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Micro environment study with varying shade intensities and foliar nutrient sprays in hybrid cultivars of *Lilium*

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Abstract
This study analysed the lucid details for explaining various technical requirements, of the *Lilium* crop under varying shade intensities and nutrient sprays. Availability of planting material is a limiting factor in the cultivation of Asiatic hybrid lily and small farmers are facing the constrains by frequently importing the *Lilium* bulbs for planting. This study analyzed the effect of shading intensity and nutrient management on growth, flowering and bulb production in hybrid cultivars of *Lilium* under green shade net. The treatment consists of 3 shades i.e., 50% shade net (S1), 75% shade net (S2), and 2 layers of 50% shade net (S3) and seven concentrations of nutrient sprays including control. Results revealed that 75% shading intensity + micronutrients @ 4 g l^{-1} + micronutrients @ 2 g ml l^{-1} improved all parameters. Among cultivars, Nashville revealed best results in all the parameters while as minimum results were observed in control among nutrient sprays and in 2 layers of 50% shade net among shade nets.

Keywords: Varying shade intensities, foliar nutrient sprays, hybrid cultivars, *Lilium*

Introduction
Lilium is one of the most beautiful and popular ornamental bulbous flowers. The appearance, beauty and colour of the bloom are very spectacular and attractive. Hybrid lilies are exceptionally useful as cut flower and pot plants (Bowser 1986) [1]. They have been long admired and demanded for their aesthetic quality and have often depicted as a symbol of purity and regality. The genus *Lilium* belongs to family Liliaceae and is native to Northern hemisphere in Asia, Europe and North America.

Lilies are one of the showiest flowers in the plant world, mostly terminal, solitary, racemose or umbellate and perfect with large colorful tepals which are available in wide variety of colours including white, yellow, orange, red, and pink. The propagation unit in *Lilium* is an underground non tunicated, highly fleshy bulb which requires skill for handling and storage. The bulb is composed of fleshly scales which are attached to a highly compressed basal plate and used for multiplication. Generally, bulbs are used for cut flower production while, bulb scales are used for large scale multiplication of the cultivar. Proper plant nutrition is essential for successful production of floricultural crops in open and also under protected conditions. Quality is one of the most important characters in the cut flower industry and this is influenced by application of nutrients. Nitrogen, phosphorus and potassium are the three important nutrients that play very important role in altering various growth, yield and quality attributes. Nitrogen, an essential component of protein, nucleic acid and many important substances like chlorophyll, is required for vegetative growth and has been used for higher production of quality flowers (Viradia & Singh, 2004) [21]. Phosphorus has been found to affect leaf size, number of nodes and amount of flowering (Zhang *et al.*, 2004). Integrated supply of micronutrients with macronutrients in adequate amount and suitable proportions is also one of the most important factors that control the plant growth in flower crops. Micronutrients are essentially as important as macronutrients to have better growth, yield and quality in plants as these are involved in all metabolic and cellular functions. Giri *et al.* (2017) [3] reported significant improvement in all flowering and bulb parameters in Oriental *Lilium* hybrid cv. Sorbonne by foliar application of MS macro and micro nutrients.

Use of shade nets aim to optimize desirable physiological responses, in addition to providing physical protection and the substantial effect on shoot elongation, branching and flowering in ornamentals crops (Oren-Shamir *et al.*, 2001) [11]. Shade nets are made of 100 per cent polyethylene inter-woven thread with specialized UV treatment with different shade intensities. It provides partially controlled atmosphere by reducing light intensity and effective heat during day time to crops grown under it. Changing the light intensity and radiation spectrum has a large impact on the total production system. Leaf area and fresh weight of leaves increased significantly under shade nets as compared to open cultivation in cordyline. Leaf area was almost double under nets compared to control. The fresh weight of leaves was also found to be highest under shade nets and lowest under open condition, showing higher accumulation of photosynthates (Gaurav *et al*., 2016). Shade nets not only decrease light quantity but also alters light quality to a varying extent and might also change other environmental conditions (Smith *et al*. 1984).

To create optimum climatic conditions, selection of the correct percentage of shade factor plays an important role to enhance plant's productivity to its optimum. The photo-selective, light-dispersive shade nets provide a new, multi-benefit tool for crop protection (Oren-Shamir *et al*., 2001) [11]. *Lilium* plants should not be grown under direct sunlight. Higher temperature will produce a dwarf crop with a smaller number of flower buds per stem. In summer months, due to high light intensity, the plants become stunted in growth. A shading screen with 50-75% shade will be beneficial (Thangam, *et al*., 2016). The quality of cut flower in *Curcuma alismatifolia* was better at a shade level of 70% with a good appeal, and the cut flower production also was better at this shade level (Thohirah *et al*., 2010) [19]. Different levels of shading induced early flowering in gladiolus during summer. It shortened the duration of first floret to show color than under control conditions (Saud *et al*., 2005) [14].

Materials and Methods

Areas of study carried out in the Division of Floriculture and Landscape Architecture, SKUAST-Kashmir between March 2017 to September 2017 and March 2018 to September 2018, using bulbs of the three cultivars of *Lilium* (Nashville, Navarin, Indian summerset) as test plants were, to improve flower quality and bulb production from flowering bulbs. Treatments were replicated thrice using split plot design (SPD). The details of the experiment are given as under

- S_1: 50% shade net
  - S_2: 75% shade net
  - S_3: 2 layers of 50% shade net
- Sub-plot treatment : Cultivars: 03
  - V_1**:** Nashville
  - V_2**:** Navarin
  - V_3**:** Indian summerset
- Sub-sub plot treatment : Nutrient sprays: 07
- N_1: No nutrients (Water spray)
- N_2: Macro nutrients (18:18:18) @ 2.0 g/ l
- N_3: Macro nutrients (18:18:18) @ 4.0 g/ l
- N_4: Macro nutrients (18:18:18) @ 2.0 g/ l + Micro nutrients @ 1.0 ml/l
- N_5: Macro nutrients (18:18:18) @ 4.0 g/ l + Micro nutrients @ 1.0 ml/l
- N_6: Macro nutrients (18:18:18) @ 2.0 g/ l + Micro nutrients @ 2.0 ml/l
- N_7: Macro nutrients (18:18:18) @ 4.0 g/ l + Micro nutrients @ 2.0 ml/l

Bulbs were planted on 18th March, 2017 and 18th March, 2018 at the Research Field of Division of Floriculture and Landscape Architecture, SKUAST- K, Shalimar Campus. Vigorous and healthy *Lilium* bulbs were planted at a depth of 10 cm at the rate of 6 bulbs bed^{-1} in case of first experiment and at a depth of 10 cm at the rate of 6 bulbs^{-1} in case of second experiment and bulbs planting of *Lilium* was soaked in biofertilizers before the planting. A light irrigation with rubber pipe fitted with sprinkler nozzle was given immediately after planting. Spraying of NPK (18-18-18), CalMax gold and GA_3 to the experimental field was started after 15 days of complete sprouting. Spraying was done with hand compressed sprayer to spray a fine mist.

The experimental site was kept weed free by periodic hand weeding. Irrigations were given as and when required, during crop growth period. Timely observations related to growth and flowering and bulb parameters were recorded. Data was recorded on plant height, days to bud emergence, days to flower opening and total bulb weight per plant (g). These data were analysed by using split plot design.

Results and Discussion

Flowering parameters

(a) Days to flower bud appearance

Data pertaining the days to flower bud appearance as influenced by various nutrient sprays, cultivars and shades is presented in Table –1

Days to flower bud appearance of the *Lilium* cultivars under present studies was found significantly different from each other. Cultivar Nashville reached bud appearance stage earlier (46.14 days) than cv. Navarin and Indian summerset, both the cultivars took (46.77 days) to flower bud appearance.

Influence of shade nets on the days to flower bud appearance was observed statistically significant. However, 75% Shade net resulted minimum (45.68 days) taken to flower bud appearance, followed by 46.91 days under 50% shade net. Maximum days to flower bud appearance 47.10 days was recorded under 2 layers of 50% shade net.

Days to flower bud appearance of all the three cultivars was significantly advanced by the application of foliar nutrient sprays. Application of macro nutrients (18:18:18) significantly advanced the flower bud appearance from 48.23 days in control to 47.24days and 47.33 days in N_2(macro nutrients - 18:18:18 @ 2.0 g l^{-1}) and N_3(macro nutrients - 18:18:18 @ 4.0 g l^{-1}), respectively. There was further improvement in flower bud appearance when macro nutrient sprays were supplemented by micronutrients. Combined application of macro and micro nutrients improved the flower bud appearance from 46.47 days in N_4(macro nutrients - 18:18:18 @ 2.0 g l^{-1}+ micro nutrients @ 1.0 ml l^{-1}) to 45.39 days in N_5(macro nutrients - 18:18:18 @ 4.0 g l^{-1}+ micro nutrients @ 1.0 ml l^{-1}). However, treatment N_7 where plants received foliar nutrient application of (macro nutrients - 18:18:18 @ 4.0 g l^{-1}+ micro nutrients @ 2.0 ml l^{-1}) reached earlier to flower bud appearance of45.20 days. Maximum days toflower bud appearance of 48.23 days was recorded in N_1(Water spray). Treatment N_5(macro nutrients - 18:18:18 @ 2.0 g l^{-1}+ micro nutrients @ 1.0 ml l^{-1}) and N_7(macro nutrients - 18:18:18 @ 2.0 g l^{-1}+ micro nutrients @ 2.0 ml l^{-1}) were statistically at par with one another.

(b) Days to opening of first flower

Data pertaining to days taken to first flower opening as influenced by various nutrient sprays, cultivars and shades is presented in Table – 1

Significant increase in days to opening of first flower was observed in all three shades however 75% Shade net resulted minimum (67.06 days) to first flower opening and maximum (68.48 days) to first flower opening was recorded in 2 layers of 50% Shade net. Significant differences were observed in number of days taken to first flower opening in all three cultivars studied. Cultivar Nashville reached to first flower opening stage in (67.52 days) and the same stage was acquired by cv. Navarin in (68.19 days) which is at par with cv. Indian summerset (68.28 days).

Number of days taken to first flower opening were significantly diverse among the different foliar nutrient applications. Least number of days (66.59) were recorded in the plants that experienced nutrient spray of N_7 (Macro nutrients (18:18:18) @ 4.0 g l^{-1}+ Micro nutrients @ 2.0 ml l^{-1}) which is at par with N_5 (Macro nutrients (18:18:18) @ 4.0 g l^{-1}+ Micro nutrients @ 1.0 ml l^{-1}). While as N_2 (Macro nutrients (18:18:18) @ 2.0 g l^{-1}) and N_3 (Macro nutrients (18:18:18) @ 4.0 g l^{-1}) are statistically at par with each other and maximum (69.61 days) to first flower opening was recorded in N_1(Water spray).

Foliar application of water-soluble fertilizer NPK (18-18-18) improved all flowering parameters. Application of macronutrients NPK (18-18-18) @ 4 g l^{-l} + Micro nutrients @ 2.0 ml l^{-l} improved all foliage parameters as compared to other lower concentrations. However, Treatment control recorded maximum days to bud appearance (48.23 days) and days to opening of first flower (69.61 days) against the minimum values recorded in the N_7 macronutrients NPK (18-18-18) @ 4 g l^{-l} + Micro nutrients @ 2.0 ml l^{-l}. Minimum number of days to flower bud appearance (32.66), and days to flower opening (3.91) were observed under the treatment N_7 macronutrients NPK (18-18-18) @ 4 g l^{-l} + Micro nutrients @ 2.0 ml l^{-l}. as compared to the control and other treatments.

Cultivar also had a significant effect on above discussed flowering parameters. Cultivar Nashville recorded minimum duration to flower bud appearance (46.14 days), and flower opening (67.52 days). The difference may be purely due to their genetic makeup as the cv. Navarin belongs the late variety group and cv. Nashville falls into the mid variety group of *Lilium*. Similar, results were observed earlier by Kamble *et al.* (2004) [8] in gladiolus, who observed significant differences in flowering time in different cultivars under study.

All the flowering parameters differed significantly due to different shade nets. The highest minimum duration to flower bud appearance (45.68 days) and flower opening (67.06 days), respectively was obtained under 75% shade net. This may This may be due to optimum light and temperature conditions inside the shade net conserves moisture that makes soil very porous which in turn promotes nutrient uptake from rootzone to upper parts of plant, wherein plants grown under shade conditions develop large thin leaves with lesser stomata to compensate for the reduction in light intensity by increasing the surface area for the process of photosynthesis, horizontal leaf orientation for better light interception, enhanced photosynthesis and respiration due to the favourable micro-climatic conditions in the shade net house and that causes earliness in the flower bud appearance and days to first flower opening (Sudhakar *et al* 2012) [16].

The probable reason of earliness in these flowering characteristics might be due to balanced ratio of macronutrients and micronutrients, as phosphorus and potassium play an important role in commencement of flowering in the plants. Potassium also is highly beneficial in overcoming the adverse effects of nitrogen and one among them is delaying of flowering. Same results are affirmed with Giri *et al.*, (2107) [3], these results are also similar with These results are in close conformity with the results of Khan *et al.*, (2006) [6] who found that in tulip number of days taken to flowering were increased with the increase in nitrogen and decreased with phosphorus, potassium and zinc. Similar results were also reported by Singh *et al.*, (2015) [17] in carnation, as they recorded lesser number of days to flower bud formation, first flowering. However, the number of days taken to flower bud appearance, days to colour break and days to flower opening were increased with the foliar application of CalMax Gold in combination with NPK 19-19-19. The reason for delaying of these parameters may be attributed to additional supply of nitrogen through CalMax Gold as higher doses of nitrogen may have caused excessive vegetative growth, hence resulted in postponement of such floral attributes. Boron plays a vital role in cell differentiation and the cellular differentiation in shoot apical meristem that might have induced the earlier flowering. Boron’s ability to cellular differentiation might have hastened the early maturity which is a prerequisite for shoot meristem to receive and interpret the incoming signals (either internal or external) and make the transition to flowering. Kumar *et al.* (2003) [5] also reported that application of boron induced early flowering in rose and gladiolus, respectively. Many researchers have reported early flowering, following application of micronutrients.

Plant height (cm)

Data regarding the plant height as influenced by shade nets and nutrient sprays in different cultivars of *Lilium* are presented in Table-1

Plant height of the *Lilium* cultivars investigated during the present studies was found significantly different from each other. Cultivar Nashville recorded maximum plant height of 76.95 cm followed by cultivar Indian Summerset with 67.20 cm, Minimum plant height of 64.40 cm was recorded in cultivar Navarin.

Shade nets had a significant effect on plant height. Plant height was recorded 70.32 cm under 50% shade net which increased to a maximum of 73.38 cm under 75% shade net and got reduced to a minimum of 67.65 cm under 2 layers of 50% shade nets. All the three shade net treatments differed significantly from each other.

Significant differences were observed in all three shades however 75% Shade net resulted Maximum (73.38 cm) Plant height and minimum (67.65 cm) Plant height was recorded in 2 layers of 50% Shade net.

Data pertaining to plant height recorded was significantly influenced by the application of foliar nutrient sprays. Sole application of macro nutrients (18:18:18) had positive influence in enhancing the plant height in all the *Lilium* cultivars. Application of macronutrients increased plant height from 58.42 cm in control to 66.39 cm in treatment N_2(macro nutrients -18:18:18 @ 2.0 g l^{-1}) and 70.21 cm with treatment N_3 (macro nutrients - 18:18:18 @ 4.0 g l^{-1}), respectively. Both these treatments differed significantly from one another and the control. Addition of micronutrients in the spray schedule further improved the plant height. Plant height increased from 71.40 cm in N_4 (macro nutrients -18:18:18 @ 2.0 g l^{-1} + micro nutrients @ 1.0 ml l^{-1}) to 78.02 cm in N_7 (Macro nutrients 18:18:18 @ 4.0 g l^{-1} + micro nutrients @ 2.0 ml l^{-1}). All the combined treatments of macro and micro nutrients differed significantly with each other. Treatment N_7

where plants received higher doses of macro and micro nutrients as foliar application, recorded maximum plant height of 78.02 cm. Minimum plant height (58.42 cm) was recorded in $N_1$where plants are sprayed with distilled water.

Significant effect of shade nets, cultivar and foliar nutrient sprays was observed on various growth parameters, viz, plant height, stem length and stem diameter.

Differences in the growth parameter were also visible in the cultivars with respect to plant height studied during the course of investigation. Maximum values for plant height were reflected by the cv. Nashville in comparison to cv. Navarin and Indian summerset. The possible reason of difference in their vegetative characteristics might be due to their different genetic makeup as well as varietal differences.

Plant height differed significantly due to different shade nets. The highest plant height (73.38 cm) was obtained under 75% shade net. This may be due to increased auxin transport leading to cell elongation below the zone of apical meristem as plants grown in low light levels were found to be more apical dominant than those grown in high light environment, resulting in taller plants under shade, similar results were also observed by (Sudhakar *et al* 2012) [16].

Foliar application of water-soluble fertilizer NPK (18-18-18) improved plant height. Application of macronutrients NPK (18-18-18) @ 4 g l^{-l} + Micro nutrients @ 2.0 ml l^{-l} improved plant height as compared to other lower concentrations. However, Treatment N_7 macronutrients NPK (18-18-18) @ 4 g l^{-l} + Micro nutrients @ 2.0 ml l^{-l} recorded maximum plant height (78.02 cm) against the minimum values recorded in the control. plant height was further improved with the combined application of macronutrients (NPK: 18-18-18)) and micronutrients (CalMax Gold @1 ml l^{-l} and 2 ml l^{-l}). Combined application of macronutrients and micronutrients proved superior in improving plant height as compared to the sole application of macronutrients. The increase in plant height might be due to supply of optimum amount of nutrients at the most critical stages of growth as the spraying of nutrients (both macro and micro) had been carried out at given period of time, thus covering almost all critical periods of growth. Giri *et al.* (2017) [3] reported that Nitrogen being important in cell division and vegetative growth resulted better plant height. Its combining effect with calcium and other macro nutrients utilizes vitamins in better proportion and catalyzes enzymatic activity for greater vegetation. Niedziela *et al*. (2015) reported that there was increased uptake of N, P, K, Ca, and Mg at and after shoot emergence in tulip plant during spring. Supplying nutrients when plant's uptake is high leads to improved and better plant growth. Phosphorus is also an important constituent of many essential compounds, and is involved in various physiological processes including cell division, development of meristematic tissues, in photosynthesis, respiration, etc. (Marschner, 1995). It also promotes root growth which in turn facilitates uptake of nutrients and results in improved growth.

Flower size (cm)

Data pertaining to the flower size as influenced by various nutrient sprays, cultivars and shade nets is presented in Table-1 Flower size of the *Lilium* cultivars investigated was found statistically significant. Maximum flower size of 17.16 cm was recorded in cv. Nashville followed by 17.12 cm in cv. Indian Summerset and minimum flower size of 17.10 cm was recorded in cv. Navarin. Cultivar Nashville and Indian summerset were statistically at par with one another.

Shade nets had a significant influence on the flower size. Maximum flower size of 17.52 cm was recorded under 75% shade net followed by flower size of 17.18 cm under 50% shade net. Minimum flower size of 16.59 cm was recorded under 2 layers of 50% Shade net. All the three shade net treatments differed significantly from each other.

Flower size was significantly influenced by the application of foliar nutrient sprays. Application of macro nutrients (18:18:18) resulted in a gradual increase in the flower size from 16.17 cm in control N_1 (water spray) to 16.81 and 16.96 cm with N_2 (macro nutrients - 18:18:18 @ 2.0 g l^{-1}) and N_3 (macro nutrients -18:18:18 @ 4.0 g l^{-1}), respectively. Combined application of macro and micro nutrients further improved the flower size which recorded maximum value of 17.71 cm with treatment N_7(macro nutrients - 18:18:18 @ 4.0 g l^{-1}+ micro nutrients @ 2.0 ml l^{-1}) followed by 17.54 and 17.33 cm with N_5 (macro nutrients - 18:18:18 @ 4.0 g l^{-1}+ micro nutrients @ 1.0 ml l^{-1}) and N_6 (macro nutrients - 18:18:18 @ 2.0 g l^{-1}+ micro nutrients @ 2.0 ml l^{-1}), respectively. Minimum flower size of 16.17 cm was recorded with N_1 (water spray).

Differences in the flower size were visible in the cultivars studied during the course of investigation. Maximum values for flower size was reflected by the cv. Nashville in comparison to cv. Navarin and Indian summerset. This variation in flower size might be attributed to the inherent genetic characters associated with the genotypes. Similar results were observed by Kamble *et al*. (2004) [8] and Punam *et al.* (2009) [12] in gladiolus.

Flower size differed significantly due to different shade nets except flower bud circumference. The flower bud length (7.68 cm), flower size (17.52 cm) and number of florets per spike (3.24) respectively was obtained under 75% shade net. This may be due to better light and temperature conditions inside the polyhouse coupled with flower bud length which enabled the accumulation of more amount of photosynthates thus resulting in more flower diameter and better flower quality (Fatmi *et al*., 2018) [2]. Improved availability of moisture under 75% shading intensity may have resulted in improved turgor and hence increases bud length, flower size and number of florets per spike. This helps the plants to put on significantly improved floral growth and hence enables them to bear more reproductive structures.

Flower size were further improved with the combined application of macronutrients (NPK: 18-18-18)) and micronutrients (CalMax Gold @1 ml l^{-l} and 2 ml l^{-l}). Combined application of macronutrients and micronutrients proved superior in improving flower size as compared to the sole application of macronutrients. The increase in all aforementioned flower size might be due to supply of optimum amount of nutrients at the most critical stages of growth as the spraying of nutrients (both macro and micro) had been carried out at given period of time This might be due to the reason that development of flower heads is also dependent on the availability of adequate food material. Nitrogen is the major nutrient taking part in the synthesis of carbohydrates. The increase in yield through foliar sprays of macronutrients and micronutrients is a function of both nitrogen uptake and the efficiency with which it is utilized for growth and flower head development (Jamwal *et al.*, 2008) [4].

Total bulb weight plant^{-1}(g)

Data regarding the total bulb weight per plant as influenced by various nutrient sprays, cultivars and shade nets is presented in Table 1

Significant differences in Total bulb weight per plant of the *Lilium* cultivars investigated during the present study was found statistically significant between the cultivars. Maximum total bulb weight per plant was recorded in cv. Nashville (60.58 g) followed by cv. Indian summerset (60.31 g) and minimum in cv. Navarin (60.23 g) which is statistically at par with cv. Indian summerset (60.31 g).

Perusal of data reveals that significant differences in total bulb weight per plant were observed in all three shade nets ascertained. However, 75% Shade net resulted maximum (68.78 g) total bulb weight per plant followed by 50% Shade net and minimum (59.91 g) total bulb weight per plant was recorded in 2 layers of 50% Shade net.

Data pertaining to total bulb weight per plant clearly depicts the significant influence of application of foliar nutrient sprays. Increasing the macronutrient concentration from 2 g/L to 4 g/L significantly increased the total bulb weight per plant from 58.90 g in control (water spray) to 59.64 g and 60.49 g in N_2(macro nutrients - 18:18:18 @ 2.0 g l^{-1}) and N_3 (macro nutrients -18:18:18 @ 4.0 g l^{-1}), respectively. Significant increase in the total bulb weight per plant was observed in all three cultivars due to the foliar application of nutrients. Application of Macro nutrients (18:18:18 @ 4.0 g/ l + Micro nutrients @ 2.0 ml/l) sprays resulted in significant improvement in total bulb weight per plant. However, treatment N_7 (Macro nutrients 18:18:18 @ 4.0 g/ l + Micro nutrients @ 2.0 ml/l) recorded maximum (61.13 g) total bulb weight per plant while as N_6 (Macro nutrients - 18:18:18) @ 2.0 g l^{-1}+ Micro nutrients @ 2.0 ml l^{-1}) and N_5 (Macro nutrients - 18:18:18) @ 4.0 g l^{-1}+ Micro nutrients @ 1.0 ml l^{-1}) are statistically at par with each other and minimum total bulb weight per plant was recorded in N_1(Water spray) with (58.90 g).

There was significant influence of genotype on total weight of bulbs per plant. Highest total bulb weight per plant was observed in cv. Nashville as compared to other two cultivars. The reason for this difference in performance of varieties might be attributed to their differences in their genetic makeup. Similar were the findings of Rao and Sushma (2015) [13], while investigating the performance of different genotypes of gladiolus.

Plant environment affects growth, development and productivity of crops, temperature and light being the most crucial factors. It is clear that lily cultivar grown under 75% green shade net condition with no flower harvesting produced maximum total bulb weight, this may be due to availability of better light conditions which resulted in higher production of bulb. These results are in concurrence with (Kumar and Singh 2019).

Improvement of total bulb weight per plant with the application of nutrient sprays might be attributed to the fact that MS media is a complete nutrition complex required by a plant for its proper growth and development as this media consists of all macronutrients that include nitrogen both in nitrate and ammonical form, phosphorus, potassium, calcium and magnesium and micronutrients like boron, cobalt, copper, iron, manganese, zinc etc. Following shoot emergence in the spring, an acute increase in nitrogen uptake occurs and continues until the shoot (scape) reaches its maximum height**.** With each increment in macro and micro nutrient concentration in sprays, there was simultaneous increase in total bulb weight per plant. Increased bulb parameters with micronutrients might be due to their role in increased cell division and greater mobilization of photosynthates to the places where the bulbs are formed. The results of the present study are in conformity with the findings of Singh *et al.* (2012) [18] who reported that application of Zn (0.50%), Fe (0.25%) and Cu (0.25%) to gladiolus plants significantly increased the size and weight of main corm.

Table 1: Effect of shade nets and nutrient sprays on flowering parameters in hybrid cultivars of *Lilium* (pooled 2017-2018)

Treatments	Days to flower bud appearance	Days to opening of first flower
Cultivar (C)		
Nashville: (C1)	46.14	67.52
Navarin: (C2)	46.77	68.19
Indian Summersret: (C3)	46.77	68.28
Sem±	0.06	0.04
CD($p\leq0.05$)	0.17	0.12
Shade (S)		
50% Shade net: (S1)	46.91	68.29
75% Shade net: (S2)	45.68	67.06
2 layers of 50% Shade net: (S3)	47.10	68.48
Sem±	0.07	0.04
CD($p\leq0.05$)	0.21	0.12
Nutrient Spray (N)		
No nutrients (Water spray): (N1)	48.23	69.61
Macro nutrients (18:18:18) @ 2.0 g l^{-1}: (N_2)	47.33	68.71
Macro nutrients (18:18:18) @ 4.0 g l^{-1}: (N_3)	47.24	68.62
Macro nutrients (18:18:18) @ 2.0 g l^{-1} + Micro nutrients @ 1.0 ml l^{-1}: (N_4)	46.47	67.85
Macro nutrients (18:18:18) @ 4.0 g l^{-1} + Micro nutrients @ 1.0 ml l^{-1} :(N_5)	45.39	66.77
Macro nutrients (18:18:18) @ 2.0 g l^{-1} + Micro nutrients @ 2.0 ml l^{-1}: (N_6)	46.07	67.45
Macro nutrients (18:18:18) @ 4.0 g l^{-1} + Micro nutrients @ 2.0 ml l^{-1} :(N_7)	45.20	66.59
Sem±	0.08	0.06
CD($p\leq0.05$)	0.26	0.19

Table 2: Effect of shade nets and nutrient sprays on plant height in hybrid cultivars of *Lilium* (pooled 2018-2019)

Treatments	Plant height (cm)	Flower size (cm)	Total bulb weight plant^{-1}(g)
Cultivar (C)			
Nashville: (C1)	76.95	17.16	60.58
Navarin: (C2)	64.40	17.01	60.23
Indian Summersret: (C3)	67.20	17.12	60.31
Sem±	0.17	0.02	0.08
CD($p\leq0.05$)	0.52	0.07	0.23
Shade (S)			
50% Shade net: (S1)	70.32	17.18	60.42
75% Shade net: (S2)	73.38	17.52	60.78
2 layers of 50% Shade net: (S3)	67.65	16.59	59.91
Sem±	0.13	0.03	0.08
CD($p\leq0.05$)	0.41	0.09	0.23
Nutrient Spray (N)			
No nutrients (Water spray): (N1)	58.42	16.17	58.90
Macro nutrients (18:18:18) @ 2.0 g l^{-1}: (N_2)	66.39	16.81	59.64
Macro nutrients (18:18:18) @ 4.0 g l^{-1}: (N_3)	70.21	16.96	60.49
Macro nutrients (18:18:18) @ 2.0 g l^{-1} + Micro nutrients @ 1.0 ml l^{-1}: (N_4)	71.40	17.14	60.62
Macro nutrients (18:18:18) @ 4.0 g l^{-1} + Micro nutrients @ 1.0 ml l^{-1}: (N_5)	74.62	17.54	60.99
Macro nutrients (18:18:18) @ 2.0 g l^{-1} + Micro nutrients @ 2.0 ml l^{-1}: (N_6)	73.61	17.33	60.83
Macro nutrients (18:18:18) @ 4.0 g l^{-1} + Micro nutrients @ 2.0 ml l^{-1}: (N_7)	78.02	17.71	61.13
Sem±	0.09	0.03	0.12
CD($p\leq0.05$)	0.29	0.10	0.35

Refrences

1. Bowser D. Florist reviews. 177, 29-32
2. Fatmi U, Singh D, Bharti S. Growth and flowering of Asiatic lily cv. Pollyanna as influenced by different growing environments. Plant Archives. 2018;18:760-762.
3. Giri TK, Beura S, Behera S, Acharjee S. Response of Asiatic *Lilium* Hybrid cv. Tresor to Foliar application of Different Group of Nutrients. International Journal of Current Microbiology and Applied Sciences. 2017;6:3280-3286.
4. Jamwal M, Parmar AM, Mishra RL, Singh DB. Effect of foliar application of urea on floral growth of gladiolus cv. American Beauty. Agricultura-Stiinnasi practicanr. 2008;3-4:67-68.
5. Kumar P, Raghava SPS, Misra RL, Singh KP. Effect of GA3 on growth and yield of China aster. Journal of Ornamental. Horticulutre. 2003;6:110-112.
6. Khan FU, Jhon AQ, Khan FA, Mir MM. Effect of NPK and Zn on growth, flowering and bulb production in tulip under polyhouse conditions in Kashmir. Journal of Horticultural Sciences. 2006;1(2):129-134.
7. Kumar R, Gobind S, Yadav DS. Growth and flowering of tuberose as influenced by different bulb size and spacing. Hariana Journal of Horticultural Science 2003;32(1/2):66-69.
8. Kamble BS, Reddy BS, Gangadharappa PM, Kulkarni BS. Evaluation of gladiolus varieties for quality parameters, flower and corm yield. Haryana Journal of Horticultural Sciences. 2004;33:74-75.
9. Kumar P, Arora JS. Effects of Micronutrients on Gladiolus. Journal of Ornamental Horticulture. 2000;3:91-93.
10. Niedziela CE, Nelson PV, Dickey DA. Growth, Development, and Mineral Nutrient Accumulation and Distribution in Tulip from Planting through Post anthesis Shoot Senescence. International Journal of Agronomy, 2012, 1-11.
11. Oren-Shamir M, Gussakovsky EE, Spiegel E, Nissim-Levi A, Ratner K, Giller YE, *et al*. Colored shade nets can improve the yield and quality of green decorative branches of *Pittosporum variegatum*. Journal of Horticultural Sciences and Biotechnology. 2001;76:353-361.
12. Punam H, Sanyat M, Lily MK. Evaluation of gladiolus cultivars for cut flower production in Jharkhand. Journal of Ornamental Horticulture. 2009;12(3):206-207.
13. Rao, Sushma. Influence of iron nutrition on growth, flowering and corm yield in gladiolus. Journal of Ornamental Horticulture. 2015;8:293-295.
14. Saud BK, Kumar S, Srivastava R. Effect of growing conditions on vegetative growth, flowering and corm production in gladiolus. Journal of Ornamental Horticulture. 2005;8:264-267.
15. Sharma JR, Gupta RB, Panwar RD. Growth, flowering and corm production of Gladiolus Cv. Friendship as influenced by foliar application of nutrients and growth regulators. Journal of Ornamental Horticulture. 2004;7:154-158.
16. Sudhakar M, Kumar SR. Effect of different shading conditions on growth, flowering and yield of *Heliconia* sp. cv. Golden Torch. Asian Journal of Horticultural Sciences. 2012;7:512-514.
17. Singh A, Sharma BP, Dilta BS, Laishram N, Gupta YC, Bhardwaj SK. Effects of fertilization on quality flower production and foliar nutrient content of carnation (*Dianthus caryophyllus* L.) Cv. Master. Bangladesh Journal of Botany. 2015;44(1):133-137
18. Singh JP, Kumar K, Katiyar PN. Effect of zinc, iron and copper on yield parameters of gladiolus. Hort Flora Research Spectrum 2012;1(1):64-68.
19. Thohirah LA, Flora CLS, Kamalakshi N. Breaking bud dormancy and different shade levels for production of pot and summer tulip (*Cucurma latifolia).* American Journal of Agriculture and Biological Sciences. 2010;5:385-388.
20. Thangam M, Safeena SA, Devi SP, Singh NP. Heliconia flowers make coconut farming more profitable in Goa. 2014. http://www. icar.org.in/en/node/8390.
21. Viradia RR, Singh SP. Production of quality roses cv. Gladiator as influenced by nitrogen nutrition and plant density. Journal of Scientific Horticulture. 2004;9:159-

163.
22. Zhang YJ, Yan F, Gao H, Xu YZ, Guo YY, Wang, EJ, *et al*. Chlorophyll content, leaf gas exchange and growth of oriental lily as affected by shading. Russian Journal of Plant Physiology. 2015;62:334-339.