Flower Crops at IHBT

Volume-I



Bhavya Bhargava • Poonam Kumari • Sanatsujat Singh • Ashok Kumar

सीएसआईआर–हिमालय जैवसंपदा प्रौद्योगिकी संस्थान
CSIR-Institute of Himalayan Bioresource Technology
पालमपुर–176 061 (हि.प्र.) / Palampur-176 061 (H.P.)

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Volume 1

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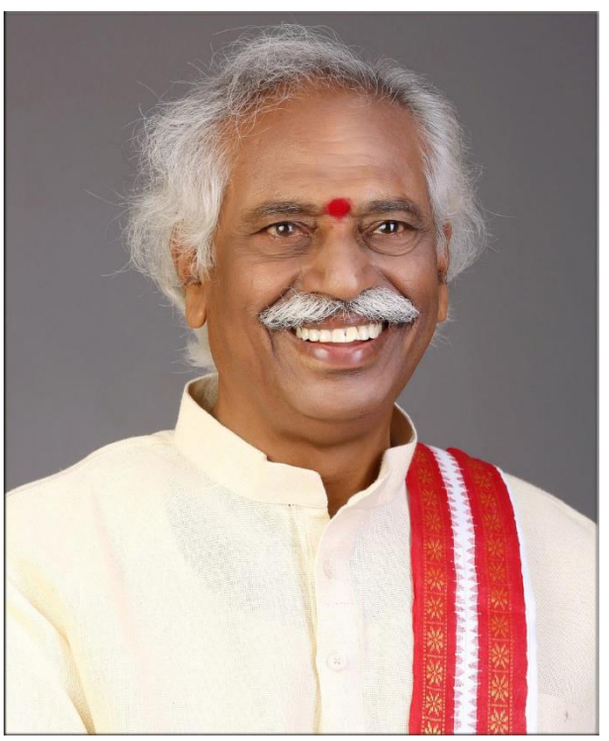
Cover Photos:
Front: Calla lily 'Him Shweta'
Back: Directorate, CSIR-IHBT

DISCLAIMER

This publication is meant for the use of students, growers, entrepreneurs and people interested in flower crops. The use of this information for cultivation, research and other application will however require detailed literature search and advice from professionals and experts.

Book released

by

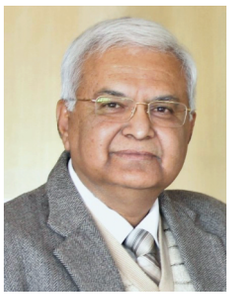


Shri Bandaru Dattatraya

Hon'ble Governor, Himachal Pradesh

on 9th July, 2020 on the occasion of CSIR-IHBT 38th Foundation Week Celebration

FOREWORD



Globally, more than 145 countries are involved in floriculture trade which is presently estimated to be at USD 48 billion. While the Netherlands, Japan, and United States of America (USA) account for nearly half of the world flower trade, Indian floriculture market was worth Rs. 8,000 Cr in 2019. The market is further projected to reach Rs. 15,000 Cr by 2024, growing at a CAGR of 20.1% during 2019 to 2024.A strong increase in the domestic demand for cut and loose flowers has made floriculture as one of the promising commercial trades in Indian agriculture.

Mountain floriculture holds a niche advantage for production of off-season as well as high value exotic commercial varieties to fetch higher returns. Working in this direction, CSIR-Institute of Himalayan Bioresource Technology, Palampur has standardized technologies for plant multiplication and cultivation of floriculture crops in open field conditions as well as under protected environment. The breeding programme undertaken at the institute has resulted in development of varieties of Gerbera, Calla lily, Rose and Gladiolus with unique color, shape and morphology.

Floriculture in India is mainly characterized by loose flowers and cut flowers growing under open field and protected environment conditions. Other floricultural segments like ornamental bulbous plants, dry flowers, fillers, indoor plants, landscape plants, seed production, nursery production, turf grass and value-added products also contribute their share in the overall growth of the sector. The present compilation in the form of a book covers information on 57 species (12 cut flowers, 1 loose flower, 14 ornamental bulbous crops and 30 annuals) of floricultural crops at CSIR-IHBT, Palampur. It is hoped that this compilation will be useful for students, scientists, teachers, farmers, tourists, entrepreneurs and others, and would serve the cause to promote the floriculture industry at large.

Date: 9thJuly 2020
CSIR-IHBT, Palampur

Sanjay Kumar
Director

PREFACE

Floriculture has transpired as an apparent commercial activity in agriculture after globalization of Indian economy. It has proved beyond doubt, a viable alternative, having a potential to generate remunerative self-employment among small and marginal farmers and also fetch the much needed foreign exchange. Over the last decade, there has been a considerable growth of 2.5 times in the production of flowers. With changing lifestyles and increasing urbanization, floriculture has attained commercial status. Awareness amongst city dwellers for clean environment has resulted in large scale development of landscape gardening, beautifying public places and interiorscaping. Total area under floriculture is 3.13 lakh hectares with a production of 2059 thousand tonnes loose flowers and 807 thousand tonnes cut flowers (NHB, 2018-19).

Floriculture has established in the State as profitable venture and is a suitable option for diversification of horticulture, in general, Himachal Pradesh has been bestowed with varied agro-climatic conditions that are congenial for successful cultivation of flower crops. The crops produced here in natural season being off-season for the plain areas of India and farmers get good returns. A large variety of floriculture products, viz. cut flowers, bulbs, seeds, live plants, etc. can be produced as economic cash crops for the benefit of farmers. Although flowers from different agro climatic zones of the state can be made available all through the year for domestic market, export quality flowers can be ensured by cultivation under controlled environment conditions in greenhouses.

In, India the floriculture industry got an appreciable boost during the last two decades due to active patronage from Govt. of India. A quantum jump and radical change in the commercial floriculture has been noticed all over India. To cope up with transformation, new flowers/cultivars have been introduced. Production technologies have been changed significantly from traditional method of flower cultivation to advanced methods such greenhouse cultivation of flower crops.

Floriculture deserves due importance in research priorities and policy planning for providing better living conditions to the people through environment services. It, therefore, has entrusted us with the task of writing this book entitled 'Flower Crops at IHBT'. This book covers the brief advanced production technology for commercial floricultural crops, bulbous crops and annual flowers grown at CSIR-IHBT Palampur. The text is supported by original pictures of the flower crops. We are sure that this publication will be quite useful to related stakeholders like students, visitors, tourists, scientists, teachers, farmers and entrepreneurs dealing with floriculture. A substantial amount of new information presented in this book is the result of the experiments carried out at the experimental farm of the Agrotechnology Division, CSIR, Institute of Himalayan Bioresource Technology at Palampur in Himachal Pradesh, India.

The authors express their deep sense of gratitude to Director, CSIR-IHBT Palampur, Dr. Sanjay Kumar for the constant motivation and support. We are also thankful to Ms. Ujala, Ph.D. scholar and Mr. Balwant Raj, Lab Attendant, Agrotechnology division for extending help in writing the book.

Date: 9th July 2020
CSIR-IHBT, Palampur

Bhavya Bhargava
Poonam Kumari
Sanatsujat Singh
Ashok Kumar

ABBREVIATIONS USED

	Temperature
	Carbon dioxide
	Relative Humidity
	Greenhouse crop
Feb	February
Mar	March
Apr	April
Aug	August
Sept	September
Oct	October
Nov	November
Dec	December
cm	Centimeter
USD	US Dollar
m	Meter
m^2	Square meter
°C	Degree celcius
ppm	Parts per million
%	Percent
yr	Year
FYM	Farm yard manure

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CUT FLOWERS

CUT-ROSE

Botanical Name: *Rosa* x *hybrida*
Family: Rosaceae

Climatic requirement

Max: 25-30°C
Min: 15-18°C

1200-2000 ppm

60-65%

Commercial Use:

Among all the commercially important flowers, rose is occupying the supreme position for their executive beauty, shapes, exhilarating hues, excellent vase life and wide choice of varieties. These are suitable for protected cultivation under plains, low and mid hills.



Propagation: T-budding

Planting time: Oct-Nov
Planting density: 6-8 plants/m^2
Planting system: 2 row system
pH: 6.2-6.8

Pruning time: Oct-Nov

Yield: 100-200 flowers/m^2

Harvesting stage:
First two petals begin to unfold

Storage temperature:
4°C (Wet storage for 5 days)

Disorders: Bent neck, Blind shoots
Diseases: Die back, Powdery mildew, Downy mildew, Black spot
Insects: Aphids, Mite, White fly, Thrips

Total Investment	Gross Returns	Net Returns
Rs. 2.68 lakhs	Rs. 4.22 lakhs	Rs. 1.54 lakhs

*Economic analysis of Rose cultivation in 500 m^2 under polyhouse conditions on yearly basis

Green House



Himalayan Wonder

Salient features	
Length of flowering shoot	78.46 cm
Diameter of flower bud	2.59 cm
Length of flower bud	4.51 cm
No. of flowering shoot/m^2/yr	213
Petal colour	Red purple
Flower vase life	7 days



Salient features	
Length of flowering shoot	62.76 cm
Diameter of flower bud	2.71 cm
Length of flower bud	4.51 cm
No. of flowering shoot/m^2/yr	215
Petal colour	Tyrian purple
Flower vase life	8 days



Himalayan Glory

GERBERA

Botanical Name: *Gerbera jamesonii*
Family: Asteraceae

Climatic requirement

Max: 20-25°C
Min: 12-16°C

1000-1400 ppm

60-65%

Commercial Use:

Gerbera ranks fifth among top ten cut flowers sold in the international market. These are suitable for protected cultivation under plains, low and mid hills. Trade in domestic market is estimated at 985 crores.

Propagation: Tissue culture, suckers

Planting time: July-August
Planting density: 6 plants/m^2
Planting system: 2 row system
pH: 6.0-7.0

Yield: 250-300 flowers/m^2

Harvesting stage:
Fully open when outer rows showing pollen

Storage temperature:
4°C (Wet storage for 3-4 days)

Disorders: Bent neck
Diseases: Root rot, Powdery mildew, Leaf blight
Insects: White fly, Caterpillars, Thrips



Him Aabha



Him Gaurav

Total Investment	Gross Returns	Net Returns
Rs. 2.78 lakhs	Rs. 4.62 lakhs	Rs. 1.84 lakhs

*Economic analysis of Gerbera cultivation in 500 m^2 area under polyhouse conditions on yearly basis

Green House



Him Apoorva



Him Saumya



Him Glow



Him Keerti

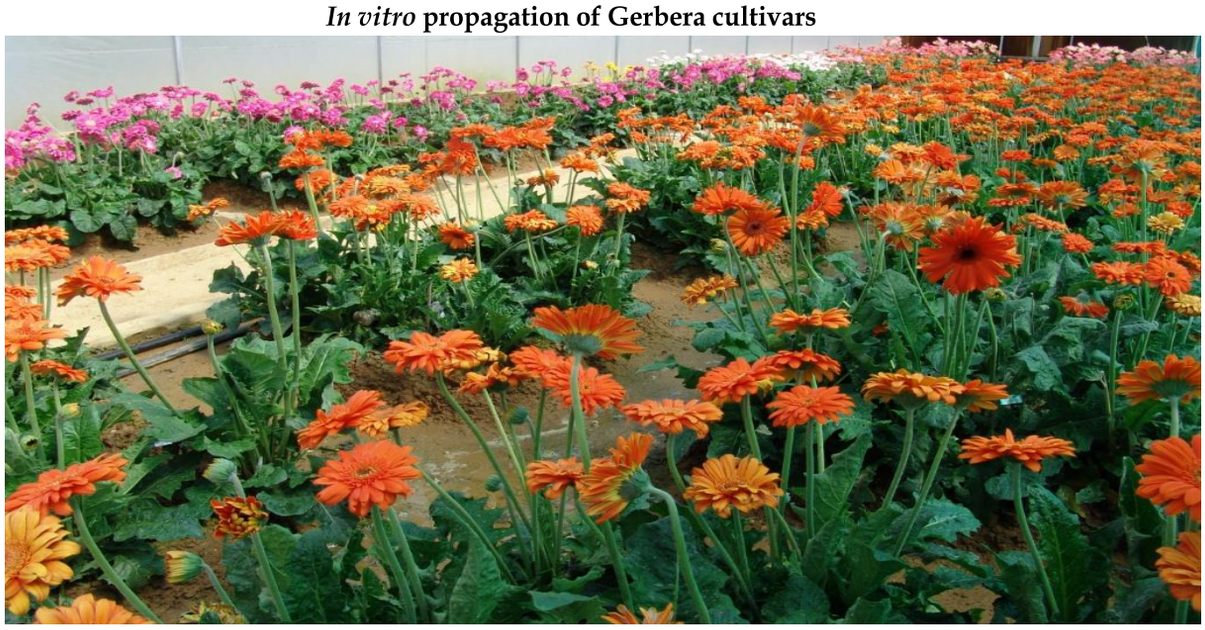
Salient features	Him Aabha	Him Gaurav	Him Aproova	Him Saumya	Him Keerti	Him Glow
Stem length (cm)	29.6	46.5	45.8	43.0	44.5	41.20
Diameter of flower bud (cm)	11.7	10.5	10.5	10.2	11.5	10.8
No. of flowers/ plant/ yr	25.5	24.4	23.3	18.8	20.0	23.5
Petal colour	Yellow orange	Red	Red bicolour	Light yellow	Yellow	Yellow orange







***In vitro* propagation of Gerbera cultivars**



Gerbera in polyhouse

LILIUM

Botanical Name: *Lilium* spp.
Family: Liliaceae

Climatic requirement

Max: 15-18°C
Min: 12-13°C

800-1000 ppm

60-70%

Commercial Use:

Lilium is a high value bulbous cut flower crop, ranks fourth in international trade. Lilium flower and bulbs production in high Himalayas such as Lahaul has been shown to be promising. The global trade is estimated at USD 155 million.

Propagation: Scaling, Bulbils

Planting time: Sept-Oct (Plains, Mid hills), Feb-March (High Hills)
Planting density: 40-50 bulbs/m^2
Planting system: 2 row system
pH: 5.5-7.0

Yield: Single flower stem/ bulb

Harvesting stage:
When lower most bud is fully coloured and elongated

Storage temperature:
1-2°C (Wet storage)

Disorders: Leaf scorch, Bud abortion, Blind shoots
Diseases: Root rot, Grey mold
Insects: Aphids, Thrips



Oriental Lilium

Lilium	Total Investment	Gross Returns	Net Returns
Asiatic	Rs. 2.08 lakhs	Rs. 3.50 lakhs	Rs. 1.42 lakhs
Oriental	Rs. 2.74 lakhs	Rs. 5.33 lakhs	Rs. 2.59 lakhs

*Economic analysis of Lilium cultivation in 500 m^2 under shade net conditions on yearly basis

Green House



Lilium bulb multiplication in Lahaul, H.P.



Lilium flower production in Lahaul, H.P.



Lilium growers in Lahaul



Grading of lilium bulbs



Cold storage of lilium bulbs





Microbulb production through scaling



Lilium bulbs



Lilium flower production at IHBT, Palampur, H.P.

CALLA LILY

Botanical Name: *Zantedeschia elliotiana*
Family: Araceae

Climatic requirement

Max: 18-28°C
Min: 15-16°C

60-70%

Commercial Use:

Calla lily are the popular floriculture plants in demand for their exotic blooms and glossy foliage. Used both as cut flowers as well as potted plants. Calla lilies are suitable for open cultivation under low and mid hill conditions.

Propagation: Tubers

Planting time: Feb-March (Mid hills)
Planting density: 6-10 tubers/m^2
pH: 6.0-6.5

Yield: 4-5 flower stem/ plant

Harvesting stage:
When spathes are 1/3rd open

Storage temperature:
4°C (Wet storage)

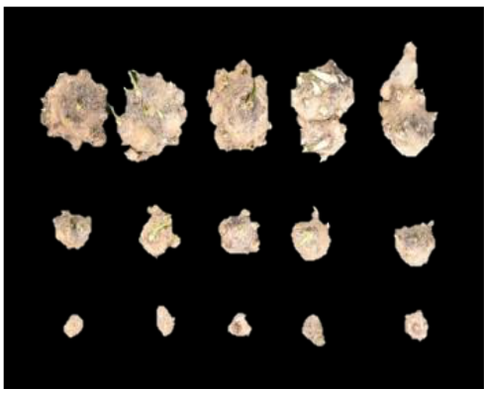


Him Sumukh

Disorders: Leaf scorch, Bud abortion, Blind shoots
Diseases: Root rot, Grey mold
Insects: Aphids, Thrips

Total Investment	Gross Returns	Net Returns
Rs. 0.63 lakhs	Rs. 1.60 lakhs	Rs. 0.97 lakhs

*Economic analysis of Calla lily cultivation in 500 m^2 area under open field conditions on yearly basis



Tuber production in *Z. elliottiana*



Tubers of *Z. elliottiana*



Growth stage of Calla lily Him Sumukh

Salient features	Him Sumukh
Plant height (cm)	124.5
No. of leaves	20.3
Flower stalk length (cm)	88.4
Flower stalk diameter (mm)	8.6
No. of flowers/ plant/ yr	3.3



Flowering stage of Calla lily Him Sumukh

CALLA LILY

Botanical Name: *Zantedeschia aethiopica*
Family: Araceae

Climatic requirement

Max: 10-21°C
Min: 12-13°C

60-70%

Commercial Use:

Calla lily are the popular floriculture plants in demand for their exotic blooms and glossy foliage. Used both as cut flowers as well as potted plants. Calla lilies are suitable for open cultivation under low and mid hill conditions.

Propagation: Rhizomes, seeds

Planting time: Sept-Oct (Mid hills)
Planting density: one plant/m^2
pH: 6.0-6.5



Him Shweta

Yield: 10-12 flower stems/ plant

Harvesting stage:
When spathes are 1/3rd open

Storage temperature:
4°C (Wet storage)

Disorders: Leaf scorch, Bud abortion, Blind shoots
Diseases: Root rot, Grey mold
Insects: Aphids, Thrips

Total Investment	Gross Returns	Net Returns
Rs. 0.63 lakhs	Rs. 1.60 lakhs	Rs. 0.97 lakhs

*Economic analysis of Calla lily cultivation in 500 m^2 area under open field conditions on yearly basis



Seeds of *Z. aethiopica*



Rhizomes of *Z. aethiopica*



Mass multiplication of *Z. aethiopica*



Harvesting stage

Salient features	Him Shweta
Plant height (cm)	128.2
No. of leaves	33.0
Flower stalk length (cm)	90.3
Flower stalk diameter (mm)	10.2
No. of flowers/ plant/ yr	6.7



Flowering stage of Calla lily Him Shweta

CHRYSANTHEMUM

Botanical Name: *Dendranthema grandiflora*
Family: Asteraceae

Climatic requirement

Max: 18-21°C
Min: 10-16°C

500-1000 ppm

60-70%

Commercial Use:

Chrysanthemum is a short day plant. It is an important cut flower due to its wide colour range and varying forms. These are suitable for protected cultivation under mid and hills.



Him Ujjwala

Propagation: Terminal stem cutting

Planting time: June-July
Planting density: 9 plants/m^2
pH: 6.2-6.7

Pinching:
Twice after 4 and 8 weeks of transplanting

Yield:
Standard: 2.5-4.5 lakh flowers/ha
Spray: 1.5-1.75 lakh/ ha



Him Pushkar

Harvesting stage:
Standards: When outer row of florets start unfurling (distant market) and half opened (local)
Sprays: Two flowers have opened (distant), 50% flower have shown colour (Local)

Disorders: Premature budding, Quilling of florets, Crown bud formation, Petal burn
Diseases: Fusarium wilt, Stem rot, Leaf spot, Grey mold, Powdery Mildew
Insects: Catterpillars, Mites, Thrips, Leaf minor

Total Investment	Gross Returns	Net Returns
Rs. 2.66 lakhs	Rs. 3.68 lakhs	Rs. 1.02 lakhs

*Economic analysis of Chrysanthemum cultivation in 500 m^2 area under polyhouse conditions on yearly basis



Him Aditya



Him Shringar



Him Shikhar



Chrysanthemum cutting production



Flowering of Him Ujjwala



Field view of Chrysanthemum plantation

BIRD OF PARADISE

Botanical Name: *Strelitzia reginae*
Family: Strelitziaceae

Climatic requirement

Max: 17-27°C
Min: 15-20°C

35-40%

Commercial Use:

The Bird of Paradise on account of its exceptionally attractive flowers, long sturdy flower stalks and excellent vase life occupies a special position among cut-flowers. The peculiar shape of this flower resembles a bird in about to take off position.

Propagation: Seeds, clumps, tissue culture

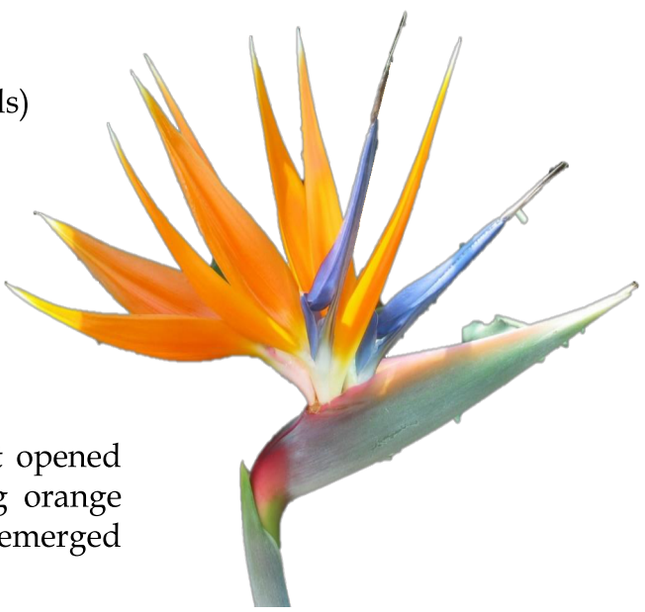
Planting time: Feb-March (Mid hills)
Planting density: Four plants/m^2
pH: 5.5-6.5

Yield: 15-20 flower stems/ plant/ year

Harvesting stage:
Local market: First floret has just opened
Distant market: Flowers showing orange yellow coloration but not yet emerged from the sheath

Storage temperature:
7°C (Wet storage)

Diseases: Root rot, Anthracnose
Insects: Mealy bugs, scale insects



Bird of Paradise

Total Investment	Gross Returns	Net Returns
Rs. 0.74 lakhs	Rs. 1.25 lakhs	Rs. 0.50 lakhs

*Economic analysis of BOP cultivation in 500 m^2 area under open conditions on yearly basis



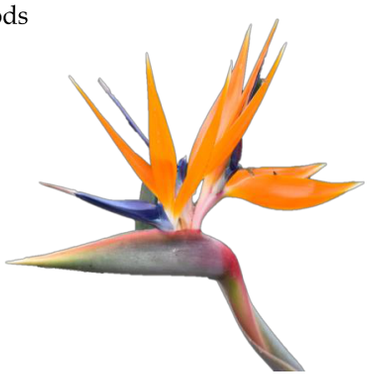
Seed Pods



Seeds



3 year old plant





Seed germination



Leaf emergence



Field view of Bird of Paradise plantation

CARNATION

Botanical Name: *Dianthus caryophyllus*
Family: Caryophyllaceae

Climatic requirement

Max: 20-24°C
Min: 13-15°C

750-1500 ppm

60-70%

Commercial Use:

Carnation is a high value cut-flower crop that ranks among top ten cut-flowers in the world. Carnations are known for their fragrance, different colours and forms, excellent keeping quality, light weight and ability to withstand long distance transport. These are suitable for protected cultivation under mid hills.

Propagation: Terminal stem cutting

Planting time: Oct-Nov
Planting density: 25 plants/m^2
pH: 6.0-7.0

Pinching: Single pinch: For early flush
Pinch and half: Flowering in two flushes
Double pinching: Delayed flowering

Yield: 150-200 flowers/m^2

Harvesting stage:
Paint brush stage

Storage temperature:
4°C (Wet storage)



Farida

Disorders: Calyx splitting, Slipiness
Diseases: Fusarium wilt, Leaf spot, Rust
Insects: Catterpillars, Mites, Thrips

Total Investment	Gross Returns	Net Returns
Rs. 3.13 lakhs	Rs. 5.23 lakhs	Rs. 2.10 lakhs

*Economic analysis of Carnation cultivation in 500 m^2 area under polyhouse conditions on yearly basis

Green House



Ambrose



Master



Kiro



Baltico



Carnation planting



Netting



Disbudding



Packaging



Field view of Carnation plantation

GLADIOLUS

Botanical Name: *Gladiolus* spp
Family: Iridaceae

Climatic requirement

10-25°C

12 to 14 hour

50-60%

Commercial Use:

Gladiolus has a very good demand in the market for their elegant attractive spikes with flowers of different hues, shapes and excellent keeping quality. Gladiolus is extensively grown for cut flower production, garden decoration and as pot plants for interior and outdoor decoration.

Propagation: Corms, cormels

Planting time: Oct-Nov (Plains), Feb-March (Mid & High Hills)
Planting density: 20-25 corms/m^2
pH: 6.0-7.0

Yield: 2.00-2.50 lakh spikes/ha

Harvesting stage:
Local market: The spike with the lowest 2 or 3 florets in about to open condition
Distant market: Spikes with well developed flower buds in tight bud stage with the floret showing colour.

Storage temperature:
4°C (Wet storage)

Disorders: Fluoride toxicity, leaf scorch
Diseases: Fusarium wilt, Botrytis, Rust
Insects: Thrips, Aphids, Mites, Nematodes



Total Investment	Gross Returns	Net Returns
Rs. 1.76 lakhs	Rs. 3.00 lakhs	Rs. 1.22 lakhs

*Economic analysis of Gladiolus cultivation in 2000 m^2 area under open conditions on yearly basis



Cute Munni



Gladiolus corms



Gladiolus cormels



IHBT-282



Field view of Gladiolus plantation

ALSTROEMERIA

Botanical Name: *Alstroemeria* x *hybrida*
Family: Alstroemeriaceae

Climatic requirement

Max: 18-22°C
Min: 12-16°C

800-1000 ppm

65-85%

Commercial Use:

Alstroemeria has got the recognition as one of the top ten flowers of the world. It is valued for wide array of flower colours, long flower stalk and excellent vase life. These are suitable for protected cultivation under mid hills.

Propagation: Rhizome

Planting time: Feb-March/ Oct-Nov
Planting density: 2-3 plants/m^2
pH: 6.0-7.0

Netting: 3-4 layers, 20-25 cm apart (mesh size: 20 x 20 cm)

Thinning: Weak chloratic shoots should be removed

Yield: 200-300 flowers/m^2



Pluto

Harvesting stage:
Florets are fully developed , showing colours in primary flowers
Storage temperature:
4°C (Wet storage)

Disorders: Fluoride toxicity, Leaf scorch
Diseases: Botrytis blight, Root rot, Rust
Insects: Aphids, Thrips



Rosita

Total Investment	Gross Returns	Net Returns
Rs. 3.01 lakhs	Rs. 5.74 lakhs	Rs. 2.73 lakhs

*Economic analysis of Alstroemeria cultivation in 500 m^2 area under polyhouse conditions on yearly basis

Green House



Tiara



Alladin



Butter Scotch



Netting in Alstroemeria



Alstroemeria cultivars in polyhouse



Field view of Alstroemeria plantation

TULIP

Botanical Name: *Tulipa gesneriana*
Family: Liliaceae

Climatic requirement

17-20°C

12 hours/ day

60-70%

Commercial Use:

Tulips are excellent flowers for garden decoration and as cut flowers for vase decoration. Tulip is occupying a prime position in top ten elite cut flowers of the world for more than five decades. Tulip flowers have good demand in the international market on account of the elegant flowers of different hues.

Propagation: Bulbs

Planting time: Oct-Nov

Planting density: 40-50 bulbs/m^2
pH: 6.0-7.0

Harvesting stage:
Darwin Tulips: Unopened flower is 50% coloured.
The flower stalk length should be at least 30 cm.
The bulbs are harvested in late summer when the leaves become dry

Storage temperature:
0-2°C (Dry storage)

Disorders: Stem topple, Flower abortion
Diseases: Botrytis blight, Basal rot
Viral diseases: Tulip breaking virus
Insects: Catterpillars, Mites, Thrips



Texus Flame

Total Investment	Gross Returns	Net Returns
Rs. 5.25 lakhs	Rs. 10.20 lakhs	Rs. 4.95 lakhs

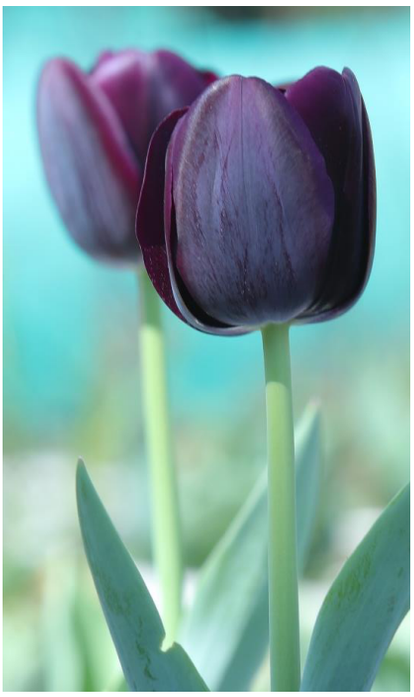
*Economic analysis of Tulip cultivation in 500 m^2 area under open conditions on yearly basis



Statement



Yellow Pomponette



Purple Flag



Field view of Tulip plantation

CYMBIDIUM ORCHID

Botanical Name: *Cymbidium* spp
Family: Orchidaceae

Climatic requirement

Max: 15-21°C
Min: 10-13°C

600-1000 ppm

50-80%

Commercial Use:

Cymbidiums enjoy a prime position in the floriculture industry for heavy substance of the flowers and high flower longevity. They are cultivated for cut flowers as well as pot plants for house decorations. Orchids are suitable for protected cultivation under mid and high hills.

Propagation: Tissue culture

Planting time: Feb-March/ Oct-Nov
Planting density: 6 plants/m^2
pH: 6.0-7.0

Substrate: Cocopeat, cocochips, rockwool

Yield: 10-12 flowers/m^2

Harvesting stage:
The optimum harvesting stage of Cymbidium is 2 bud open stage

Storage temperature:
5°C (Wet storage)

Diseases: Root rot, Botrytis
Insects: Thrips, Aphids, Snails



CM-1024



CM-1054

Total Investment	Gross Returns	Net Returns
Rs. 5.51 lakhs	Rs. 9.96 lakhs	Rs. 4.45 lakhs

*Economic analysis of Cymbidium orchid cultivation in 500 m^2 area under shade net conditions for 5 years

Green House



CM-1002



CM-1024



CM-1051



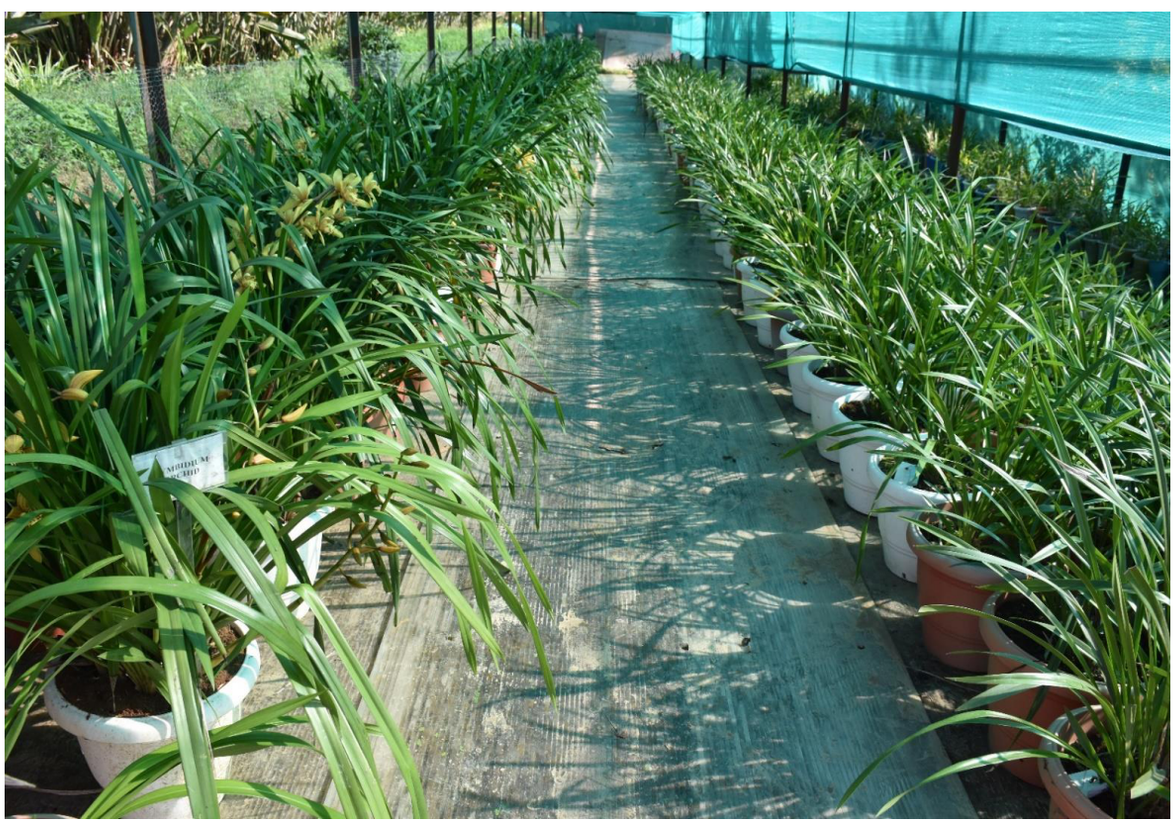
CM-1054



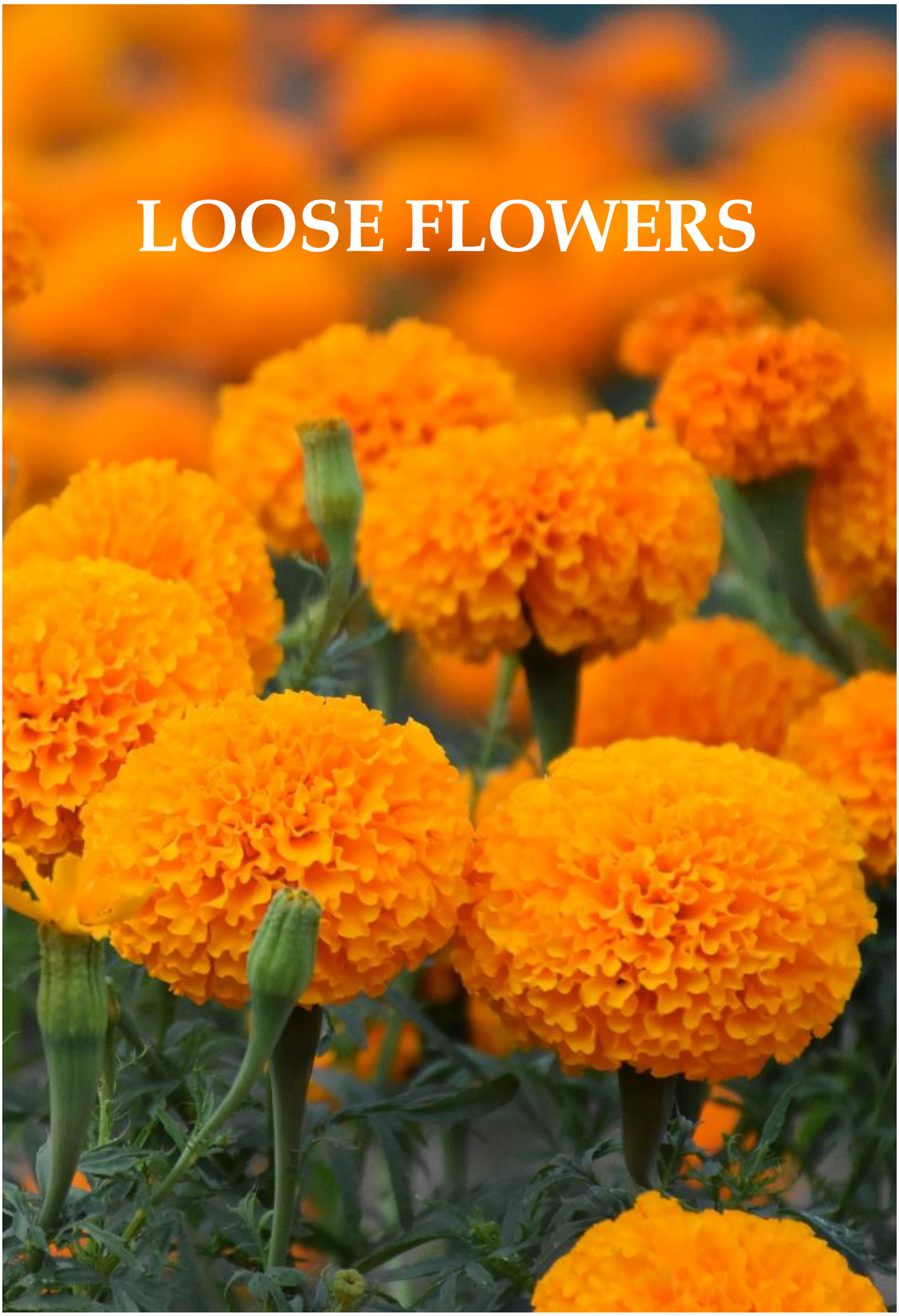
CM-1023



CM-1078



Field view of Cymbidium orchid plantation


LOOSE FLOWERS

MARIGOLD

Botanical Name: *Tagetes erecta*
Family: Asteraceae

Climatic requirement

25-30°C

10-12 hours/ day

50-60%

Commercial Use:

Marigold is one of the most commonly flowers for garden decoration and extensively used as loose flower for making garlands for religious and social functions. These are suitable for open field cultivation under plains, low, mid and high hills.

Propagation: Seeds

Planting time: Feb-March/ May-June/ Sept-Oct (Plains and low hills)
Jan-Feb/ May-June (Mid hills)
March-Apr/ May-June (High hills)

Planting density: 9 plants/m^2
pH: 7.0-7.5



IHBT Sel 1.

Pinching:
Removal of terminal shoot about 2-3 cm long

Yield: 15-18 t/ha

Harvesting stage:
Fully open flowers are harvested during cool hours

Diseases: Damping off, Leaf blight
Insects: Mites, Caterpillars

Total Investment	Gross Returns	Net Returns
Rs. 1.75 lakhs	Rs. 3.40 lakhs	Rs. 1.65 lakhs

*Economic analysis of Marigold cultivation in 2000 m^2 area under open conditions on yearly basis



Seeds



Nursery raising



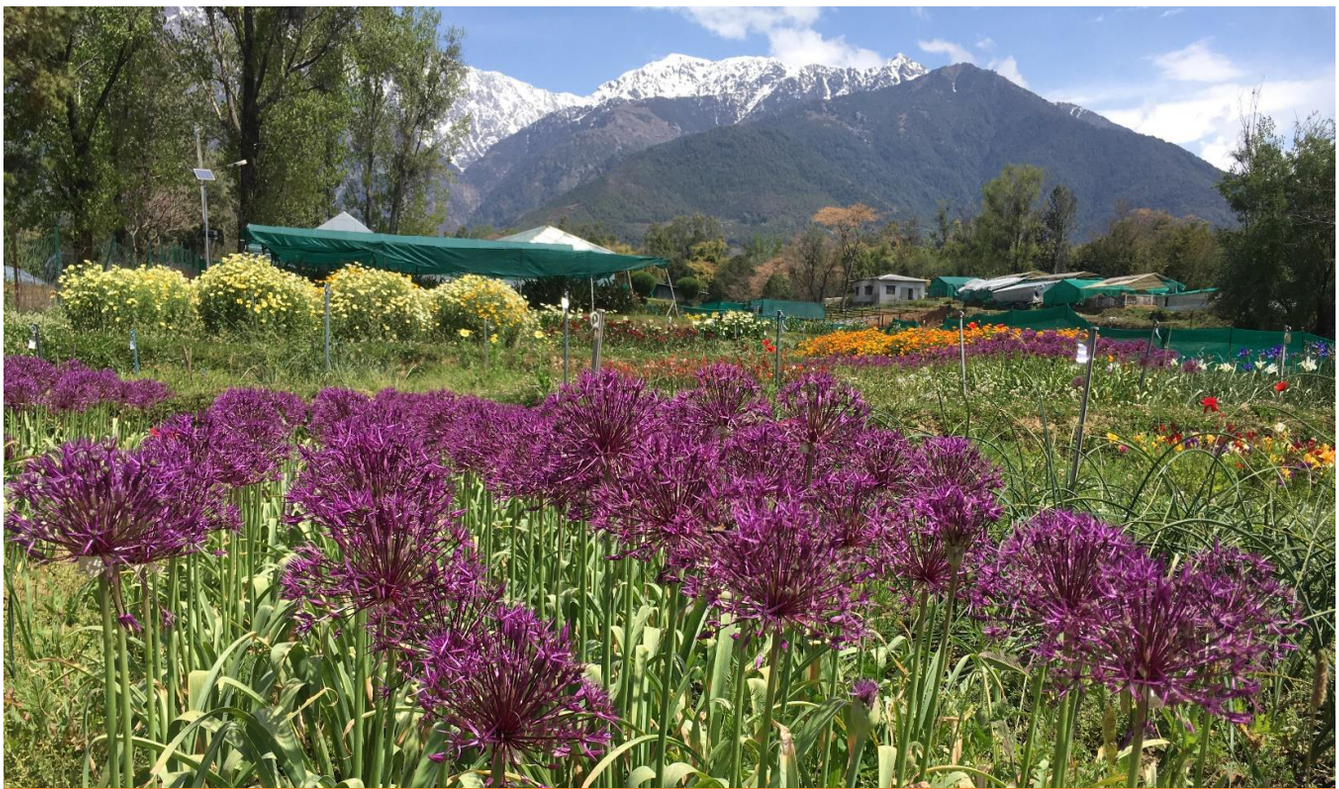
Plantation in field



Flower production



Field view of Marigold plantation



Ornamental Bulbous Plants



Agapanthus

Botanical name: *Agapanthus africanus*

Family: Amaryllidaceae

Origin: Africa

Uses: Landscape plant, pot plant and herbaceous borders

Propagation: Bulb and seeds

Planting time: Spring

Flowering time: July-Sept





Allium

Botanical name: *Allium species*

Family: Amaryllidaceae

Origin: Northern Hemisphere

Uses: Landscape plant and as pot plant

Propagation: Bulb

Planting time: Oct-Nov

Flowering time: March-April

Amaryllis



Botanical name: *Hippeastrum sp.*

Family: Amaryllidaceae

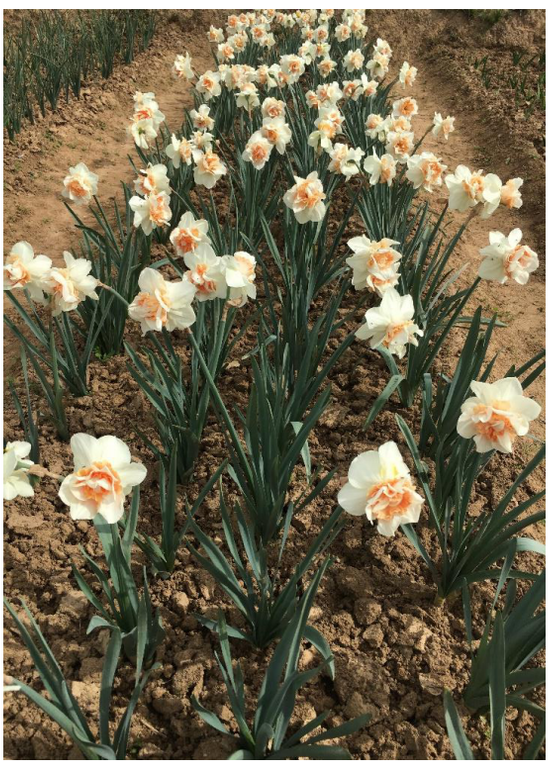
Origin: South Africa

Uses: Suitable for wild garden, shrubberies, on slopes of lands, rockeries and pots

Propagation: Rhizome

Planting time: Sep-Oct

Flowering time: April to June



Daffodil

Botanical name: *Narcissus pseudonarcissus*

Family: Amaryllidaceae

Origin: Northern Hemisphere

Uses: Cut flower and pot plant

Propagation: Bulb

Planting time: Sep-Oct

Flowering time: Dec-April

Day lily



Botanical name: *Hemerocallis fulva*

Family: Amaryllidaceae

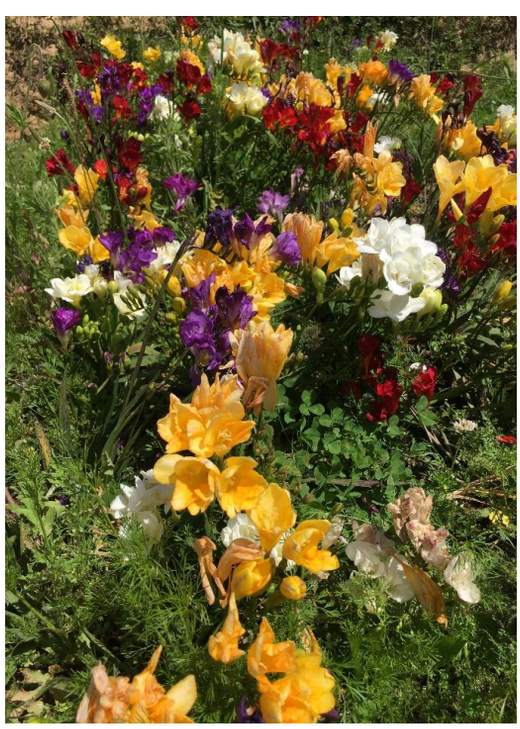
Origin: Asia and Europe

Uses: Bedding plant, pot plant and herbaceous border

Propagation: Division of clumps and seeds

Planting time: March

Flowering time: May-August



Freesia

Botanical name: *Freesia refracta*

Family: Iridaceae

Origin: South Africa

Uses: Pot plant and indoor decoration

Propagation: Corms

Planting time: Sep-Oct

Flowering time: Feb-March

Glory lily



Botanical name: *Gloriosa superba*

Family: Colchicaceae

Origin: India

Uses : Bedding and pot plant

Propagation: Tubers

Planting time: March- April

Flowering time: July- Sep



Hyacinth

Botanical name: *Hycinthus orientalis*

Family: Liliaceae

Origin: Asia Minor

Uses: Bedding and pot plant

Propagation: Bulb

Planting time: Sep-Oct

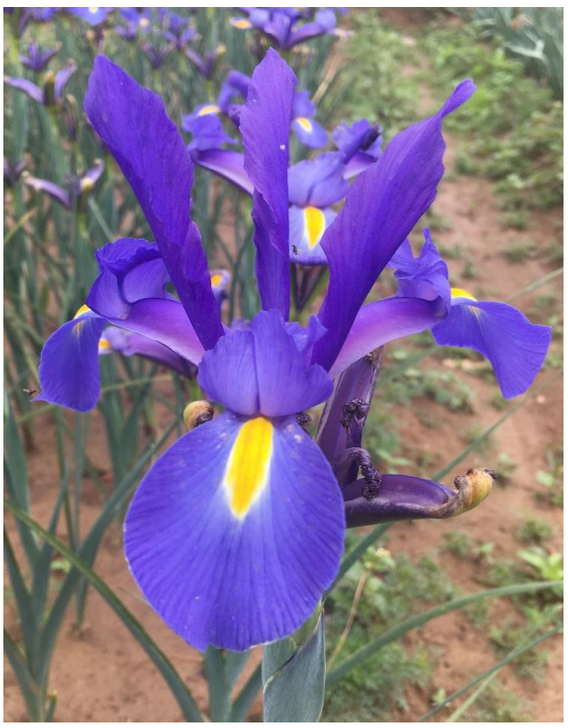
Flowering time: Feb-May

Iris

Botanical name: *Iris reticulata*

Family: Iridaceae

Origin: Himalayas
Uses: Bedding plant and cut flower
Propagation: Rhizomes
Planting time: Sep-Oct
Flowering time: Feb-April





Ixia

Botanical name: *Ixia maculata*

Family: Iridaceae

Origin: South Africa
Uses: Bedding and pot plant
Propagation: Corms
Planting time: Sep-Oct
Flowering time: April-May

Muscari



Botanical name: *Muscari botryoides*

Family: Liliaceae

Origin: South Europe

Uses: Bedding and pot plant

Propagation: Bulb and seed

Planting time: Feb-May

Flowering time: Sep-Oct



Nerine

Botanical name: *Nerine sarniensis*

Family: Amaryllidaceae

Origin: South Africa

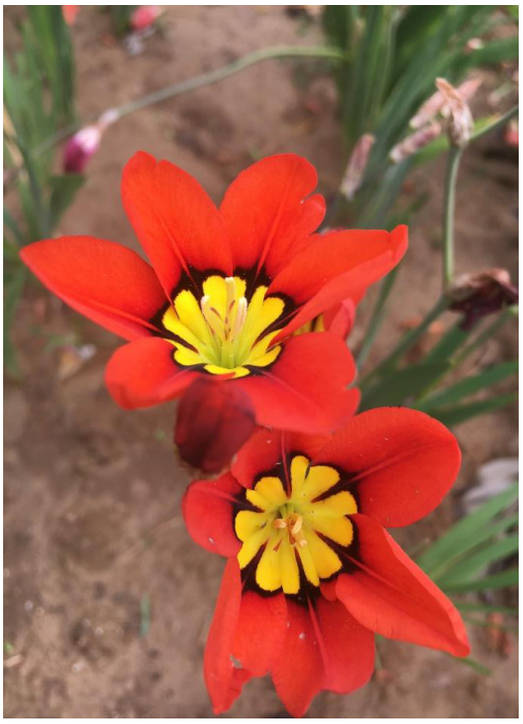
Uses: Pot plant

Propagation: Bulb

Planting time: Nov-Dec

Flowering time: Aug-Oct

Sparaxis



Botanical name: *Sparaxis tricolor*

Family: Iridaceae

Origin: South Africa

Uses: Bedding plant

Propagation: Bulb

Planting time: Sep-Oct

Flowering time: March-April



Zepher lily

Botanical name: *Zephyranthes sp.*

Family: Amaryllidaceae

Origin: South America

Uses: Edging for paths and beds

Propagation: Bulbs

Planting time: Oct-Nov

Flowering time: April-July



ANNUALS



Annuals or seasonal are the group of plants which complete their life cycle (germination, vegetative growth, flowering, seedling and finally death of the plants) under a given site within one season or a year.

Important features of annuals

❖Easily grown plant .

❖Varied growth habit, form, flower- colour, size, shape and season of flowering.

❖Provide mass effect in garden.

❖Cover a place with in a short span of time.

Landscape uses of annuals

❖Specimen plant

❖Fragrant flowers

❖Hanging basket plant

❖Screening

❖Bedding plant

❖Edging

❖Rockery

❖Herbaceous border

❖Border plant

❖For shady areas

Uses of annuals

- Specimen plant : Almost every annual can be grown for this purpose
- Fragrant flowers : Sweet alyssum, sweet william, stock, viola, sweet pea, sweet sultan
- Pot plant : Almost every annual except annual climber
- Hanging basket plants: Daisy, verbena, portulaca, nasturtium, ice plant and sweet alyssum
- Screening : Kochia , hollyhock , sweet pea
- Rockery: Annuals which thrive well and flower profusely in poor soil with less water like verbena, ice plant, nasturtium, phlox, nemesia, stock and vendium
- For shady areas : Salvia, cineraria, clarkia and verbena
- Dry flowers: Acroclinum, helichrysum, statice

Growing and management of annuals

- Seeds are sown in pots, boxes and on raised nursery beds depending upon the quantity of seeds to be sown
- The soil should be well prepared by incorporating well rotten FYM
- Soil should be sterilized by formalin (2%) and covering with polythene.
- Seeds are sown in lines which should be 5-6 cm apart and depth should be about 0.5 cm
- After sowing, seeds should be covered with sieved mixture of FYM and soil
- Watering should be done twice or thrice a day.
- The bed should be covered with news paper or light cloth to ensure darkness which ensures better germination
- The seeds start germinating within 2-3 days and then covering is removed
- It takes about one month to grow the seedlings sufficiently and are ready for transplanting
- Regular weeding and hoeing is essential for the development of these seedlings into healthy plants
- Regular water supply is essential for the successful growing of these annuals

Classification of Annuals according to the growing Season

Summer Season Annuals



These plants grow luxuriantly and produce flowers under high temperature. The seeds are sown in end of February or beginning of March and seedlings are transplanted in end of March-April. Examples are Zinnia, Kochia, Portulaca, Tithonia, Gaillardia, Gomphrena, Sunflower, Cosmos etc.

Rainy season annuals



The seeds are sown in end of May or beginning of June and seedlings are transplanted after one month. For example Balsam, Cock's comb, Gaillardia, Amaranth etc.

Winter annuals



These annuals are able to tolerate low temperature. These are sown in September-December in the plains and during September-November or February-April in hills. For example Ice palnt, Dog flower, Calendula, Daisy, Nasturtium, Phlox, Cornflower, Helichrysum, Petunia, Pansy etc.

Summer and Rainy Season Annuals



Amaranth

Botanical name: *Amaranthus caudatus*

Family: Amaranthaceae

Flower colour: Purple red

Height (cm): 90-135 cm

Remarks: Drooping tail like inflorescence, very good for drying





Balsam

Botanical name: *Impatiens balsamina*

Family: Balsaminaceae

Flower colour: Wide range of colours

Height (cm): 20-60 cm

Remarks: Good for semi shady, sunny areas for pots, beds, borders, rockery in the drained soil.

Blanket Flower

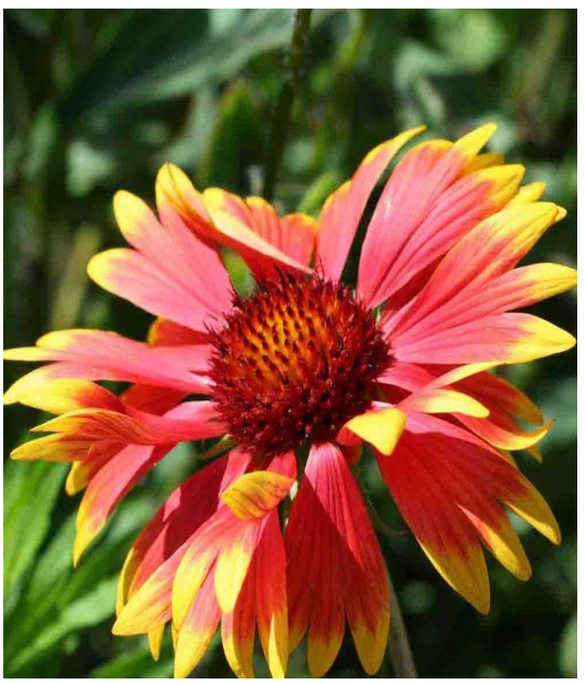
Botanical name: *Gaillardia aristata*

Family: Asteraceae

Flower colour: Wide range of colours

Height (cm): 30-60 cm

Remarks: Good for beds, borders, edge, rockery, pots, and cut flowers.





Cock's comb

Botanical name: *Celosia argentia var. cristata*

Family: Amaranthaceae

Flower colour: Red, Yellow, golden-yellow

Height (cm): 20-80 cm

Remarks: Large crested flower heads like comb, suitable for bedding plant borders and dry flowers.

Portulaca

Botanical name: *Portulaca grandiflora*

Family: Portulacaeae

Flower colour: Wide range of colours

Height (cm): 15-30 cm

Remarks: Annual with drooping succulent branches, good for shady and semi shady areas in hanging baskets and window sills





Summer cypress

Botanical name: *Kochia elegans*

Family: Chenopodiaceae

Flower colour: Valued for beautiful foliage

Height (cm): 40-80 cm

Remarks: Columnar to pyramidal shape, very good light green foliage. Good for pots, beds and borders.

Zinnia

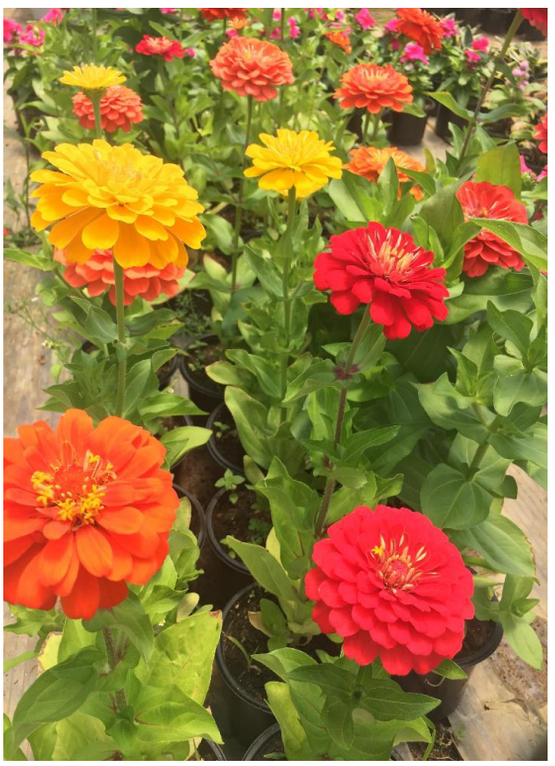
Botanical name: *Zinnia elegans*

Family: Asteraceae

Flower colour: White, yellow, violet, pink, red, liliac

Height (cm): 15-120 cm

Remarks: Flower size larger to small. Good for beds, borders, background and as loose flowers.





Vinca

Winter Season Annuals



Acroclinum/ Paper flower

Botanical name: *Acroclinum roseum*

Family: Asteraceae

Flower colour: White and pink

Height (cm): 40-70 cm

Remarks: Flower are single or double and retain their colour and form on drying.





Ageratum/ Floss flower

Botanical name: *Ageratum houstonianum*

Family: Asteraceae

Flower colour: Blue-mauve

Height (cm): 15-45 cm

Remarks: Suitable for bedding, as cut flower and dry flower.

Annual chrysanthemum

Botanical name: *Chrysanthemum coronarium*

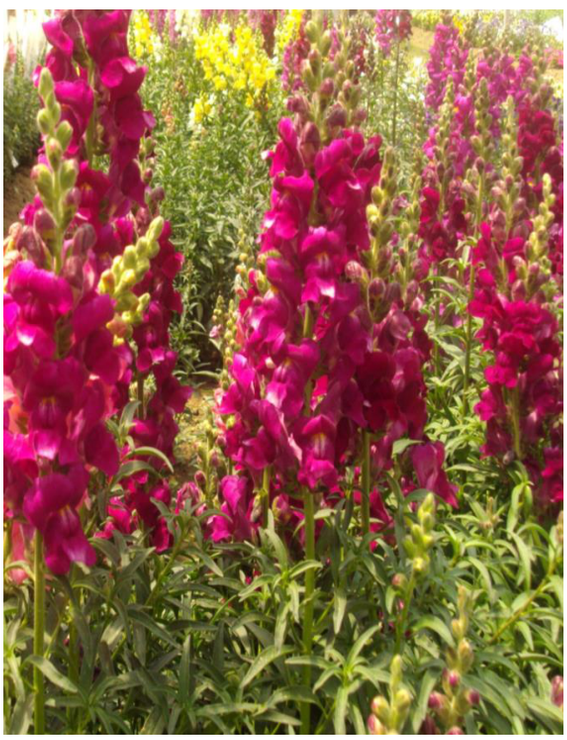
Family: Asteraceae

Flower colour: White, yellow, pink, red, orange, scarlet, mahogany, bronze

Height (cm): 30-100 cm

Remarks: Flowers are single, semi double and double, good for bedding and cut flower purpose.





Antirrhinum/ Dog flower

Botanical name: *Antirrhinum majus*

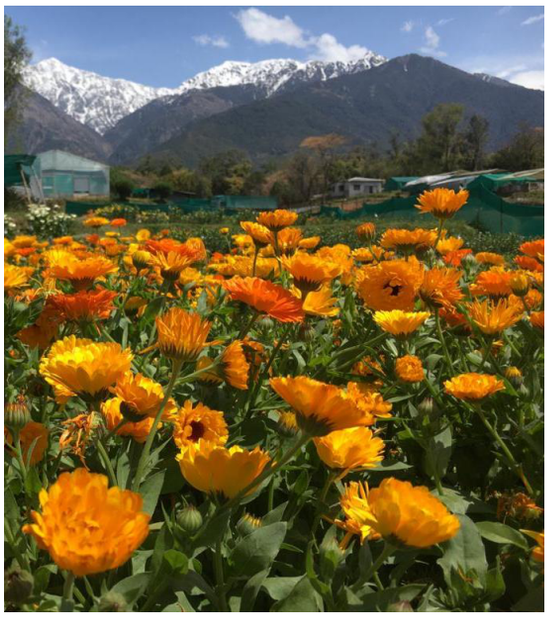
Family: Scrophulariaceae

Flower colour: Wide range of colours

Height (cm): 30-90 cm

Remarks: Very good for bedding, cut flower and pot plant.

Calendula/ Pot marigold



Botanical name: *Calendula officinalis*

Family: Asteraceae

Flower colour: Yellow, golden yellow

Height (cm): 20-50 cm

Remarks: Flowers are single, semi double and double, good for pots, beds and cut flowers.



California poppy

Botanical name: *Eschscholzia californica*

Family: Papaveraceae

Flower colour: Yellow, orange, red, pink, crimson

Height (cm): 30-40 cm

Remarks: Flowers are open cup shaped, single or semi double or double. Suitable for bedding, rockery and pots.

Corn flower



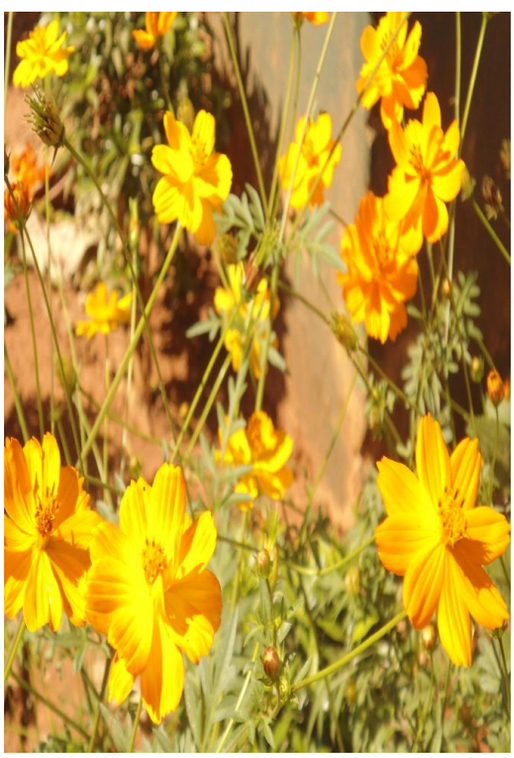
Botanical name: *Centaurea cyanus*

Family: Asteraceae

Flower colour: Blue, white, light pink and maroon

Height (cm): 30-90 cm

Remarks: Good for beds, borders, edging and cut flowers.



Cosmos

Botanical name: *Cosmos bipinnatus*

Family: Asteraceae

Flower colour: White, mauve, purple, rose, crimson etc.

Height (cm): 80-120 cm

Remarks: Fine texture foliage. Good for borders, bedding and background.

Daisy

Botanical name: *Bellis perennis*

Family: Asteraceae

Flower colour: White, pink

Height (cm): 20-30 cm

Remarks: Suitable for bedding, pots, hanging baskets and drying.





Dimorphotheca

Botanical name: *Dimorphothea aurantiaca*

Family: Asteraceae

Flower colour: White, yellow, orange and salmon in colour with dark brown disc

Height (cm): 30-60 cm

Remarks: Good for beds, borders, rockery and pots.

Gazania



Botanical name: *Gazania splendens*

Family: Asteraceae

Flower colour: Red, orange, creamy, yellow, white, brown

Height (cm): 20-30 cm

Remarks: Very good for pots, beds and as cut flower.



Helichrysum/ Straw flower

Botanical name: *Helichrysum bracteatum*

Family: Asteraceae

Flower colour: Red, pink, white, mauve, yellow

Height (cm): 60-90 cm

Remarks: Suitable for beds, borders, and dry flowers

Hollyhock

Botanical name: *Althea rosea*

Family: Malvaceae

Flower colour: Wide array of colous

Height (cm): 100-200 cm

Remarks: Well suited for planting in the back row of herbaceous border or for screening purpose.





Ice plant

Botanical name: *Mesembryanthemum criniflorum*

Family: Aizoaceae

Flower colour: Pink, white, salmon, orange, red, crimson, rose, apricot

Height (cm): 20 cm

Remarks: Very good for pots, edge, hanging baskets, beds in sunny dry areas.

Larkspur

Botanical name: *Delphinium ajacis*

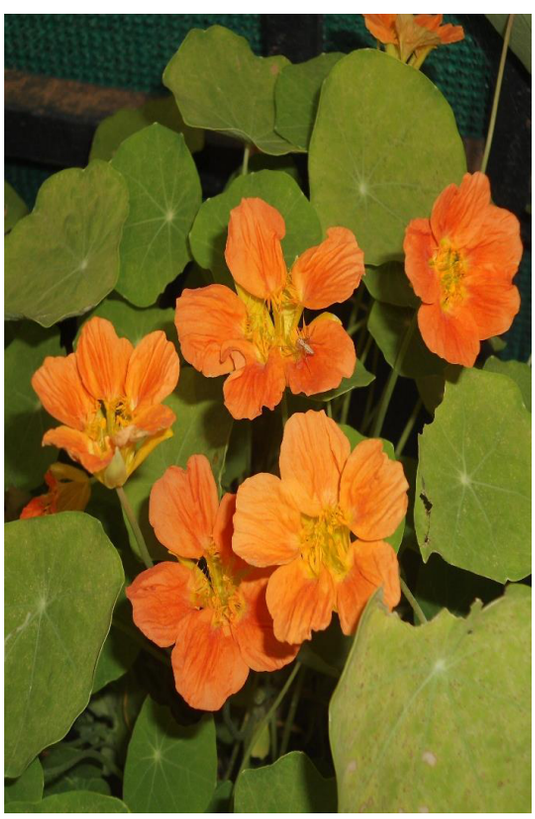
Family: Ranunculaceae

Flower colour: Wide range of colous

Height (cm): 60-120 cm

Remarks: Fine texture dark green foliage. Good for beds, borders, pots and as cut flower.





Nasturtium

Botanical name: *Tropaeolum majus*

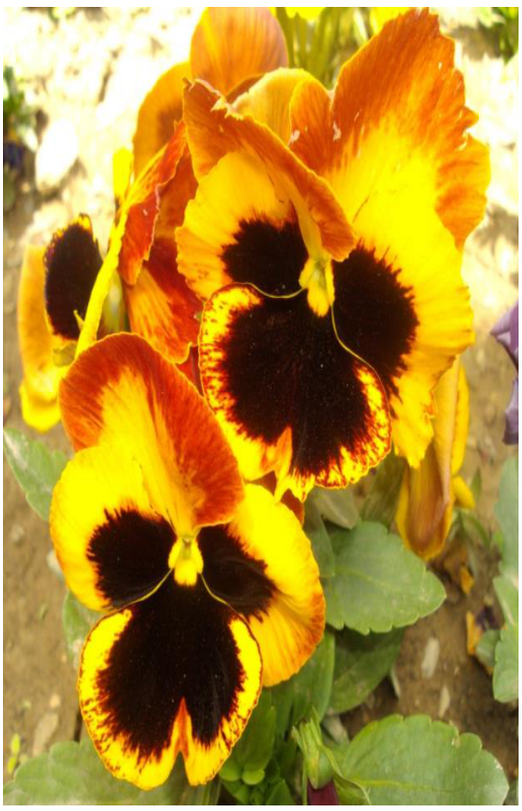
Family: Tropaeolaceae

Flower colour: Yellow, orange, scarlet and crimson

Height (cm): 2 m

Remarks: Trailing plant with single and semi double flowers good for screening, hanging baskets.

Pansy



Botanical name: *Viola* x *wittorckiana*

Family: Violaceae

Flower colour: White, red, deep violet, blue, yellow

Height (cm): 20-30 cm

Remarks: Flowers are sweet scented. It is most ideally suitable for pot, edging, border, rockery, bedding, window boxes.



Petunia

Botanical name: *Petunia hybrida*

Family: Solanaceae

Flower colour: White, cream, yellow, pink, blue, purple mauve, salmon and bicolored with star like patterns.

Height (cm): 30-40 cm

Remarks: Flowers are bell shaped single, semi double and double. Good for pots, beds and borders.

Phlox

Botanical name: *Phlox drummondii*

Family: Polemoniaceae

Flower colour: Wide array of colours

Height (cm): 15-45 cm

Remarks: Suitable for edge, beds, pots, window-sills, rockery in sunny and semi-shady areas.





Salvia

Botanical name: *Salvia splendens*

Family: Labiatae

Flower colour: Red, white, cream and purple

Height (cm): 30-90 cm

Remarks: It is ideally suited for shady situation and corners of the garden. It is an ideal plant for pots, beds and under the trees.

Statice

Botanical name: *Limonium sinuatum*

Family: Plumbaginaceae

Flower colour: Wide range of colours

Height (cm): 60-70 cm

Remarks: Suitable for planting in beds and borders. It is highly suitable as cut flower and can be used as dry flower which can be kept for several years.





Sweet alyssum

Botanical name: *Alyssum maritimum*

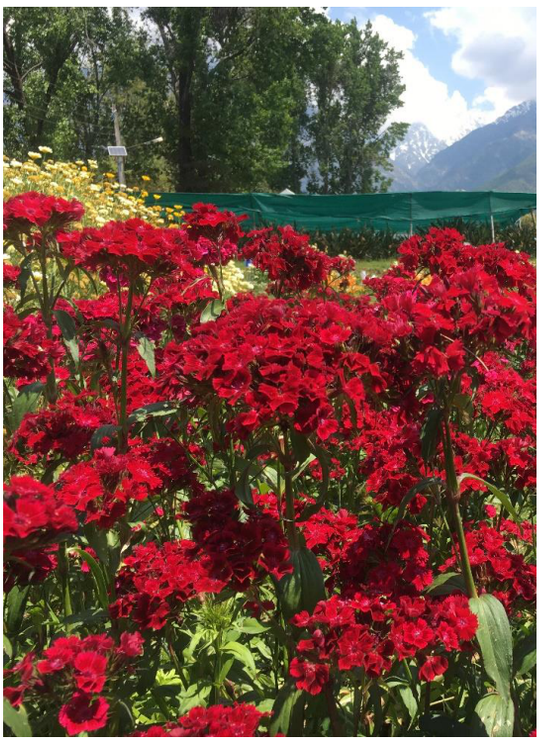
Family: Cruciferae

Flower colour: White, purple, rose and liliac

Height (cm): 20-35 cm

Remarks: It is an excellent flower for edging, pot growing, hanging baskets, beds and window boxes.

Sweet William



Botanical name: *Dianthus barbatus*

Family: Caryophyllaceae

Flower colour: Pink, red, white, purple, scarlet, maroon

Height (cm): 15-45cm

Remarks: Sweet smelling flowers. Good for beds, edge, pots and cut flowers.



Phlox

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परिकल्पना: जैवार्थिकी के उन्नयन हेतु प्रौद्योगिकीय उद्भवता एवं विकास में हिमालयी जैवसंपदा के संपोषणीय उपयोग द्वारा विश्व स्तर पर अग्रणी होना

VISION: To be a global leader on technologies for boosting bioeconomy through sustainable utilization of Himalayan bioresources

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