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# Lisianthus: New cut flower crop for mid Himalayan region

**Lisianthus [*Eustoma grandiflorum* (Raf). Shinn] is a promising new flower crop that has been recently introduced in India. This flower crop is gaining tremendous popularity in the floral industry worldwide due to its rose-like flowers, excellent post-harvest life, and blue flowers. Lisianthus can be used as either cut flowers or as flowering pot plants and flowers are available in various colours, such as blue, purple, white, pink and bicolour. Its flowers are widely used for making bridal bouquets and many other special flower arrangements. This flower crop can be successfully cultivated under the moderate climate of mid Himalayan region. This crop has been recently introduced at ICAR-Indian Agricultural Research Institute, Regional Station, Katrain, Kullu, HP and the agro-techniques have been standardized for its successful cultivation under mid Himalayan region.**

LISIANTHUS [*Eustoma grandiflorum* (Raf). Shinn] is one of the newer flower species brought to the world market and more recently introduced to the Indian market. In European and Asian markets it is already listed among the top selling cut flowers. It is gaining popularity with the floral industry worldwide due to its rose-like flowers, excellent post-harvest life, and blue flowers. It is also widely used as a flowering potted and bedding plant. Lisianthus is herbaceous annual, with slightly succulent bluish green leaves and large funnel shaped flowers growing on long straight stems. The flower has a stem 60 to 80 cm long and carries 5 to 7 flowers per stem. Multi-branched stems of Lisianthus have several flower buds that open successively. Each flower lasts more than a week after opening and, since there are several flower buds on a stem, others continue to open for several more days. Double- and even triple-petal lisianthus have resulted in luxurious blooms. This flower crop can be successfully cultivated under the moderate climate of mid Himalayan region. The agro-techniques for its cultivation have been standardized for its successful cultivation under mid Himalayan region. The flowering in Lisianthus can be obtained from April to October depending upon the variety, planting time and growing conditions.

**Temperature**

Lisianthus can be produced in open fields, naturally ventilated polyhouses or in low cost polytunnels that simply protect the plants from wind and rain or in climate-controlled greenhouses. It prefers moderate climate and can be grown at an altitude range of 1,000-1,800 meters above mean sea level. For better growth and quality flower production, the optimum day and night temperatures should be maintained between 20-24°C and 16-18°C, respectively. Some cultivars of Lisianthus are extremely susceptible to high temperatures, and may respond by rosetting or premature flowering. Higher temperatures (above 28°C) during the first four weeks of transplanting can induce rosetting in susceptible varieties. High humidity levels should be avoided. If temperature is higher, keep night temperatures approximately 4°C cooler than day temperatures. Although, the cooler growing

temperature can add to stem strength and caliper, but it inhibits plant development and greatly adds to crop time.

**Light**

The optimal light levels for lisianthus flower are 4,000 to 6,000 ft candles. Plants may produce more florets under high light intensities, but higher intensities may result in less intense flower colours. In the field, during high light intensities, the use of shading is desirable. Shading increases stem length, but reduces floret number and stem diameter.

**Cultivar selection**

A number of hybrids from multinational companies like Sakata Seeds (Japan), Miyoshi seeds (Japan), Pan American Seed Company (USA) and Gold Smith Seeds (USA) are available in the markets. The cultivar selection in Lisianthus should be made on the basis of colour, floret number (single or double) and market demand. Double types, with blue flower colour are in great demand in the market. Few promising genotypes of lisianthus are Echo double blue, Echo double champagne, Echo double lavender, Echo double pink (Sakata, Japan), Art marine, Bolero blue picottee, Shallot green, Gavotte yellow, Purple flamingo and Bolero white (Miyoshi seeds, Japan) are found suitable for commercial production under mid Himalayan region.


Different Lisianthus cultivars suitable for cultivation under mid Himalayan region. (a) Echo double Blue; (b) Echo double Pink; (c) Echo double Lavender; (d) Echo double Champagne.

**Propagation**

Lisianthus is mainly propagated through seeds. In hilly areas, the seeds can be sown from mid-December to February under controlled environmental conditions. The Lisianthus seeds are very small (19,000 seeds per gram), and seedling growth is very slow. For these reasons, it is advisable to purchase plug seedlings from commercial nurseries. In markets, most of the seed companies are supplying pelleted seeds of this flower crop. Initially, seeds can be sown in pots or 392 or 406-cell plug trays and then seedlings can be transplanted into 48 cell trays to continue growth before planting. Do not cover the seeds after sowing. Seed germination can be hampered upon covering the seeds with the soil/ germination media. Throughout seedling phase, maintain the air temperature at 18 to 21°C (night) and 21 to 24°C (day) as the initial seedling development is very slow and thus fertilization is extremely important. The seedlings after 30 days of sowing should be fertilized with liquid water soluble fertilizers like NPK (19:19:19) @ 1 g/l and Calcium nitrate @1.5 g/l at weekly intervals. Add water sparingly, enough to keep the young seedlings moist.

Vegetative propagation through rooting of cuttings and micro-propagation are the alternative methods for propagation of this crop.

**Soil preparation**

Soil preparation prior to planting is the most important part of Lisianthus production. It should be grown in disease-free soils. Lisianthus is very susceptible to soil-borne diseases. Soil sterilization with formaldehyde is recommended. Formaldehyde can be applied as spray or soil drench, cover the bed immediately with polythene sheets for 7 days. After removing the polythene cover, allow the soil to aerate for another 6-8 days. The planting beds should be thoroughly irrigated one week prior to planting to remove any traces of the chemical. Soil solarization, Methyl Bromide (25-30 g/$m^2$) or Basamid/Dazomet (30-40 g/$m^2$) can also be used for soil disinfection.

For its successful cultivation, the soil *p*H must be maintained from 6.5 to 7.2. A *p*H below 6.0 is damaging and above 7.5 can reduce the intensity of flower colour. Low *p*H can result in poor growth and weak stems and leads to Zinc toxicity. The soil EC should be maintained at about 1.5 mmhos/cm. It also requires high calcium and adequate phosphorous levels for growth. Adjust the *p*H and add calcium and phosphorous prior to planting. High salt levels can delay flowering and can promote rosetting in susceptible varieties.

**Planting**

Generally, 8-12 weeks (65-80 days) are required from seed sowing to final transplanting in the field. The seedlings with four to five pairs of true leaves are

generally transplanted. Seedlings must be transplanted before they become root-bound. Any growth restriction in the seedling stage will result in decreased stem quality of the mature plant. Under the mid Himalayan conditions, lisianthus can be planted from mid-March to June for growing under open field conditions.

Lisianthus crop in flowering at IARI, Regional Station, Katrain, Kullu, Himachal Pradesh

**Planting density**

The planting density depends upon the light conditions. The planting densities of 64 to 96 plants/$m^2$ are recommended. Typical planting density in areas of high light is 84 plants/$m^2$ or even higher. However, in areas of low light, the planting density should be 64 plants/$m^2$. In areas with varying light levels, growers can utilize higher density plantings in the summer, and lower density in the winter.

**Crop timing**

Crop cycle from transplant to harvest is related to variety and environment. In general, lisianthus production from transplant requires up to 15 to 18 weeks under low light and temperatures, but can be as fast as 11 to 12 weeks when transplanted under optimal light and temperature conditions. Though, the best quality cut stems in lisianthus are produced when it is grown at lower temperatures, however, it extends the crop time and may not be economically feasible.

**Nutritional requirements**

Lisianthus is a heavy feeder and grows best with high fertility levels in the soil. High nitrogen and potassium fertilization are required for good growth. Fertilization using a 15:0:15 N:P:K fertilizer is recommended. Nitrogen should be predominantly in the nitrate form; potassium should be equal to nitrogen. Feeding with liquid fertilizer at 200 ppm N and K at every irrigation or every other irrigation is recommended. When growing outdoors a three month slow-release fertilizer has been recommended. Calcium deficiency can cause tip burn of young foliage, bud abortion and poor stem strength. Use supplemental calcium during production unless the soil has high calcium content; calcium nitrate may be used as one component of the fertilizer solution to provide calcium. Fertilizer applications should be discontinued as buds become visible.

**Irrigation**

Lisianthus irrigation requires careful attention. Excessive irrigation increases plant susceptibility to soil-borne fungal pathogens. On the other hand, drought stress can cause premature flower initiation resulting in short, weak stems. Generally, the lower the light and temperature, the less water the plants require. Most growers establish the crop with overhead irrigation, and then switch to drip irrigation after roots are established in the beds. This crop also responds positively to overhead irrigation during periods of high heat and light. Increasing humidity in the greenhouse with an early afternoon irrigation can increase stem length in regions with high heat and light. Avoid high humidity and overhead irrigation after buds have formed however, since botrytis can develop.

**Light and Shading**

Light is also an important component for successful Lisianthus cultivation. Light intensity and day length significantly affect crop growth, crop time and flower quality in this crop. The response varies variety to variety. The optimal light levels for Lisianthus flower are 4,000 to 6,000 ft candles. In regions with low light intensity, supplemental high-intensity lighting may be necessary to produce a quality crop. The higher light promotes high bud count and good flower development. However, excessive light (over 7000 ft candles) reduce stem length of Lisianthus. Shading may be needed to increase stem length. During winters, when day length is shorter than 12 hours, supplemental light (incandescent or HID) can be used. Long day (greater than 14 hours) or night interruption from 10 PM to 2 AM can accelerate flowering.

**Pinching and Staking**

Some growers perform single pinching after 20-25 days of transplanting. Generally, pinching causes shorter stems and delays flowering. To encourage a good second flush, plants should be cut back after the first picking. One to two layers of support netting (4 × 6 in./15 × 20 cm) are recommended.

**Harvesting**

The Lisianthus cut flowers are harvested when one or more flowers are open. Growers often remove the first and sometimes the second flowers that open before harvesting. This increases the number of flowers open on a stem at one time. Flowers should be harvested in the mornings, when flower and plant tissues are cool. Remove field heat by transferring harvested bunches to buckets containing water. Lisianthus is not known to be sensitive to ethylene. However, pulsing with 10% sucrose for 24 hours after harvest has been reported to increase vase life of this flower. The vase life of cut Lisianthus ranges from 12-15 days depending upon cultivars.

Lisianthus Flowers

**Production challenges**

**Rosetting:** Rosetted plants have a cluster of leaves with very short internodes on the stem. The most common cause of rosetting is high temperatures sometime during young plant production. Susceptibility to rosetting varies with variety and can be affected by conditions during seed production. Although, the rosetted plants will usually begin to grow eventually, but the stem quality is often reduced. Rosetted plants also take unacceptably long time to flower and the results are unacceptable for commercial production. Plants that exhibit rosetting can be induced to grow with one or two spray applications of gibberellic acids (10-100 ppm). New series such as Avila, Balboa and Catalina have demonstrated good resistance to rosetting.

**Pests and diseases:** Aphids, thrips, whiteflies, red spider mite and leaf miners cause significant damage to this crop. They also act as vectors to the viruses. Viruses cause the usual symptoms - leaf yellowing, mottling, chlorosis and distortion and poor flowering. Tomato spotted wilt and Impatiens necrotic spot viruses are spread by thrips, bean yellow mosaic virus by aphids, tomato yellow leaf curl virus by whiteflies, and tobacco mosaic virus by humans. Initiating a spray program as soon as the problem occurs can eliminate the pest quickly; controlling a major outbreak can be quite difficult.

*Botrytis* blight, Downy mildew, *Rhizoctonia* stem Rot, *Pythium* root rot, *Fusarium* crown, and Stem rot, and *Fusarium* wilt are among the most frequent diseases contracted. Proper soil drainage can prevent most of these fungi from attacking the plant. Fortnight drenching with captan (0.2%) and alternate spray of Dithane M-45 (2g/l) and Carbendazim (2g/l) can prevent attack of fungal diseases.

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