

## Original Research Article

# STUDIES ON THE UPPER LEAF NECROSIS IN ORIENTAL LILIUMS

### ABSTRACT

Oriental Lilium is one of the commercial bulbous flower crops grown for its cut flower and ornamental value. Upper leaf necrosis is a nutrition disorder which is specific to certain conditions and often misconceived with other disorders. The symptoms of upper leaf necrosis occur on the growing portions of the upper 3 to 5 pair of young leaves in oriental lilium and it is more specific. The imbalance of calcium and boron nutrients which is actively involved in the growing regions of plants viz., root tip, bud development and in the meristematic tissues resulting in deficiency causes upper leaf necrosis in the Oriental lilium. The research on supplementing the deficiency of the nutrients through foliar application during the vegetative phase on critical days in oriental lilium variety Paradero helped in alleviating the necrosis symptoms. Treatments with foliar application of 0.08% & 0.1% each of calcium nitrate & borax applied from 30 to 45 days after planting at 5 days interval resulted in no visible necrosis symptoms (score 0), early appearance of flower bud (48 days) and a greater number of flower buds (3 - 4). Treatment with foliar application of 0.1% each of calcium nitrate & borax ensures a greater number of flower buds (4) per plant.

**KEYWORDS:** Upper leaf necrosis (ULN), chlorosis, calcium, boron, leaf tip, Oriental liliums

### INTRODUCTION

Floriculture particularly cut flower is an ever shining and enterprising industry in terms of utility towards potential value for trade, business and aesthetic sense. Lilium is a commercial cut flower bulbous crop truly representing purity as a symbol of love in view of its flower value. The oriental lilium is now the fourth significant crop worldwide (Jayashree, 2020). The flower crop is grown in the Nilgiris mountain range in the Western Ghats hill of Tamil Nadu, Southern part of India in an area of 40 ha under cool temperate environment. The geographical location of the crop cultivation lies in Kotagiri with Latitude: 11° 25' 48.00" N and longitude of 76° 51' 58.79" E. The climate prevailing in the range is best suited for the growing of bulbous lilium cut flower in greenhouse production system under naturally ventilated aerodynamic structures. Lilium bulbs are imported from the Netherlands to India

**Comment [DV1]:** Change to "that"

**Comment [DV2]:** Change to "pairs"

**Comment [DV3]:** Follow one specific format for this either Oriental Lilium or oriental lilium in between and the end sentences

**Comment [DV4]:** Change to "are"

**Comment [DV5]:** Follow one specific format for this either Oriental Lilium or oriental lilium in between and the end sentences

**Comment [DV6]:** Add "present" before research

**Comment [DV7]:** Add "the" and Follow one specific format for this either Oriental Lilium or oriental lilium in between and the end sentences

**Comment [DV8]:** Write it as (3-4) and remove the spaces in between the numbers

**Comment [DV9]:** Change to "Ghat hills"

**Comment [DV10]:** There is no need to specifically mention this here as in the previous sentence there was a mention of its cultivating regions and in this sentence it was particularly mentioning only one place with area co-ordinates as it will spoil the beauty of the running sentence while reading and if you to mention, use it in materials and methods

**Comment [DV11]:** Change to region or mention the temperature range at which it is growing

through containers under -2°C temperature. The crop is preferred to grow mostly under soilless system of cultivation with coco peat as media.

**Comment [DV12]:** Give space after number “-2°C”

The commercially cultivated types of liliium with Asiatic, Oriental and Longiflorum x Asiatic types (LA) hybrid types are having demand in the international flower auction market. Oriental liliium types which has pink and white are the two major colours available fetching premium price. The total duration of the crop is 110 to 120 days. Liliium is a climate and nutrient sensitive crop which needs special attention throughout the cultivation of the crop. The upper leaf necrosis is a nutrient based crop regulation needs attention in remediating by supplementing with bulb treatment and foliar application of calcium and boron (Yao-Chien William, 2007). The prevalence of the upper leaf necrosis symptoms is more pronounced during the winter months of a year particularly during November to February. The requirement and demand of the flowers are more especially during the winter months of a year. The concept of high value and low volume and high investment with intensive cultivation system makes crop cultivation to grow with more scientific and enterprising so that, the value of the business and utility is known to the flower grower.

**Comment [DV13]:** Remove it and add “Comma (,)”

**Comment [DV14]:** Write this sentence more specifically

The scientific profound of taking up the work from the inputs to increase the efficiency will helps to maximize the economy and value to the crop for horizontal expansion. With the background, the hypothesis was formulated to address the gaps in the requirement and supplementing the nutrients with bulbous treatment during the initial period and foliar formulations during the critical days of a growth in a crop cycle which will certainly add a value and economic benefit to the crop.

**Comment [DV15]:** Change to “this”

## MATERIALS AND METHODS

The research on the management of the upper leaf necrosis was carried out in the Horticultural Research Station, Ooty, The Nilgiris belonging to the Tamil Nadu Agricultural University, Tamil Nadu in India. The hill range is located in an altitude range of 1000 metres to 2600 metres above mean sea level. The work was taken up during the period of winter months from November to February in a year where the occurrence and chance of upper leaf necrosis will be more. The research was undertaken during the period of winter months from the year 2016 to 2018. The completely randomized design was employed for taking up the experiment with three replications and seven treatments. The Liliium bulbs imported from Netherlands which were kept under -2°C were subjected to calcium chloride @ 2.5 g per litre of water for 10 minutes and planting of bulbs were taken up subsequently following the cultural requirements for the management of the crop. The research was taken under pot culture by imposing the set of treatments with calcium nitrate and borax under different

**Comment [DV16]:** Don't mention periods repeatedly as it will spoil the beauty of the sentence

**Comment [DV17]:** Give space after number “-2°C”

combinations of dosages as 0.05%, 0.1%, 0.15%, 0.2%, 0.25%, 0.3% and as control without application of foliar nutrients and bulb treatment. The foliar application was taken up and done with treatments between 25 to 45<sup>th</sup> day at 5 days intervals. The trial was carried out duly following the norms and procedures to be considered in layout and execution of a research trial under field conditions in greenhouses. The meteorological parameters on temperature, light intensity and relative humidity, vegetative parameters namely plant height (cm), number of leaves and buds per plant, days taken for flower bud appearance, days to first harvest and the stage of appearance of upper leaf necrosis prevailing during the trial was recorded. The incidence of upper leaf necrosis and severity index was documented as per the symptoms prevailed and score value defined by Yao-Chien *et al.*, 2005. The obtained data were subjected to statistical analysis as suggested by Panse and Sukhatme, 1985.

List 1 : List of symptoms

Score	Symptoms
0	No visible necrosis symptoms
1	Chlorotic spots
2	Curled leaf margin
3	Marginal necrosis
4	Dead leaf tip
5	>50 % of the leaf area was necrotic

## RESULTS AND DISCUSSION

Lilium cut flower production are more pronounced with the occurrence of more physiological symptoms and nutritional factors. The leaf tip burn, necrosis, scorch, leaf burn is the most commonly occurring symptoms related to liliums. The symptoms of upper leaf necrosis occur on the growing portions of the young leaves in oriental lilium and it is more specific in the top three to five pair of leaves. Chang, 2002; Chang and Miller, 2003 reported that, there is a very low bulb calcium content that cannot meet calcium demand when the upper leaves are expanding. The young expanding leaves of Lilium variety 'Star Gazer' are highly overlapped before flower buds are visible. This leaf 'enclosure' reduces transpiration of young leaves and encourages the development of Upper Leaf Necrosis. Calcium deficiency may result in problems such as upper leaf necrosis in the Lilium Oriental hybrid 'Star Gazer'. Choi *et al.*, 2005 reported that a good fertilizer accelerates calcium uptake enhances the quality of both cut flowers and lily bulbs.

**Comment [DV18]:** Mention what you have applied in the control either water or sterile distilled water or what is there in it

**Comment [DV19]:** Mention the treatment specially with the dosages applied

**Comment [DV20]:** Change to "interval"

**Comment [DV21]:** Add "and"

**Comment [DV22]:** Change to "are"

**Comment [DV23]:** Change to "was a" and write sentences in either past or in present perfect tense

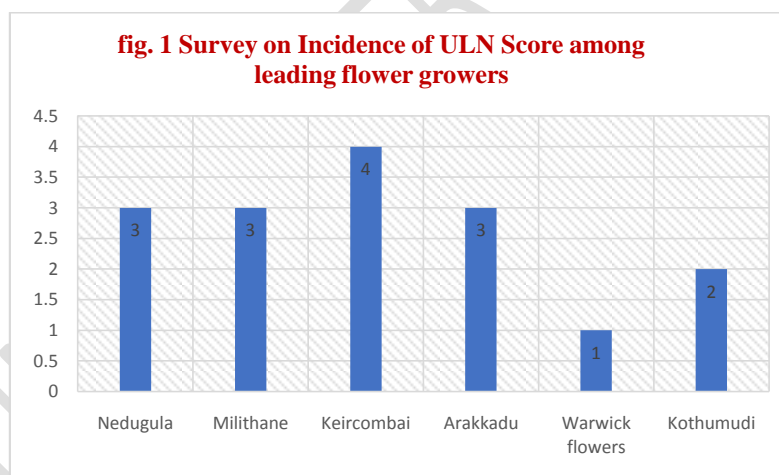
Tsai *et al.*, 2011 corroborated that both low transpiration rates due to overlapping young leaves and an unbalanced calcium distribution during the fast growth period caused Upper Leaf Necrosis in oriental lilies. Leaf enclosure further affected calcium transportation in young leaves and promoted Upper Leaf Necrosis. Chang and Miller, 2003 thought that the lower and middle leaves relied more on calcium supplied from the bulb, while upper leaves and flowers relied more on calcium uptake from the roots, because roots were not enough strong and could not supply calcium for the upper leaves.

Survey on the occurrence of upper leaf necrosis has been done in six leading liliu growing units in Ooty and Kotagiri taluks of The Nilgiris district were done prior to taking up the experiments. The report clearly depicts upper leaf necrosis symptoms prevalence in most of the liliu flower growers and giving an economic loss for the growers. The survey taken up with the liliu growers have given a precise information about the prevalence of upper leaf necrosis and the necessity to take up the research which will help the growers to get a solution for the problem. The loss out of the necrosis symptoms is that, the total value of the flower stem has got no value after its gets affected. The leaf and even flower buds in sometimes are getting affected by this occurrence of upper leaf necrosis.

**Comment [DV24]:** Mention the name of the growing units

**Comment [DV25]:** Write it as "experiment"

**Comment [DV26]:** Change to From the report or mention the report of survey



In commercial cultivation of the liliu crop, the fertigation for liliu bulbs starts from 20 days after planting. Bulbs serve as a storage house for the supply of nutrients during the first 20 days of crop growth. The water-soluble fertilizers were given daily to the crop in soilless (Cocopeat) medium of cultivation. The upper leaf necrosis symptoms express during the 30 to 45 days of crop growth. Cocopeat acts as a medium for the growth of plants and the additional supply of nutrients has to be met through foliar application. This will help in

reducing the occurrence of upper leaf necrosis symptoms. The typical symptom of upper leaf necrosis occurring in the oriental lilioms is similar to those symptoms occurring in other crops caused by calcium deficiency. Similar type of necrosis has been identified and reported by Yao-Chien Chang, 2005 in oriental lilioms. The observations on vegetative and flowering phase on critical days were recorded for the occurrence of upper leaf necrosis. Treatments T<sub>4</sub> & T<sub>5</sub> expressed better response for foliar application of 0.08% & 0.1% each of calcium nitrate & borax applied during 30 to 45 days after planting at 5 days interval which resulted in no visible necrosis symptoms (score 0), early appearance of flower bud (48days) and a greater number of flower buds (4). The treatment T<sub>5</sub> expressed better response for foliar application of 0.1% each of calcium nitrate & borax applied during 30 to 45 days after planting at 5 days interval for upper leaf necrosis and flowering parameters.

**Table 1: Effect of calcium and boron on upper leaf necrosis appearance on vegetative & yield parameters in oriental lilioms**

Treatment	Plant height (cm)	Number of leaves per plant	Days taken for flower bud appearance	Number of flower buds per plant
T <sub>1</sub>	80.50	36.00	64.00	3.00
T <sub>2</sub>	82.80	39.50	64.00	4.00
T <sub>3</sub>	85.00	40.50	60.00	3.00
T <sub>4</sub>	86.50	42.00	52.00	3.00
T <sub>5</sub>	83.00	38.00	48.00	4.00
T <sub>6</sub>	95.00	44.00	64.00	3.00
T <sub>7</sub>	78.00	34.00	60.00	2.0
Mean	84.40	39.14	58.86	3.14
SE(d)	0.32	0.25	0.48	0.05
CD (0.05)	0.75	0.47	0.89	0.09

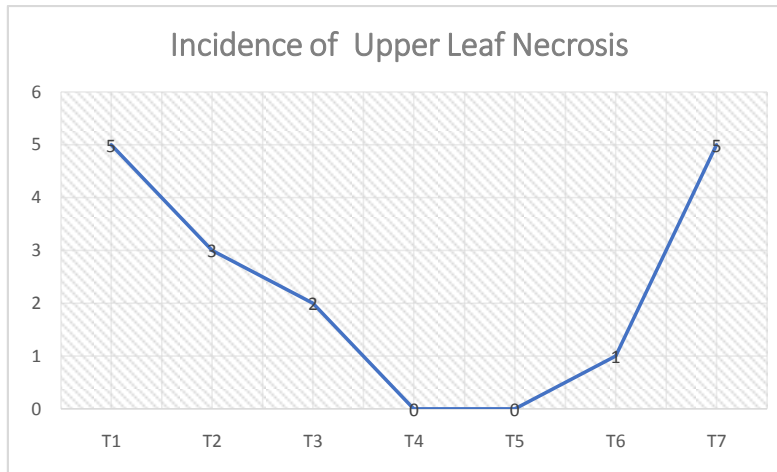
*\*90 days after planting*

**Comment [DV27]:** This dosage was not mentioned in the materials and methods

**Comment [DV28]:** Rewrite this sentence clearly mentioning which was applied in each treatment with specific dosage as mentioned in materials and methods

**Comment [DV29]:** Please write the table heading in a understandable manner

**Fig. 2 Incidence of upper leaf necrosis appearance in oriental liliun**



The occurrence of the symptoms of ~~the~~ necrosis are particularly during the less evaporation days coupled with less light or low duration of light and when the transpiration/evaporation of the plants is lesser when compared with high intensity of light ranges. Cocopeat acts as a medium for the growth of plants and the additional supply of nutrients has to be met through foliar application. This will help in reducing the occurrence of upper leaf necrosis symptoms. Foliar application of 1 gram per litre of calcium nitrate and borax applied during 30 to 45 days after planting at 5 days interval **help** in reducing the incidence of upper leaf necrosis in oriental liliun. The management of proper ventilation system inside the greenhouses by temperature and humidity in the day time during the winter months will help in the evapo-transpiration and uptake of nutrients. Similar result was also reported by Wu *et al.*, 2022 in *Ornithogalum dubium*.

**Comment [DV30]:** Change to "helps"



**Plate. 1:** Severely affected symptom of Upper leaf necrosis in Oriental lily variety 'Paradero'

## CONCLUSION

Foliar application of 1 gram per litre of calcium nitrate and borax applied during 30 to 45 days after planting at 5 days interval helps in reducing the incidence of upper leaf necrosis in oriental lilies. Bulb dipping with calcium chloride @ 2.5 g/litre of water for 10 minutes duration before planting is to be done. The management of proper ventilation system inside the greenhouses by temperature and humidity in the day time during the winter months will help in the evapo-transpiration and uptake of nutrients.

## REFERENCES

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2. Jayashree, N. (2020). Influence of benzyl adenine and gibberellic acid on morphological behaviour of Asiatic lily. M. Sc. (Hort.) Thesis, University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka (India).
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**Comment [DV31]:** Rewrite the following sentence with specific emphasis of the result and mention a little details why it is necessary to maintain or regulate the meteorological conditions and more specifically write the finding with good sentence formation will enhance the beauty of this work.

6. Ya-Hsun Tsai, Hadi Susilo, and Yao-Chien Alex Chang, 2011. Effects of temperature and defoliation on upper leaf necrosis in *Lilium* 'star gazer'. Acta Hort. 886, 289-297.
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9. Panse, V. G. and Sukhatme, P. V. 1985. Statistical Method for Agricultural Workers. Indian Council of Agricultural Research, New Delhi.

**Comment [DV32]:** Add latest references and include more references