Agri Articles

(e-Magazine for Agricultural Articles)

Volume: 06, Issue: 04 (JULY-AUG, 2026)

Available online at http://www.agriarticles.com

Year-Round Beauty Off-Season Flower Production through Bulb Management

Pooja Patel[1], Suman Dhaka[2], *Dr. Rishubh Motla[3], Dr. Praveen Kumar Yadav[4] and Yogesh Kumar[5]

[1]Research Scholar, Department of Horticulture (Floriculture and Landscaping), Mahatma Gandhi University of Horticulture and forestry patan durg Chhattisgarh

[2]Department of Floriculture and Landscaping, Dr. Punjab Rao Deshmukh Krishi Vidhyapeeth, Akola

[3]Research Scholar, Floriculture and Landscaping Architecture, Sardar Vallabbhai Patel University of Agriculture and Technology Modipuram, Meerut 250110

[4]Assistant Professor, Department of Agriculture, Mata Gujri College, Fatehgarh Sahib, Punjab 140406 (An Autonomous College)

[5]Research Scholar, Department of Horticulture, School of Agricultural Sciences, Nagaland University, Medziphema Campus

*Corresponding Author's email: rishumotla7@gmail.com

Bulbous ornamental crops such as tulip, narcissus, hyacinth, lily, iris, freesia, and amaryllis are highly valued in the floriculture industry for their attractive flowers and commercial importance. However, their seasonal flowering pattern limits the year-round availability of flowers, resulting in market fluctuations, over supply during peak seasons, and shortages during festivals and special occasions. Bulb forcing is an important horticultural technique that overcomes this limitation by manipulating environmental factors such as temperature, light, humidity, and dormancy to induce flowering at predetermined times. The process is based on the physiological requirements of bulbs for floral initiation, chilling, rooting, and subsequent growth under controlled greenhouse conditions. Standard rooting-room forcing and special pre-cooling (non-rooting-room) forcing are the two major techniques widely adopted for commercial production of bulbous ornamentals. The application of plant growth regulators, including ancymidol and ethephon, further improves plant quality by regulating stem elongation and maintaining compact growth. Successful bulb forcing also depends on proper bulb selection, storage, chilling duration, moisture management, nutrient supply, environmental control, and effective pest and disease management. Adoption of these scientific management practices enables the production of high-quality cut flowers and potted plants throughout the year, ensuring a continuous market supply, higher profitability for growers, reduced post-harvest losses, and greater consumer satisfaction. Consequently, bulb forcing has become an indispensable technology for sustainable and profitable off-season floriculture production.

Keywords:- Bulb forcing, ornamental crops, Plant growth regulators, Off-season flower production and Controlled environment cultivation

Introduction

Bulbous ornamental crops such as tulip, narcissus (daffodil), hyacinth, lily, iris, freesia, and amaryllis occupy an important position in the floriculture industry due to their attractive flowers, wide range of colors, and high commercial value. However, most bulbous plants are seasonal in nature and flower only during specific periods of the year when environmental conditions are favorable. This seasonal flowering often results in an oversupply of flowers during peak seasons and a shortage during special occasions such as Christmas, New Year, Valentine's Day, Easter, and Mother's Day. Consequently, flower growers receive lower prices during the peak flowering period, while market demand remains high during the off-season (Larson, 2012).

To overcome this limitation, bulb forcing has emerged as an effective horticultural technique that enables flowering outside the natural blooming season. Bulb forcing refers to the manipulation of environmental factors, particularly temperature, light, and humidity, to induce flowering at a predetermined time. Through carefully controlled storage and temperature treatments, growers can accelerate or delay flower development, thereby ensuring year-round availability of flowers and maximizing economic returns (De Hertogh, 1992).

The physiological basis of bulb forcing is closely associated with floral induction, initiation, and development within the bulb. Many bulbous species require a sequence of warm and cold temperature treatments to complete flower bud formation and break dormancy. Chilling treatments promote root development, stimulate flower initiation, and enhance uniform flowering, while subsequent warm temperatures encourage rapid stem elongation and flower opening (Kamenetsky and Okubo, 2012). Advances in greenhouse technology, environmental control systems, and plant growth regulators have further improved the efficiency and reliability of bulb forcing programs.

Today, bulb forcing is widely practiced in commercial floriculture for producing high-quality cut flowers and potted plants according to market demands. Proper bulb management, including storage conditions, pre-cooling treatments, rooting practices, and greenhouse environmental control, plays a crucial role in achieving successful flowering schedules. Therefore, understanding bulb forcing techniques and management practices is essential for the profitable production of bulbous ornamental crops throughout the year.

Off-season production

Cut flowers, which are available during the normal season, are plentiful, thus fetching a low price. Sometimes the farmers must sell their produce even at a loss. In some cases, flowers that could not be sold are either left on the plants or are spoiled after being harvested. Thus, it would be beneficial for farmers to produce cut flowers during the off-season period to obtain higher price, although the inputs may be higher.

Flower forcing is an operation or treatment on the plant, after it reaches the ripeness-to-flower stage, in order to stimulate it to flower at a specific date (e.g., on New Year’s Day), or during an off-season period. The flowering date/period may be earlier or later than the normal date/period of flowering. The goals of flower forcing are off-season production and specific-date production.

Flower forcing can be achieved by adjusting the factors affecting flowering behaviour, viz., photoperiod, temperature, and humidity. Chemical flower forcing can be done through the application of fertilizers, used both for retarding and stimulating flowering; and plant hormones, including gibberellin, growth retardants and growth inhibitors. Mechanical flower forcing is achieved by operations such as pruning, leaf trimming, ringing, budding or grafting, smoking, low-temperature storage, and breaking dormancy.

The objectives of forcing plants to flower during off-season or at certain specific dates are:

A) To avoid surpluses of in-season cut flowers

Most cut flowers are produced during their respective seasons, which have favourable conditions suitable for their production. Thus, large quantities are available and, therefore, fetch a low price or are even unsaleable.

B) To avoid wastage or spoilage of surplus cut flowers

Unlike most other products, cut flowers are perishable with time. They are either spoiled or left as waste if not used or sold.

1. To avoid the danger of epidemics

In-season production of cut flowers is subject to some insect attacks and disease epidemics due to the presence of favourable climatic conditions for their growth.

2. To distribute employment throughout the year

Cut flower production requires intensive labour. During the normal peak season of production, most labourers are engaged in one job or another. Off-season cut flower production helps to distribute employment throughout the year, a benefit to the nation's economy.

3. To increase farmers' income

The farmer's income will be higher by selling products that are in high demand.

4. To reduce imports and trade deficit

It is the florists' custom to import cut flowers from abroad to satisfy the demands of the customers during certain times of the year when domestic production is not possible, even at a much higher price. Off-season cut flowers, or those produced at certain specific periods, help to reduce imports and the balance of trade.

5. To satisfy customers at the time of their needs.

The need for cut flowers for customers is not seasonal, but spreads all year round, depending on certain specific occasions. Off-season cut flowers, or those produced at certain specific dates, are to satisfy the customers at the time of their needs.

Factors affecting flowering

A) Temperature: Temperature, especially low temperature, is an important factor for flowering. Winter wheat, for example, will not flower at all if not exposed to low temperatures; likewise, coloured bracts underneath poinsettia flowers will not turn red or other colours if the temperature is high.

B) Photoperiod: This is a cycle of day length within 24 hours. Flowering of a plant in response to photoperiod is known as 'photoperiodism'. Plants can be classified as short-day, long-day, or day-neutral plants. A short-day plant is one in which flowering takes place when the day length is shorter than a critical value (any number of hours of day length per day); while a long-day plant is one in which flowering takes place when the day length is longer than a critical value. A day-neutral plant is one in which flowering is not affected by photoperiod.

Forcing operation

A) Adjusting Factors Affecting Flowering

1. Temperature: For low-temperature requiring plants, the temperature can be adjusted by keeping the plant parts, mostly bulbs or seeds, in the refrigerator or freezer.
2. Photoperiod: Photoperiod can be adjusted either by providing supplementary light from artificial sources, such as tungsten bulbs and fluorescence lamps, to prolong day length, or by keeping the plants in a dark room to shorten day length.

B) Chemical Flower Forcing

Four types of chemicals affect flowering, namely fertilizers, plant hormones, ethylene, and other chemicals.

1. Fertilizers: Certain fertilizers affect the C/N ratio of the plant, which in turn affects flowering. The broader C/N ratio, i.e. higher C, will induce flowering, while the narrower C/N ratio, i.e. lower C, will keep the plant in vegetative phase. Adjusting fertilizer formula can be used to retard or stimulate flowering.
2. Plant Hormones: There are two main types of plant hormones what affect flowering, namely:

- Gibberellins: Gibberellins have the unique ability among plant hormones to stimulate extensive growth of intact plants. It has been demonstrated that gibberellins can substitute for the long-day requirement in some species, and interact with light. They also overcome the need some species have for an inductive cold period to flower (vernalization). It appears that the formation of flowers caused either by long days or by cold periods might normally depend upon the buildup of endogenous gibberellins during these periods, because the gibberellin content on some affected plants increases following these treatments.

- Growth retardants (e.g. CCC) promote initiation of floral primordium by reducing endogenous GA levels or antagonizing its inhibitory effect on floral initiation.

3. Ethylene: Ethylene has been popularly known to induce flowering in the pineapple. A sprinkle of acetylene, a precursor of ethylene, on top of the pineapple plant is quite effective in inducing the pineapple plant to flower. An ethylene-releasing substance, called ethephon or Ethrel, is commercially available.

C) Mechanical flower forcing

1. Pruning: Pruning helps to broaden the C/N ratio, thus stimulating flowering. This can be seen in the case of bougainvillaea, in which flowering takes place soon after pruning, with the application of proper fertilizers and watering. Other flowers, such as roses, also need pruning for flowering induction.
2. Pinching: The operation of pinching involves the removal of the growing point of a shoot along with a few leaves. Pinching is done at a stage when the plants are young and between 7 and 15 cm in height, depending on their habits of growth. The plants which need pinching include China aster, dahlia, chrysanthemum, marigold, carnation, and rose.
3. Low-temperature Storage: Many plants are promoted to flower by low-temperature storage. This can be done by keeping the plants, usually the bulbs or corms, in the refrigerator for a period of time before they are taken out for planting.
4. Breaking Dormancy: Seeds and buds of some plants are in a dormant stage, i.e. no growth at all, for a period of time. Breaking dormancy can be done by exposure to low temperature or treatment with chemicals and gibberellins. The latter, i.e. gibberellins, are more commonly used in association with flowering. Applied gibberellins break dormancy of many cold-requiring seeds and induce flowering of many cold-requiring plants.

Table: 1 Flower season of important flowers

Sl. no.	Crop	Normal season of flowering	Off season
1.	*Jasminum sambac* *Jasminum grandiflorum* *Jasminum auriculatum*	February - June June-September May - September	July-January October-May October - April
2.	*Rosa centifolia*	March - October	November - February
3.	Tuberose	February - October	November - January
4.	Chrysanthemum	September- February	March-August
5.	Carnation	February - April	June - August
6.	Marigold	January - April	May - July
7.	Gerbera	October - December	April - June

Bulb forcing techniques/management

1. Standard Forcing Technique (Rooting-Room Forcing)

This is the most commonly used forcing method for tulips and narcissus. In this technique:

- Bulbs are first stored under warm conditions to complete floral initiation.
- They are then subjected to cold treatment (5–9°C) in rooting rooms.
- Root development occurs before greenhouse planting.
- After adequate chilling, bulbs are transferred to warm greenhouse conditions for flowering.

The cold treatment promotes root growth and floral development while preventing excessive shoot elongation. Standard forcing provides uniform flowering and high-quality flowers (De Hertogh, 1992).

Example: Tulip Forcing

Tulip bulbs are harvested during summer and exposed to warm temperatures (17–20°C) to promote floral organ formation. After flower initiation, bulbs are pre-cooled at 7–9°C for approximately six weeks and subsequently rooted under cold conditions. Following a cumulative chilling period of 15–20 weeks, bulbs are transferred to greenhouses maintained at approximately 17–18°C for flowering (Moe and Wickström, 1973).

2. Special Pre-cooling Technique (Non-rooting-Room Forcing)

In this method, bulbs receive cold treatment before planting without prior rooting. After pre-cooling, bulbs are planted directly in greenhouse conditions where rooting and flowering occur simultaneously.

This technique is commonly used in:

- Lily (Lilium)
- Freesia
- Dutch Iris
- Calla Lily
- Amaryllis
- Paperwhite Narcissus

The method reduces production time and greenhouse space requirements while ensuring satisfactory flowering performance (Lee et al., 2010).

Use of Plant Growth Regulators in Bulb Forcing

Plant growth regulators (PGRs) are often employed to improve plant quality during forcing.

Ancymidol

Ancymidol is a growth retardant used primarily in tulips. It reduces plant height without negatively affecting flowering time or flower size, making it useful for potted bulb production (Koksal et al., 2009).

Ethephon

Ethephon is used to regulate stem elongation and improve plant compactness, particularly in narcissus and daffodil production (Koksal et al., 2009).

Management Practices for Successful Bulb Forcing

The success of bulb forcing depends on proper management of several factors:

- Selection of healthy, disease-free bulbs.
- Maintenance of appropriate storage temperatures.
- Accurate scheduling of chilling treatments.
- Adequate moisture during rooting.
- Balanced nutrient supply.
- Proper greenhouse temperature and humidity management.
- Regular monitoring for pests and diseases.

Careful coordination of these practices ensures uniform flowering, high-quality blooms, and enhanced profitability (Larson, 2012).

References

1. Larson, R. A. (Ed.). (2012). Introduction to floriculture. Elsevier.
2. Koksal, N., Gulen, H., & Eris, A. (2009). Total soluble sugars in tulip bulbs and freesia corms during storage. *VI International Postharvest Symposium*, 877, 1791–1797.
3. Lee, A. K., Suh, J. K., & Roh, M. S. (2010). Flowering and changes in respiration in Asiatic hybrid lilies as influenced by bulb vernalization. Scientia Horticulturae, 123(3), 366–371.
4. Moe, R. and Wickström, A. L. F. (1973). The effect of storage temperature on shoot growth, flowering, and carbohydrate metabolism in tulip bulbs. Physiologia Plantarum, 28(1), 81–87.
5. De Hertogh, A. (1992). Bulbous and tuberous plants. In Introduction to Floriculture (pp. 195-221). Academic Press.
6. Kamenetsky, R., & Okubo, H. (2012). Ornamental Geophytes: From Basic Science to Sustainable Production. CRC Press.