Climatic Requirements of Major Flowers in Nepalese Context

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PREFACE

Flower cultivation is itself a complicated process. Climate condition, Humidity, Soil content, rainfall, nutrients and many of the aspects affect in plant physiology. The quality of blooming flower in the hand of customer depends on climate, environment along with seed/ seedlings and physical infrastructure. So, farmers involving in the farming of flower need right guidelines.

Floriculture promotion policy 2069 aims to increase the production and productivity of flowers. On the implementation of this policy, FAN (Floriculture Association Nepal) and MoAD (Ministry of Agriculture Development) plan to fulfill the technical need of farmers. This book Climatic Requirements of Major Flowers in Nepalese Context is an integral part of the policy. Basic information of some common flowers of present marketing practices is included on this guide book. This is our first attempt. In coming days FAN will publish further volume and edition.

Collection of technical information is a complicated process. Our expertise tried to have their best. As this is first attempt, there may be some shortcomings. We expect valuable suggestions and comments from technical experts and growers which will be very helpful to correct and moderate on proper direction.

The main object of this publication is collection of technical information and its dissemination. We hope it would fulfill the object to some extent. The goal of FAN and MOAD is production strengthening through right technical feedback which helps to increase internal production and productivity and in long run import substitution and export promotion.

I would like to thank Ministry of Agriculture Development for the implementation of Floriculture Promotion Policy. Likewise; I would like to thank the technical experts for their wide role. Likewise, our special thanks go to Dr. Umed Pun, Dipak Lamichhane, Executive members and other technical persons for their valuable comments and information to finalize the book.

Lok Nath Gaire
President
Floriculture Association Nepal

CONTENTS

1. CLIMATIC REQUIEMENT OF FLOWERS

1.1 Introduction

Climate is the important factor to be considered while selecting the appropriate sites and determining the kinds of flowers that could be grown well in a given location. Among the climatic factors, temperature and frost occurrence, day length and light intensity, wind movement, humidity, rainfall amount and distribution of a given location are all paramount. Of these, winter temperature is a major limitation factor for the plant growth and development including flowering. In addition, the microclimate of the location is equaled important that it might have very localized microclimates as the locations could be somewhat warmer or cooler than the surrounding areas. However, production management factors like soil type, and soil moisture, nutrition and irrigation are also equally important aspects for flower production appropriately.

Plants grow best within a range of optimum temperatures, both cold and hot. That range may be wide or narrow depending on the varieties and species. To thrive, plants need proper amount of light that the partial-shade loving plants might be injured by too much sun. Plants have different requirements for soil moisture, and this might vary seasonally. Plants being hardiness might be injured if soil moisture is too low in late autumn and they enter dormancy while suffering moisture stress. Some plants need short exposure to cold temperature for flowering.

Another important factor for the success is the soil type and preparation. The four elements of good soil are inorganic materials, organic materials, water and air. The ideal soil should have the following composition, containing 50 % pore space, of which half is water and another half is air. The remaining 50 % is about 44 to 46 % inorganic material viz. sand: silt: clay (3:1:1 ratio); and 4 to 6 % organic material. Similarly, plants require appropriate soil pH that most plants do not tolerate a soil with extremes in pH because it affects the release of essential elements to the plants. Bed preparation is a good time to address issues of nutrient and pH adjustments.

Thus, this book has been produced to provide guideline to the flower growers for selecting the appropriate sites or locations based on the climatic requirements of flower species. The information is based on peer review of books, internets, inputs from the farmers' knowledge and experiences, flower expertise.

1.2 Nepal's Geography and Climates

Nepal has a geographic and climatic advantage for growing various flower species during different seasons. Due to the diverse geography of the country, climates vary from hot tropical in the plain terrain to freezing temperate climate in high mountains. As the elevation rises there is a drop in temperature by 1 °C per 150 m altitude.

Nepal climate offers opportunities to produce varieties of flower species of premium quality. However, very few plants can be grown satisfactorily over the entire range of varied growing conditions. It is

therefore, important to know the local climate and which ornamental plant species grow well in the area.

1.2.1 Agro-climatic Zones

Geographically, the country has three agro-climates: tropical plain terai, sub-tropical mid hills and cool temperate high hills. Nepal has also many microclimates that also play a part in determining the kinds of plants that can be grown in the specific landscape. A microclimate is simply the local climate on a small site that is formed by the area's physiographic structures such as hills, valleys, site-facing direction or windbreaks. These features may change airflow patterns, alter day length or light intensities, trap heat during the day, or in other ways modify local climate. Likewise, the site of hills facing north has cooler weather than the slope facing south.

i. Tropical Zone

The whole terai, inner terai and foot hills are categorized as the tropical region in Nepal. The regions at altitude ranges from less than 100 to 1000 m fall under this zone. The climate of this region is characterized as very hot and wet summer; and dry and mild winter. The temperature during summer months exceeds over 39 °C and even higher in some western parts, while the winter temperatures range from 7 to 27 °C (Figure.1). The hot temperature prevails throughout the year except winter period. The annual temperature is 32 °C. There is no frost. The relative humidity remains higher during monsoon season and reaches lower on March-April (Figure-2). The potential regions for growing cut flowers including ornamental plant species in this zone include: Nepalgunj, Rupandehi, Chitwan, Janakpur, Biratnager and Jhapa. The detail of the agro-meteorological records of the tropical centers are given in the Annexes 1, 2 and 3.

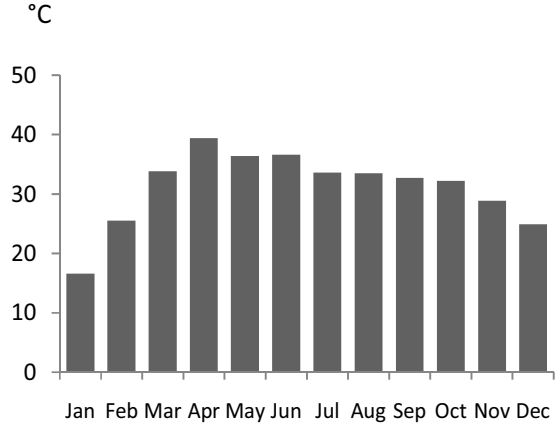


Figure 1 Temperature record in western in terai region

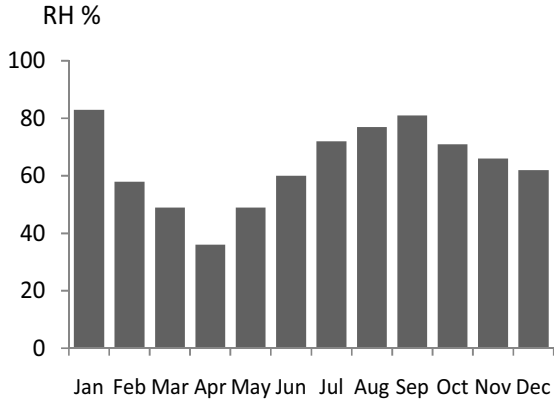


Figure 2 Relative humidity record western terai region

However, the eastern terai is very humid, proceeding hot and dry air towards western terai. The climate of Jhapa, Sunsari and Morang including other districts in the eastern terai are relatively moist and cooler than western region (Figure 3 and 4). Similarly, the weather in the inner terai is also hot, but not as much as terai. During winter a light frost may occur, being cooler in foot hills. In the morning, there is growing occurrence of foggy situation in whole plain terai belt.

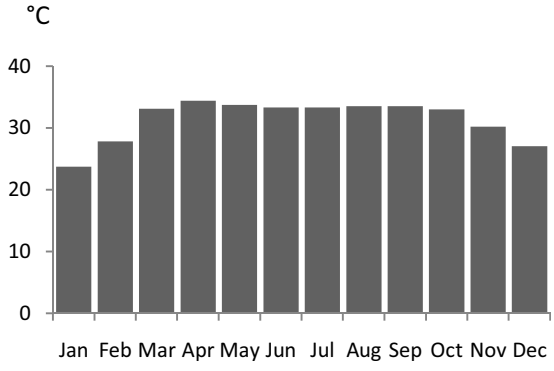


Figure 3 Temperature record in eastern terai region

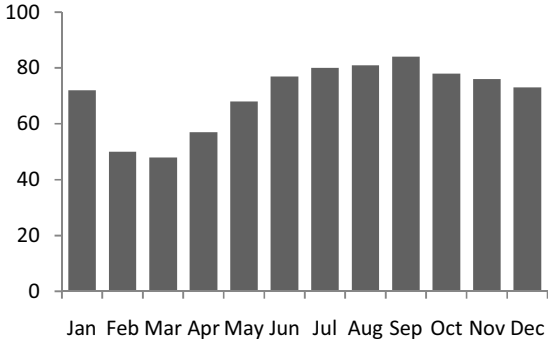


Figure 4 Relative humidity record in eastern terai region

ii. Subtropical Zone

The sub-tropical zone includes whole mid-hills and some low hills, ranging from 1000 m to 1500 m altitude. The region is cooler than the tropical areas. It has distinct summer with humid and moderate temperature and dry winter with mild frosty. The summer temperatures range from 15 to 33 °C with average annual temperature of 21 °C. The average winter temperature is 19.7 °C, while during spring; it is 27.3 °C (Annexes 4, 5, 6, 7, and 8). The temperature starts rising from March and reaches to about 28-30 °C. It is almost stable for medium temperature throughout the monsoon till August (Figure 5).

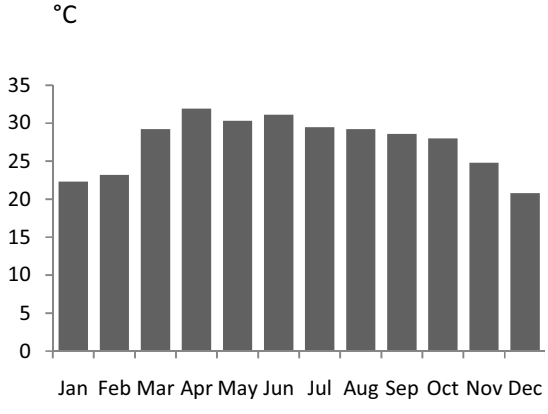


Figure 5 Temperature record in Kathmandu valley

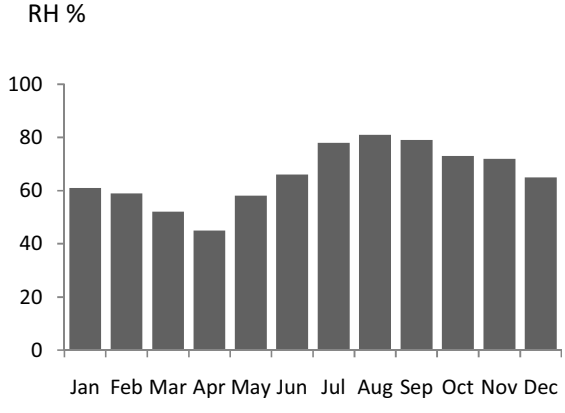


Figure 6 Relative humidity record in Kathmandu valley

The dry period with below 60 % relative humidity prevails during winter. In the Kathmandu valley, the climate is almost mild with moderate humidity throughout the monsoon till October (Figure 6). Similarly, the temperature range in the eastern hills is alike to Kathmandu valley that found not wide fluctuation (Figure 7 and 8).

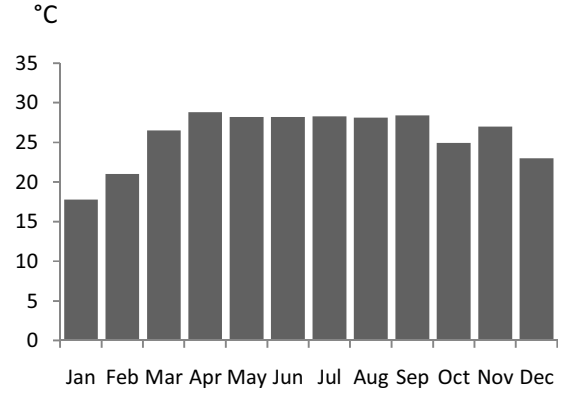


Figure 7 Temperature record in eastern hills

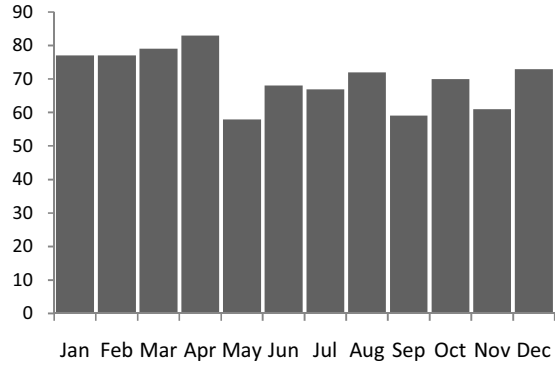


Figure 8 Relative humidity record in eastern hills

There is high potential for growing all kind of flower species in this zone. The most potential regions includes Kathmandu valley including its adjoining districts such as Kavrepalanchowk, Dhading, Makawanpur and Nuwakot in the central region. Similarly, western mid-hills including Pokhara valley and its surrounding districts such as Syangja, Tanahun, and Gorkha have equal potential for floriculture.

iii. Temperate Zone

The high hill regions beyond the sub-tropical zone in the north, the altitude ranging from 1600 to 3000 m fall in the temperature zone. It features with mild temperate summer climate including winter frost. Cold persists throughout the year with an average annual temperature below 15 °C. Snow occurs more often in winter, severe to plant growth and development. However, the summer temperature remains warm with maximum of 22.9 °C and minimum of 15°C (Figure 9 and 10).

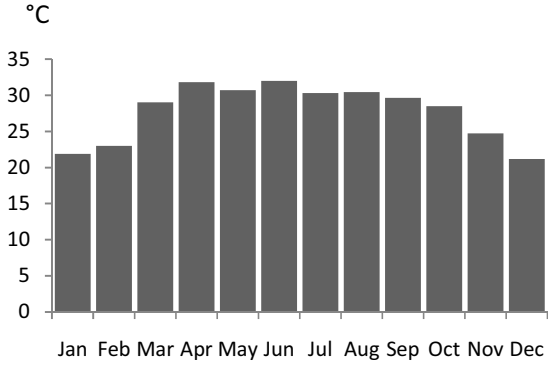


Figure 9 Temperature record in High hills

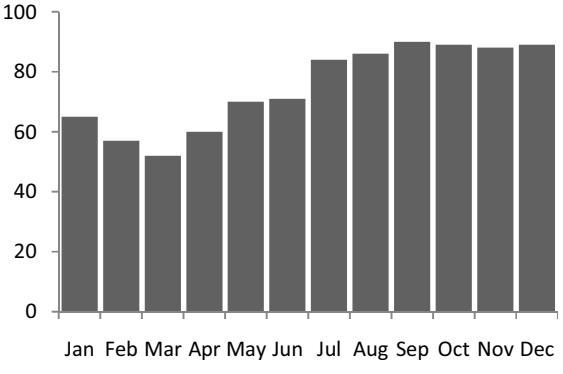


Figure 10 Relative humidity record high hills

1.2.2 Seasons

Nepal has typical four seasons: summer, autumn, winter and spring. The wet summer season starts from June to September that draws moist air from the Indian Ocean, while main monsoon occurs at the same period. Then dry, cool and clear autumn and winter seasons commence from October to February, while the temperature starts decreasing to freezing in high regions.

The hot and dry season still continues till mid-June as spring season begins with increasing temperature from March. From March till pre-monsoon, an intensive water-stress condition prevails when cumulative effects of the long dry season are exacerbated by temperature rising over 30 °C in the tropical regions as well as in some sub-tropical sites. The problem in dry season for flower production is more aggravated by hot wind blowing from west in terai regions.

1.2.3 Rainfall

The rainfall distribution plays a crucial role for maintaining climatic factors, including temperature, humidity and soil temperature and moisture. The monsoon season starts from mid-June as rising temperature; and ends by mid-October, where 80 % of the precipitation occurs. An occasional winter rainfall occurs as mostly in the western parts; during winter season. The average annual rainfall is 1500-2000 mm, but its distribution varies by agro-climatic zones, such as from as little as 160 millimeters in the rain shadow north of the Himalaya to as much as 5500 millimeters in the Pokhara region. The average annual rainfall of major regions during 2010 is mentioned in Figure 11, 12, 13 and 14.

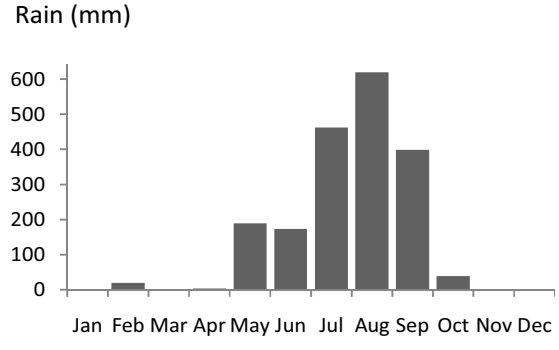


Figure 11. Rainfall in Rupandehi in 2010

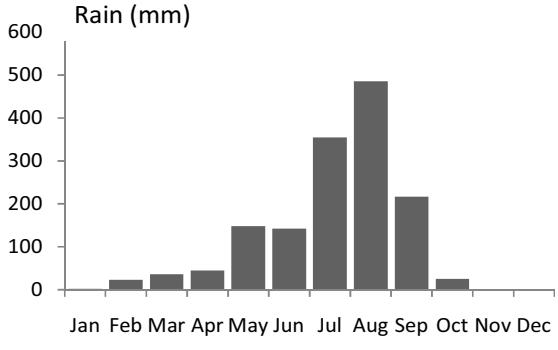


Figure 12. Rainfall in Kathmandu in 2010

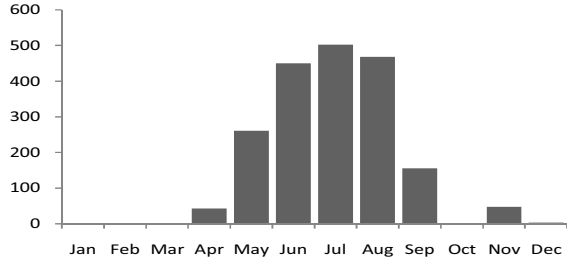


Figure 13 Rainfall in Ilam in 2010

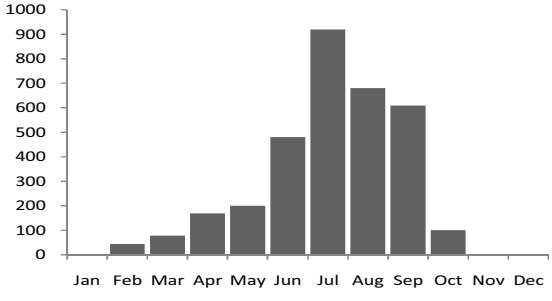


Figure 14 Rainfall in Kakani in 2010

The amount of precipitation distribution occurs heavier over the hills than in the terai, while it is scanty in the Himalayan regions. Similarly, monsoon rainfall occurs earlier and heavier in eastern regions than western parts. The annual rainfall is about 1500-2000 mm in the eastern terai while it is only 1000-1500 mm in the western terai.

Table 1 Average summer and winter agro-meteorology of different regions in Nepal during 2010.

Region	Summer (May-September)				Winter (November-February)			
	Max (°C)	Min (°C)	RH (%)	Rain (mm)	Max (°C)	Min (°C)	RH (%)	Rain (mm)
Kakani	22.9	15.0	90.8	2463	16.3	6.1	86.0	37
Kathmandu	29.7	19.3	72.4	1348.0	22.8	5.2	64.3	285.0
Lilitpur	268	17.9	73.2	1303.0	19.7	4.7	65.5	26.0
Bhaktapur	22.2	15.2	92.4	1584.0	14.1	5.1	64.7	25.0
Dhading	32.5	22.4	84.8	1636.0	24.1	10.1	84.0	9.0
Kavrepalanchowk	26.5	17.4	78.0	972.0	17.5	5.3	75.0	43.0
Makawanpur	32.7	23.3	83.4	2473.0	24.2	9.9	81.2	13.0
Pokhara	30.6	21.2	80.2	2889.0	22.7	9.3	74.7	44.0
Chitwan	34.2	24.9	84.4	2265.0	24.3	10.8	86.2	23.0
Rupandehi	34.5	25.3	67.8	1843.0	23.9	11.1	67.2	20.0
Nepalgunj	35.2	24.8	62.6	1405.0	23.4	10.2	62.0	32.0
Janakpur	34.2	26.1	57.6	877.0	25.6	11.0	82.7	5.0
Biratnagar	32.9	25.5	75.0	1808.0	25.6	11.8	67.2	0.0
Jhapa	33.5	23.8	78.0	2900.0	27.2	10.8	67.8	25.0
Ilam	28.3	19.2	64.0	1388.0	22.4	15.2	70.3	51.0

1.2.4 Soil Types

Nepal has different soil types, varying from Terai to the higher mountains. In Terai, chiefly alluvial clay soil is found, fertile for agriculture and near river areas; it has coarse and highly porous sandy soils. But, mostly the soil is stable and fine textured with higher water table. Inner terai has also various soils including alluvial clay, homogenous sandy soil or mixture of two. Similarly, the sandy gravel and gravel soil are mostly found in churiya that is not fertile soil. There are also various types of soil in the mid-hills. Mostly, the sand mixed colluvial red soil is found across the mid-hill regions. But rocky soil is predominant. The lacustrine soil is found in the Kathmandu valley, which is very fertile for agriculture including flowers. The mountain soil is comprised of boulders, sands and stone.

2. FLOWERS

2.1 Cut flowers

The flowers that cut from the plants becoming ready to use for different purposes are presumed as cut flowers. Most cut flowers are popular choices as gifts on special occasions, either as a single cut flower or as a bunch or a bouquet. A good cut flower should have appeal and beauty; sweet fragrance, long stemmed and extended vase life.

Rose is the most popular, while gladiolus, carnations, gerberas, marigold, orchid, and chrysanthemums have a huge demand in the cut flower markets in Nepal. Likewise, tuberose, lilies, tulips, alstroemerias, anthuriums, and static are among the other major cut flowers. Each cut flower has specific requirements for climate and management for quality production. But, Nepal has endowed with almost all kind of climates from tropical to temperate required for the flowers.

2.2 Flowering Ornamental Plants

Ornamental plants are grown for decorative purposes in gardens and landscape design, as houseplants and specimen display. Most commonly these are grown for the display of aesthetic features including: flower, leaves, scent, overall foliage texture, fruits, and stems of aesthetic forms. Adding plants to home will beautify any interior and increase the amount of oxygen in a room, purifying the air.

The climatic requirement is vital while considering for making appropriate conditions and management for flowering ornamental plants. The major climatic factors to be considered include light condition, humidity and temperature including water and fertilizer requirements. Proper light condition is very important as each plant has its own specification. Watering inappropriately will be the major cause of plant death. Watering regularly until allowing drained out. Most flowering ornamentals planted outdoors need frequent watering as compared to indoor one.

The optimum amount and time of fertilizing is very crucial that the ideal time starts from March to October when plants are actively growing. The amount and type of fertilizer are specific to flower species and condition. The placement and repotting of flowering ornamentals are also important for maintaining them. Transferring to a new pot is best done in spring or early summer. The most important consideration is to ensure a well draining soil, when planting and potting. Avoid placing plants in a draught where large fluctuation occurs in temperature and in a hot spot. For those plants that need humid, improve its level by placing clay granules on the pots or group houseplants together.

2.3 Flowering & Bulbous Houseplants

Flowering houseplants are the most attractive as well as the easiest way to plant flowers in a garden and take care of it. When in full bloom, any bulb garden will result in the most wonderful, attractive sight. Varieties of bulb plants have their own requirements as well as their own specifications. Thus, it is necessary to choose the plant species that are suitable for cultivation in the local environment.

2.4 Cacti:

Cactus is a succulent fascinating ornament plant with over hundred varieties. They are mostly drought tolerant found in dry areas worldwide, storing water in thick leaves. The flowering cacti have showy flower and colors. They require little water and fertilization in general. Cacti prefer well-draining soil, partial sun and cooler night temperature.

2.5 Herbaceous Annuals and Perennials Flowers

2.5.1 Introduction

The herbaceous flowers are featured as single season and/ or multiple season growing flowers, most with a wide range of colors, textures, and forms. They are preferred for mass effect in outdoor garden beds, and they also provide season-long colors in pots and containers. Usually seeding in early spring, plants grow and flower through summer and autumn. However, some tender herbaceous flowers are perennial to nature, grown for their interesting foliage colors or textures. Most herbaceous annuals and perennials are easy to grow if provided the right site and soil preparation; performing best in direct sun and warm weather, while some prefer shade and/or cool climates.

2.5.2 Climate Requirements

Temperature

Herbaceous seasonal flowers are classified as cool-season and warm season plants. Many have both an upper and lower temperature threshold, beyond which they do not thrive. At a smaller scale, microclimatic temperature differences that occur over a site or landscape can have a dramatic impact on the success of plants. The southwest slope exposed to full sun is much warmer than north-facing slope. So, it is advised to match the plants temperature preference to the microclimate for best performance.

Light

Flowers grow and flower best in full sun, thus the amount of sunlight available is a primary consideration for placing plants in the right location. As a general rule, the more sunlight, the more profusely plants will bloom. A plant that prefers full sun might bloom in partial shade, but blooms will be fewer. Similarly, one that blooms well in light shade might have only sporadic blooms in dense shade.

Air Movement

Air circulation is another important environment consideration. When stagnant air pockets occur, foliage will remain damp, encouraging diseases to develop. Good air flow is desirable, but high winds can easily damage seedlings and tender blooms

Soil

Soil type, texture, and condition are as important as light availability. A rich garden soil works best for most flowers. This type of soil holds moisture well and provides a good growing medium. Clay soils tend to crust over or form large cracks as they lose moisture. Sandy soils dry out quickly. To correct too clay, rocky or sandy soils, soil amendments with organic matter or topsoil or replacement will improve plant performance.

Water and drainage

The moisture-holding capacity of the soil and its internal drainage are closely linked to soil type. The ideal soils should have about 45 % mineral matter, 5 % organic matter and 50 % pore space, which should be split evenly between water-filled and air-filled pores. When pore space is too small, the soil lacks oxygen and is said to poorly drained.

Excellent internal soil drainage is important. Plants are more likely to crown rots, root diseases and wilting, under poor drainage. The poor drainage soil can be improved by organic matter. However, external drainage in the growing location is equally important.

2.5.3 Site Selection and Soil Preparation

The crucial thing, while selecting the appropriate site is the available light and soil type. Many need full sun, six or more hours a day. Some do best in the shade. Consider the balance between good air circulation and protection from strong winds. Cold air during winter on high altitudes can kill tender herbaceous.

The planting process begins with soil preparation. The first step is to ensure proper drainage, next is the soil amendment. The prepared bed should have high quality topsoil. Regardless of soil type, amend the existing soil by addition compost, manure or other organic matter. Next add a complete fertilizer. The fertilizer should be high in phosphorus including sulfur. The final step is to till the soil to a depth of at least 12 inches.

Prepare the soil ahead of time. Poor soil can stunt or kill flowers. If site has not been planted before, start improving the soil in the fall before planting flowers the following season. Work in three to six inches of organic matter to improve the soil. This is particularly important to improve drainage in heavy clay soils or improve water-holding capacity in sandy soils. Better test your soil for pH and nutrient levels, and correct accordingly by adding lime to increase pH or adding fertilizer to correct nutrients level.

2.5.4 Planting Options

Herbaceous flowers are grouped into hardy, half hardy and tender based on their responses to low temperature. Hardy annuals, such as snapdragons and calendula, will tolerate frosts. But tender annuals suffer with freezing temperatures during winter. Half-hardy annuals will tolerate mild frost. If growing tender annuals, pay special attention to the winter cold. So, start planting, only when temperatures begin warming since many tender annuals only thrive in warm soils and air temperatures.

2.5.4.1 Growing Nursery Indoors

Growing healthy, vigorous and acclimatized plants should have the objective of nursery entrepreneurs. Sufficient light, temperature and moisture in media are the three important factors for growing nursery plants.

Start seeds in a sterile, light, free-draining seed-starting mix. Use fresh seed, and determine whether or not they require light for germination. Scatter seeds thinly and cover lightly, possibly with vermiculite. Cover containers with plastic and place out of direct sun in a warm spot until seeds germinate. Temperatures between 25 °C and 28 °C are usually adequate. After seeding, water with a fine spray to avoid washing. The bed kept moist with daily light watering until germination is complete.

When seeds begin to germinate, remove plastic and place containers in light. Keep soil moist so plants don't dry out. When seedlings develop two true leaves, thin out to one per cell. In flats, thin to about one plant every 1.5 inches, or transplant to individual cells. Provide new plants with full sunlight for at least 10 hours each day. Most potting mixes have very low fertility, so newly set plants should be watered well and can be given a quicker start by applying a water soluble, high phosphorus starter fertilizer (9-45-15). Harden off plants before transplanting.

Most annuals that need warm soil and air to thrive should be transplanted in early spring. Make sure the plants have been hardened off properly by stepwise acclimatization of plants to outdoor conditions and are ready for the rigors of the garden. If at all possible, choose a cool, cloudy day to transplant. Sun, heat, and wind during transplanting can stress seedlings, causing leaves to wilt and even killing the transplants.

Before transplanting, loosen the soil well and dig a hole large enough to accommodate the root system. It is important to plant most annuals at the same depth at which they were grown in containers. Planting too deep or too shallow stresses the plants. Water plants thoroughly after transplanting. Don't let the soil dry out for the first week or two while the seedlings' roots get established. Check daily to make sure that the soil around the transplants is moist and that the plants aren't wilted. Mulching can help soil retain moisture.

2.5.4.2 Direct Seeding

Many species are easy to plant and grow right in the garden. Before seeding the bedding soil should be kept moist until seeds sprout, then thin to proper spacing. Many annuals self-seed prolifically if flower heads do not remove before they mature. The seeds usually sprout the following year near where the plant grew.

2.5.5 Cultural management

Most herbaceous are relatively easy-care. The regular cultural practices and maintenance tasks include soil preparation, watering, fertilizing, and disbudding to keep plants healthy and blooming.

Soil Preparation

Soil tilled deeply, decomposed manures worked into the soil and turned over properly, a complete fertilizer 5-10-5 works the best, and surface leveled properly, well drained condition.

Watering

A basic irrigation system should be part of the plant during growing season to maintain consistent, optimum moisture levels. Some are drought tolerant; while most others require plenty of water. Thorough watering during growing, but do not over saturate. Soaker hoses and drip irrigation do this best, if overhead irrigation as early in the morning to dry quickly as wet foliage promotes diseases. Allow the soil to become moderately dry before watering again.

Fertilizing

They need fertile, well-drained soil for healthy growth. Thus, it is important to incorporate organic matter when preparing beds. Some soils may also benefit from incorporating granular fertilizer before planting. Slow release sources of nitrogen applied at planting can meet nitrogen needs for the entire season. Regular fertilization with a balanced fertilizer is necessary to keep plants vigorous and blooming. A light application of nitrogen for several times during the growing season would be the best that first application in late April then repeat once or twice depending on the needs of the species. But, applying excess nitrogen is likely to be lush vegetative growth and poor, delayed flowering.

Perennials usually do not require as much fertilizer as annuals. A light application of a balanced fertilizer when begin their spring growth is sufficient for most perennial species. In midsummer, when plants are flowering many annuals benefit from side-dressing of a fertilizer high in nitrogen.

Mulching

Most annuals benefit from applications of organic mulches to retain moisture in the soil and smother weeds. Grass clippings, shredded leaves or bark, compost, and other organic materials also improve the soil as they break down.

Pinching

Some annuals respond well to pinching -- removing the growing tips by pinching off the small, developing leaves at the ends of stems. This forces more lateral growth, making the plant bushier and shorter.

Deadheading

Many annuals benefit from removing flowers once they begin to fade. A weekly walk through the garden deadheading spent blooms will keep many annuals flowering longer and more profusely. Some will stop blooming and die if not deadheaded. A few need to be cut back severely in midseason to encourage a new flush of growth and flowering in late summer and fall. Some annuals readily self-seed. If you want to prevent them from doing so, you need to deadhead faithfully. A few annuals, such as begonias, do not benefit from deadheading.

Plant protection

Most foliar diseases can be problems in poor air circulation and wet condition. Thus, it would be better to keep foliage dry as much as possible by watering in the morning. If root rots and diseases are a problem, avoid over-watering and improve drainage.

Damping off is probably the most serious disease for herbaceous flowers. It spreads quickly and can be carried on soil, tools, and containers. It is necessary to sterile soil and containers before use to prevent such diseases. When infected with diseases, it is advised to prune and destroy diseased parts of the plant as soon as possible.

CUT FLOWERS

ROSE
GLADIOLUS
CARNATION
GERBERA
MARIGOLD
ORCHID
CHRYSANTHEMUM
TUBEROSE
LILIES
ANTHURIUM
STATIC
TULIP
ALSTROMERIA

2.1 Cut Flowers

1. ROSE

Botany

Family: Rosaceae

Genus: Rosa spp.

Woody perennial plants; native to Asia. The queen of flowers, most fascinating and top commercial cut flower in the world. Most delightful fragrant and long lasting flower used for garlands, bouquets, loose and singly cut flowers, flower vase to all garden flowers as a symbol of love.

In Nepal, it ranks first among cut flowers, growing mostly in Kathmandu valley and its adjoining districts. Hybrid Tea type is the most commonly grown rose for cut flower. Most cut roses are hybrids European varieties, grown in plastic houses in temperate climate; while in semi-open condition in warmer climates.

Climate

Typically grow in warm climates, and flower in the summer months. They prefer mild temperate climates that can't stand too hot or too cold. The optimum temperature ranges between 15 °C and 28 °C, however it would be better 15 to 18 °C for night and 20 to 25 °C for day temperatures. Roses are highly versatile group of flowers that thrive in different climates. The commercial European varieties grow well in temperate climate under good winter protection. But, when temperature rises to over 30 °C during summer, it will lead to stress and extreme low humidity levels. Under this situation, it is advised to keep down the temperature as low as possible by opening the ventilation in controlled climatic condition.

The tropical climate of Terai region, enjoying long and hot humid summers would be appropriate for a number of rose species, specifically; China-origin roses thrive well. Most of the modern roses originated from Europe do well in temperate mild climate; however they do not in harsh winter. The regions of prolonging harsh winter frosts are inappropriate for rose that will kill most rose varieties.

Light

Light is important factor for growth as this flower needs full sunlight and good air circulation in growing locations. Roses require about six hours of direct sunlight a day. However, morning sun is more preferable than afternoon that helps to dry the leaves quicker, reducing the potential for disease. Shade in the afternoon is a plus as it helps to prolong flower quality. Too little sun or too much wind exposure can also affect budding. Dry and hot wind damages plant causing water stress. An overly shaded area prevents the plant from producing optimum foliage and flower buds. If they get less light, the plants won't bloom as well and will be more susceptible to attack from pests and diseases.

Rose fails to open in moist, foggy zones, so a clear and dry-sunny weather condition is very much important during flowering. The color development may result in dull with the lack of heat and light.

The humid weather is inappropriate as it attracts many fungal diseases, powdery mildew particularly.

Soil

An ideal soil is fertile loamy, however they grow in a wide range of soils, but a relatively fertile and sufficiently loose with adequate organic matter would be better. They prefer well-drained soil as poorly drained soils and wet feet spell death for roses.

A soil pH of 5.5 - 6.0 is optimum. They need good soil preparation by addition of well rotted manure or compost before planting helps ensure strong growth. Spring is the time to begin soil preparation. The most importantly, soil should be free from nematodes and soil diseases.

Feeding

Roses, especially the repeatedly flowering varieties, need a generous supply of nutrients regularly throughout the growing season. Slow release or organic fertilizers will be the most effective, however foliar spraying are also valuable for a quick effect. Nutrient deficiencies can result in small flowers, fewer buds and overall poor growth. Roses generally need fertilizing in spring after the leaves grow in, then after each blooming flush. Stop feeding the plants about six weeks before frost; otherwise they produce tender new growth that suffers from winter damage.

When creating a rose bed, apply about 2" - 4" of organic matter prior to tilling. Phosphorous is also beneficial for root development and getting well-established. Bone meal is a good organic source of phosphorous and can be added with 40 gram per plant.

Irrigation

Roses need a steady supply of moisture to keep them healthy and blooming. So it is important to water them deeply. This encourages their roots to extend farther down where moisture stays longer. While watering, soaker hose is appropriate not to keep leaves wet that wet condition encourages most diseases, so better to avoid watering with a sprinkler.

However, overwatering or poor drained soils may lead to root disease and nutritional deficiencies. Depending on the time of year, irrigation frequency is scheduled but regular watering is essential to ensure adequate moisture. Mulching with organic matter is a very important part of rose growing that helps to conserve moisture, keeping the ground cool and feeding the microorganisms in the soil.

Hybrid teas are likely to considerable damage during winter frost. They must go completely dormant. To accomplish this, stop fertilizing early enough so growth slows down. No fertilizer should be applied after August till early spring.

Care and management

The basic practices for care and management to grow quality flowers include regular irrigation and fertigation, pruning, bending, removing suckers, controlling pests and diseases, climate control and weeding.

2. GLADIOLUS

Botany

Family: Iridaceae

Genus: Gladiolus species

A perennial bulbous and half-hardy flowering plant; native to South Africa. A popular bulbous cut flower with magnificent inflorescence with florets of dazzling colors, varying forms and sizes that gladiolus is an essential component of most flower arrangements including bouquets. It is also important garden plant and interior decoration.

Second most important cut flower in Nepal has comparative advantage for cost and quality production over India.

Climate

It prefers mild climate and sunny situation for proper growth and flowering, however it can be grown in a wide range of climates from terai to an altitude of 2500 m. But, very hot and too cold conditions are harmful. Optimum growth occurs at temperatures between 10 and 25 °C where night temperature should not be above 16 °C.

However, it can tolerate temperature over 27 °C only if the relative humidity is high and soil moisture levels are optimum. The lower temperature is critical as below 10 °C ceases growth and development that plants cannot tolerate frost.

Light

Sunny conditions, not shady that it requires at least 80 % of total sunlight. Light levels affect flower initiation that from initiation of third leaf until the time of flowering, optimum light is very important. The quality of flower spikes and yield is better in a long-day condition than short-days. The light requirement is of 8 hours a day for most of the varieties.

So, the location of south-east facing with exposing of uninterrupted sunlight is preferable. However, the site should be sheltered from strong winds. Constant humid weather is inappropriate as it attracts many pathogens.

Soil

A deep (at least 30 cm), well-drained clay to sandy loam soil is considered appropriate. However, it can be grown in a wide range of soil varying from light sandy to clay loam soils. A heavy clay soil with poor drainage is inappropriate. For best growth, a slightly acidic soil of about pH 5.5 to 6.5 is suitable where most of the nutrients become available to the plants.

The soil should have adequate water holding capacity. If the soil is light and sandy, adequate amount of organic manure should be applied, whereas sandy soil could be added in case of heavy soils to improve the soil texture.

Fertilization

Application of organic manure is of paramount importance for both flowering and corm development. However, too much manure should be avoided as this leads to make the flower spikes too tall and slender. Manorial dosage of 250 kg of FYM,

1.5:1.4:1.4 kg of NPK, and 120 g of zinc per 100 m2 and is appropriate for fertilizing the gladiolus. Generally, iron deficiency occurs, so iron-chelate application during planting is required.

Irrigation

Before planting, the prepared field should have sufficient moisture; afterward no watering is required till sprouting. The frequency of irrigation should be twice a week during warm months and once a week during winter. Watering should be reduced after flower harvest. Irrigation at least a week before lifting of corm would be done for easy lifting of corms.

Planting and care

Well rested corms of appropriate size to 5 cm planting is generally carried out during spring to summer at 5-6 cm and 10-12 cm deep into the soil. Organic mulching with straw after planting is ideal for keeping the soil moisture and temperature optimum, and conserving the topsoil from erosion, eventually germination and rooting will be improved.

3. CARNATION

Botany

Family: Caryophyllaceae

Genus: Dianthus caryophyllus

Half-hardy perennial, herbaceous plant. This is native to Mediterranean area and is an excellent cut flower in the world, with longer shelf life and multiple uses for cut flowers, single vase, loose flower arrangement and garden edging. It could be grown across the mid-hills cooler, mild and moderate humid climates throughout the year.

In Nepal, getting popular and identified as the exportable cut flowers because of climate suitability for quality production.

Growing condition

Carnation is generally grown in controlled climatic condition. In Nepal, however growing in plastic house is common practice.

Relative humidity:	70-75 % (50-60 %)
Day temperature:	20-25 °C
Night temperature:	10-15 °C
Critical photoperiod:	13 hours

Temperature

Prefer cool weather for better color and stronger stems. It requires cool summers and maximum sunlight during winter for ideal growth. The ideal night temperature which is sensitive for plant growth is between 10 °C and 15 °C.

Calyx splitting is caused by the formation of a large number of petals or by lateral buds inside the calyx at low temperature. The flower bud is most sensitive to low

temperature. Temperature fluctuations at the time of buds open up, may also cause calyx splitting. The carnation is a facultative long day plant, and the effect of temperature on growth and development may be modified by the day length.

Sunlight

The plants require full sunlight, about 4-5 hours every day. Flower initiation occurs when the plants have 18 pairs of leaves and generally flowering happens in summer in long days. Flower bud development is enhanced by high light intensity. There is an interaction between amount of ambient light and number of long-days for flower initiation. A good supply of light is required for high quality flower formation. Extremely high light intensity results in photo-inhibition, pale foliate and flowers. This can be overcome by shading with a screening net. High light intensity increases flower size, number of petals and stem diameter. Low light intensity reduces the number of flowering shoots, flower quality and freshness.

Day length

Carnation is a quantitative long-day plant, so production and development of flower buds are improved under long-day conditions. For quality flower, providing long day condition for about four to six weeks would be appropriate when the shoots have four to seven pairs of leaves.

Soil

The plants thrive best in porous, well-drained soils which will provide enough oxygen at root level. They prefer sandy soils with some addition of well-decomposed manure or peat. The optimum soil depth is 1 m and a pH of between 5.5 and 6.5 is required.

Peat is an excellent organic matter for growing carnation. Pulverized and decomposed pine bark and well-rotted FYM also serve as good manure. Soil sterilization by solarization with formalin treatment and or white plastic coverage would be the best. A soil rich in manure or well-fed with nitrogen is not suited to the carnation. It may cause heavy vegetative growth, fewer blooms or even lead to the calyx splitting.

Irrigation

Carnation does not require much water, except in the hot months. Growers must be careful not to make the soil too wet by splashing. The foliage of the plants must be kept free from getting moist. The best irrigation system is a drip system which will keep the foliage and flowers dry. Drip system with drippers at 30 cm spacing (5-6 L/m2/day).

An overhead irrigation system can be used only until the flower buds are visible. Insufficient water will result in poor-quality blooms.

Mulching should not be done for carnation. Sufficient air circulation around the stems is very necessary for appropriate growth.

Nutrition:

Manuring as basal:

Oil seed cake	: 250 g/m2
Phosphorus	: 50 g/m2

Magnesium sulphate : 55 g/m2

Top dressing:

Calcium Ammonium Nitrate and MOP at 5:3 ratios: 2.5 g/plant/month

The following fertigation schedule can be adopted for intensive production under polyhouse conditions.

Nutrients	Quantity (g/m2/week)	
	Till bud formation	Bud formation to harvest
Tank-A (Monday and Thursday)		
Ammonium Nitrate	3.0	2.0
19:19:19	3.0	2.0
Magnesium Sulphate	2.5	2.5
Boron	1.0	1.0
Trace elements	1.0	1.0
Tank – B (Tuesday and Friday)		
Potassium Nitrate	5.0	5.0
Calcium Nitrate	8.0	9.0

4. GERBERA

Botany

Family: Asteraceae

Genus: Gerbera

Gerbera is a tender herbaceous perennial plant, growing in clumps with solitary flower heads on a long slender stems above the foliage; native to south America, Africa and Asia. A very popular and widely used decorative garden plant and/or cut flower. The domesticated cultivars are mostly hybrid, G. hybrid crossed between G. jamesonii and G. viridifolia.

This is most fascinating cut flower in Nepal, increasing demand domestically that its production is concentrated at Kathmandu valley and its surroundings in controlled and semi-controlled climatic condition.

Temperature The ideal temperatures for growth and development are 15 °C to 18 °C at night and 24 °C during the day. The plants cannot tolerate high temperatures over 32 °C, and low temperatures of 15 °C. The night temperature should be too high, to stimulate bud induction.

Moisture The plants should be watered in the early morning to allow them to dry off before the cool night to discourage disease infection.

Humidity During winter, and in dark and cool periods with high humidity in the greenhouse,

Botrytis can be a serious problem. So, the humidity must be kept below 70 % during the day and below 85 % at night.

Light

Light shade is required to reduce excessive green house temperatures during summer. The plants for flowering require short days, while flowering is delayed during long days. To get more vegetative growth before flowering the photoperiod should be increased with supplemental lights.

Soil and fertilization

Soil selection is very important for gerbera. It prefers highly porous and well-drained sandy soils amended with organic matter for nutrient and water retention. Shallow and compacted soils are not preferred. The pH should be kept optimum at 5.5 to 6.5 to get maximum efficiency for nutrients absorption. During winter, soil temperature should be kept warm between 18 °C and 20 °C.

Soil disinfection by solarization with plastic and or formalin treatment is absolutely necessary. Pre-planting application of lime at a rate of 150 g/ m2 with organic manure or peat including neemcake at a rate of 1 kg/ m2 would be better to improve fertility and the texture of the soil. However, the growing media should have an appropriate composition of soil, sand and organic matter at 55%, 15 % and 30 % respectively. The media mixing with rice husk at 4 kg / m2 is preferable.

5. MARIGOLD

Botany

Family: Asteraceae

Genus: Tagetes erecta

African marigold

Annual or perennial herbaceous plant, native to Maxico and Central America. Commercially important flower for cut flower, garlands, essential oils and medicinal values. Easy cultivation and excellent keeping quality and extensively used in religious and social functions in Nepal. This flower is grown commercially in Nepal.

Climate

Marigold has wide adaptability to various soils and climates. The congenial condition for marigold is those areas where summer is not very hot and winter not too severe. It requires mild climate for luxuriant growth and flowering. The optimum temperature is 13-18 °C at night and 18-23 °C at day. High temperature causes growth cease so flower production is affected adversely and flower size is also reduced to a great extent. On the other side, plants are damaged by frost during severe winter.

The environmental conditions after transplanting markedly influence the growth and flowering. Mild weather of 14.5 °C to 28 °C during growing period greatly improves flowering. Botrytis ruins the blooms during humid weather.

Light — African varieties are short-days plant that they do not bloom well until mid-summer. They grow best on full sunlight that at least 6 hours of direct sun each day is necessary, while blooms will become sparse under less light.

Soil — Can be grown in a wide variety of soils. However, a deep, less fertile sandy loam soil having good water holding capacity and well-drained is desirable. The soil pH for the plant is better to have neutral of 7.0 to 7.5

Fertilization — They do not require much fertilizer. Better to use single application of organic fertilizer early in the growing season. Besides, boron and calcium applications are essential to increase flowering and quality production respectively.

Irrigation — Requires sufficient amount of moisture during growing and flowering period. Moisture stress at any stage of growth affects adversely normal growth and flowering.

6. ORCHID

Botany

Family: Orchidaceae

Genus: many genus and species

Excellent cut flowers, having all kinds of shapes, sizes and colors with long lasting quality. Now, it is gaining commercial importance as a cut flower or potted plants in Nepal.

The main genus of commercially cultivated in Nepal is Cymbidium, sympodial type as showy plants blooming during the winter. Basically hybrid varieties are popular.

Climatic — Orchids are found growing from the tropics to the temperate climates. The climate of Kathmandu valley is considered appropriate for growing of export quality flower.

Sub-tropical climates that warm, sunny days and cool night (12-15 °C) are perfect for cymbidium. It prefers cool climate that optimum summer temperature of 30 °C and minimum winter temperature of 5 °C. It can be grown in pots under greenhouses with protection with agro-net during winter and net plus plastic sheet coverage during rainy period.

It is grown outside during the spring, summer and fall, and it has to be moved inside the screen house at the first threat of frost.

Without lots of daytime sun and cool evening temperature (12-15 °C), it is hard to bloom. Cymbidiums are considerably more cold tolerant than other species. The larger plants need an extended period of cold to provoke a bloom, while the miniatures are not quite dependent on cold weather to bloom. It can withstand freezing temperatures, although frost will kill them. Night down to 5 °C is fine. On

the other side, it can also withstand considerable summer heat.

Light	It requires lots of bright indirect light to flower, preferably few hours of morning sun and shady afternoon. Faster growth and good quality plants can be obtained by extending the day-length to 18 hours. During the growing season, it prefers dappled sunlight, or about 50 % shade. They can be moved outdoors in the summer, providing they are not put into direct sunlight. If the plants are growing indoors, southeast or east window is preferable.
Water	It needs copious water during the growing season (spring, summer and fall) that the purer the water, the better the plants. During winter bloom, it requires less water. Over-watering kills plant, so watering should be done thoroughly by drenching the plant and then allow the excess water to quickly drain out. The top 50 % of the soil should be dry out before watering again. Better to keep plant optimum moisture, avoid over and under-watering. Soil type, temperature, month, humidity and pot size all influence watering needs.
Potting media	The growing medium must be a special soil or potting medium of porous and drainable. The usual medium contains a proper combination of peat moss, bark, compost, and wood pieces including litters. Most growers recommend pine bark, perlite, peat moss, and other loose organic materials like leaf litter in some combination.
Fertilization	During active growing season outside, it needs heavy feeding regularly with 20:20:20 at rate of 56 g per 380 L water. Bimonthly application of orchid fertilizer is needed or if available better to use of slow-release pellets at the beginning of the season. High nitrogen fertilizer will cause rapid foliage growth at the expense of the bloom. When plants are moved indoors in the fall, stop all nutrients. Never feed an orchid while blooming; this may discourage the plant from flowering or distort the flowers. Fertilize only when the plant is actively producing new leaves.
Flowering	The cymbidium blooms in the winter when night temperature starts declining to about 10 C and night period becomes longer. Besides, the reduced water supply triggers blooming also. The miniature types require cold weather to bloom.
Pruning	Once the flowers die, cut the spike off from the bottom. If the entire stalk turns yellow, it is time to prune the orchid back to about an inch from where the stalk originated on the main stem. Pruning helps the plant produce more flowers during the next season.
Resting period	Cymbidium appreciates a resting period; so once a year moves your orchid to a cool dark area for a month. After it has rested return it to its usual bright location. This helps increase the number of blooms. It will also tolerate cooler positions out of full sun in a north – or east facing room.

7. CHRYSANTHEMUM

Botany

Family: Asteraceae

Genus: Chrysanthemum indicum

Chrysanthemums are both annual and perennial herbaceous and sometimes partly woody. It was originated from China and has large number of cultivars varied in growth habit, size, color and shape of blooms, ranging from tall to dwarf varieties for cut flower and pot planting. These are categorized as standard and spray type depending on their branching habit.

Light

It requires full sunlight all day, five to six hours light for healthy plant growth. When they are grown under shade the plants tend to grow taller, have weaker stems and small flowers, and bloom later in the fall. Most cultivars are short-day plant, which require short days or long night to flower. Under long-day conditions, they tend to remain vegetative and they naturally flower in autumn and winter.

Temperature

Night temperature of 15 °C to 20 °C during the early days of bud formation is highly desirable as the bud becomes visible, while day temperature of between 20 °C and 28 °C. High temperatures may cause wilting of the plants, delay the production schedule, reduce floral quality, and cause some buds not to open at all. While, low temperature during bud initiation and vegetative growth may delay flowering and budding and result in dwarf plants. Low night temperature during the flowering period may lead to fluctuate in color development.

Soil

This flower requires well-drained, sandy loam of good texture and aeration because of its shallow root system. Poorly drained soils may cause soil-borne diseases during the wet summer periods.

For best growth, the soil should be neutral or slightly acidic with a pH of 6.5 to 7.0. Very light, sandy soils are not recommended because of their poor moisture-holding capacity.

Irrigation

The plants require less water during the growth period, but must be ensured not to exist stress condition. And water supply should be reduced as the plants approach the flowering stage. Both drought and waterlogged conditions should be avoided as these conditions may lead to stunted growth.

8. TUBEROSE

Botany

Family: Asparagaceae

Genus: Polianthes tuberosa

Tuberose is a herbaceous perennial bulbous fragrance flower and high position for cut-flower trade and essential oil industry. Half-hardy plants as bulbous are made up of scales and leaf bases. Roots are adventitious and shallow.

The flower spikes with numerous white blooms in summer and autumn. Mexican origin ideally suited to warm weather, sun, heat and time. Suitable for both open gardens and containers as indoors.

Temperature	Sunny, hot areas with light shade during the hottest part of the day are preferable. The optimum temperate ranges 21 to 24 °C as growth diminishes at lower temperature of below 15 °C. Warm climate plants, but can tolerate some frost if mulched. Plants undergo dormant during winter. For areas that reach summer temperature as high as 35 °C, partial shade during the hottest part of the day is considered appropriate for tuberose.
Light	Bright light, with at least five to six hours of sunlight each day, but shading during the hottest part of the day.
Soil	Prefers fertile and well-drained moist soil. If poorly drained soil, amend with organic material, peat moss, compost or decomposed manure. Also applying compost during planting to increase the nutrient contexts and drainage of the soil.
Fertilizer	Generous feed during active growth period. Start feeding once first growth appears and then once every month. The plants are heavy feeders and appreciate application of 8-8-8 fertilizer while they are actively growing. Mulching with organic materials would be helpful for conserving moisture and nutrients to the plants.
Irrigation	It requires deep watering from growth starting throughout the growing season, preferably on weekly basis depending on the season. Do not overwater as plant bulbs easily get rot. Gradually reduce the watering when commencing winter and the foliage starts to yellow and stop it over dormant period.
Culture	Grow from tuberous bulbs that have clumps of multiple bulbs. Plant the entire clump with 2-3 "of soil above the top. The growing period takes four to five months of warm weather and abundant moisture to bloom. Tuberose flower in mid to late summer. After blooming has finished for the season, leave the foliage in place; do not cut it off. The leaves will gather sunlight and

provide nourishment for next year.

Leaves may be removed late in the season, when they yellow. Your tuberose will rest for a few months before beginning the next growing cycle. From about one month before winter reduce watering to prepare the bulb for dormant. Lifting the bulbs for next season can be and put in air and shade for several days, then place in cool and dry storage.

Cut off the foliage once it yellows and dies back in early autumn as the plant is going to dormant during the winter. After planting, water generously to settle the soil around the bulbs. Roots and top growth will form within a few weeks.

9. LILIES

Botany
Family: Liliaceae
Genus: Lilium
Species: lancifolium

Tiger lily, Native to china, Japan, and Korea. True lilies are perennial plants that grow from scaly bulbs. Fragrant, especially white lilies. Grown in gardens as houseplants or in containers. The bulbs are usually planted in the fall or spring, blooming in the summer.

Climates — They thrive in a diverse climates and soil conditions, but require lots of sun and excellent drainage. Thrive in full sun, but they will tolerate light shade. They are hardy and can tolerate the heat. If planted in a location that is shaded during the hottest portion of the day, the flowers will remain fresher.

Temperature — Besides the absolute extremes of hot and cold, lilies can withstand large range of temperature, from 15 °C to 22 °C. Tropical regions can be a problem since lilies need a cold season that drops below 18 °C for at least eight weeks. This dormant season enables them to store up nutrients and energy to produce their next round of blooms. The ideal location should have direct sun all morning during the summer, with partial shade during hot afternoon.

Light — At least six hours of full sunlight daily is the basic requirement of lily for producing vibrant colorful flowers. Otherwise, the plants produce long and thin stems causing weak flowers under shade or less-than full sun. The plants require high relative humidity of 80-85 % that the fluctuation in humidity levels can cause stress and leaf scorch.

Soil — They prefer slightly acidic soil, rich in organic materials and well-drained. Lilies are highly susceptible to fungal growth on leaves, stems and roots, so the soil must be quick to drain. However, while planting soil must have sufficient moisture. So

organic compost, manure or peat moss must be added on raised bed. A cool, porous and well-drained soil is essential for the good growth of lilies.

Planting

Planting is generally done in early spring, to ensure a good spring and summer bloom. Planting in moist, well-drained loamy soil in full sun in the spring, while bulb division for propagation can be done in the fall. Because lilies do best when their roots are kept cool and moist, plant them next to shrubs or other plants that can give them some shade. It is also good idea to mulch around the lilies to keep the soil moist and cool.

Watering and feeding

After planting soil should be adequate moisture by regular irrigation as it does not require daily watering, but when watering, be sure to water deep enough to reach the bulb.

Feed the plants with balanced fertilizer every few weeks during the growing season. Avoid high-nitrogen fertilizers.

Mulches and care

As the soil becomes warm during late spring, apply organic mulch around the plant root zones to conserve the soil moisture and keep the soil cooler against too hot during the summer.

Remove stems and foliage when leaves become yellow. The mulch should be removed in late fall. Remove spent flowers to encourage new blooms.

10. ANTHURIUM

Botany

Family: Araceae

Genus: Anthurium

Species: andreanum

A herbaceous plant growing as epiphytes on other plants, some are terrestrial; native to the Americas. Originated from South America is a plant produces beautifully colored spathe and a tail like spike. The diversity in varieties has been greatly increased in recent years through breeding and selection, currently more than 100 commercial varieties.

Temperature

The ideal day temperatures of 25 °C to 32 °C and night temperature of 21 °C to 24 °C. A high temperature will results in drying of the foliage and flowers and finally ends with the fading of the plant. Night temperature of between 4 °C to 10 °C can result in slow growth and yellowing of lower leaves, and even will kill the plant. It is also be affected by temperature above 32 °C.

It prefers bright shaded light as direct sun can burn the plant. If the light intensity

is too low, the plant won't flower and the leaves will become distorted. Windbreak with some dwarf species trees in the growing site would be beneficial.

Soil — Prefers well-drained and coarse-textured as well as more organic soil that has good water holding capacity and good drainage. It can withstand sandy loam to clay soils. Peat moss, coconut husk, brick pieces, pine bark and perlite are better to use along the soil as growing medium. Mulching is needed that plant roots grow into the mulch and spread.

Fertilization — The plants should be fertilized every other month. Liquid fertilizer would be better for use throughout the growing period. A light solution of a 3:1:2 fertilizer ratios should be used and it is probably best to dilute to ¼ strength.

Irrigation — Soil should be kept moist at all times, but not drenched. Plants should be irrigated thoroughly, but it should be allowed to dry slightly between irrigation times. Over irrigation should be avoided as it may cause root damage and yellowing. Too much drying of the plant will cease the plant growth and burns the tip of the plant. It prefers a winter rest at 15 °C for about 6 weeks with little water. It helps plant to bloom profusely in the next season.

11. STATICE

Botany
Family: Plumbaginaceae
Genus: Limonium
Species: sinnuatum

One of the most popular dried flowers. It has bluish purple bloom in summer, however, whites, yellow, pinks violet and orange color available. Annuals with sturdy stems and compact, colorful blooms, also excellent for dried flower arrangements. Long lasting in the vase. Special uses for fresh cut flower and dried fillers. For dried flowers- cut the flowers when in full bloom. Blooms occur in mid to late summer.

Temperature — The plants prefer warm weather and slightly dry conditions. They are hardiness to winter low temperature as well as very drought tolerant, tender perennial as they thrive in hot, sunny spots.

Light — Full sun spring outdoors planting.

Soil — Thrives in rich sandy soil as plants need well-drainage as the plants can tolerate drought soil.

Propagation — By seed- seeding outdoors or preferably indoors 8 to 10 weeks before the spring starts. Start seeding indoors, two months before the last winter for earlier bloom.

Fertilization — Need compost generously at planting time. Low maintenance plant, light fertilizer in early spring. Feed again in mid-August with a good 10-10-10 fertilizer.

Plant care and Irrigation — Plant care needs minimal practice once the plant is established. When planted outside the plant needs only occasional watering and pinching back as needed. Overwatering should be avoided.

12. TULIP

Plant Details
Family: Liliaceae
Genus: Tulipa
Species: gensneriana

This is a bulbous perennial flower, ideal for bedding plants as well as containers. Most varieties are excellent for cut flowers. Some varieties can be naturalized in grass. Flowering from early spring through early summer. Although the plants are perennials, new planting is to be done each year for better production.

Grow best in fertile, well-drained soil in full sun, sheltered from strong winds. The plants dislike excessively wet conditions.

Flowering time: usually March to May
Planting time: August to September
Height: varies from 15 cm to 75 cm spread 15 cm
Aspect: full sun
Hardiness: fully hardy

Climates — The flower grows best in areas with dry summers and cold winters. However, plants prefer full sun and shading during hot period of the day. A high temperature can ruin the tulip bulb. It requires a period of cold while they are dormant.

Soil — Neutral to slightly acidic, fertile, and dry or sandy soil is appropriate. Better to incorporate organic matter into the soil to improve soils, making much more suitable for tulip cultivation. Apply manure before planting.

Watering — Plants dislike excessive moisture that rainy summer and wet soil are deleterious to tulip, so need moderate watering during summer. While over watering causes bulb rotting due to fungal disease growth.

Planting — Most bedding type tulips are best re-planted each year in early autumn. If left in the ground they are unlikely to re-flower. For the propagation of new tulip bulbs, flower should be cut and leave the stem and the leaves to dry off, three weeks after blooming. After one and half month, collect the bulbs and keep in a cool, dry place.

13. ALSTROEMERIA

Botany

Family: Alstroemeriaceae

Genus: Alstroemeria

Species: species

Plant details

Common known as Peruvian lily, is a fleshy rooted herbaceous perennial forming spreading clumps of erect stems bearing narrowly lance-shaped leaves, with umbels of showy funnel-shaped flowers in summer. Delicate blooms, stem length varies from 40 cm to 1 m with terminal umbels of light orange flowers. Use with elegant flowers, flower vase, arrangement, Alstromeria has a long cut flower and last longer.

Plants grown from a cluster of tubers (Rhizomes) that need cool temperature exposure to induce flowering.

Climate	Most cultivars will bloom in the late spring and early summer. The roots are hardy to a temperature of -5 °C. The plant requires at least six hours of sunlight. The plants can stay outdoors during the winter with protecting with organic mulches.
Light	Location receiving full day sunlight or partial shade is suitable for growing Alstroemeria.
Soil	This flower should grow in fertile, moist but well-drained soils as addition of organic matter, compost, peat moss and 2-3 inches raised-beds could be done to improve the drainage.
Water	Regular watering is necessary, but it should be light.
Care	Young plants best left undisturbed to form clumps, mulch for the first two winters. Pull stems up after flowering, leaving tubers in ground. Propagate by division in autumn or very early spring.

FLOWERING ORNAMENTAL PLANTS

AZALEA POINSETTIA GARDENIA BOUGAINVILLEA HYDRANGEA

1. AZALEAS: Rhododendron simsii, Ericaceae

Plant Details

Azaleas are half hardy flowering ornamental shrubs, one of the most popular spring bloomers. Azaleas are an extremely versatile and showy group of plants. As being rhododendron family, the beautiful flowers thrive in forest environments. They can be evergreen or deciduous, evergreen is native to Japan while deciduous is America origin. Blooming occurs from early March to late June.

Climates and Cultivation

The plants grow best in a cool location with full sun, away from scorching sunshine, but partial shade from trees and any other structures that an east or north exposure is the best location. The brighten flowers perform well under moist and cool conditions of moderate temperature of 10-15 °C in dappled shade.

The shrubs need fairly acidic soil rich in organic matter with both good drainage and moisture retention. About 50 % peat moss, red wooded compost, leaf mould added to 30 % topsoil and 20 % sand, makes a good soil mix for the plant.

They do best if fertilized when new growth begins appearing in the spring. Spring and early summer fertilization can be helpful if soil nutrients are low, but not a high amount of fertilizer at a time as it may cause burning of delicate roots. Feeding 3-4 time between March and September is adequate. However, fertilizing after July is not suggested since it could lead to tender new growth that will be killed in the winter. So better to fertilize only after the blooms have dropped. Apply only a few tablespoons of a granular slow-release nitrogen fertilizer. If the plants become chlorotic, add chelated iron until the foliage greens again. The established azalea plants do not need fertilizing but do prefer moist roots.

The plant will often die in the moisture stress condition. In indoor condition, the container/potted plants should place on a pebble tray to maintain humidity. A sunny windowsill is an ideal position during winter. In mid-April, repot with compost and feed with a high-potassium, liquid feed at weekly intervals. Plants can be stood outdoors in a cool, shady site for the summer if kept constantly moist, but must be brought indoors before the severe winter chill.

Mulching does best to keep plants healthy that the best mulches will feed the plants, retain moisture levels in the soil and add acidity to soil levels. Ideal mulches are rotten oak leaves, pine bark or wood chips.

2. POINSETTIA: Euphorbia pulcherrima, Euphorbiaceae

Plant Details

Excellent flowering shrub, having distinctive red and green leaf combinations, besides wide range of colors, from blue to pink.

Besides natural environment, it is grown as an indoor houseplant where it prefers a morning sun, then shade in the hotter part of the day. The plant requires an uninterrupted long, dark nights followed by bright sunny days for around two months in autumn in order to encourage developing colored bracts. Commercially, they can be grown under greenhouse.

Climates and Cultivation

They need bright, but filtered light, away from strong sun and draughts. An ideal temperature of 15-18 °C to color up well in warm rooms, so make sure they do not get too cold that a minimum temperature of 13-15 °C is required. Keeping plants continuously in cold condition cause wilting when transferred outside environment. Sparse watering is required as overwatering can damage the plants. Flowering and bract coloring is initiated by short winter day-length, occurring naturally in December and January. So from November onwards, plants should be put in a dark room after twelve hours of daylight. The flowering life of plants is extended by creating humid condition, so mist plants regularly.

Feed monthly with a low nitrogen, high potassium fertilizer. Repot them, growing in a light, cool place over summer, while potting, use three parts to one part grit. Plants response pruning back to about 10 cm in April for new growth for the best result.

3. GARDENIA: Garnenia spp. Rubiacea

Plant Details

An evergreen fragrant and long season flowering shrub, grown for their attractive foliage and highly scented showy flowers, flowering during summer to autumn. Height of 60 cm to 2 m plants prefer bright aspect but not direct sunlight, frost tender. Plants prefer warm temperatures of around 20 °C.

Climates and Cultivation

Both bed and container planting is possible. Over summer, place in a light situation but

shade from direct sun, otherwise the plants may be scorched or the leaves may wilt.

In indoor condition, west facing windowsill is ideal. Night temperatures between 15-18 °C with a day temperature of 21-24 °C would be optimum as fluctuation can damage flower buds. Keep the temperature and airflow optimum but without draughts. Bright light is needed but hot direct mid-day sun. In winter, place the plant in as much light as possible such as in a south facing areas. Provide a minimum temperature of 16 °C if possible although 10-15 °C is acceptable.

Watering and feeding

They grow best in high and uniform humid conditions. Mist the leaves frequently in hot weather to the expanded clay granules container. Over spring and summer, keep the soil media moist, but not saturated. Over winter, when the plants are not growing, reduce the watering, without allowing the soil media to dry out between watering.

They require high nutrient levels from six weeks after potting, use a high nitrogen liquid feed every week in spring and summer. Over winter, feed with a balanced fertilizer with trace elements at five or six-week intervals.

Pruning and training

Keep the plants in shape by light pruning, in February or March as soon as flowering is ended.

4. BOUGAINVILLEA: Bougainvillea spp.; Nyctaginaceae

Plant Details

Evergreen climber, flowering with vibrantly colored bracts brighten garden during the summer and autumn, the tropical climbers are suitable for large containers placed in the garden, or house, but must be kept winter cold free.

Climates and Cultivation

It needs a bright sunny position, but protection from direct sunlight and a minimum night temperature of 10 °C as large climbers they can be planted directly into a conservatory border or in large containers.

The plants perform better during summer in open garden, but low temperature during winter is problem that should be protected. Enrich soil media with well decomposed compost and a balanced granular fertilizer or slow released fertilizer.

Spring and summer

Increase water in February-March as the increasing light levels and temperatures stimulate growth. Maintain high humidity in bright periods to encourage buds to break. Repot if necessary in early

spring, using fresh compost based soil media. If containerized, place outdoors in full sun, ideally 18-21 °C at night, a few degrees warmer by day. During mid-April when plants are actively growing, regular watering and feeding weekly with a high nitrogen liquid fertilizer.

When bracts show color, changed to a balanced liquid feed and move plants to cooler conditions with good ventilation and protection from direct sun, this encourages the bracts to mature and persist longer. When bracts start dropping resume high nitrogen feed to encourage a second flush of bracts. Change to a high potassium feed when bracts begin to show color. Once flowering ends, reduce watering frequency and feeding in September,. Maintain night temperature of 10 °C.

Pruning and training

It requires a light spur training to restrict size. They flower on the current seasons growth so pruning in late winter or early spring, just before growth begins.

5. HYDRANGEA: Hydrangea macrophylla; Hydrangeaceae

Plant Details

A popular flowering ornamental plant, native to south-east Asia grown for their large flower heads. Plants are sturdy and carry attractively serrate bright green leaves. Inflorescences are in terminal globose bunches and carry small pink to blue flowers. Over 70 species exist. Flowering from early spring to late Autunm. They can be either deciduous or evergreen, though the widely cultivated temperate species are all deciduous.

Climates and Cultivation

In the humid tropical condition, plants thrive and flower well under partially shade situations. Most species can be grown in full sun or partial shade that they do not like extremely hot conditions. Thus, select the areas that plants receive some afternoon shade.

While can be grown in a wide range of soils, the plant prefers rich, moist soil that drains easily. Amending the soil with compost prior to planting is helpful. New planting in spring is accompanied by adding thin mulching and thorough watering. In dry period, deep watering once a week is necessary following spring and summer fertilzing in a year as plants are heavy feeders. A balance fertilzer 10-10-10 including sulfur, compost and peat moss can be used for the best results. Be sure to spread it around the drip line of the plant and not the base. Afterward water well. A light annual dose of liquid iron would be beneficial to keep the leaves a healthy green. Easy transplanting can be in fall or winter. Since flowers are produced on new growth, pruning is required once blooming ceases.

FLOWERING HOUSEPLANTS

GERANIUM KALANCHOES BEGONIA

1. GERANIUM: Pelargonium hortorum; Geraniaceae

Plant Details

Geraniums are hardy perennials that will last only one season. Blooming from late spring to the first frost, suited for versatile uses from hanging baskets to containers, outdoor-indoors. More than 200 species and many hybrids are available.

Do best in full sun, grow in any soils and do not require frequent watering. As these plants can be prone to root rot, water only when the soil dries. Fertilizing is necessary to develop healthy, strong roots. As well be sure to deadhead to encourage fuller and more frequent blooms.

Outdoor culture

Planting only when frost danger is over and the soil temperature reaches 15 °C. Site should have enough sunlight, ideally eight hours or better. Soil should be porous enough to allow for good water drainage, oxygen penetration and healthy root growth. Incorporation of peat, compost, or perlite before planting would be benefitted. Geraniums will not bloom well if over fertilized although it needs fertilizing. Dry fertilizer of 10-10-10 at planting time and next at mid season in July, then water thoroughly. Allow the soil to dry off between watering to avoid root rot. Remove faded flowers and dry leaves, these attract botrytis. Protective fungicide sprays may be necessary during periods of cool, moist weather. If have a bright location indoors, bring geranium inside and keep them growing as houseplants until it is warm enough to put them out the following spring.

Indoor culture

Growing geranium indoors is success only when enough light to promote flowering. It thrives in full sunlight. Overwatering will cause plants to rot. Feel the soil to determine when to water. The plants tolerate dry soil conditions better than excess moisture. It does not require frequent fertilization for 2-3 months if potting with a good soil mix. Water soluble 20-20-20 can be used @ 1 teaspoon in 1 gallon of water. For plants that are kept indoors year round, fertilization during growth period only. Geranium thrives in a wide range of temperature. The ideal temperature in the night is 12 °C and 18 °C preferably it is grown at warm temperature. But avoid cold, drafty areas as well as hot, dry locations. Pinching is crucial as removing the growing point will encourage well branching. Rooting in the cuttings comes easily in spring and summer.

2. KALANCHOES: Kalanchoe species; Crassulaceae

Plant details

A perennial herbaceous, thick-leaved succulent potted indoor plant and can also grow outdoors. The clusters of tiny flowers produce a large bloom of variety colors. The deep green, scalloped leaves are just as attractive as the flowers. The sculpted foliage persists after bloom. The starry flowers are long lasting and bloom in winter to spring. The flowering Kalanchoe is a fairly low-maintenance succulent house plant, thriving in the low humidity of winter. They need short winter light periods to form new buds.

Climates and Cultivation Requirements

Light: Need more light, preferably a south-facing window in winter and bright indirect light in summer. If plant looking leggy and thin, probably it is not getting enough light. Window plant

Soil: The plants do best in a well-draining potting mix. Temperature: Temperature is not problem, but better to keep between 15 °C and 30 °C. Water: Over-watering is the main cause of failure. So allow soil to get dry between watering. Fertilizer: while blooming, feed it every few weeks with a balanced organic fertilizer. Summer care: It can place outdoors in summer, but be sheltered from rain. Propagation: Very easy to propagate by stem or leaf cuttings. Maintenance: Remove spent flowers to keep plants clean and healthy. By providing additional winter light condition and stimulating night period for six weeks, continuous blooming can be obtained.

3. BEGONIA: Begonia semperflorens; Begoniaceae

Plant Details

Commonly known as Wax begonia. Three types include tuberous, perennials and semperflorens, all grow between six to nine inched in height and come in varying shades of red, pink, white and yellow. Highly popular of being large variety of species and extensive hybrids. Besides of its beautiful blossoms, it has thick, green foliage. Most suitable for border effect in the garden, and pot/containers uses.

The optimum light for the plants is partial shade, however they thrive in full sun to shade light range. They grow best in any soil type, but it should be moist and well-drained.

Watering and placement in right location is most important for its care. Plants remain live for more than one year if the conditions do not get too extreme with low winter temperature, flooding rains or drought. The cool season is ideal. Plants are shade loving that do not tolerate direct sun well. Regular deadheading and pinching are required for compact and healthy plants.

BULBOUS HOUSEPLANTS

DAHLIA
CYCLAMEN
CANNA
AMARYLLIS

1. DAHLIA: Dahlia species; Asteraceae

Plant Details

Dahlias are tuberous rooted herbaceous perennial with showy flower-heads in summer and autumn. This flower is suitable for borders and beds as well as containers plants. Clump-forming deciduous require full sun south-facing or east-facing, moist but well drained all kind of soil.

Climates and cultivation requirements

Sun exposure: full sun

Soil type: sandy loamy

Bloom time: summer

Dahlias are best planted in fertile, humus-rich, well drained, warm soil in April-May. They grow well in sunny location, full morning sun along with some partial shade in the afternoon to bloom. These colorful spiky flowers generally bloom from mid-summer to first frost, Though not well suited to extremely hot and humid climates; dahlias brighten up any sunny locations in the cool, moist climates.

Planting — Plants do best in the well-drained soils with enough moisture receiving plenty of sunlight. Full sun with 6-8 hours of direct sunlight, protecting from the wind. Thrive in rich, well-drained soil of pH 6.5-7 slightly acidic. Enriched with organic matter and general purpose fertilizer. Don't water the tubers right after planting; this encourages rot. Wait until the sprouts appeared above the soil to water. Avoid overwatering only after established deep watering 2-3 times a week required. Benefit with low nitrogen liquid fertilizer 5-10-10 fertilizer after sprouting and then every 3 to 4 weeks from mid-summer until early autumn.

Propagation — Propagate by soft wood cutting taken in spring or divide the tubers ensuring each division has a viable bud.

Plant care — Pinch out growing tips to encourage bushy plants and stake. Water freely in dry periods. Deadhead as the flower fade to prolong flowering. Mulching during winter can be helpful. Cut back to near ground level in the autumn, before lifting and storing for the winter. Lift and store tubers in autumn to replant or use as a source of cuttings in spring.

Grow in frost free areas, however tubers enables them to survive periods of dormancy that means in temperate climates by lifting tubers and storing in cool would be successful.

2. CYCLAMEN: Cyclamen persicum, Primulaceae

Plant Details

A beautiful patterned foliage and uniquely-formed flower, perennial, tuberous herbaceous flowering plants grow indoors as well outdoors for the containers. Fragrant blooms and miniatures, and a range of flower colors, loving shade condition.

Common species is persicum, frost tender kept below 20 °C when flowering as temperature above 20 °C may induce the plant to go dormant.

Climate and Cultivation Requirements

Prefer mild climates, a bright-light situation, away from direct sunlight, most species are frost-hardy, but some cannot tolerate. In most species, leaves come up in autumn, grow through the winter, and blooming in early spring. Plants undergo dormant as a result of constant temperature above 21 °C during summer, but reappear when cooler temperatures return.

Plant prefers part shade to shade, not down low temperature of -1 to 4 °C. Plant feed with mild liquid fertilizer every two weeks, keeping soil evenly moist. Fertile, well-drained soil is ideal. Thorough watering as occasional drying out of the soil is less harmful than overwatering

Remove spent flowers by twisting the stems and giving them a sharp pull. After flowering continue careful watering and feeding until leaves yellow, and then reduce watering as the plant becomes dormant for the summer. As new growth appears, replace the top few centimeters of compost in the container with fresh compost and resume regular watering.

3. CANNA: Canna gneralis; Cannaceae

Plant Details

Cannas are vibrant tender perennial with large, attractive foliage including showy flower in shades of red, orange, yellow and pinks. The plants with rhizomatous roots, it is a useful summer bedding plant for both containers and borders, but does well in cool conservatories in summer. Widely grown in temperate and subtropical regions in the garden, sometimes as potted plants.

Group: Tender perennial

Flowering time: June to October outside

Planting time: March and April

Aspect: Sunny

Hardiness: Tender

Cultivation

Being tropical origin, most cultivars have been developed in temperate climates. They grow best in full sun with moderate water in well-drained rich or sandy soil. The ideal locations that receive 6-8 hours of sunlight each day and are moved to a warm location for the winter. They grow from rhizomes, but are frequently grown as annuals in temperate zones. In all areas, high winds tear the leaves, so shelter is advised.

The rhizomes are frost tender and will rot if left unprotected in winter. In areas of very low temperatures, the rhizomes can be dug up before severe winter and stored in a protected area (7 °C) for replanting in the spring. Otherwise, they should be protected by a thick layer of mulch over winter.

Starting off rhizomes: Start rhizomes off into growth in March by planting in 20 cm posts using compost. The rhizomes should be covered with compost, leaving any young shoots exposed. Water lightly. Keep the rhizomes at a temperature of 10-16 °C in sunny conservatory. If weather is still cool, delay potting until April. Increase watering as growth develops.

Planting in borders and containers: Move the plants to a cool greenhouse in mid-April and gradually harden off before planting out at the end of May. In borders, choose a sheltered, sunny spot and soil that has been improved by digging in well rotted manure. Also apply a general purpose fertilizer at 70g per sq m.

Plant care: To help keep your cannas healthy. Water freely in dry spells. Apply a liquid fertilizer in midsummer. Dehead to encourage continued flowering. Little pruning or training is needed. Just stake clumps in exposed positions. When a flower spike has no more buds, prune it down. Under glass, grown in full light but shade from hot sun. If temperatures are maintained above 10 °C, it will remain in growth all winter and flower occasionally.

Overwintering: In mild areas: plants can be left outside all year in a sunny, sheltered position. However, apply a 15cm deep layer of mulch in winter and be prepared that there may be losses in very cold or wet winters.

In colder areas: protect from freezing temperature. Otherwise, lift the rhizomes once the top growth begins to wither in autumn. Cut down the foliage and stems to about 15 cm. Dry out and then store in or place in a warm frost-free areas for the winter. Little, if any, watering should be necessary.

4. AMARYLLIS: Amaryllis beladona; Amaryllidaceae

Plant Details

A bulbous and succulent houseplant, also known as Hippeastrum, blooming from late fall until early spring and blooming from 6-8 weeks after planting. They are popular for their 6 to 10 inch trumpet shaped flowers that are born on 1 to 2 foot stalks. Although red and scarlet are the most popular colors, the flowers may be pink, white, salmon, apricot, rose, bicolor or picotee and in both single and double forms.

Potting — Choose large, firm bulbs which show only the stubs of old foliage. Use a light, well-drained potting mixture containing some peat moss. About 1/3 of the bulb should be above the soil level. Firm the soil and water well.

Care — Place the pot in a sunny, warm room. Day temperature 18-25 °C and night temperature of 5-10 °C. Water sparingly until the first shoots appearance. Once growth begins, water when the soil is dry-making sure it is evenly moist but not overly wet. Trace elements iron and magnesium better with complete fertilizer. Once the flower buds are ready to open, better to place in cooler, less direct light sites. Aftercare when the blooming period is over, place the pot again in a sunny well ventilated position. Water and feed regularly to promote vigorous foliage.

FOLIAGE INDOOR HOUSEPLANTS

- ARECA PALM
- DRACAENA
- CALADIUM
- PRAYER PLANT
- KENTIA PALM
- SANSEVERIA
- SPIDER PLANT
- SYNGONIUM
- CAST-IRON PLANT
- PHILODENDRON
- DIEFFENBACHIA

1. ARECA PALM: Chrysalidocarpus lutesens; Arecaceae

Plant Details

A popular palm species for an ideal indoor houseplant, adorning home keeps the air moist and fresh all the time as an excellent air humidifier and toxin remover. A faster grower with low maintenance it lends a tropical touch to your home.

Climate and Cultivation Requirements

A key factor for the successfully growing this plant is providing just the right amount of light. They need bright, indirect light from south- or west-facing aspect. The leaves turn yellowish-green in direct sunlight. The plants do not tolerate neglect. Water enough to keep the soil lightly moist in spring and summer, and allow the soil to dry slightly between watering in fall and winter.

Fertilize plant with slow releasing fertilizer in spring that would be sufficient for whole season. Micronutrient along the houseplant fertilizer in liquid form would be best. Do not feed areca palm in fall and winter. Areca palm can tolerate trimming without serious harm, making it possible to keep mature plants indoors for their full lifespan of up to 10 years. Repotting every two to three years as the main reasons for repotting is to replace the aged potting soil and remove fertilizer salt deposited.

2. KENTIA PALM: Howea forsteriana, Arecaceae

Plant Details

An elegant palm for indoor containers can be grown almost anywhere in home or office. Its shade tolerant, cold tolerant and not tall has become one of the most popular indoor palms. As an indoor condition, plant can be survive in low light conditions but grows better and develops more fronds in medium indirect light.

Cultivation Notes

Growing conditions include: light-indirect sunlight; water- water weekly in summer, letting soil to dry between watering. Over-watering should be avoided; temperature- prefers warm temperature, however it can tolerate 10 °C; soil- Well-aerated potting soil that drains quickly but still holds water, add some sand if the soil appears too heavy moisture; and fertilizer- fertilize monthly in the spring and summer when the plant is actively growing.

Repotting: Repot only when the plant is completely root bound, maybe every third year. While repotting, use same size pot and disturb roots as little as possible. Better to move the plant outdoors to a shady location for the summer months, increasing water and fertilizer.

3. CAST-IRON PLANT: Aspidistra elatior; Asparagaceae

Plant Details

Commonly known as Cast-Iron Plant, is a foliage houseplant. Botanically, it is a perennial herbaceous plants growing from rhizomes, surviving shade, cool conditions and neglect. Successfully grown outdoors in shade in temperate climate, where they can generally cope with temperature down to minus 5 °C, being killed by frost -5 to -10 C. In addition to shade, it requires an open-light condition, acidic and humus-rich soil.

Climates and cultivation requirements

Temperature: Typically need not to worry about this in the average home. A temperature between 7 – 29 °C is ideal. Light: Prefers open light but not direct sun, so north-facing window, or a shady place receiving bright light would be the good choice for the plant. Watering: It needs a fair amount of water during the active growing season, however, need of waiting to let it dry out for next watering. In the winter months, be careful not to over watering. Humidity: Not important. Feeding: Feed during growing season about once every two or three months with a weak solution. Repotting: Only repot the plants occasionally. It dislikes disturbance, frequent repotting will kill the plant. For young plants, this should be no more than once a year and for a mature, once every three or four years. A pot slightly bigger than the current one and standard potting soil should be used. Propagation: By dividing clumps with careful handling, keeping at least two or three stems in each division.

4. DRACAENA: Dracaena spp.; Asparagaceae

Plant Details

Most popular among houseplants with innate tenacity to survive in any conditions. Dracaena's lush green color makes it an attractive option for decorating home and office interiors.

Climates and Cultivation Requirements

When growing plant, locate it in brightly filtered light of a sunny window. Room temperatures of 15-21 °C are best during the day, with night temperature about 10 °C. However it can perform best at normal temperature except too cold.

Appropriate fertilization is also a part of how to care for a dracaena. Feed every two weeks in spring and summer with a balanced fertilizer. Reduce it to once a month during fall and no fertilization in winter so the plant benefits from a period of dormancy. The height control by pruning canes of older plants is useful. Plant care involves keeping the soil moist, but never soggy. Yellowing leaves indicate over-watering or poor drainage.

5. SANSEVERIA: Sansevieria hyacinthoides; Asparagaceae

Plant Details

Commonly known as Snake plant, a perfect indoor houseplant. It keeps the inside home clean, removing toxins such as formaldehyde and benzene. The succulent plant can survive low light levels and drought.

Climates and Cultivation Requirements

Growing from cuttings is relatively easy. Leaf cuttings are the usual method but the easiest method is by division. The most important thing to remember is that they easily rot, so a free draining soil needs.

After propagating, put them in indirect sunlight and don't water them too much, especially during the winter. It is better to let these plants dry out some between watering. Little fertilizer can be used if the plants are in a pot.

6. PHILODENDRON: Philodendron spp.; Araceae

Plant Details

Shrub, or climbers, with glossy, leathery, evergreen, simple to pinnately divided leaves, and tiny flowers borne within arum-like white, green or reddish spathes.

Climates and Cultivation Requirements

Grow indoor best in loam-based potting compost in moderate to bright filtered light with partial shade from hot sun, mist daily. The south-east facing location sheltered from direct sunlight, moist and well drained is ideal. Will tolerate low light.

Keep soil lightly moist spring through fall, so water moderately and apply a balanced liquid fertilizer monthly during growing period, but sparingly watering should be at other times. Yellow leaves are caused by overwatering. Tolerant of dry air, but likes humid. Mist foliage occasionally. Low maintenance patio and container plants.

Temperature: Average room temperature 60-75°F/16-24 °C. Soil: Peat moss-based potting mix Fertilizer: Feed monthly spring through fall with a balanced liquid fertilizer diluted by half. Propagation: Take stem tip cuttings in spring or early summer. It roots easily in water or moist soil.

7. CALADIUM: Caladium spp; Araceae

Plant Details

Common name: Elephant ear

Colors: Red Pink White having their unique and exciting color combination of two or more colors with fancy leafed types, heart-like. It also blooms, but grown for its colorful foliage. Colorful leaves from tubers. Multiple uses from borders, bed and containers and hanging baskets. Shade tolerant but also can stand full sun if watered well.

Climates and Cultivation Requirements

They grow in tropical environment that prefer warm, moist and shady conditions, protecting from direct sun. They grow best in semi-shade under the tree coverage that moist and warm soil at about temperature of 21 °C as cool soil causes caladium tubers to rot. These plants enjoy slightly acidic soil of 6 and 6.5 pH. Organic mulches would be helpful retaining moisture and plant health.

They grow from corms and can be propagated by dividing the tubers. Caladium bulb storage: as foliage begins to die down in the fall, reduce water, dig up and air dry bulbs for a week. Store in a dry location at above 15 °C. Planting the top of the bulb ½ to 2 inches below the surface with the eyes up in the peat mix media keeping moist throughout the season by mulching and proper watering. Fertilize every six weeks with a 6-6-6 type fertilizer or slow release type fertilizer using about a teaspoon per bulb.

Plant care

Keep the condition of indirect or bright-diffused light outdoors. Moderately moist soil is preferred. Water thoroughly when just the soil surface is dry to the touch. Do not allow plants to stand in water. When used outdoors, it prefers partial or full shade in containers or ground beds, they prefer a rich soil. Caladiums planted outdoors should be dug before severe winter and will remain dormant over the winter.

8. SPIDER PLANT: Chlorophytum comosum; Asparagaceae

Plant Details

A flowering perennial herbaceous plant, most popular as indoor houseplant for its variegated leaves and greenish-white inflorescence. Appreciating for air cleaner, the plants with darker green leaves with white stripes are often used for hanging baskets and containers.

Climates and Cultivation Requirements

The easier to grow, being able to thrive in a wide range of conditions and providing with well-drained soil and bright, indirect light and they will flourish.

They grow best at temperature between 18 and 32 °C, however tolerating temperature down to 2 °C. Water them well but not soggy, which can lead to root rot. Spider plants prefer to dry out some between watering.

When caring the plant, one thing to be taken into account that they enjoy cooler temperatures around 13-18 °C. They prefer a semi-potbound environment; repot them only when their large, fleshy roots are visible and watering is difficult. It also benefit from occasional pruning, cutting them back to the base. Propagation is possible through division. After propagating, place them in a ventilated bright location.

9. DIEFENBACHIA: Diefenbachia spp.; Araceae

Plant Details

A perennial herbaceous, leathery alternate leaves with white spots and flecks making attractive indoor foliage.

Climates and Cultivation

Prefers medium sunlight, moderately dry soil and temperature of 17-27 °C. The plant can be grown indoors in temperate areas with a minimum temperature of 5 °C. They need filtered sunlight through a window, while moderately moist soil with regularly fertilization would be sufficient.

But, direct sun burns the leaves and too much light causes the vibrant leaf color to fade. When it does not get enough light, the new leaves are small and far apart on the stem. Lower leaves turn yellow when exposed to cold. It prefers high humidity

but does well in basic household humidity

The best soil for plants is a rich organic mixture that drains quickly. Water well and then allow the top 2-3 inches of soil to dry out before watering again. It does best when watering on a regular schedule. Fertilizer requires when actively growing new leaves happens. Better to feed every two week in the summer and once a month in the spring and fall. Never feed in the winter. Plants like to be a little pot-bound. Report a plant in the spring only if the roots have filled the existing pot. Aggressively prune a plant to keep it bushy and prevent it from getting top heavy.

10. PRAYER PLANT: Maranta leuconeura; Marantaceae

Plant Details

A colorful foliage houseplant for attractive crowded oval evergreen leaves with sheathing stalks. Perennial herbaceous for indoors, can also be grown outdoors during warm weather on a shaded porch, balcony. Perfect for all kinds of containers. Very decorative on a small table or in a hanging basket.

Climates and Cultivation

The ideal conditions include mild tropical under shady areas with bright light. A temperature of 10-17 °C would be better. Plant feed: apply a balanced liquid fertilizer monthly. Watering: water every week depending on light and temperature. Keep soil evenly moist, but not soggy wet. Soil: light and compost mix. Basic Care: rotate plants often to maintain uniform growth in their position. Trim plant if needed to maintain desired size and shape. They have Rhizomes and perennial clumps, so can be propagated through cuttings or by root division.

11. ARROWHEAD PLANT: Syngonium podophyllum; Araceae

Plant Details

A house plant for attractive variegated leaves in Araceae family, native to tropical rain forests. As juvenile forms usually seen on small houseplant. Looks great spilling over container edges. Very decorative on a small table or in a hanging baskets. May be displayed outdoors in warmer weather.

Growing Requirements

A winter temperature of 16-18 °C, rising to 20-30 °C during the growing season. Requiring high humidity, including misting the leaves regularly and good light, but not direct light,they tolerate low light levels. Water freely from spring to autumn, sparingly in winter. Feed regularly in spring and summer. If preferred juvenile foliage, cut off all the climbing stems. Repot every spring. Propagation easy by cutting and air layering.

Succulents thrive in a wide range of low climates. Storing water in their fleshy leaves stems, and even roots, these plants are drought tolerant and easy to grow. Succulents are easily propagated through division, offsets, stem cuttings, and even rooting leaves.

With fanciful forms and colorful foliage, these plants have become a hot trend in home décor and floral design. These plants will thrive outdoors in any climates spring through fall, or even indoors all year round in a sunny location. Well suited to outdoor gardens in mild winter climates, some succulents line the sempervivum can handle much colder climes.

CACTI

CACTUS: Cactaceae

Plant Details

A fascinating ornamental, characterized by the stems succulents capable of storing water during wet season in order to survive extended periods of drought. High temperature tolerance. They have the capacity to survive in adverse conditions. Generally, cacti go dormant during the hot dry period in the drier regions, and only grow and flower when there is moisture. In cool regions, surviving temperature of below -30 °C by undergoing dormant.

In general, the two most common classes are those of sun-loving and shade loving.

Sun-loving cacti

Prefers direct sunlight for a large portion of the day, placing in south or west exposure so they will get at least few hours of direct sunlight each day. It seems need less water, but a good rule of thumb is to water when the top 2-3 cm of soil is dry that it requires once a month in winter. Overwatering or waterlogged condition should be avoided as this may result in root rots.

The growing medium is the key to plant health. So, contrary to conception as most cacti do thrive in pure sand, cacti will respond favorably to a rich soil that is free-draining. Two parts of peat-based potting soil with one part very coarse sand is considered suitable medium. Fertilizer (15-15-30 including trace elements) can be applied while watering during the summer. Most cacti tolerate a wide range of growing temperature, but temperature specific corresponding cactus type. When temperatures are either too hot or too cold, a cactus will often simply go dormant. An ideal place in winter would be a sunny cool room. During the summer, they will do best being moved outdoors where they can receive brighter light and cool humid condition during the night. But, it would be best if placing in partial shade for the first few weeks.

Shade-loving cacti

Growing in moist tropical condition as these types have a trailing growth habit and flattened stem segments Do not tolerate intense sun, but will thrive in an east window. They also grow well under artificial lights. Flowering on many tropical cactus respond to day length. Rich organic medium high in peat. Watering is not a huge issue as long as the plants are never permitted to stand in water or dry completely. Light is the only critical factor for success. Ideally the plants kept in an east or west window.

They do not have annual dormancy since shade-loving cacti continue growing throughout the year; they require a more regular supply of nutrients and will benefit from mild fertilizer at the time of watering. They prefer well draining medium. As these tends to be less tolerant of temperature extremes, so better to place in the shade of a tree where they will receive bright but filtered light.

HERBACEOUS ANNUALS AND PERENNIALS FLOWERS

- Zinnia
- Calendula
- Verbena
- Vinca
- Coleus
- Phlox
- Aster
- Dianthus
- Salvia
- Pansy
- Cornflower
- Snapdragon
- Impatiens
- Petunia
- Gazania
- Plume celosia
- Amaranthus

1. ZINNIA: Zinnia elegans; Asteraceae

Plant Details

Colors: Orange, Pink Red Variegated Violet White Yellow

Zinnias are colorful and long lasting. Half-hardy annuals and perennials; flowering in summer in moderate climate in sunny location with good soil drainage.

Growing tips

Prefers full sun, excellent heat and drought tolerance winter; easy to grow. Careful watering, keeping foliage dry to prevent powdery mildew. Planting when soil is warmed in spring.

Growing zinnia plants can be inexpensive, particularly when growing them from seed. Seeds of zinnia flowers should usually be sown directly into the sunny flower bed, as developing roots do not like to be disturbed. Space the seeds for growing zinnia plants properly, usually several inches to a couple of feet apart depending on the size of the mature plant. This allows for adequate air circulation around the plants as they grow. The plants mostly susceptible to powdery mildew and other fungal as they are closely planted or wet from overhead watering prevails.

Caring

Watering at the base of the plants. A soaker hose is ideal instead of overhead for keeping foliage and petals dry off. Watering in the early morning, for allowing the foliage and flowers to dry off before nightfall. Keep the soil moist, but not soggy, for young plants. Mature zinnias require less watering, as grown flowers are somewhat drought tolerant. With proper placement and correct watering, zinnia plants provide long-term color and beauty in the summer flower bed. Growing zinnia plants benefit from deadheading and flower removal. Pinching back results in a bushier and more attractive plant. Comments: it loves the heat, requiring less water and easier to establish.

2. PHLOX: Phlox drummondi; Polemoniaceae

Plant details

Colorful flower, having mass effect. Phlox are one of those bounteous summer flowers for large sunny flowerbed. Many kinds, garden and meadow phlox produce large panicles of fragrant flowers in a wide assortment of colors. To grow best, they need amply moist soil for best overall health. Two common types: spring-blooming creeping phlox and summer-

blooming tall phlox. Tall phlox are susceptive to powdery mildew, especially in regions with hot, humid summers, so choose resistant varieties.

Easy care/low maintenance; multiply readily, Fragrant, Good for cut flowers, containers and bedding

Site selection	Select a site with moist, well-drained soil. Some types prefer full sun while other types thrive in shade. Heat and drought tolerance frost fee
Planting	Plant in spring, spacing plants 1-2 feet apart, depending on the variety. Prepare garden bed by following tilling the soil to a depth of 12-15 inches, then mix 2-4 inch layer of compost. Transplant the plant by digging hole, carefully fill in around the root ball and firm the soil gently. Water thoroughly.
Care	Apply a thin layer of compost each spring, followed by a mulch to retain moisture and control weed. Water gently. As flowers fade, cut back old flower stems to encourage re-bloom.

3. PANSY: Viola wittrockiana; Violaceae

Plant details

Color: blue lavender orange pink red variegated white yellow Perennial, but often grown as annual for fall bloom, spring bloom, winter bloom, winter interest with multiple forms. Ground cover cut flowers, fragrance, good for containers with low maintenance.

Available colors: flowers in shades of blue, purple, orange, yellow, white, and bicolor

Bloom time:	spring to summer
Lowest temperatures:	- 34 to -29 °C
Light:	Sun to Part Shade

Cool season pansies brighten landscape and container gardens fall through spring with little care required. Plant them in combination with Sweet Alyssum and enjoy the perfume and beauty of the pretty faces on pansies.

Optimum light:	sun	Soil moisture:	well-drained
Light range:	full/part-sun	Drought tolerance:	medium
Soil texture:	Any		
Season of color:	fall winter spring		

Climates and Cultivation

Full sun to semi-shade, spring and fall outdoor planting. Earliest blooming flowers, blooming in late

fall, early winter and early spring.

Many now winter hardy in cold climates that can tolerate cool temperatures and freezing conditions. Do well in cool climate. Newer cultivars more heat tolerant. Beautiful flower in both garden beds and containers, best planting in fertile, moist soil. Watering about once or twice a week and fertilized once a month. As well, do not forget to remove dead blooms to encourage new growth and prolong blooming. They tolerate cool temperatures and are ideal for planting around spring flowering bulbs or in window boxes. They self seed freely, but are not invasive. Violets do best in lightly shaded places in soil that remains moist.

Basic care	They are low maintenance and easy to grow
Plant feed	Slow release feed in spring.
Watering	Keep soil evenly moist
Soil	Fertile, humus-rich, well-drained soil
Basic care	Grow in fertile, humus-rich, well-drained soil. Keep soil moist, watering freely in dry weather. Remove faded flowers. Apply a summer mulch to retain moisture. Planting from spring through fall.

4. PETUNIA: Petunia spp.; Solanaceae

Plant Details

Sun exposure : full Sun

Flower color : Red, Pink, Yellow, Purple and White

Bloom time : Spring, Summer, Fall

A tender annual flower of spring-summer-fall outdoors. Need at least five hours of sunlight, can tolerate relatively harsh conditions and hot climates. Easily grown, semi-hardy annuals that can also tolerate cool temperature and a moderate frost. Multiple uses for summer bedding to containers and hanging baskets since plants are more susceptible to rain damage.

Planting	Grow well in low humidity, moist soil. Need water once a day during drier period. Grow from seeds, but easier to transplanting. Start seeding for raising nursery indoors as seeds are very small, so need careful nursery growing under ample light condition and watering. When three leaves, can transplant them outside in well-drained soil in full sun during spring. It would be better if the plants have shelter from the wind. Space the plants about 1 foot apart.
Care	Petunias tolerant heat, so don't water frequently. A thorough watering once a week should be sufficient. The spreading types and those in containers require more frequent watering though. Fertilizer monthly to ensure good growth. Remove faded/dead flowers to prolong blooming

5. CALENDULA: Calendula officinalis; Asteraceae

Plant Details

Commonly known as Pot Marigold, masses of sunny blooms well into autumn make calendula an excellent backup for the garden.

Semi-hardy annual, prefers full sun, spring outdoor annual. However, flowers best in cool weather of spring and fall. Ideal choices for beds, borders, and cutting gardens. Also perfect for all kinds of containers. Cut flowers are long-lasting in fresh bouquets.

Bloom time:	Summer to autumn
Lowest temperature:	-7 to -1 °C
Plant light:	Sun to Part Shade
Plant feed	Fertilize regularly for best display.
Watering	Keep soil evenly moist
Soil	Fertile, well-drained soil
Basic care	Very easy to grow in virtually any location. Best in fertile, well-drained soil. Keep soil moist, watering freely in dry weather. Remove faded flowers for best display.

6. ASTER: Callistephus chinensis; Asteraceae

Plant Details

Asters are popular garden plants for their showy flower heads and the availability of flowers in multiple colors. Most perennial Annual or biennial herb commonly known as China Aster

Blooming for late summer and fall in red pink, white purple and blue. They grow well in full sun or light shade and in a fertile and well-drained soil. Mulching would be beneficial.

Culture	Light requirement: grows in part shade/part sun. Soil tolerances: clay, sand, acidic; loam; alkaline. Asters are one of the easiest perennials to cultivate as the biggest problem is powdery mildew. Drought resistant. Propagated by dividing clumps or from seeds

Asters prefer moist well-drained soil condition growing in full sun, but they can tolerate light shading. Mature clumps should be divided every 3-4 years in the early spring or late fall after the flowering has finished. Pinching back earlier to blooming to create a bushier plant and to prolong the fall bloom.

Plant care — Planting in a sunny area with good air circulation, powdery mildew can usually be avoided. Need regular watering. Fail to survive the winter if kept too moist.

Management — Seed started indoors gives best results. Direct seeding is considered good. The flower prefers cool temperature and full sun, planting in spring outdoors. Day temperature of 20-30 °C and night temperature of 15-17 °C are ideal. Open sunny locations with well-drained red loamy soils of 6-7 pH. Planting throughout the year under mid climates. Plants are susceptive to Fusarium wilt and mites.

7. CORNFLOWER: Centurea cyanus; Asteraceae

Plant Details

A drought tolerant annual, originally having blue color but white pink and red also available. They can spread and naturalize easily when planted in sunny areas. Once planting, growing exists year after year as the reseed freely.

How to grow

Full sun to semi-shade in various soil types, when planting spring outdoors and fall outdoors, most prolific bloom during early summer. Reseeds easily. Start working as early as in spring. Winter sowing is also possible as plants can tolerate the harsh cold and are very hardy.

Plant care — Place the plant such that it gets sufficient sunlight, but not too much of it. When the top half of the soil is dry, begin watering. Every alternate month, fertilizer the plant with a liquid fertilizer while watering. Care also includes deadheading the plants to prevent prolific self-seeding, weeding out spring.

8. GAZANIA: Gazania rigens; Asteraceae

Plant Details

Commonly known as African daisy is an herbaceous, tender perennials or showy annual bloom in the sunny area or the containers. In temperate regions, they are usually grown as half-hardy annuals. Drought-tolerant ground cover, brilliant color of their flower heads which appear in the late spring and are often in bloom throughout the summer to autumn.

Climates and cultural requirements

They prefer a sunny position and are tolerant of dryness and poor soils. A clumping mound of grass-like foliage produces Gazania treasure flowers. This easy-to-grow bloom is tolerant of poor, dry or sandy soil. Heat and salty spray does not deter its growth or beauty blossoms either. Full sun frost free needs well drained sites. Grow in moderately fertile, well-drained soil in full sun. deadhead regularly to prolong flowering. Will survive winter outdoors in mild areas. Water in prolonged dry spells. Suggested planting locations and garden types Banks and sloppy areas and containers

Propagation Propagate by softwood cutting taken from the base of shoots in later summer and kept in frost free condition over winter.

9. VERBENA: Verbena officinalis; Verbenaceae

Plant Details

Long lasting blooms during the hottest days of summer heat. Both annuals and perennial types choose perennial verbena for a better summer show if humidity is high in summer. If location gets 8-10 hours of sun each day flower will grow best.

The verbena flower is not particular about soil, except that it must be well-draining. Poor soil is acceptable for verbena growing conditions. But when planting in soggy soil following spring rain, the flowers are often lost.

So, improvement on drainage can be through well-composted organic material. While the verbena flower is drought resistant, the blooms are improved with regular watering each week, but it should be at the base to avoid wetting the foliage.

Climates and cultural requirements

A limited application of complete, slow-release fertilizer is also a part of verbena plant care. First trimming in spring and again the occasional needed for optimum blooms throughout the summer. Fertilizer lightly following the trim and water well.

When planting verbena, remember to water, fertilize and trim for long lasting color in the summer and beyond. Full sun, spring outdoors planting, prefers cool temperatures. Cutting types more heat tolerant. Available from seeds or cuttings.

10. DIANTHUS: Dianthus chinensis; Caryophyllaceae

Plant details

Common name: China pink

Dianthus is commonly known as China Pink. This is a herbaceous short-lived perennial plant, produces small pink, red or white flowers in spring and midsummer, with some varieties featuring bicolor blooms. With proper care china pinks provide low maintenance to garden beds or container planting.

Climates and Cultivation

Cool weather, sufficient sun to semi-shade and regular watering results in healthy flower. These flowers can't tolerate hot weather, so provide them with some afternoon shade in warmer climates. In areas with cool, mild summers they can tolerate all-day sun.

Prefers a rich soil amending with compost before planting. It must be drained well while retaining enough moisture so it does not dry out too quickly.

Spring outdoor planting flowers from spring to mid-summer. Prefers cool temperature. Many survive winter, but species vary in hardiness. These plants are best grown in a bright sunny position with a light, well-drained, yet moist soil. A light annual dressing of dolomite lime is beneficial.

Water and fertilizer	Water weekly, which moistens the soil to a 6-inch depth, when the top 1 to 2 inches of soil begins to dry. Mulching can be helpful for retaining moisture and keeping soil cool. A soluble fertilizer 24-8-16 blend provides sufficient nutrients to keep plants healthy and blooming. Mix 1 table spoon fertilizer with 1 gallon of water for every 10 square feet of bed. An application made every seven to 10 days supplies enough nutrients for the plants.
Pruning	Regular deadheading helps keep the flower in bloom. The flowers require pinching off after they begin to wilt. It tends to flower all at once, so cut back the plants by

up to a third of their height after a flush of blooming. The plants will grow back fuller and produce a new flush of flower buds, allowing them to remain in bloom later into the summer.

Problems

The most problem is crown rot in overly wet soil that can be corrected by following careful watering. But also planting in a well-drained site prevents the issue. Although diseases are rare, if a plant appears ill, remove it and destroy it to prevent the disease from spreading. Mites and aphids may feed on the foliage, so rinse them off with a sharp spray of water. Slugs can also pose a problem.

11. SNAPDRAGON: Antirrhinum majus; Plantaginaceae

Plant details

Tender perennial, but often grown as annuals for blooming in early spring outdoors. Numerous varieties with dwarf, intermediate and tall flowering stems for the range of colors. Though mostly annual, proper care can make the plants to continue next year as they are a short-lived perennial.

Climates and cultivation requirements

Full sun planting, prefers cool temperatures. Hardy annual that can tolerate cool temperature and freezing condition. Antirrhinum grows best in a fertile, moist, humus-rich well-drained soil in a sunny position. Some species are reasonably drought tolerant but still need moisture if they are to flower well. Planting is carried out in full sun location during spring outdoors. Do not overwater, as that can cause growth stunted or killing, water only when the soil is dry. But, avoid overhead watering. Mulch is appropriate.

Regular removal of spent flowers will encourage branches and new blooms. To encourage buds to bloom, remove the top 5-8 cm of the stem. Taller plants may need staking. Rust diseases can cause problems in humid conditions.

12. VINCA: Catharanthus roseus; Apocynaceae

Plant Details

An evergreen herbaceous plant. Full sun and spring planting, excellent heat tolerance. Do not plant until soil warmed in spring.

Hardiness in dry and infertile soil condition, warm season bedding plants. It is noted for its long flowering period, throughout the year in tropical

conditions, and from spring to late autumn in temperature climates. Full sun and well-drained soil are preferred.

Climate and cultural requirements

Well-draining areas with the poorest soil. This plant does not grow well in fertile conditions. Transplant outdoors after frost passed out and the soil starts warming up to at least 18 °C. Locate in full sun or partial shade. These plants love full sun, but appreciate a sunny spot that is partially shady during the hottest hours of the afternoon.

Apply mulch to the planting site that helps retain soil moisture and discourage weed development. Water the newly planted plants thoroughly to moisten the soil evenly but not enough to make it soggy or wet throughout the first growing season. Allow the soil surface to become dry to your touch before watering again. Once established, these drought-tolerant plants can survive on the available rainfall. But it does not tolerant standing in water. Feed liquid or granular fertilizer for blooming plants once monthly throughout the growing season. They are self-cleaning so you never need to deadhead them.

13. PLUME CELOSIA: Celosia plumose; Amaranthaceae

Plant Details:

Celosia having upright plumes. These delightfully bright feathers of bloom bring vertical interest and long-lasting color to sunny plantings. The perfect choice for beds and borders. Superb for baskets, containers and window boxes. Excellent cut flowers for fresh or dried arrangement.

Available colors: Red, Pink, Yellow, Orange

Bloom time:	Summer
Height range:	6-18 "
Lowest temperature:	4 to 10 °C
Light:	Full Sun

Climate and cultural notes

Full sun and frost free, easily grown. Tolerant of heat and poor soil. A tender annual, celosias do not tolerate cool weather and should not be planted until the soil has warmed in spring. It provides summer decoration.

Very easy to grow in virtually any site, preferably well-drained soil. Prepare the pulverizing soil; add organic matter such as manure, peat moss until soil is loose and easy to work. Give plants an

extra boost by adding a granulated fertilizer or a balanced feed 12-12-12. Check for suggested spacing as crowding plants can result in fewer blooms and weak growth. Shade planting tends to grow slower.

Watering — Water as needed to keep soil evenly moist, especially in hot period. New plantings should be watered daily for a couple of weeks. After that, depending on the weather and soil type, watering is adjusted to every two or three days. Clay soils hold moisture longer than sandy soils, so expect to water more frequently in sandy setting.

Fertilizing — Apply a balanced liquid fertilizer monthly. Also fertilizers in granulated, slow-release, organic or synthetic forms can be used. Determine which application method is best for the situation and select a product with a nutritional balance designed to encourage blooming.

Pruning — Prune plants freely to maintain the desired size and shape. Pinching plants back stimulates dense, bushy new growth and encourages more flowers. Remove old flowers to keep plant looking healthy and prevent seed production that drains the plants energy at the expense of forming new flowers. Some plants are grown only for their attractive foliage. Their flowers are not very showy and any buds should be pinched off to keep the foliage looking its best.

14. SALVIA: Salvia splendens; Lamiaceae

Plant details

Color: lavender red violet white

Season of color: year round

Popular annual for sunny gardens, enjoying from October through May. Hundreds of different types, beautiful tall vivid red flower spikes and attractive, often gray green leaves. Often used to decorate ornamental gardens. They are valued for their very long season of bloom, right up until frost. Fragrance good for containers.

Cultivation

The plants do best in full sun to part shade in moist but well-drained soil, planting in spring outdoors. Low maintenance, drought tolerant, heat tolerant. Good plant for the cool season. But, they are a temperate plant, as summer humidity and heat usually take them. Propagation: propagate by seed-sow seeds indoors early in spring with full light at 20-25 °C

15. IMPATIENS: Impatiens balsamina; Balsaminaceae

Plant Details

Flowers for shady spaces, but tender annuals that cannot tolerate cool weather and frost. Outstanding for growing in containers and hanging baskets.

Commonly named as Balsam, prefers full sun, abundant moisture and rich soil in frost free climates. Colors of red, pink, salmon, orange, white, yellow, violet and bicolor, are blooming in summer.

Lowest temperature: -1 to 4 °C
Plant light: Part shade to Shade

Plant feed	Apply a balanced liquid fertilize monthly.
Watering	Keep soil evenly moist
Soil	Fertile, well-drained soil
Basic care	Very easy to grow virtually in any location, best in fertile, well-drained soil. Keep soil moist, watering freely in dry weather. Remove faded flowers for best display.

16. AMARANTHUS: Amaranthus spp. Amaranthaceae

Plant details

Genus Amaranthus tricolor, a summer annual, many species of short-lived perennials. It has showiest vibrant, ornamental red, yellow, and green foliage. Small flowers, borne from summer to early autumn. Often used as summer bedding, in containers, or handing baskets, as houseplants. Heat and drought tolerant, requires full sun, planting in early spring, suitable for poor even soggy soils.

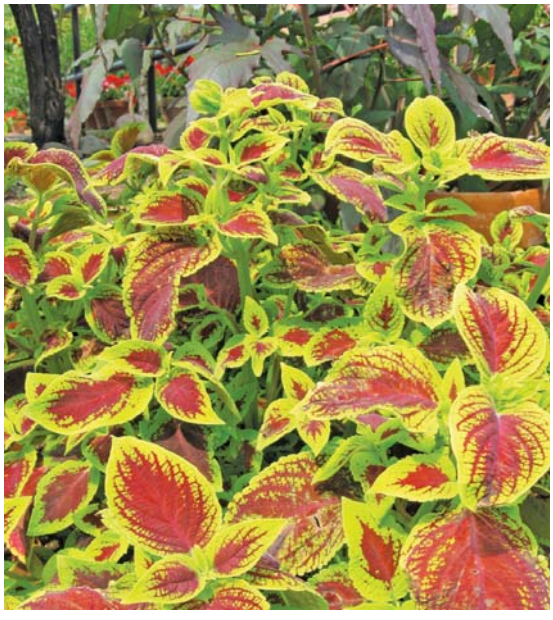
Growing	Amaranthus prefers partly shady to full sunlight conditions. The soil type is not overly important, though it should be moderately fertile, moist in full sun, having a pH between 6 and 7; for best performance, the soil is not too rich, as this soil type encourage growth instead flowering. It can be grown outdoors or indoors when the

danger of frost is passed. Indoors, grow in full light with ample water and high humidity. Propagation: sow seed at 20 °C in mid-spring. Seeding and growing seedlings need sufficient light condition, protecting from cold.

Plant care — Regular watering needed to maintain soil moisture all season. From the start of the growing season, apply slow-release or all-purpose fertilizer monthly.

17. COLEUS: Solenostemon scutellorioides; Lamiaceae

Plant Details



Colorful foliage and bushy evergreen in orange, pink, red, variegated, violet, and yellow colors; full sun to semi-shade tolerant.

Optimum light : Partial Shade
Light range : Full Sun - Shade
Soil texture : Sandy/Loam
Soil moisture : Medium
Season of color : year-round

Most colorful bedding plant for summer and fall. Soil with rich organic matter is appropriate. They may live many years in the proper soil if protected from frost. Pinch tips to control height and reduce flowering as the foliage is the main draw. Pinching helps keep them sturdy and shorter avoiding plants from summer wind. Coleus thrives in full summer sun with proper care.

Cultivation — Grow under loam-based potting compost in bright filtered to moderate light. Pot up annually in spring. Grow outdoors in humus-rich moist, but well-drained soil, enriched with well rotted manure. Provide a sheltered frost-free environment.

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Annexes

Annex 1. Agro-meteorological record of Rupandehi and Nepalgunj in 2010.

Month	Rupandehi (109 m amsl)				Nepalgunj (165 m asml)			
	Temperature (°C)		RH % 17:45 pm	Precipitation (mm)	Temperature (°C)		RH % 17:45 pm	Precipitation (mm)
	Max	Min.			Max	Min.		
January	16.6	9.1	83	1	16.9	8.3	75	2
February	25.5	10.7	58	19	25.1	9.6	50	28
March	33.8	16.3	49		33.2	15.5	36	0
April	39.4	21.6	36	3	39.3	20.1	23	0
May	36.4	23.1	49	189	38.6	22.7	33	58
June	36.6	25.8	60	173	38.6	25.3	45	140
July	33.6	26.1	72	463	33.6	25.7	79	783
August	33.5	26.4	77	619	32.9	25.8	79	363
September	32.7	25.1	81	399	32.4	24.6	77	61
October	32.2	21.1	71	39	31.9	20.3	66	68
November	28.9	16.1	66	0	27.6	15.3	68	1
December	24.9	8.8	62	0	24.3	7.8	55	1
Year	31.2	19.2	63.7	1905.0	31.2	18.4	57.2	1505

Annex 2. Agro-meteorological record of Chitwan and Janakpur in 2010.

Month	Chitwan (256 0 m amsl)				Janakpur (90 m asml)			
	Temperature (°C)		RH % 17:45 pm	Precipitation (mm)	Temperature (°C)		RH % 17:45 pm	Precipitation (mm)
	Max	Min.			Max	Min.		
January	20.1	9.5	82	4	20	7.7	62	0
February	25.5	9.8	67	19	27.4	10.2	61	5
March	33.1	15.8	52	0	32.1	14.8	53	5
April	38.1	19.9	43	63	37.4	22.2	49	44
May	35.2	23.2	76	205	35.5	24.6	50	158
June	35.4	24.9	79	372	35.4	26.5	55	94
July	33.6	25.7	84	705	33.6	26.5	58	324
August	33.9	25.9	99	460	33.7	26.9	61	301
September	33.2	24.8	84	523	32.9	25.9	64	0
October	31.4	20.9	97	49	32.2	22.4	59	12
November	27.9	15.8	96		29.5	16.8	56	
December	23.7	8.1	100		25.7	9.5	32	
Year	30.9	18.7	79.9	2400.0	32.3	20.6	54.4	943.0

Annex 3. Agro-meteorological record of Biratnager and Jhapa in 2010.

Month	Biratnagar (72 m amsl)				Jhapa (143 m amsl)			
	Temperature (°C)		RH % 17:45 pm	Precipitation (mm)	Temperature (°C)		RH % 17:45 pm	Precipitation (mm)
	Max	Min.			Max	Min.		
January	20.2	9.3	74	0	23.7	7.4	72	0
February	26.7	10.8	51	0	27.8	9.9	50	0
March	33.1	18.2	47	0	33.1	16.2	48	0
April	35.6	23.2	52	33	34.4	21.9	57	9
May	33.6	24.2	65	136	33.7	22.7	68	202
June	33.1	25.6	74	409	33.3	23.5	77	720
July	32.5	26	79	564	33.3	24.3	80	1106
August	32.8	26.3	81	444	33.5	24.9	81	571
September	32.4	25.2	79	255	33.5	23.8	84	301
October	31.9	22.3	78	29	33	20.9	78	92
November	29.7	17.1	74	0	30.2	16	76	25
December	25.8	10	70	0	27	10	73	0
Year	30.6	19.9	68.7	1870.0	31.4	18.5	70.0	3026

Annex 4. Agro-meteorological record of Lalitpur and Kathmandu in 2010.

Month	Lalitpur (1400 m amsl)				Kathmandu (1337 m asml)			
	Temperature (°C)		RH % 17:45 pm	Precipitation (mm)	Temperature (°C)		RH % 17:45 pm	Precipitation (mm)
	Max	Min.			Max	Min.		
January	19.3	2.9	65	4	22.3	3.1	61	2
February	19.4	4.3	49	22	23.2	4.8	59	23
March	25.6	9.7	49		29.2	10.9	52	36
April	28.9	13.5	39	49	31.9	13.9	45	45
May	27.5	15.6	63	90	30.3	16.8	58	148
June	28.7	17.9	67	173	31.1	19.5	66	142
July	26.7	19.3	75	337	29.5	20.6	78	355
August	26.2	19.2	81	354	29.2	20.6	81	486
September	25	17.6	80	349	28.6	19.2	79	217
October	24.7	13.2	77	75	28	14.9	73	25
November	21.7	8.5	77		24.8	9.9	72	
December	18.5	3.2	71		20.8	2.9	65	
Year	24.4	12.1	66.1	1453.0	27.4	14.0	66.2	164.1

Annex 5. Agro-meteorological record of Dhading and Pokhara in 2010.

Month	Dhading (1420 m amsl)				Pokhara (827 m asml)			
	Temperature (°C)		RH % 17:45 pm	Precipitation (mm)	Temperature (°C)		RH % 17:45 pm	Precipitation (mm)
	Max	Min.			Max	Min.		
January	22.8	6.9	87	0	21.9	7.6	65	0
February	24.4	9.2	83	9	23	9.4	57	44
March	32.1	15.6	91	68	29	15.4	52	78
April	33.1	16.9	83	174	31.8	18.1	60	169
May					30.7	19.4	70	200
June	33.7	21.7	85	97	32	21.4	71	481
July	33	22.7	84	579	30.3	22.4	84	919
August	32.2	23.1	83	543	30.4	22.3	86	680
September	31.2	22.1	87	417	29.6	20.9	90	609
October	29.7	17.9	85	27	28.5	17.2	89	101
November	26.6	14.4	83		24.7	13.6	88	
December	22.8	10.2	83		21.2	6.8	89	
Year	29.9	17.4	84.7	1914.0	27.8	16.2	75.1	3281.0

Annex 6. Agro-meteorological record of Kakani and Kavrepalanchowk in 2010.

Month	Kakani (2064 m asml)				Kavrepalanchowk (1552 m amsl)			
	Temperature (°C)		RH % 17:45 pm	Precipitation (mm)	Temperature (°C)		RH % 17:45 pm	Precipitation (mm)
	Max	Min.			Max	Min.		
January	21.9	7.6	65	0	16.8	4.1	80	1
February	23	9.4	57	44	17.8	4.7	71	42
March	29	15.4	52	78	24.7	10.2	57	14
April	31.8	18.1	60	169	28.3	13	54	67
May	30.7	19.4	70	200	28.1	14.8	59	41
June	32	21.4	71	481	28.8	17.8	66	65
July	30.3	22.4	84	919	26	18.7	86	367
August	30.4	22.3	86	680	25.5	18.6	90	330
September	29.6	20.9	90	609	24.2	17.2	89	169
October	28.5	17.2	89	101	22.5	13.4	81	8
November	24.7	13.6	88		19.3	8.9	78	
December	21.2	6.8	89		16.1	3.6	71	
Year	27.8	16.2	75.1	3281.0	23.2	12.1	73.5	1104.0

Annex 7. Agro-meteorological record of Makawanpur and Bhaktapur in 2010.

Month	Makwanpur (474 m asml)				Bhaktapur (2163 m asml)			
	Temperature (°C)		RH % 17:45 pm	Precipitation (mm)	Temperature (°C)		RH % 17:45 pm	Precipitation (mm)
	Max	Min.			Max	Min.		
January	22.2	8.4	83	2	11.5	3.2	62	0
February	24.6	9.3	71	11	12.7	4.2	72	25
March	32.2	15.5	55	17	20.1	9.6	64	10
April	36.3	19.9	53	53	24	13.4	60	44
May	34	21.7	69	285	21.5	14	83	60
June	33.9	23.4	79	459	23.9	15.2	90	191
July	32.1	24.4	85	433	22.5	15.9	97	484
August	32.1	24	91	900	22	16.1	95	633
September	31.4	23	93	396	21.1	14.8	97	216
October	29.6	19.3	90	121	20.7	11.6	83	53
November	26.7	14.4	88		17.6	8.4	71	
December	23.4	7.8	83		14.7	4.6	54	
Year	30.6	18.4	77.9	2677.0	20.1	11.6	78.7	1716.0

Annex 8. Agro-meteorological record of Ilam in 2010.

Month	Ilam (1300 m amsl)			
	Temperature (°C)		RH % 17:45 pm	Precipitation (mm)
	Max	Min.		
January	17.8	10.8	77	0
February				0
March	26.5	17.1	79	0
April	28.8	19.2	83	43
May	28.2	18.8	58	261
June				
July	28.3	18.8	67	503
August	28.1	19.5	72	468
September	28.4	19.7	59	156
October	24.9	16.5	70	0
November	27	18.6	61	48
December		16.3	73	3
Year	26.4	17.5	69.9	1482.0

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