allowed to dry in shade for 3-4 days. Before storing, tubers are treated with 0.2 % captan for 30 minutes.

3) i) Dimorphotheca 25 - 40 cm
   ii) Poppy 20 - 25 cm
   iii) Helichrysum 30 - 40 cm
   iv) Sweet William 15 - 25 cm

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