INFLUENCE OF LIGHT INTENSITY ON DIFFERENT CULTIVARS OF POTTED GERBERA

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CERTIFICATE

This is to certify that the thesis entitled **"Influence of Light Intensity on Different Cultivars of Potted Gerbera"** submitted to the Department of Horticulture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **Master of Science in Horticulture**, embodies the result of a piece of bona fide research work carried out by **Champa Das**, Registration No. **08-3230** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that any help or source of information, received during the course of this investigation has been duly acknowledged.

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ABSTRACT

The experiment was conducted during the period from July 2009 to February 2010 at Horticulture Farm, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh to find out the influence of light intensity on different cultivars of potted gerbera. The experiment consisted of two factors: Factor A: Light intensity: L_0; Full sunlight; L_1; 40% reduced sunlight; L_2; 60% reduced sunlight and Factor B: Cultivars: 5 different colored cultivars namely, C_1; White colored flower; C_2; Pink colored flower; C_3; Light pink colored flower; C_4; Yellow colored flower and C_5; Orange colored flower. The two factors experiment was laid out in Complete Randomized Design (CRD) with three replications. Significant variation was recorded for different growth and flower character due to different light intensity, cultivars and their interaction effect. The maximum number of flowers per plant (15.64) was found from L_1 and lowest (11.90) from L_2. Maximum flowers (15.20) per plant was produced by C_5 and the lowest (12.48) from C_1. For combined effect L_1C_5 produced the highest number of flowers (18.98) and L_2C_1 produced the lowest. So, it may be concluded that orange colored flower under 40% reduced sunlight gave the best results.

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CHAPTER I

INTRODUCTION

Gerbera *(Gerbera jamesonii* L.*)* belongs to the family Asteraceae is an herbaceous perennial flower crop, with long stalks and daisy-like flower, a native of South Africa. It is a popular cut flower grown throughout the world in a wide range of climatic conditions. It is popularly known as 'Barberton daisy' or 'Transvaal daisy'. It grows well in tropical and subtropical regions, but in a temperate climate should be protected from frost and cultivated in glasshouses. Genus *Gerbera L.* consists of 30 species, which are of Asiatic and South African origin. Among the different species, *Gerbera jamesonii* is the only species under cultivation. Development of *Gerbera jamesonii* as a floricultural crop is traced from its cultivation as a novelty in South Africa to its establishment as a commercial crop in 1930s. Modern gerbera arose from *Gerbera jamesonii* hybridized with *Gerbera viridifolia* and possibly other species (Leffriing, 1973). There is a wide range of variation available in this flower.

Its magnificent inflorescence with a variety of colour has made it attractive for use in garden decorations, such as herbaceous borders, beddings, and pots and for cut flowers as a long vase life (Bose *et al.,* 2003). In Bangladesh, gerbera was introduced recently and it is gaining popularity. It has great potential for local as well as export market. In Bangladesh, gerbera is mainly grown in summer. It cannot tolerate extreme high temperature, cold and heavy rainfall. Heavy rainfall and water logging conditions are very much harmful for gerbera. It can be grown on all types of soil but loam soil with moist condition is better for its desired development. These plants grow slowly and most new gerbera developed for pot plant production are 6-8 inches in height and produce flowers up to 4 inches across. Range of colors available has increased to include a wide array of pastel colors.

Plant breeder have done a wonderful job of developing outstanding flower colors, including purple, rose, pink, white, and various bicolor and introduced double and semi-double flowering forms, adding to the beauty of this flower. Production of gerbera has increased dramatically in recent years in Bangladesh.

In Bangladesh,there are a huge amount of homestead areas or near about homestead area where shade is unavoidable due to standing trees. The flowers producers easily grow there different flowers that properly grown in low light or shading condition. So, there is a tremendous need to screen these flowers under low light environment for evaluating their adaptability and yield potential. To serve this purpose, higher yielding and partial shade tolerant cultivars should be introduced. Research works on the partial shade tolerance of these flowers are very scanty in our country. Adaptive responses of plant to low irradiance include an increase of leaf area ratio, leaf to stem mass ratio and stem length, decreased leaf thickness and root growth relative to shoot growth (Corre, 1983). Under partial shade condition stimulation of cellular expansion and cell division in leaf could be one of the possible factors that contribute to the individual leaf area increase (Schoch, 1982). Upto 50% reduced sunlight, the concomitant increase in main stem length and internode length to main stem length probably due to the apical dominance under shade condition (Hillman, 1984). Photosynthetically active radiation is the major factor regulating photosynthesis, dry matter production and yield of crops (Rao and Mitra, 1998). Plants encounter shading, showed decreased photosynthesis which ultimately induced yield reduction and possibly impairs its quality (Morgan *et al.*, 1985).

Considering the above mentioned facts it was found that very few research works related to growth, yield and development of gerbera cultivars in reduced light and in these relations have been carried out in our country. Under consideration, the present study was conducted with the following objectives:

1. To find out the influence of light intensity on potted gerbera production.
2. To select the suitable gerbera cultivar for the commercial production in Bangladesh.

CHAPTER II

REVIEW OF LITERATURE

Gerbera is an attractive flower but attained less concentration in respect of various agronomic aspects. The available recommended cultural practices of this flowers is not available in respect of optimum growth and flower production performance under reduced light condition with different cultivars. Very few research works related to growth, flower production and size of the flowers due to reduced light in different cultivars have been carried out in abroad. The research work so far done in Bangladesh is not adequate and conclusive. However, some of the important and informative works and research findings related to the light intensity and cultivar response of different crops, so far been done at home and abroad, have been reviewed in this chapter under the following headings-

2.1 Review related to light intensity

Haque *et al.* (2009) conducted an experiment at the experimental farm of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh. Bottle gourd cv. High-green (hybrid) was grown to investigate the morpho-physiological changes and yield performance under four different levels of light (100, 75, 50 and 25% PAR). It was observed that some of the morphological characters like main stem length, internode length and individual leaf area increased, whereas main stem diameter and numbers of leaves per plant decreased due to the reduced light levels. At 50% PAR number of leaves per plant did not decrease significantly in bottle gourd. Leaf weight ratio (LWR) remained more or less similar up to 50% reduction of PAR. SPAD value increased with the reduction of PAR level i.e. partial shading stimulated chlorophyll synthesis in leaves.

In order to improve the light composition in the solar greenhouse, Wang *et al.* (2007) supplied red, blue, UV-A and UV-B light, and the effects of the different light qualities on the growth characteristics of cucumber were investigated. Being under different light quality (red, blue) the plant height, flower bud differentiation and photosynthesis rate improved greatly, while for UV-A and UV-B the growth rate is lower compared with the control. The transpiration rate of cucumber leaf under red and blue light is higher compared with the UV-A and UV-B light. When under UV-B light the stoma conduction, transpiration rate, and the CO_2 concentration between cells as well as the photosynthesis rate were decreased, at the same time the germination rate, fresh and dry weight, plant height and flower differentiation number were decreased; while the stoma density and thickness of cucumber leaf were increased greatly.

The possibility of intercropping cinnamon (*C. verum* [*C. zeylanicum*]) with rubber (*H. brasiliensis* clone RRIC 100) planted with the standard inter row spacing of 8.1 m was examined in Sri Lanka by Pathiratna and Perera (2005). The inter row space in control plots was grown with *Pueraria phaseoloides* as a cover crop. Measurements of light availability and root length density of both the crops in the inter row space and the cinnamon bark yield and its components were recorded for eight years. PAR transmission from the rubber canopy into the middle of the inter row was reduced to 20.6% by the eighth year. The length density of fine roots (RLD in cm/1000 cm3) of rubber in the inter row increased from 6.4 in the third year to 175.8 in the eighth year in intercropped plots while those of control plots increased from 77.7 to 138.5. RLD of cinnamon in intercropped plots decreased from 51.8 in the third year to 33.5 in the eighth year. Length per stick, weight and bark yield of cinnamon also declined. The reduction in bark yield of cinnamon per bush was 70.5% by the eighth year. The dry matter content of bark was highest (9.36%) when the light level was approximately 60%. Adverse effects of poor light availability and competition from rubber on cinnamon at this spacing by the fifth year were evident.

A study was conducted by Wang *et al*. (2003) to investigate illumination effect and its influence on the growth of some medicinal plants in an intercropping system with *Populus tomentosa* at different row spacing. The daily average light intensity between rows decreased with decrease in row spacing.

The height growth of *Glycyrrhiza uralensis*, *Platycodon grandiflorus* and *Pinellia pedatisecta* was different when intercropped with *Populus tomentosa*. Results indicated that among the medicinal plants studied, only *Platycodon grandiflorus* and *Pinellia pedatisecta* can be intercropped with trees.

Field experiments were conducted by Shikata *et al*. (2003) in Japan in 1999 to analyse the effect of intercropping with maize on the growth and light environment of cowpea and to evaluate the canopy photosynthetic rate in relation to the leaf area index (LAI), light interception, and leaf net photosynthetic rate. Cowpea was grown as a sole crop at a row spacing of 70 cm (sole cropping, SC) or was intercropped with maize in alternating rows at a row spacing of 70 cm (intercropping-sparse, IC-S) and 35 cm (intercropping-dense, IC-D). Dry weight, leaf area of cowpea and maize, and light intensity in canopy were measured by the stratified clip method at 3-week-intervals. Leaf net photosynthetic rate of cowpea was determined to estimate the canopy photosynthetic rate. In IC-S, cowpea developed more leaves than in SC, although the plant population of cowpea in IC-S was half of that in SC. Superior light interception obtained by intercropping with maize led to an increase of the LAI with a decrease of the light extinction coefficient and resulted in a high canopy photosynthetic rate in IC-S. On the other hand, in IC-D, the canopy photosynthetic rate of cowpea decreased drastically due to mutual shading of cowpea leaves in the upper layer.

In Nordic winter conditions with a shortage of natural light, it is very important to grow species and cultivars suited for low light and artificial lighting reported by Sevelius (2003). The present study was conducted to determine if leaf net CO_2 exchange, chlorophyll a fluorescence, oxygen evolution, chlorophyll a and b content, or leaf morphology would be useful in assessing gerbera (*Gerbera cantabrigensis*) growth in low light. Biomass accumulation as well as flower yield was lowest in Lynx. Susceptibility to photoinhibition and recovery thereafter showed small defect in Lynx.

The number of stomata per unit area was lowest in Lynx. Lynx also had higher total chlorophyll content than the other two cultivars. Surprisingly, there were no significant differences between the cultivars in chlorophyll a quenching or in leaf CO_2-exchange. Chlorophyll a fluorescence, or some part of it, seems to be a possible tool to screen plants suitable for low light.

A field experiment was conducted by Sharaiha and Battikhi (2002) in the summer season of 1999, at the Faculty of Agriculture Research Station, University of Mutah, South Jordan. The objective of this experiment was to study the benefit of microclimate modification, as affected by intercropping system with two different row arrangements (2:2 and 1:2), on the yield of maize (cv. Reward) and two potato cultivars (Berca and Frisia). Maize and potato yields were increased especially under the 2:2 intercropping row arrangements. The increase of potato yield might be related to the reduction in air heat units (by 210 and 28), soil heat units (by 80 and 88), and light interception (by 350 and 344 micro mol m^{-2} $second^{-1}$) for Frisia and Berca, respectively, compared to their sole crops. Moreover, the values of soil moisture storage and evapotranspiration for Frisia tended to decrease under intercropping compared to sole cropping. While water use efficiency of Frisia under intercropping was significantly higher than under sole cropping. The higher yield of maize under the 2:2 row arrangement compared to maize sole crop was related to the higher values of the microclimatic factors. Planting Frisia and Berca in association with maize were efficient compared to their sole crops, based on the land equivalent ratio, in all the combinations tested.

Baumann *et al*. (2002) established an ecophysiological model was used to improve understanding of interplant competition based on physiological, morphological and phenological processes. The model was parameterized based on characteristics of the plants in monocultures and its performance was evaluated for the crop mixtures using experimental data from different growing seasons. A light interception routine accounting for row-geometry was compared to a routine assuming a homogeneous horizontal leaf area distribution.

The models simulated the light distribution among the species equally well. The production of the two crops in the mixture was accurately simulated using parameter values based on monoculture growth characteristics. Morphological characteristics of the species such as the relative growth rate of leaf area during early growth and specific leaf area largely determined the competitive strength of the species. Dry matter production of the species, particularly if grown in mixture, was highly sensitive to maximum plant height and radiation use efficiency. Celery (*Apium graveolens*) was found to be a stronger competitor than leek and clear responses of quality characteristics to plant density in monoculture and mixtures were observed. The model was used to determine ranges of plant densities that enable the intercropping system to meet current quality standards of the component crops.

Cucumber plants were grown by Peil and Lopez (2002) under greenhouse and shading screen-inducing conditions of diffuse light during summer in Southern Spain, with two intensities of fruit removal viz., one fruit remaining per leaf axil (no fruit removal) and two fruits remaining per three leaf axils (fruit number manually restricted) to analyse the effects of fruit removal on biomass partitioning and growth of aboveground plant parts. The effects of fruit removal on biomass production were greater in terms of vegetative rather than total fruit growth and of dry rather than fresh weight. Increasing fruit removal intensity increased dry matter allocation to the vegetative organs and the total aboveground dry matter production. Although dry matter production of the vegetative parts of the shoot strongly increased with increasing fruit removal intensity, the dry matter allocation between stems and leaves was not affected. Dry matter content of leaves increased and specific leaf area decreased when the number of fruits on a plant was manually restricted, but fruit fresh and dry weight production and dry matter content were only slightly affected. The number of harvested fruits per plant was not affected by fruit removal intensity, but decreased abortion rate and increased growth rate of the individual fruits (which in turn decreased the growing period from anthesis to harvest).

Biomass partitioning and growth of fruits and vegetative organs are discussed in relation to the change of the balance between assimilates for different plant parts caused by sink demand reduction.

Light interception of a cucumber row crop was investigated by Peil *et al.* (2002) under greenhouse conditions during two growth periods (spring and summer). Measurements of the photosynthetic active radiation (PAR) were performed throughout the growth periods at the top (PARo) and at the bottom (PARt) of the crop. Shading screen-inducing conditions of diffuse light was used in summer, leading to a reduction of the integral of the incoming PAR (Sigma PARo) of 33% (1036 and 691 mol m-2 in spring and summer, respectively). The contrasting conditions of Sigma PARo induced changes in the geometric characteristics of the crop (height, row width and leaf area), which influenced the amount of intercepted light. The intercepted PAR (Sigma PARi= Sigma PARo- Sigma PARt) experienced a higher reduction than the one observed in Sigma PARo, which was calculated to be 37% (684 and 429 mol m-2 in spring and summer, respectively). Maximum values of light interception efficiency were relatively high (0.90 and 0.87 in spring and summer, respectively). To estimate the intercepted light by the crop, an existing model of canopy light interception (M_1) by a row crop was used along with a simple estimation approach based on the Lambert-Beer's law. Validation of the models was performed using experimental data, assuming that all PARo in summer was diffuse. Validation results showed that both approaches were able to correctly estimate the daily intercepted PAR under contrasting conditions of PARo, tending to overestimate at high LAI values, although only the M1 model was able to simulate daily variations of PARi.

Intercropping provides an important means of raising not only productivity and land-use efficiency of smallholder rubber lands, but also income generation during the unproductive immature phase of the rubber tree reported by Rodrigo *et al.* (2001). To evaluate current recommendations for intercropping rubber in Sri Lanka, we assessed the effects of a range of planting densities of banana, the most common companion crop of rubber on productivity and resource capture.

In this paper, we test the hypothesis that rubber/banana intercropping, even at high densities of banana, results in an increase in biomass per unit land area and per crop plant due to an increase in both radiation capture and radiation-use efficiency. Five treatments were imposed: sole crop rubber (R); sole crop banana (B); and three intercrop treatments comprising an additive series of one (BR), two (BBR) and three (BBBR) rows of banana to one row of rubber. Dry matter production in the rubber-based treatments was directly related to planting density, being least in the sole rubber and greatest in BBBR intercrop. A_4 fold increase in dry matter across treatments was derived from an increase not only in light capture (270%) but also radiation-use efficiency (RUE, 230%). Neither R nor BR treatment, which is currently recommended for intercropping in Sri Lanka, achieved full ground cover with fractional interception remaining below 40 and 50%, respectively. Fractional interception was greatest in BBBR treatment, and by the end of the measurement period, total intercepted radiation was 23 and 73% greater than that in the BBR and BR intercrops, respectively. Shade did not limit either photosynthesis or growth of component crops in the intercrops, even when planting density of banana was increased 3-fold. In fact, intercropping increased growth of both rubber and banana components suggesting that shade associated with the denser intercrop canopies, moderated the microclimate and alleviated plant stress. These results highlight the potential gains that can be made by intercropping and optimizing planting density for improved resource capture in immature rubber plantations.

A field experiment was conducted by Roodagi, *et al*. (2001) in Karnataka, India, during 1997-98, to determine the effect of sowing methods and intercropping on leaf area index (LAI), light transmission ratio (LTR) and cane yield of sugarcane. Sowing methods consisted of normal sowing (ridge and furrow, 90 cm) and paired row methods (60-120-60 cm). Sugarcane was grown as a sole crop and in intercrops with sunn hemp, maize, cowpea, soyabean, groundnut, potato and French bean (*Phaseolus vulgaris*). LAI, LTR and cane yield did not vary significantly under the different sowing treatments.

At 90 and 150 days after sowing (DAS), sole crop sugarcane had the highest LAI (1.74 and 3.85, respectively), followed by cane + sunn hemp and cane + cowpea. LTR was highest in sole crop at 30 DAS, and in cane + sunn hemp, cane + cowpea and sole crop at 60 DAS. The highest cane and sugar yields were in the cane + sunn hemp intercropping system, while the lowest were in cane + maize intercropping system

Gerbera jamesonii cv. Illusion, *Rosa hybrida* cv. Frisco, *Kalanchoe blossfeldiana* cv. Tenorio and *Ficus benjamina* cv. Exotica were grown under laboratory conditions by Buwalda *et al*. (2000) and exposed to 3 different patterns of temperature variation at 2 levels of average temperature (18 and 22^{0}C) and 2 light levels (2.5 and 5.5 mol PAR m^{-2} d^{-1}) over a growing period of 72 days. The experiments were carried out in 16 phytotrons of 15 m^2 each with light levels of 2.5 and 5.5 mol PAR m^{-2} d^{-1} and 4 temperature levels (14, 18, 22 and 26^{0}C). *F. benjamina* final fresh weight, shoot length and number of side shoots were superior at the higher light level. Plant performance was positively correlated with temperature levels except for plants grown at 26^{0}C, where performance was similar to that of plants grown at 22^{0}C. Growth of *K. blossfeldiana* was not affected by temperature but showed a strong response to light. Plants grown under the high light level had almost twice the biomass of those exposed to the low light level. Flower production of *G. jamesonii* was positively correlated with temperature at the higher light level. Cumulative fresh weight of the flowers was stimulated by temperature fluctuations with a 6-day period at the higher temperature level. The rate of development of rose shoots was positively correlated with light and temperature. The temperature fluctuations had no effect on the rate of development or specific weight of the flowers, but fluctuations with a 12-day period slightly reduced vase life. In general, no adverse effects on production or quality were found, which indicates that in greenhouse climate control, it is sufficient to maintain a certain average temperature.

Three experiments were conducted Bodson and Verhoyen (2000) between November and April during 1994-97 to investigate the effects of photoperiod, supplementary light intensity and daily supplementary light integral on gerbera (*Gerbera cantabrigensis* cultivars Estelle and Ximena) flowering in poor natural light conditions. The plants were subjected to different photoperiods (12, 18 and 24 h), light intensities (75, 112.5, 150 and 300 micro mol/m^2 s^{-1} PAR) and supplementary lighting periods (12, 18 and 24 h). In all experiments, the 12-h photoperiod produced the highest number of inflorescences if the same daily supplementary light integral was used. Doubling the daily light integral by extending the photoperiod to 24 h did not increase the flower yield except in the case of Estelle in one experiment. On the other hand, an increase in the daily light integral by increased supplementary light intensity strongly affected the number of inflorescences in the 12-h photoperiod. As the quantity of gerbera flower yield was strongly affected by supplementary lighting regimes, the grower must be aware of different distributions of the same light energy over one day, which may lead to a change of about 45% in number of inflorescences. If only the number of inflorescences is considered, a combination of short photoperiod and high light intensity can be recommended.

A greenhouse study was carried out by Labeke and Dambre (1999) in Belgium to investigate the effects of supplementary light on Gerbera cv. Tiffany (small flowers) and cv. Optima (large flowers). Gerbera was planted on 11 August 1998 on rockwool mats (6/m^2 for cv. Tiffany and 4/m^2 for cv. Optima). Supplementary light (approx. 3000 lux) was used when natural light reached 150 W/m^2. Data were collected weekly (until June 1999) on the number of flowers/plant, stem length, weight and diameter of flowers. Supplementary light increased the number of flowers/m^2 of cv. Optima significantly (by 33.5%), especially between December and May (compared to the control). Supplementary light also resulted in longer stems (between December and May) and heavier flowers (between October and March). Supplementary light increased flower production in cv. Tiffany slightly (by 6%).

However, significant increases were measured for flower diameter (between October and December), stem length (between December and April), and stem weight (between October and May).

A field experiment was conducted by Ahmed and Jahan (1998) during rabi season 1992-93, in Gazipur, Bangladesh to evaluate the effect of intercropping wheat (cv. Sonalika) with potato (cv. Cardinal) on light interception, leaf area index and dry matter production. The treatments comprised 100% potato + 100% wheat in 1 or 2 rows, 100% potato + 50% wheat in 1 or 2 rows, and 100% potato + 25% wheat in 1 or 2 rows. Photosynthetically active radiation (PAR) on potato canopy in intercrop treatment were reduced 2 to 15% at 42 days after sowing (DAS) and 4 to 20% at 52 DAS by wheat canopy but the PAR absorption efficiency of the total canopy of intercrop treatments were greater than their individual canopy absorption. Leaf area index (LAI) and dry matter production by the component crops were reduced due to intercropping.

In many crop models, light intercepted by a canopy (IPAR) is calculated by Flenet *et al*. (1996) from a Beer's Law equation: $IPAR = PAR \times (1 - \exp(-K \times LAI))$, where k is the extinction coefficient, PAR the photosynthetically active radiation, and LAI the leaf area index. The effect of row spacing on k was investigated for maize, sorghum, soyabeans and sunflowers to provide information for modelling. Data from literature and from an experiment conducted at Temple, Texas, were evaluated. The effects of time of day and stage of crop development on k for different row spacings were also investigated. Seeds of all species were sown in rows 0.35, 0.66, or 1.00 m apart. Measurements of canopy light interception were taken near solar noon to two dates before anthesis. At anthesis, extinction coefficients were determined at 08.45, 10.15, and 11.45 h (solar time). The extinction coefficient showed a linear decrease as row spacing increased. For each crop, the effect of row spacing on k was described by one linear regression for most data. It is recommended that modelling light interception for different row spacings should account for these effects.

2.2 Reviews related to gerbera cultivars/varieties

'Liangfen' was developed by crossing female 'Aruba' and male 'True Love' by Li-Shen Chong *et al*. (2008). It belongs to wide-petal standard cut flower gerbera (*Gerbera jamesonii*) cultivar, with pink petal, blank centre, semi-double. The diameter of flower head is 10-12 cm, the peduncle length is 50-55 cm, and the vase life can last 12-15 days. The annual yield is 30-35 stems per plant. It is highly resistant to *P. cryptogea* and is suitable for protected cultivation.

Youl-ChoiSeong *et al*. (2006) was derived *Gerbera hybrida cv. Raon*, by crossing cultivars Kippros and Rora in Korea Republic in 1994, was selected in 2000 after the investigation its characteristics from 1995 to 1999. Raon is a cut-flower cultivar with large, double-type, dark orange flowers, with 11 days of vase life. It is adaptable in any greenhouse region in Korea.

Youl-ChoiSeong *et al*. (2006) was derived *Gerbera hybrida* cv. *Noble Hugging*, a seedling selected from an F_1 population derived from crossing cultivars Michelle and Picasso in Korea Republic in 1998, was finally selected in 2003 after the investigation of its characteristics. The single flower of cv. Noble Hugging consists of ivory ray flowers and black disc. And it has long, strong flower stalk and long cut-flower longevity. It is adaptable in any greenhouse region in the country.

Misty Red is a new red gerbera (*Gerbera hybrida*) cultivar developed by Chung-YongMo *et al.* (2005) from a cross between Ximena and Florense, followed by seedling and line selections at the Flower Breeding Research Institute, Gyeongnam Agricultural Research and Extension Services, Korea, in 2000. Misty Red is characterized by red, semi-double type, large flowers; good harmony in ray floret colour and flower centre colour; as well as stable flower shape. The vase life was 10.2 days. The average yield of Misty Red was 49.6 flowers per plant a year in greenhouse yield trails carried out from 2002 to 2003. Misty Red is suitable for cultivation under greenhouse conditions in Korea.

Performance of 9 exotic cultivars of gerbera (*Gerbera jamesonii*) was studied by Singh and Mandhar (2004) under fan and pad cooled greenhouse environments at the Indian Institute of Horticulture Research, Bangalore, Karnataka, India from July 1998 to June 1999. Greatest plant height (48.83 cm), and number of suckers (5.16) and leaves (46.27) per plant were obtained with Tiramisu, Lyonella and Ornella, while the lowest values of the aforementioned parameters were recorded for Whitsun (47.88 cm), Sunset (3.82) and Tiramisu (26.74), respectively. Flowering was earliest (47.88 and 57.47 days for 50 and 100% flowering, respectively) in Whitsun and latest (83.10 and 88.30 days) in Tiramisu. Greatest diameter of flower (10.70 cm) and length of flower stalk (58.27 cm) were recorded for Tiramisu and Lyonella, respectively. Thickest (0.70 cm diameter) and heaviest (22.20 g) flower stalks were observed in Twiggy, whereas the thinnest (0.60 cm diameter) and lightest (13.94 g) stalks were observed in Whitsun. Highest total number of flowers produced per plot in a year, and the mean number of flowers per plant and per month in a year were obtained with Ornella (1058.00, 47.26 and 5.02, respectively), followed by Thalassa (988.00, 44.52 and 4.61), whereas the lowest were obtained with Tara (591.33, 29.48 and 2.82), followed by Sunset (600.00, 31.15 and 3.11). Percentage of 1st grade flowers was highest in Lyonella (73.85), Sunset (70.41) and Tiramisu. (70.54), and lowest in Tara (47.16) and Thalassa (47.87). The highest percentage of discard flowers was recorded for Thalassa (37.30), followed by Whitsun (20.47). Based on the overall performance, Lyonella, Omella, Tiramisu and Twiggy are recommended for commercial cultivation.

Anuradha and Gowda (2000) studied the association of cut flower yield with growth and floral characters in gerbera. In studies on 25 gerbera. genotypes at Bangalore, cut flower yield exhibited a high level of positive and significant correlation with number of leaves per plant, weight of ray florets and days taken to flower opening. Path analysis revealed that number of leaves per plant had the greatest positive direct effect on flower yield.

A greenhouse study was carried out in Belgium to investigate the effects of heating on the growth of Gerbera cv. Tiffany (small flowers) and cv. Optima (large flowers), Labeke *et al*., (1999). Gerbera was planted on 11 August 1998 on rock wool mats ($6/m^2$ for cv. Tiffany and $4/m^2$ for cv. Optima). Two independent heating systems (above-ground and sub-surface) were used. The day/night temperature regime was $20/18^0$C. Treatments included the simultaneous use of both systems (control), and the use of the above-ground system if the minimum heating level was not reached with use of the sub-surface system alone (at 50^0 C). Data were collected weekly (until June 1999) on the number of flowers/plant, stem length, and weight and diameter of flowers. For cv. Optima, the sub-surface heating regime resulted in a significant increase in the number of flower (145.8 compared with 117.6 in the control treatment), and significantly shorter stems (between September and April). Non-significant differences in flower production were found for cv. Tiffany (286.8 and .240 flowers/m^2 for the 2 regimes, respectively). However, stem length and weight were significantly lower with the subsurface heating system.

Mahanta *et al*. (1998) studies on variability and heritability of some quantitative characters in gerbera (*Gerbera jamesonii*). Ten cultivars of gerbera were evaluated for 14 characters in trials conducted at Assam Agricultural University. For all these characters, data are tabulated on range, mean, genotypic and phenotypic coefficient of variability, heritability and genetic advance. Plant height, vase life, flower size exhibited greater genetic variability and high heritability coupled with high genetic advance. It was suggested that these characters be used as selection criteria for the improvement of gerbera. Broad-sense heritability estimates were very high for all the characters except days to flower.

Wahi *et a*l., (1991) studied a factor analysis in gerbera. Factor analysis was performed using morphological traits in 31 genotypes of gerbera. Phenotypic correlation matrices indicated that flower number/plant is increased by selection for shoots/plants and leaves/plant. Results from genotypic correlation matrices advocated selection for flower diameter, flower stalk length, leaves/plant and number of days from flower bud appearance to opening. Both correlation matrices showed leaf size to be related to flower longevity.

CHAPTER III

MATERIALS AND METHODS

The experiment was conducted during the period from July 2009 to February 2010 to find out the influence of light intensity on different cultivars of potted gerbera. The materials and methods that were used and followed for conducting the experiment presented under the following headings-

3.1 Experimental site

The study was conducted in the Horticulture Farm, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, Bangladesh. The location of the experimental site is $23^{0}74^{/}$N latitude and $90^{0}35^{/}$E longitude and at an elevation of 8.2 m from sea level (Anon., 1989).

3.2 Climatic condition of the experimental site

Climate of the experimental site was subtropical, characterized by heavy rainfall during the months from April to September (Kharif season) and scanty rainfall during the rest of the year (Rabi season). Maximum and minimum temperature, humidity and rainfall during the study period were collected from the Bangladesh Meteorological Department (climate division), Agargaon and have been presented in Appendix II.

3.3 Planting materials

Different cultivars of gerbera were used as planting materials of the experiments. The seedlings of these cultivars were collected from Bangladesh Green Roof Movment nursery, Rampura, Polashbag, Dhaka.

3.5 Treatment of the experiment

The experiment consisted of two factors:

Factor A: Three levels of light intensity, such as-

i. Full sunlight (L_0)

ii 40% reduced sunlight (L_1)

iii. 60% reduced sunlight (L_2)

Factor B: Five Gerbera cultivars, such as-

i. White colored flower (C_1)
ii. Pink colored flower (C_2)
iii. Light pink colored flower (C_3)
iv. Yellow colored flower (C_4)
v. Orange colored flower (C_5)

a) white colored flower

b) Pink colored flower

c) Light pink colored flower

d) Yellow colored flower

e) Orange colored flower

There were 15 (3 × 5) treatments combination such as L_0C_1, L_0C_2, L_0C_3, L_0C_4, L_0C_5, L_1C_1, L_1C_2, L_1C_3, L_1C_4, L_1C_5, L_2C_1, L_2C_2, L_2C_3, L_2C_4 and L_2C_5.

After the gerbera seedling establishment, nylone nets were hanged at a height of 2.3 meters with bamboo sticks to reduce light intensity. Single layer net was used to reduced the light intensity upto 40% (approx.) and double layer net was use to reduce light upto 60%.

3.6 Design and layout of the experiment

The two factors experiment was laid out in Complete Randomized Design (CRD) with three replications. 45 pots were used in the experiment. Size of the each pot was $10^{//}$.

3.7 Pot preparation

Soil and cowdung were mixed and pots were filled 7 days before transplanting. Pots were placed on 21th July 2009. Weeds and stubbles were completely removed from the soil. Weeds and stubbles removed soil with decomposed cowdung were used in the pots. Recommended chemical fertilizers (NPK as 5, 10, and 5 g in each pot) were mixed with the soil. Pots were prepared 3 days before transplanting. Pots were placed on 21 July 2010.

3.8 Production Methodology

3.8.1 Planting of Seedlings

Forty five seedlings were planted at 7 cm depth in 45 pots on 24 July, 2009 with maintaining proper care.

3.8.2 Weeding and irrigation

Weeding and irrigation were done in all the pots as and when it required**.**

3.8.3 Disease and Pest management

Experimental crop was infected by powdery mildew during the early growing stage. Disease was controlled by spraying Dithane M-45. Fungicide was sprayed two times at 15 days interval. Crop was also attacked by mites during the growing stage.

3.9 Data collection

Data were collected in respect of the following parameters from each pot with in the mentioning period.

3.9.1 Number of leaves per plant

Number of leaves per plant was recorded by counting all the leaves from each plant of each pot and the mean was calculated. It was measured in number at every 30 days interval after 20 days of transplanting (DAT) and continuing upto 200 DAT.

3.9.2 Leaf length (cm)

Length of leaf was recorded by measuring length of 5 leaves from each plant of each pot and the mean was calculated. It was measured in cm at every 30 days interval after 20 days of transplanting (DAT) and continuing upto 200 DAT.

3.9.3 Leaf width (cm)

Width of leaf was recorded by measuring breadth of 5 leaves from each plant of each pot and the mean was calculated. It was measured in cm at every 30 days interval after 20 days of transplanting (DAT) and continuing upto 200 DAT.

3.9.4 Diameter of flower bud

Diameter of flower bud was recorded by measuring diameter of flower bud using Digital Caliper-515 (DC-515) of 5 flower buds from each pot and the mean was calculated. It was measured in cm at every 1 day interval after flower bud initiation continuing upto flower anthesis.

3.9.5 Diameter of flower

Diameter of flower was recorded by using Digital Caliper-515 (DC-515) of 5 flowers from each pot and the mean was calculated. It was measured in cm at every 1 day interval after flower blooming upto 6 days after anthesis.

3.9.6 Peduncle length (cm)

Length of peduncle was recorded by measuring length of 5 peduncles from each pot and the mean was calculated. It was measured in cm at every 1 day interval after initiation and continuing upto 6 days.

3.9.7 Peduncle diameter (cm)

Diameter of peduncle was recorded by measuring diameter of peduncle using Digital Caliper-515 (DC-515) of 5 peduncles from each pot and the mean was calculated. It was measured in cm at every 1 day interval after initiation and continuing upto 6 days.

3.9.8 Days to bud initiation to blooming

Days to bud initiation to blooming were measured by counting the number of days from bud initiation to blooming of flowers and recorded.

3.9.9 Flowers per plant

Flowers per plant were measured by counting the total number of flowers that blooms from a flowers and recorded.

3.9.10 Leaf area (cm^2)

Leaf area was measured by using CL-202 Leaf Area Meter.

3.9.11 Measurement of light intensity (lux)

Light intensity was measured by light intensity meter in a 15 days interval.

3.10 Statistical analysis

Collected data for various characters were statistically analyzed using MSTAT program. Mean for all the treatments was calculated and the analysis of variance for each of the characters was performed by F (variance ratio) test. Difference between treatments was evaluated by Duncan’s Multiple Range Test (DMRT) test at 5% level of significance (Gomez and Gomez, 1984).

CHAPTER IV

RESULTS AND DISCUSSION

The experiment was conducted to find out the influence of light intensity on different cultivars of potted gerbera. Data on different growth parameters and flower characters were recorded. The analyses of variance (ANOVA) of the data on different parameters are presented in Appendix II-IX. The results have been presented with the help of table and graphs and possible interpretations given under the following headings:

4.1 Number of leaves per plant

Significant variation was recorded from number of leaves per plant at different days after transplanting with different light intensity, cultivars and their interaction effect on potted gerbera (Appendix II). In case of light intensity, at 20, 50, 80, 110, 140, 170 and 200 DAT the maximum number of leaves per plant (12.04, 19.52, 23.39, 28.51, 31.38, 35.80 and 37.30) was found in L_1 (40% reduced sunlight) which was closely followed (11.19, 18.79, 22.57, 26.04, 30.47, 33.34 and 34.69) by L_0 (full sunlight) and the minimum number of leaves per plant (9.85, 16.72, 20.62, 22.43, 25.89, 28.60 and 32.14) from L_2 (60% reduced sunlight) (Figure 1). Similar opinion also expressed by Kubota and Hamid (1992) and reported that under low light condition, plant expense more energy to structural development compare to the plant grown under full sunlight. Haque *et al.* (2009) found that numbers of leaves per plant decreased due to the reduced light levels. Pathiratna and Perera (2005) also reported similar results.

For different cultivars of gerbera, at 20, 50, 80, 110, 140, 170 and 200 DAT, the maximum number of leaves per plant (12.84, 20.80, 24.60, 31.80, 31.60, 46.00 and 46.78) was recorded from C_5 (orange colored flower), which was statistically identical (11.39, 18.63, 22.48, 26.82, 29.27, 34.97 and 38.88) with C_2 (Pink colored flower), while the minimum number (10.50, 17.93, 21.56, 23.91, 28.54, 27.87 and 30.60) from C_1 (white colored flower) (Figure 2). Different varieties produced different number of leaves based on their genetic characters.

In case of interaction effect of light intensity with cultivar, at 20, 50, 80, 110, 140, 170 and 200 DAT the maximum number of leaves per plant (12.84, 20.80, 24.60, 31.80, 32.75, 46.00 and 46.78) was recorded from L_1C_5 (40% reduced sunlight and orange colored flower), whereas the minimum number of leaves per plant (8.70, 15.63, 18.87, 20.30, 24.63, 25.10 and 27.22) from L_2C_1 (60% reduced sunlight and white colored flower) (Table 1).

4.2 Leaf length

Different light intensity, cultivars and their interaction effect on potted gerbera showed statistically significant variation for leaf length at 20, 50, 80, 110, 140, 170 and 200 DAT for (Appendix III). In case of light intensity, at 20, 50, 80, 110, 140, 170 and 200 DAT the longest leaf (8.84 cm, 10.96 cm, 15.40 cm, 18.62 cm, 24.72 cm, 28.93 cm and 30.44 cm) was recorded from L_1 (40% reduced sunlight) which was closely followed (7.43 cm, 9.49 cm, 13.06 cm, 16.98 cm, 20.44 cm, 24.95 cm and 27.27 cm) by L_0 (full sunlight), whereas the shortest leaf (5.96 cm, 7.78 cm, 10.15 cm, 13.30 cm, 17.98 cm, 19.04 cm and 22.31 cm) was recorded from L_2 (60% reduced sunlight) (Figure 3). Upto 50% reduced sunlight, the concomitant increase in main stem length and inter-node length to main stem length probably due to the apical dominance under shade condition earlier reported by Hillman, 1984).

For different cultivars of gerbera, at 20, 50, 80, 110, 140, 170 and 200 DAT, the longest leaf (8.09 cm, 9.87 cm, 13.93 cm, 20.43 cm, 24.75 cm, 26.24 cm and 28.63 cm) was recorded from C_5 (orange colored flower), which was statistically identical (7.94 cm, 9.86 cm, 13.56 cm, 18.53 cm, 24.62 cm, 26.31 cm and 29.15 cm) with C_2 (Pink colored flower), while the shortest leaf length (6.73 cm, 8.87 cm, 11.76 cm, 12.87 cm, 16.21 cm, 22.18 cm, and 23.40 cm) was recorded from C_1 (white colored flower) (Figure 4).

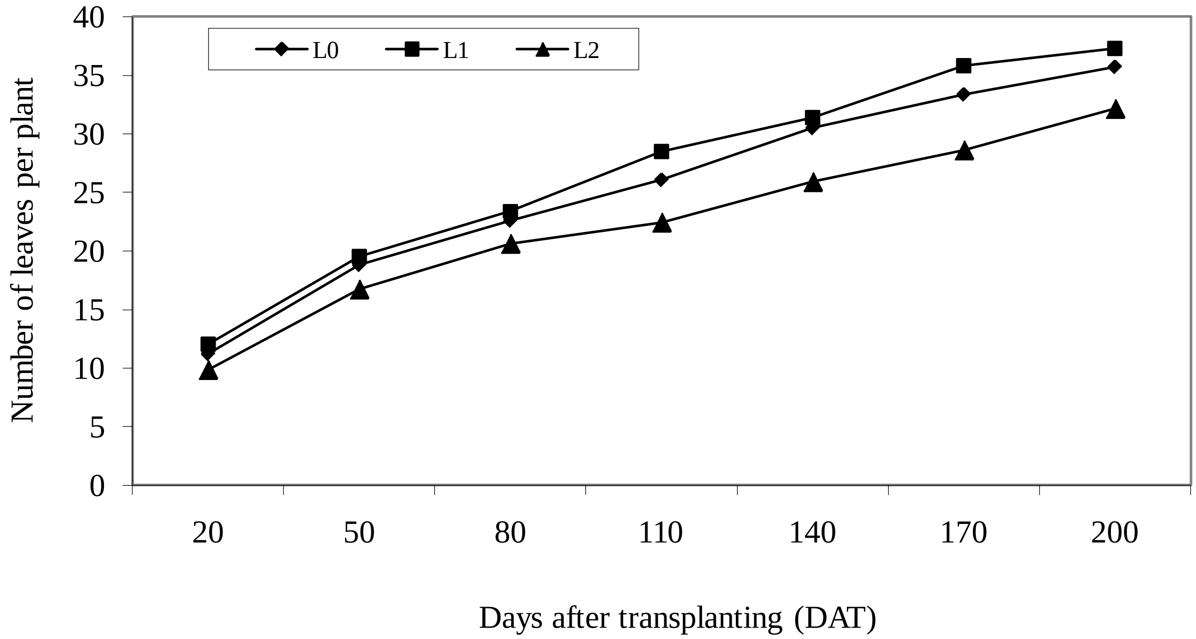

Figure 1. Effect of light intensity on number of leaves per plant of gerbera; L_0: Full sunlight, L_1: 40% reduced sunlight and L_{2-}: 60% reduced sunlight

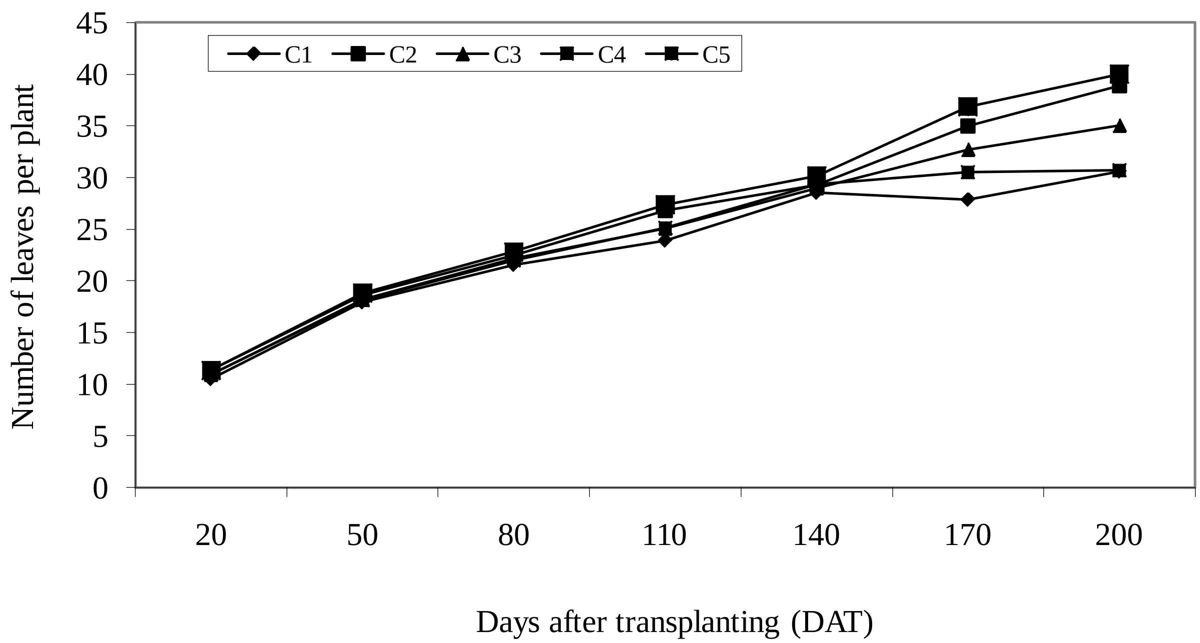

Figure 2. Effect of cultivars on number of leaves per plant of gerbera; C_1: White colored flower, P_2: Pink colored flower, C_3: Light pink colored flower, C_4: Yellow colored flower and C_5: Orange colored flower

Table 1. Interaction effect of light intensity and different cultivars on number of leaves per plant at different days after transplanting on potted gerbera [x]

Treatment [y]	Number of leaves per plant at						
	20 DAT	50 DAT	80 DAT	110 DAT	140 DAT	170 DAT	200 DAT
L_0C_1	11.43 bcd	19.07 b	23.00 bcd	24.74 efg	29.23 cd	29.30 fg	34.30 defg
L_0C_2	12.17 abc	19.83 b	23.40 ab	27.30 cd	30.80 bc	40.30 b	43.90 ab
L_0C_3	10.97 def	19.07 b	22.47 bcde	26.50 cde	31.26 ab	36.30 cd	38.38 cd
L_0C_4	10.47 defg	17.90 c	21.67 cdef	25.67 def	30.36 bc	29.20 fg	27.10 h
L_0C_5	10.93 def	18.10 c	22.32 bcdef	26.00 cdef	30.67 bc	31.60 ef	34.78 def
L_1C_1	11.37 bcde	19.10 b	22.80 bcd	26.70 cde	31.76 ab	29.20 fg	30.28 fgh
L_1C_2	12.37 ab	19.70 b	23.13 bc	29.70 b	30.70 bc	38.00 bc	40.36 bc
L_1C_3	11.23 cde	18.17 c	22.90 bcd	26.50 cde	30.07 bc	29.80 efg	33.80 defg
L_1C_4	12.42 ab	19.84 b	23.50 ab	27.84 c	31.60 ab	36.00 cd	35.29 de
L_1C_5	12.84 a	20.80 a	24.60 a	31.80 a	32.75 a	46.00 a	46.78 a
L_2C_1	8.70 h	15.63 f	18.87 g	20.30 i	24.63 e	25.10 h	27.22 h
L_2C_2	9.63 gh	16.35 ef	20.90 f	23.47 gh	26.30 e	26.60 gh	32.39 efg
L_2C_3	10.60 defg	17.33 cd	21.00 ef	22.23 h	25.57 e	32.00 ef	32.90 efg
L_2C_4	10.03 fg	16.73 de	20.83 f	21.83 hi	24.77 e	26.30 gh	29.69 gh
L_2C_5	10.30 efg	17.57 c	21.50 def	24.30 fg	28.20 d	33.00 de	38.48 cd
$LSD_{(0.05)}$	0.965	0.762	1.347	1.769	1.687	3.274	4.165
Level of significance	0.01	0.01	0.01	0.01	0.01	0.01	0.01
CV(%)	5.25	4.49	3.64	4.14	3.46	6.03	7.13

[x] In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly at 0.05 level of significance

[y] L_0; Full sunlight, L_1; 40% reduced sunlight, L_2; 60% reduced sunlight and C_1; White colored flower, C_2; Pink colored flower, C_3; Light pink colored flower, C_4; Yellow colored flower, C_5; Orange colored flower

In case of interaction effect of light intensity and cultivar of potted gerbera, at 20, 50, 80, 110, 140, 170 and 200 DAT the longest leaf (10.10 cm, 12.43 cm, 18.99 cm, 29.10 cm, 33.78 cm, 32.28 cm and 32.96 cm) was recorded from L_1C_5 (40% reduced sunlight and orange colored flower), while the shortest leaf (5.05 cm, 7.26 cm, 8.79 cm, 10.10 cm, 13.44 cm, 16.08 cm and 18.65 cm) from L_2C_1 (60% reduced sunlight and white colored flower) (Table 2).

4.3 Leaf width

Leaf width showed significant variation for leaf width at 20, 50, 80, 110, 140, 170 and 200 DAT for different light intensity, cultivars and their interaction effect on potted gerbera (Appendix IV). In case of light intensity, at 20, 50, 80, 110, 140, 170 and 200 DAT the longest width of leaf (4.43 cm, 7.58 cm, 8.76 cm, 9.23 cm, 11.76 cm, 15.19 cm and 16.25 cm) was found from L_1 (40% reduced sunlight) which was closely followed (3.98 cm, 5.57 cm, 7.59 cm, 8.84 cm, 11.34 cm, 13.63 cm and 15.77 cm) by L_0 (full sunlight) and the shortest leaf (3.00 cm, 3.80 cm, 5.68 cm, 8.21 cm, 9.94 cm, 11.09 cm and 13.54 cm) was recorded from L_2 (60% reduced sunlight) (Figure 5). Wang *et al.* (2007), Pathiratna and Perera (2005) also reported similar results from their experiments.

For different cultivars of gerbera, at 20, 50, 80, 110, 140, 170 and 200 DAT, the longest width of leaf (4.02 cm, 6.65 cm, 7.80 cm, 8.83 cm, 11.35 cm, 13.82 cm and 15.71 cm) was recorded from C_2 (Pink colored flower), which was statistically identical (3.94 cm, 6.17 cm, 7.79 cm, 8.77 cm, 11.34 cm, 13.77 cm and 15.63 cm) with C_5 (Orange colored flower), while the shortest width of leaf (3.50 cm, 5.05 cm, 6.74 cm, 8.70 cm, 10.61 cm, 12.64 cm and 14.59 cm) from C_1 (white colored flower) (Figure 6).

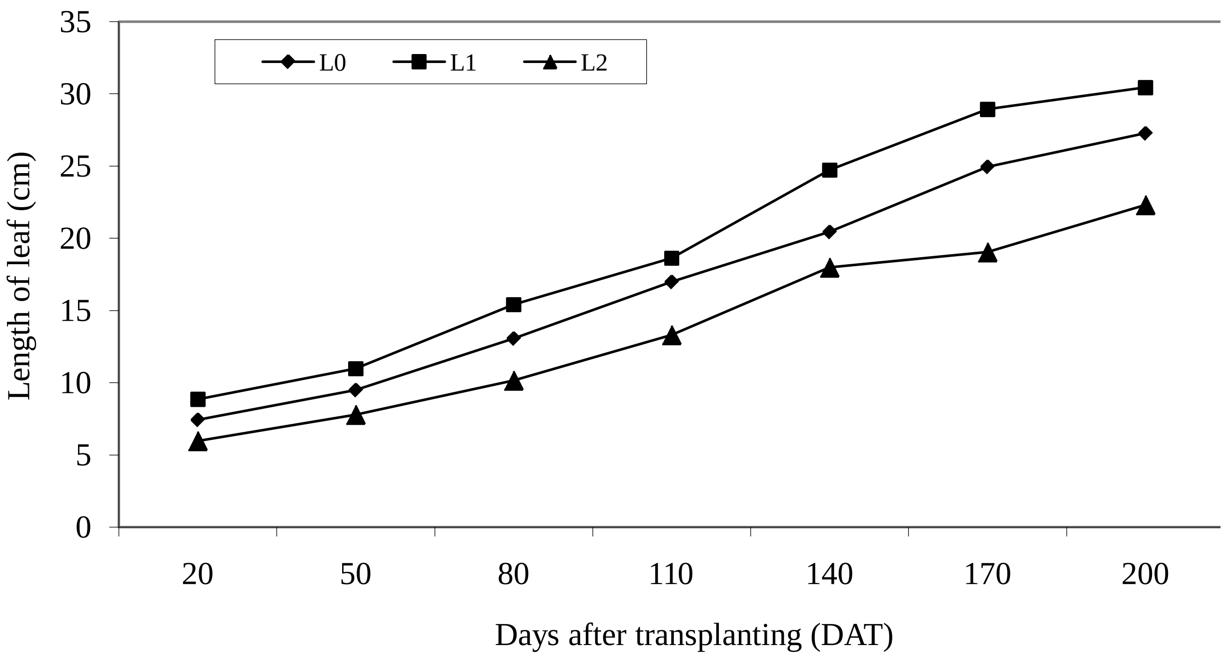

Figure 3. Effect of light intensity on length of leaves of gerbera; L_0: Full sunlight, L_1: 40% reduced sunlight and L_{2-}: 60% reduced sunlight

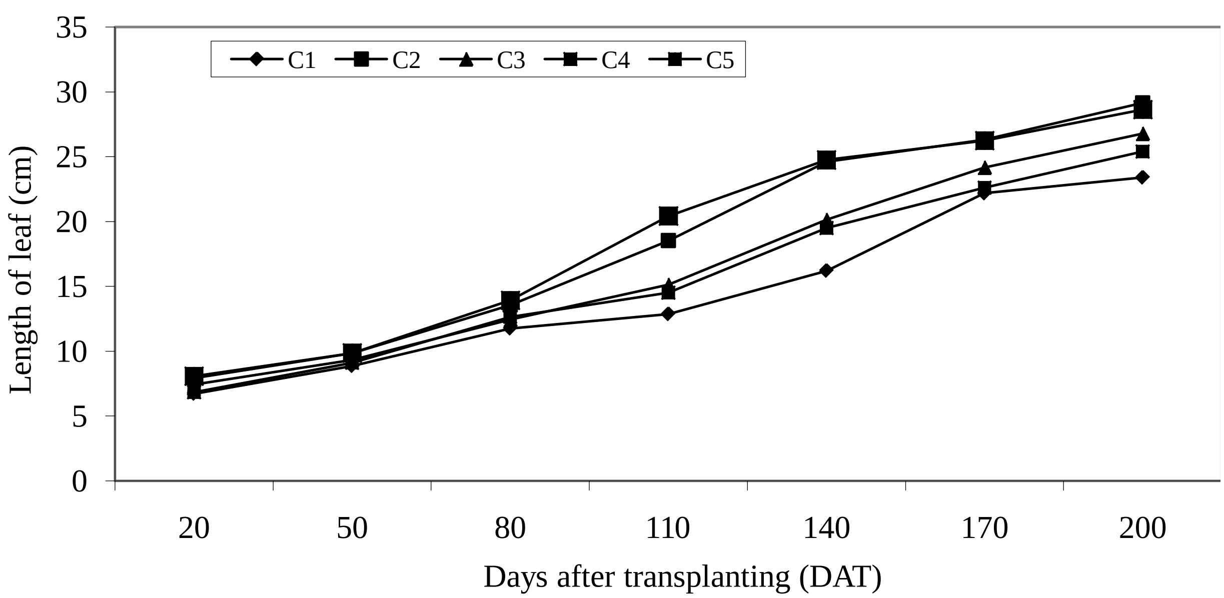

Figure 4. Effect of cultivars on length of leaf of gerbera; C_1: White colored flower, P_2: Pink colored flower, C_3: Light pink colored flower, C_4: Yellow colored flower and C_5: Orange colored flower

Table 2. Effect of light intensity and different cultivars on length of leaf at different days after transplanting on potted gerbera [x]

Treatment [y]	Length of leaf (cm) at						
	20 DAT	50 DAT	80 DAT	110 DAT	140 DAT	170 DAT	200 DAT
L_0C_1	7.24 e	9.27 d	13.59 d	16.20 cd	18.28 fgh	24.84 de	23.21 h
L_0C_2	8.52 c	10.90 b	16.59 b	23.20 b	27.58 b	27.28 c	31.92 ab
L_0C_3	7.78 d	9.90 c	12.60 e	16.40 cd	20.83 ef	25.32 d	28.93 de
L_0C_4	6.28 f	8.53 ef	11.10 f	14.10 de	17.67 fgh	23.49 ef	25.95 g
L_0C_5	7.30 e	8.88 de	11.40 f	15.00 de	17.83 fgh	23.81 ef	26.31 g
L_1C_1	7.90 d	10.09 c	12.90 e	12.30 efg	16.92 gh	25.64 d	28.35 ef
L_1C_2	9.25 b	11.11 b	14.70 c	17.20 cd	26.17 bc	29.95 b	30.32 bcd
L_1C_3	8.37 c	9.93 c	13.50 d	15.40 de	22.44 de	29.15 b	29.48 cde
L_1C_4	8.57 c	11.23 b	16.89 b	19.10 c	24.31 cd	27.64 c	31.11 abc
L_1C_5	10.10 a	12.43 a	18.99 a	29.10 a	33.78 a	32.28 a	32.96 a
L_2C_1	5.05 h	7.26 g	8.79 i	10.10 g	13.44 i	16.08 i	18.65 i
L_2C_2	6.05 fg	7.56 g	9.39 h	15.20 de	20.11 efg	21.71 g	25.21 g
L_2C_3	6.12 fg	8.20 f	11.19 f	13.60 def	17.14 gh	18.04 h	21.91 h
L_2C_4	5.69 g	7.58 g	9.99 g	10.40 fg	16.56 h	16.74 hi	19.16 i
L_2C_5	6.86 e	8.30 f	11.40 f	17.20 cd	22.64 de	22.62 fg	26.62 fg
$LSD_{(0.05)}$	0.469	0.435	0.525	3.190	2.930	1.371	1.814
Level of significance	0.01	0.01	0.01	0.01	0.01	0.01	0.01
CV(%)	3.80	2.77	4.45	9.74	8.35	3.38	4.08

[x] In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly at 0.05 level of significance

[y] L_0; Full sunlight, L_1; 40% reduced sunlight, L_2; 60% reduced sunlight and C_1; White colored flower, C_2; Pink colored flower, C_3; Light pink colored flower, C_4; Yellow colored flower, C_5; Orange colored flower

In case of interaction effect of light intensity and cultivar of potted gerbera, at 20, 50, 80, 110, 140, 170 and 200 DAT the maximum width of leaf (4.71 cm, 9.54 cm, 9.93 cm, 10.48 cm, 11.94 cm, 16.61 cm and 16.68 cm) was recorded from L_1C_5 (40% reduced sunlight and orange colored flower), whereas the minimum (2.69 cm, 3.30 cm,5.09 cm, 7.87 cm, 9.27 cm, 10.16 cm and 12.77 cm) from L_2C_1 (60% reduced sunlight and white colored flower) (Table 3).

4.4 Diameter of flower bud

Significant differences was observed for diameter of flower bud at 1, 2, 3, 4, 5 and 6 days after bud initiation for different light intensity, cultivars and their interaction effect on potted gerbera (Appendix V). In case of light intensity, at 1, 2, 3, 4, 5 and 6 days after bud initiation, the highest diameter of flower bud (1.26 cm, 1.77 cm, 1.83 cm, 2.27 cm, 2.36 cm and 2.69 cm) was found from L_1 (40% reduced sunlight) which was closely followed (1.18 cm, 1.49 cm, 1,58 cm, 1.88 cm, 2.13 cm and 2.15 cm) by L_0 (full sunlight) and the lowest (0.99 cm, 1.19 cm, 1.30 cm, 1.39 cm, 1.60 cm and 1.85 cm) was recorded from L_2 (60% reduced sunlight) (Figure 7).

For different cultivars of gerbera, at 1, 2, 3, 4, 5 and 6 days after bud initiation, the highest diameter of flower bud (1.39 cm, 1.62 cm, 1.65 cm, 2.02 cm, 2.62 cm and 2.69 cm) was recorded from C_5 (orange colored flower), which was statistically identical (1.35 cm, 1.59 cm, 1.64 cm, 1.96 cm, 2.35 cm and 2.68 cm) with C_2 (Pink colored flower), while the lowest diameter of flower bud (0.92 cm, 1.35 cm, 1.48 cm, 1.46 cm, 1.54 cm and 1.63 cm) from C_1 (white colored flower) (Figure 8).

In case of interaction effect of light intensity and cultivar of potted gerbera, at 1, 2, 3, 4, 5 and 6 days after bud initiation the highest diameter of flower bud (1.76 cm, 2.02 cm, 2.07 cm, 2.87 cm, 3.80 cm 3.82 cm) was recorded from L_1C_5 (40% reduced sunlight and orange colored flower), whereas the lowest (0.77 cm, 1.01 cm, 1.11 cm, 1.16 cm, 1.19 cm and 1.28 cm) from L_2C_1 (60% reduced sunlight and white colored flower) (Table 4).

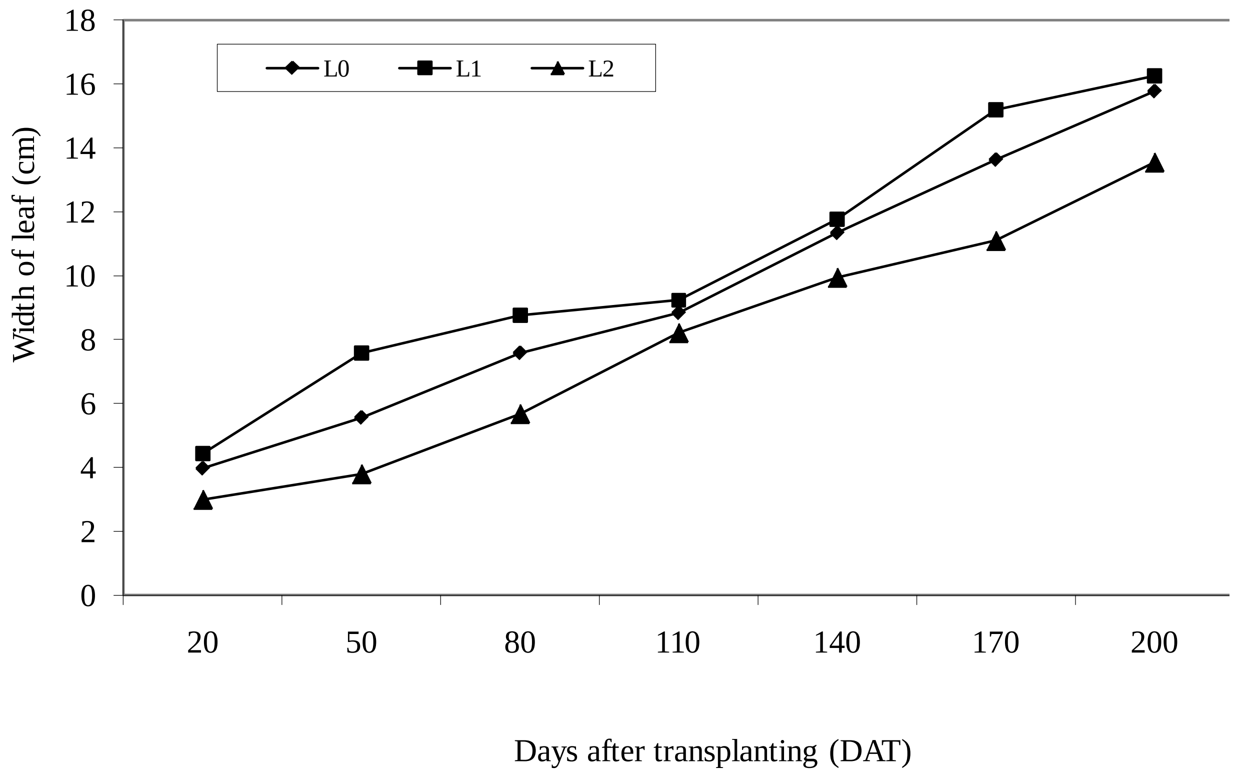

Figure 5 Effect of light intensity on width of leaf of gerbera; L_0: Full sunlight, L_1: 40% reduced sunlight and L_{2-}: 60% reduced sunlight

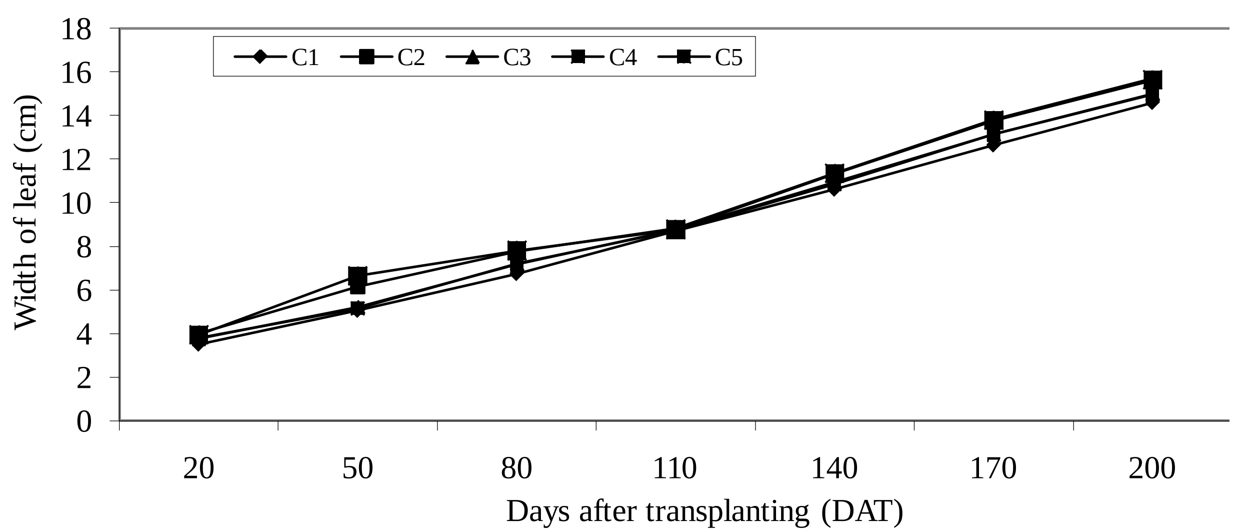

Figure 6. Effect of cultivars on widthof leaf of gerbera; C_1: White colored flower, P_2: Pink colored flower, C_3: Light pink colored flower, C_4: Yellow

Table 3. Effect of light intensity and different cultivars on breadth of leaf at different days after transplanting on potted gerbera [x]

Treatment [y]	Breadth of leaf (cm) at						
	20 DAT	50 DAT	80 DAT	110 DAT	140 DAT	170 DAT	200 DAT
L_0C_1	3.60 e	5.62 c	7.03 e	9.09 c	10.95 de	13.32 de	14.94 bc
L_0C_2	4.56 a	7.38 b	8.90 b	9.17 c	11.64 abc	15.27 b	16.28 a
L_0C_3	3.86 d	5.64 c	7.42 d	8.91 d	11.51 abc	13.52 de	16.14 a
L_0C_4	3.93 cd	4.42 de	7.23 de	8.58 fg	11.26 cd	13.01 e	15.80 ab
L_0C_5	3.97 bcd	4.80 d	7.38 d	8.48 g	11.35 bcd	13.05 e	15.67 ab
L_1C_1	4.20 b	6.24 c	8.09 c	9.15 c	11.59 abc	14.44 c	16.07 a
L_1C_2	4.49 a	7.60 b	8.86 b	9.30 b	11.84 a	15.36 b	16.31 a
L_1C_3	4.12 bc	5.88 c	7.88 c	8.74 e	11.68 abc	13.82 d	16.23 a
L_1C_4	4.60 a	7.64 b	9.03 b	9.47 a	11.77 ab	15.70 b	16.25 a
L_1C_5	4.71 a	9.54 a	9.93 a	10.48 a	11.94 a	16.61 a	16.68 a
L_2C_1	2.69i	3.30 g	5.09 h	7.87 k	9.27 f	10.16 h	12.77 d
L_2C_2	3.00 gh	3.54 fg	5.61 g	8.02 j	10.57 e	10.84 g	14.54 c
L_2C_3	3.30 f	4.10 ef	6.20 f	8.67 ef	9.64 f	12.07 f	12.67 d
L_2C_4	2.87 hi	3.42 g	5.38 gh	8.16 i	9.50 f	10.74 g	12.89 d
L_2C_5	3.14 fg	4.62 de	6.10 f	8.34 h	10.74 e	11.64 f	14.83 bc
$LSD_{(0.05)}$	0.230	0.594	0.316	0.118	0.435	0.525	1.039
Level of significance	0.01	0.01	0.01	0.01	0.01	0.01	0.05
CV(%)	3.60	6.30	2.57	4.84	2.37	4.37	4.10

[x] In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly at 0.05 level of significance

[y] L_0; Full sunlight, L_1; 40% reduced sunlight, L_2; 60% reduced sunlight and C_1; White colored flower, C_2; Pink colored flower, C_3; Light pink colored flower, C_4; Yellow colored flower, C_5; Orange colored flower

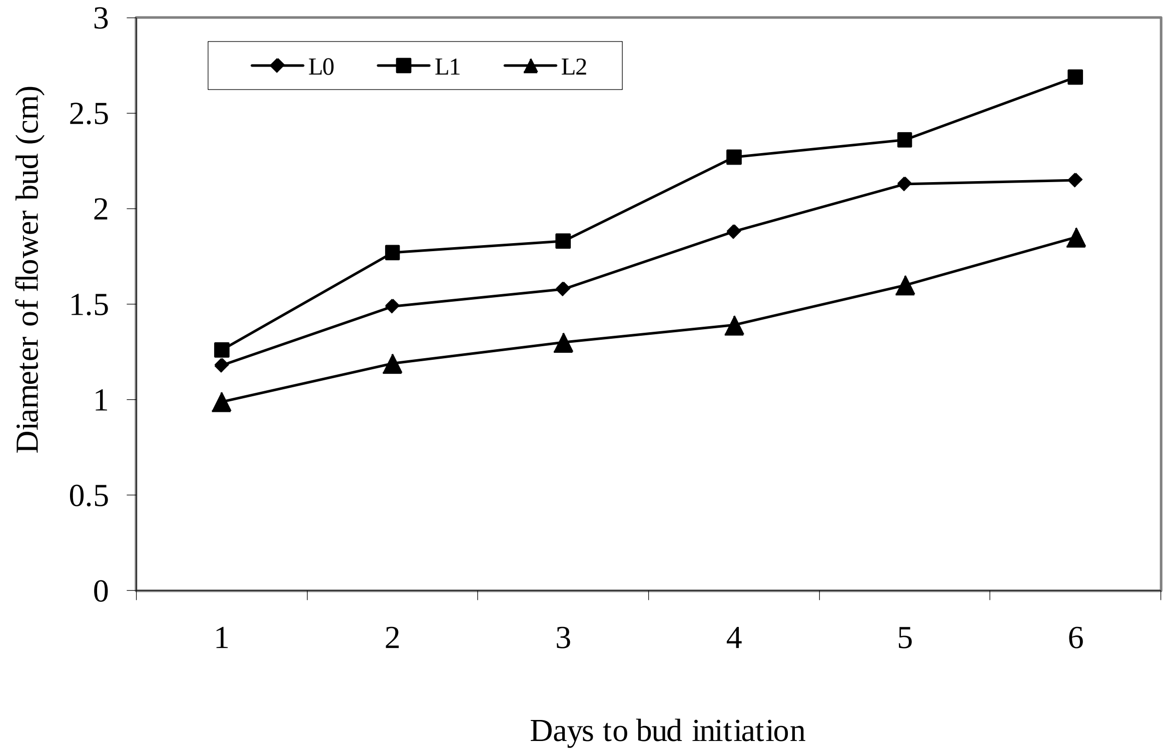

Figure 7 Effect of light intensity on diameter of flower bud of gerbera; L_0: Full sunlight, L_1: 40% reduced sunlight and L_{2}-: 60% reduced sunlight

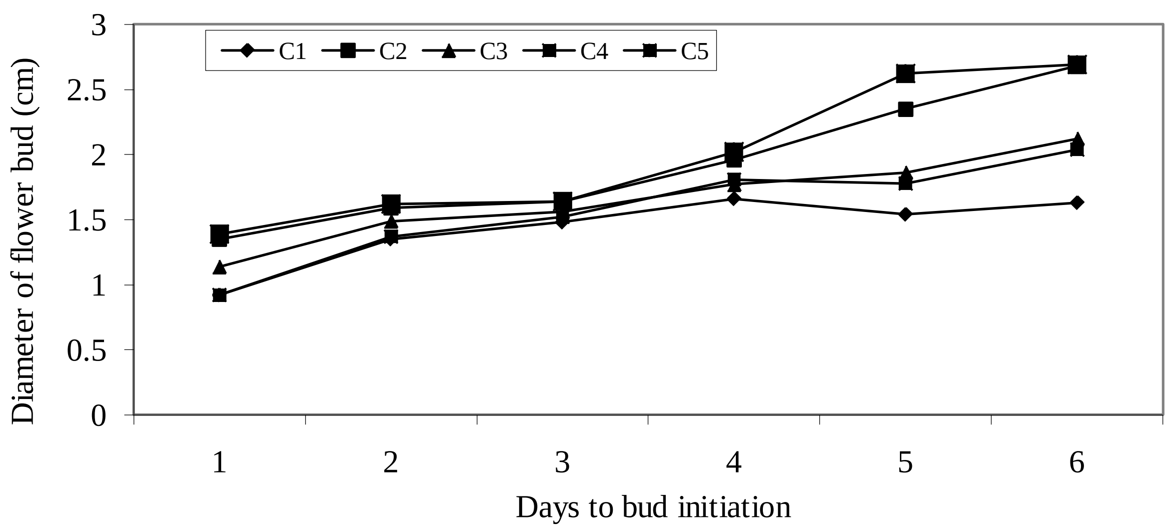

Figure 8. Effect of cultivars on diameter of flower bud of gerbera; C_1: White colored flower, P_2: Pink colored flower, C_3: Light pink colored flower, C_4: Yellow colored flower and C_5: Orange colored flower

Table 4. Effect of light intensity and different cultivars on diameter of flower bud at different days after bud initiation on potted gerbera [x]

Treatment [y]	Diameter of flower bud (cm) at					
	1 day	2 day	3 day	4 day	5 day	6 day
L_0C_1	1.11 ef	1.45 e	1.54 d	1.97 d	2.01 cde	1.88 fgh
L_0C_2	1.61 ab	1.70 c	1.82 b	2.47 b	3.01 b	3.05 b
L_0C_3	1.32 cd	1.56 d	1.65 c	1.80 e	2.04 cde	2.20 ef
L_0C_4	0.73 i	1.26 f	1.42 ef	1.55 f	1.71 def	1.81 gh
L_0C_5	1.13 def	1.46 e	1.48 de	1.60 f	1.84 def	1.83 gh
L_1C_1	0.89 ghi	1.58 d	1.68 c	1.85 e	1.46 fg	1.71 h
L_1C_2	1.42 bc	1.85 b	1.85 b	2.15 c	2.16 cd	2.87 bc
L_1C_3	1.08 efg	1.67 c	1.65 c	1.95 d	1.90 def	2.41 de
L_1C_4	1.16 def	1.71 c	1.87 b	2.52 b	2.43 c	2.64 cd
L_1C_5	1.76 a	2.02 a	2.07 a	2.87 a	3.80 a	3.82 a
L_2C_1	0.77 i	1.01 h	1.11 g	1.16 i	1.19 g	1.28 i
L_2C_2	1.00 fgh	1.21 fg	1.26 g	1.26 h	1.87 def	2.11 efg
L_2C_3	1.03 fgh	1.22 fg	1.37 f	1.56 f	1.64 ef	1.74 h
L_2C_4	0.86 hi	1.14 g	1.26 g	1.36 g	1.19 g	1.67 h
L_2C_5	1.28 cde	1.37 e	1.38 f	1.60 f	2.16 cd	2.43 de
$LSD_{(0.05)}$	0.190	0.091	0.075	0.091	0.419	0.334
Level of significance	0.01	0.01	0.01	0.01	0.01	0.01
CV(%)	9.91	3.80	2.77	5.84	8.33	9.00

[x] In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly at 0.05 level of significance

[y] L_0; Full sunlight, L_1; 40% reduced sunlight, L_2; 60% reduced sunlight and C_1; White colored flower, C_2; Pink colored flower, C_3; Light pink colored flower, C_4; Yellow colored flower, C_5; Orange colored flower

4.5 Diameter of flower

Different light intensity, cultivars and their interaction effect on potted gerbera varied significantly for diameter of flower at 1, 2, 3, 4, 5 and 6 days after flower bloom for different light intensity, cultivars and their interaction effect on potted gerbera (Appendix VI). In case of light intensity, at 1, 2, 3, 4, 5 and 6 days after flower bloom, the highest diameter of flower (1.87 cm, 2.23 cm, 4.14 cm, 4.39 cm, 5.99 cm, 6.04 cm) was found from L_1 (40% reduced sunlight) which was closely followed (1.61 cm, 2.04 cm, 3.30 cm, 4.10 cm, 5.11 cm and 5.83 cm) by L_0 (full sunlight) and the lowest (1.23 cm, 1.75 cm, 2.86 cm, 3.45 cm, 3.48 cm and 3.53 cm) was recorded from L_2 (60% reduced sunlight) (Figure 9). Wang *et al.* (2007), Pathiratna and Perera (2005) also reported similar results earlier from their experiment.

For different cultivars of gerbera, at 1, 2, 3, 4, 5 and 6 days after flower bloom, the highest diameter of flower (1.71 cm, 2.16 cm, 3.77 cm, 4.35 cm, 5.28 cm and 5.68 cm) was recorded from C_5 (orange colored flower), which was statistically identical (1.70 cm, 2.15 cm, 3.75 cm, 4.17 cm, 5.20 cm and 5.66 cm) with C_2 (Pink colored flower), again the lowest diameter of flower (1.43 cm, 1.82 cm, 3.01 cm, 3.56 cm, 4.39 cm and 5.19 cm) from C_1 (white colored flower) (Figure 10). Li-Shen Chong *et al*. (2008) reported that wide-petal standard cut flower gerbera (*Gerbera jamesonii*) cultivar, with pink petal, blank centre, semi-double the diameter of flower head is 10-12 cm.

In case of interaction effect of light intensity and cultivar of potted gerbera, at 1, 2, 3, 4, 5 and 6 days after flower bloom, the highest diameter of flower (2.08 cm, 2.38 cm, 5.02 cm, 5.11 cm, 6.91 cm and 6.92 cm) was recorded from L_1C_5 (40% reduced sunlight and orange colored flower). On the other hand, the lowest (1.04 cm, 1.54 cm, 2.45 cm, 3.01 cm, 3.08 cm and 4.09 cm) was recorded from L_2C_1 (60% reduced sunlight and white colored flower) (Table 5).

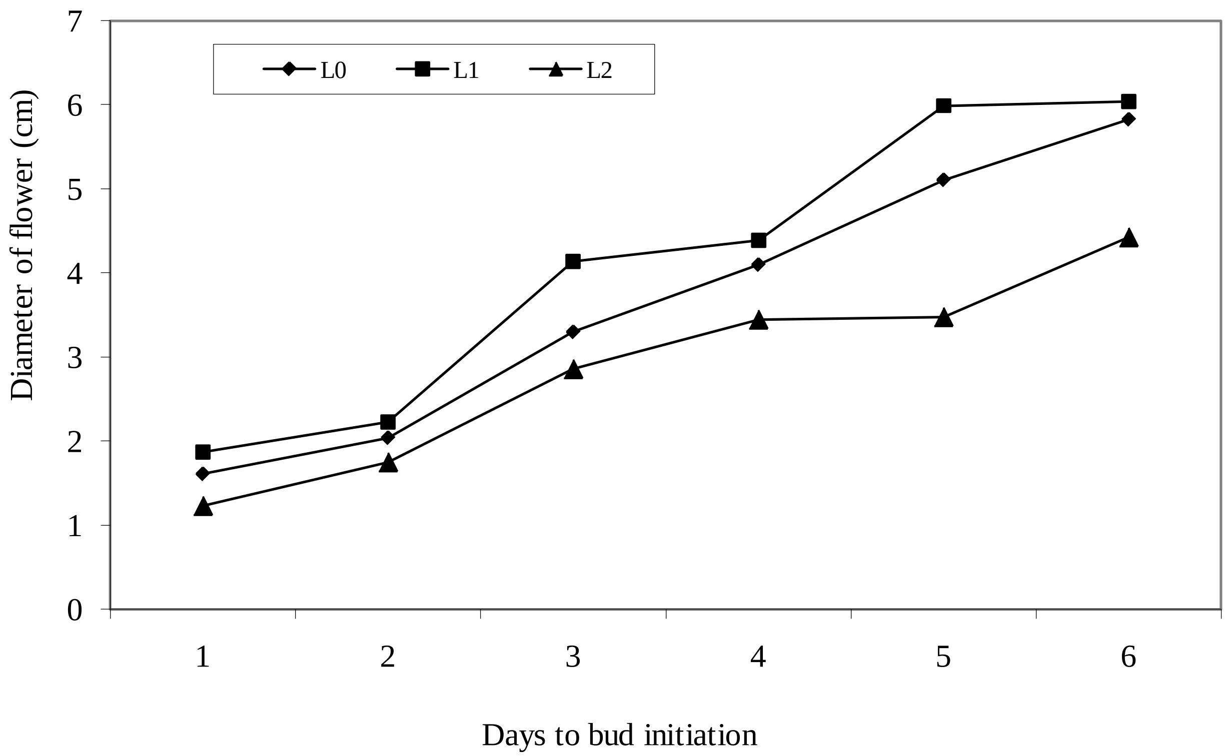

Figure 9 Effect of light intensity on diameter of flower of gerbera; L_0: Full sunlight, L_1: 40% reduced sunlight and L_{2-}: 60% reduced sunlight

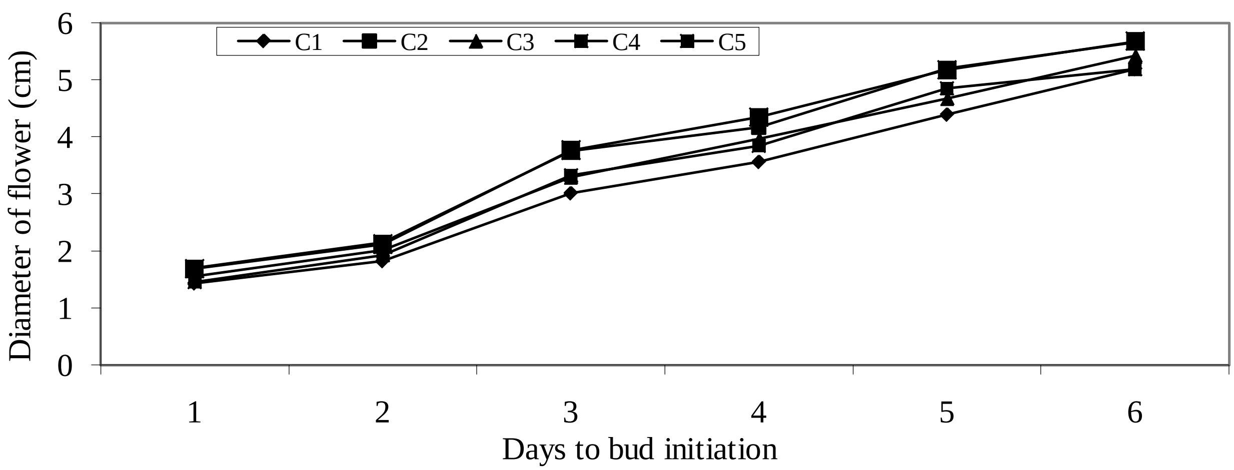

Figure 10. Effect of cultivars on diameter of flower of gerbera; C_1: White colored flower, P_2: Pink colored flower, C_3: Light pink colored flower, C_4:

Table 5. Effect of light intensity and different cultivars on diameter of flower at different days after flowering blooming on potted gerbera [x]

Treatment [y]	Diameter of flower (cm) at					
	1 day	2 day	3 day	4 day	5 day	6 day
L_0C_1	1.60 de	1.81 h	2.92 def	3.73 de	4.58 g	5.83 cd
L_0C_2	1.76 c	2.32 ab	4.23 b	4.54 b	6.20 bc	6.37 b
L_0C_3	1.63 d	2.14 de	3.18 d	4.34 b	4.86 f	5.99 c
L_0C_4	1.52 ef	1.97 g	3.02 de	3.87 cd	4.97 ef	5.29 e
L_0C_5	1.54 ef	1.99 g	3.13 d	4.03 c	4.91 f	5.66 d
L_1C_1	1.65 d	2.11 ef	3.65 c	3.95 cd	5.50 d	5.64 d
L_1C_2	1.93 b	2.22 bcd	4.21 b	4.53 b	6.01 c	6.22 b
L_1C_3	1.88 b	2.17 cde	3.50 c	3.92 cd	5.21 e	5.69 d
L_1C_4	1.78 c	2.27 abc	4.33 b	4.44 b	6.32 b	6.01 c
L_1C_5	2.08 a	2.38 a	5.02 a	5.11 a	6.91 a	6.92 a
L_2C_1	1.04 i	1.54 i	2.45 g	3.01 g	3.08 j	4.09 h
L_2C_2	1.40 g	1.92 g	2.81 ef	3.43 f	3.40 i	4.38 g
L_2C_3	1.16 h	1.73 h	3.22 d	3.65 e	3.98 h	4.62 f
L_2C_4	1.08 hi	1.57 i	2.65 fg	3.24 f	3.24 ij	4.28 g
L_2C_5	1.46 fg	2.01 fg	3.17 d	3.92 cd	3.72 h	4.76 f
$LSD_{(0.05)}$	0.091	0.106	0.264	0.197	0.264	0.190
Level of significance	0.01	0.01	0.01	0.01	0.01	0.01
CV(%)	5.38	3.19	4.62	3.00	3.26	5.09

[x] In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly at 0.05 level of significance

[y] L_0; Full sunlight, L_1; 40% reduced sunlight, L_2; 60% reduced sunlight and C_1; White colored flower, C_2; Pink colored flower, C_3; Light pink colored flower, C_4; Yellow colored flower, C_5; Orange colored flower

4.6 Length of peduncle

Significant variation was recorded for length of peduncle at 1, 2, 3, 4, 5 and 6 days after peduncle initiation for different light intensity, cultivars and their interaction effect on potted gerbera (Appendix VII). In case of light intensity, at 1, 2, 3, 4, 5 and 6 days after peduncle initiation, the longest peduncle (1.58 cm, 9.41 cm, 17.99 cm, 22.74 cm, 24.22 cm and 28.53 cm) was observed in L_1 (40% reduced sunlight) which was closely followed (1.50 cm, 7.40 cm, 15.96 cm, 19.37 cm, 23.47 cm and 26.56 cm) by L_0 (full sunlight) and the shortest peduncle (1.41 cm, 7.12 cm, 12.85 cm, 17.02 cm, 20.74 cm and 22.61 cm) was recorded from L_2 (60% reduced sunlight) (Figure 11).

For different cultivars of gerbera, at 1, 2, 3, 4, 5 and 6 days after peduncle initiation, the longest peduncle (1.53 cm, 9.19 cm, 16.86 cm, 21.67 cm, 23.48 cm and 26.79 cm) was recorded from C_5 (orange colored flower), which was statistically identical (1.52 cm, 9.12 cm, 16.70 cm, 21.59 cm, 23.46 cm and 26.75 cm) with C_2 (Pink colored flower), whereas the shortest peduncle length (1.47 cm, 6.45 cm, 13.84 cm, 17.01 cm, 22.01 cm, 24.82 cm) from C_1 (white colored flower) (Figure 12). Li-Shen Chong *et al*. (2008) reported that wide-petal standard cut flower gerbera (*Gerbera jamesonii*) cultivar, with pink petal, blank centre, semi-double the peduncle length is 50-55 cm.

In case of interaction effect of light intensity and cultivar of potted gerbera, at 1, 2, 3, 4, 5 and 6 days after peduncle initiation the longest peduncle (1.62 cm, 10.68 cm, 19.27 cm, 24.86 cm, 24.91 cm and 30.12 cm) was recorded from L_1C_5 (40% reduced sunlight and orange colored flower), again the shortest peduncle (1.37 cm, 5.32 cm, 10.93 cm, 13.94 cm, 19.08 cm and 21.01 cm) from L_2C_1 (60% reduced sunlight and white colored flower) (Table 6).

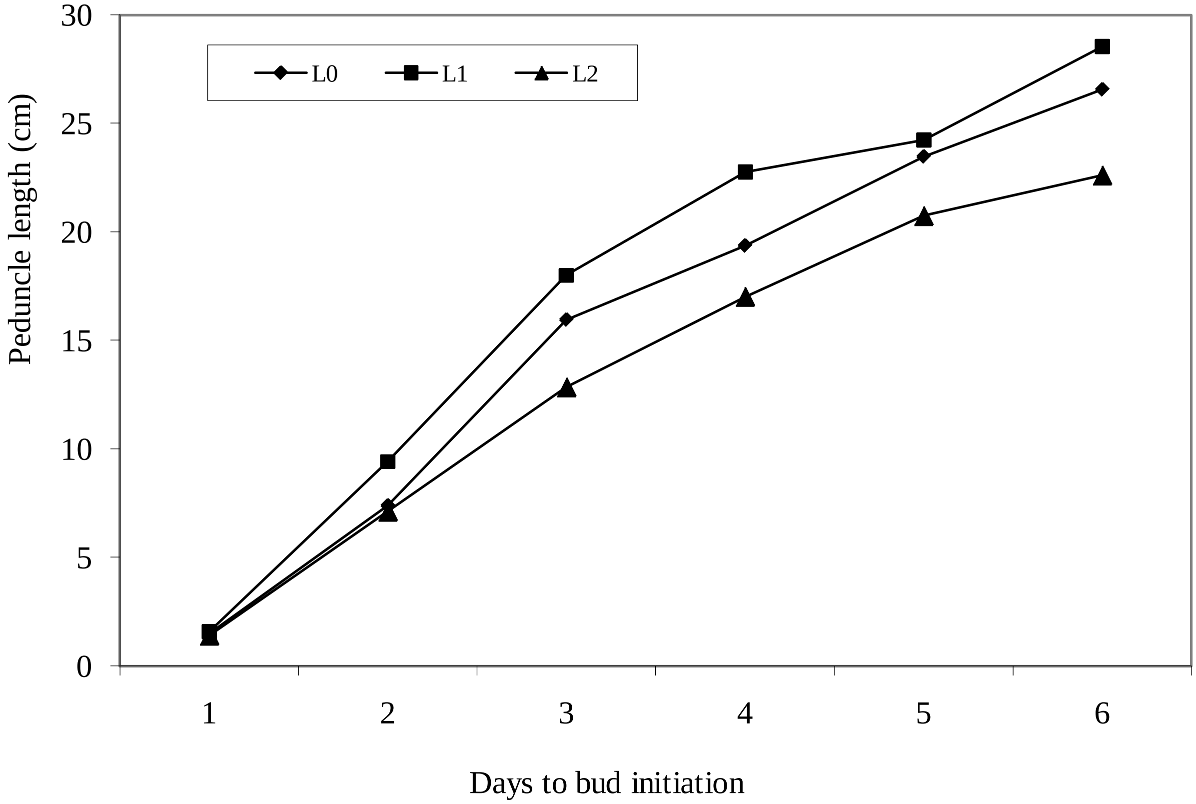

Figure 11 Effect of light intensity on peduncle length of gerbera; L_0: Full sunlight, L_1: 40% reduced sunlight and L_{2-}: 60% reduced sunlight

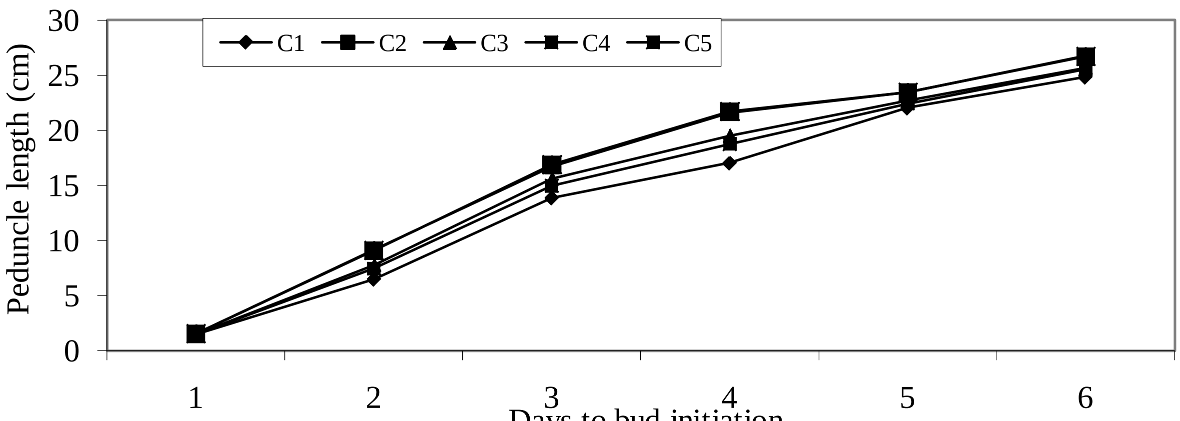

Figure 12. Effect of cultivars on peduncle length of gerbera; C_1: White colored flower, P_2: Pink colored flower, C_3: Light pink colored flower, C_4:

Table 6. Effect of light intensity and different cultivars on peduncle length at different days after peduncle initiation on potted gerbera [x]

Treatment [y]	Peduncle length(cm) at					
	1 day	2 day	3 day	4 day	5 day	6 day
L_0C_1	1.48 cd	5.50 h	13.51 i	15.84 f	22.98 cd	25.85 f
L_0C_2	1.54 b	9.48 bc	17.98 b	22.80 b	24.30 abc	28.49 bc
L_0C_3	1.51 bc	7.92 e	16.66 e	20.36 c	23.61 abcd	26.62 ef
L_0C_4	1.47 cd	6.74 g	15.61 fg	18.48 d	23.04 bcd	25.85 f
L_0C_5	1.51 bc	7.36 f	16.03 f	19.38 d	23.43 abcd	25.98 f
L_1C_1	1.55 ab	8.54 d	17.08 de	21.26 c	23.96 abc	27.61 cd
L_1C_2	1.60 a	9.64 bc	17.83 bc	22.86 b	24.51 ab	28.78 b
L_1C_3	1.56 ab	8.30 de	17.44 cd	21.26 c	23.53 abcd	27.08 de
L_1C_4	1.56 ab	9.90 b	18.31 b	23.44 b	24.47 abc	29.05 b
L_1C_5	1.62 a	10.68 a	19.27 a	24.86 a	24.91 a	30.12 a
L_2C_1	1.37 f	5.32 h	10.93 k	13.94 g	19.08 g	21.01 i
L_2C_2	1.42 def	8.24 de	14.29 h	19.10 d	21.57 e	22.98 h
L_2C_3	1.41 ef	7.12 fg	12.79 j	16.98 e	20.97 ef	23.29 gh
L_2C_4	1.38 f	5.68 h	10.96 k	14.32 g	19.83 fg	21.82 i
L_2C_5	1.44 de	9.24 c	15.28 g	20.76 c	22.25 de	23.96 g
$LSD_{(0.05)}$	0.053	0.517	0.506	0.919	1.317	0.896
Level of significance	0.05	0.01	0.01	0.01	0.05	0.01
CV(%)	5.99	3.88	4.95	2.80	3.46	5.07

[x] In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly at 0.05 level of significance

[y] L_0; Full sunlight, L_1; 40% reduced sunlight, L_2; 60% reduced sunlight and C_1; White colored flower, C_2; Pink colored flower, C_3; Light pink colored flower, C_4; Yellow colored flower, C_5; Orange colored flower

4.7 Diameter of peduncle

Diameter of peduncle varied significantly for at 1, 2, 3, 4, 5 and 6 days after peduncle initiation for different light intensity, cultivars and their interaction effect on potted gerbera (Appendix VIII). In case of light intensity, at 1, 2, 3, 4, 5 and 6 days after peduncle initiation, the highest diameter of peduncle (0.60 cm, 0.65 cm, 0.77 cm, 1.14 cm, 1.26 cm and 1.69 cm) was found from L_1 (40% reduced sunlight) which was closely followed (0.56 cm, 0.63 cm, 0.75 cm, 1.04 cm, 1.22 cm and 1.55 cm) by L_0 (full sunlight) and the lowest (0.48 cm, 0.57 cm, 0.68 cm, 0.89 cm, 0.99 cm and 1.27 cm) was recorded from L_2 (60% reduced sunlight) (Figure 13).

For different cultivars of gerbera, at 1, 2, 3, 4, 5 and 6 days after peduncle initiation, the highest diameter of peduncle (0.56 cm, 0.64 cm, 0.76 cm, 1.09 cm, 1.21 cm and 1.75 cm) was recorded from C_5 (orange colored flower), which was statistically identical (0.57 cm, 0.63 cm, 0.74 cm, 1.07 cm, 1.16 cm and 1.64 cm) with C_2 (Pink colored flower), again the lowest diameter of peduncle (0.52 cm, 0.60 cm, 0.71 cm, 0.94 cm, 1.11 cm and 1.22 cm) from C_1 (white colored flower) (Figure 14).

In case of interaction effect of light intensity and cultivar of potted gerbera, at 1, 2, 3, 4, 5 and 6 days after peduncle initiation the highest diameter of peduncle (0.64 cm, 0.69 cm, 0.82 cm, 1.27 cm, 1.32 cm and 2.26 cm) was recorded from L_1C_5 (40% reduced sunlight and orange colored flower), whereas the lowest (0.41 cm, 0.52 cm, 0.62 cm, 0.79 cm, 0.90 cm and 1.03 cm) from L_2C_1 (60% reduced sunlight and white colored flower) (Table 7).

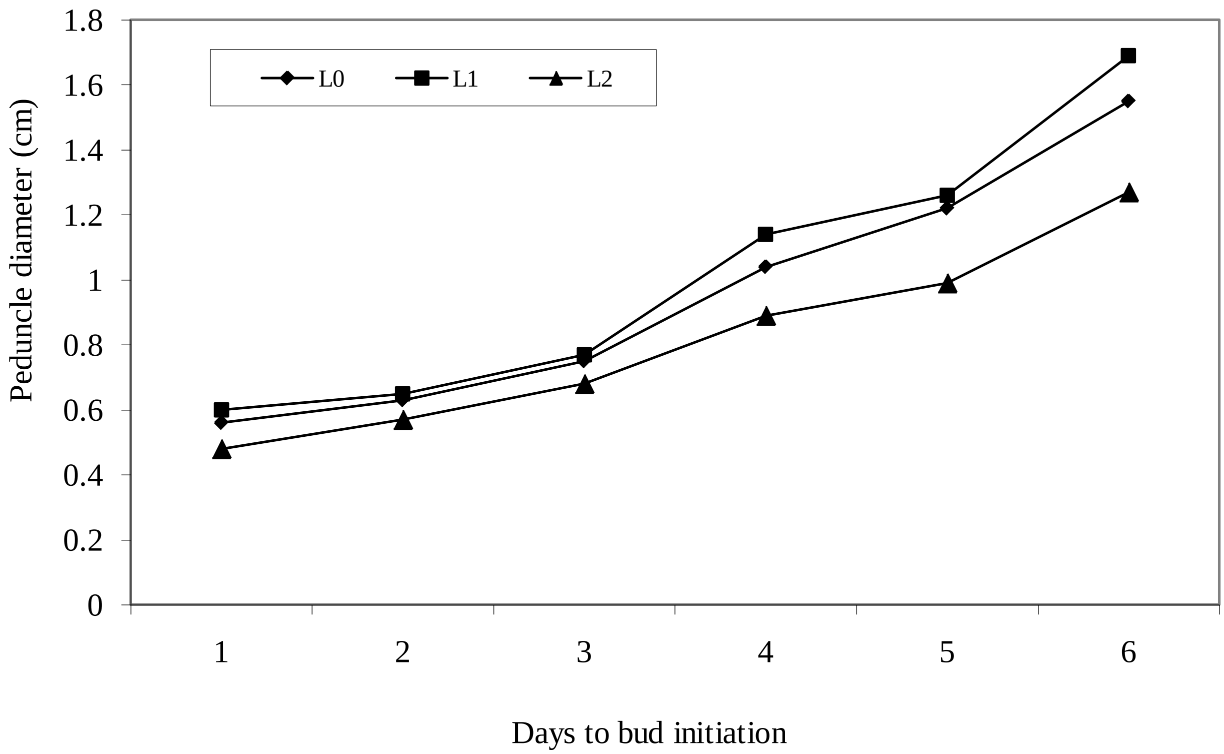

Figure 13 Effect of light intensity on peduncle diameter of gerbera; L_0: Full sunlight, L_1: 40% reduced sunlight and L_{2-}: 60% reduced sunlight

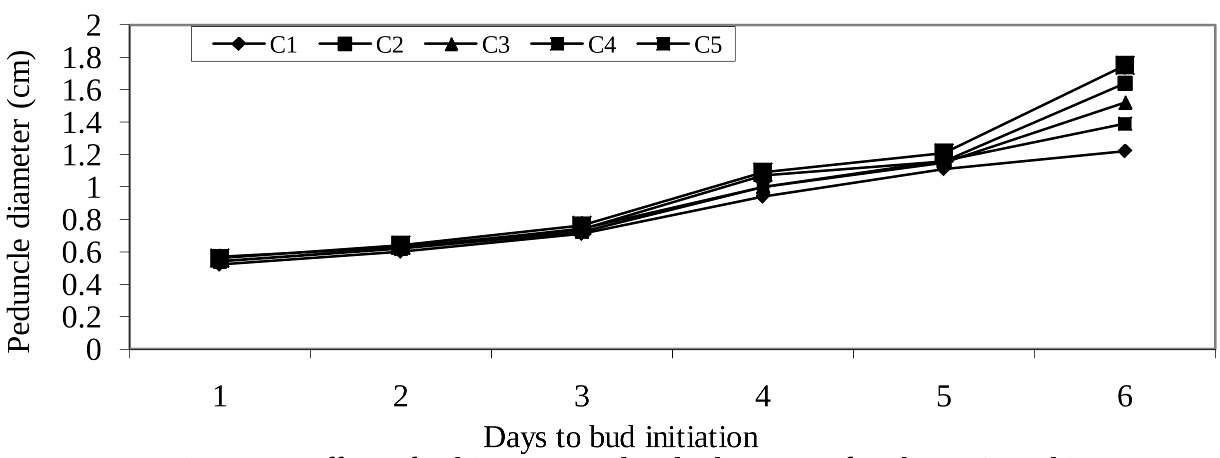

Figure 14. Effect of cultivars on peduncle diameter of gerbera; C_1: White colored flower, P_2: Pink colored flower, C_3: Light pink colored flower, C_4: Yellow colored flower and C_5: Orange colored flower

Table 7. Effect of light intensity and different cultivars on peduncle diameter at different days after peduncle initiation on potted gerbera [x]

Treatment [y]	Peduncle diameter (cm) at					
	1 day	2 day	3 day	4 day	5 day	6 day
L_0C_1	0.57 bcd	0.63 cd	0.75 bc	0.97 e	1.14 cd	1.32 efg
L_0C_2	0.60 abc	0.66 b	0.77 ab	1.08 cd	1.23 b	1.94 b
L_0C_3	0.55 cdef	0.64 bc	0.75 bc	1.06 cd	1.26 ab	1.72 c
L_0C_4	0.52 defg	0.61 ef	0.72 bcd	1.03 d	1.22 bc	1.32 efg
L_0C_5	0.54 defg	0.62 de	0.74 bc	1.04 d	1.23 b	1.46 de
L_1C_1	0.57 bcde	0.63 cd	0.75 bc	1.05 d	1. 28 ab	1.32 efg
L_1C_2	0.62 ab	0.66 b	0.77 ab	1.19 b	1.24 b	1.81 bc
L_1C_3	0.56 bcde	0.62 de	0.76 ab	1.06 cd	1.20 bc	1.36 def
L_1C_4	0.61 ab	0.66 b	0.76 ab	1.11 c	1.28 ab	1.70 c
L_1C_5	0.64 a	0.69 a	0.82 a	1.27 a	1.32 a	2.26 a
L_2C_1	0.41 h	0.52 h	0.62 e	0.79 h	0.90 g	1.03 h
L_2C_2	0.48 g	0.57 g	0.70 cd	0.94 ef	1.01 e	1.18 fgh
L_2C_3	0.52 defg	0.60 f	0.70 cd	0.89 fg	0.98 ef	1.48 de
L_2C_4	0.50 fg	0.58 g	0.68 d	0.86 g	0.93 fg	1.15 gh
L_2C_5	0.51 efg	0.60 ef	0.72 bcd	0.97 e	1.11 d	1.53 d
$LSD_{(0.05)}$	0.053	0.017	0.053	0.053	0.075	0.169
Level of significance	0.01	0.01	0.05	0.01	0.01	0.01
CV(%)	5.46	2.55	4.06	3.68	4.21	6.61

[x] In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly at 0.05 level of significance

[y] L_0; Full sunlight, L_1; 40% reduced sunlight, L_2; 60% reduced sunlight and C_1; White colored flower, C_2; Pink colored flower, C_3; Light pink colored flower, C_4; Yellow colored flower, C_5; Orange colored flower

4.8 Days form flower bud initiation to flower bloom

Significant variation was observed for days from flower bud initiation to flower bloom different light intensity, cultivars and their interaction effect on potted gerbera (Appendix IX). In case of light intensity, the maximum days from flower bud initiation to flower bloom (18.63 days) was found from L_0 (full sunlight) which was closely followed (16.31 days) by L_2 (60% reduced sunlight) and (16.00 days) from L_1 (40% reduced sunlight) and they were statistically identical (Table 8).

For different cultivars of gerbera, the highest days from flower bud initiation to flower bloom (19.02 days) was recorded from C_5 (orange colored flower), which was statistically identical (18.84 days) with C_3 (light pink colored flower), while the lowest (14.66 days) from C_4 (yellow colored flower) (Table 8).

In case of interaction effect of light intensity and cultivar of potted gerbera, the highest days from flower bud initiation to flower bloom (21.64 days) was recorded from L_0C_3 (full sunlight and light pink colored flower), again the lowest (13.85 days) from L_2C_4 (60% reduced sunlight and yellow colored flower) (Table 9).

4.9 Number of flowers per plant

Number of flowers per plant varied significantly for different light intensity, cultivars and their interaction effect on potted gerbera (Appendix IX). In case of light intensity, the maximum number of flowers per plant (15.64) was found from L_1 (40% reduced sunlight) which was closely followed (14.10) by L_0 (full sunlight) and the lowest (11.90) was recorded from L_2 (60% reduced sunlight) (Table 8).

For different cultivars of gerbera, highest number of flowers per plant (15.20) was recorded from C_5 (orange colored flower), which was statistically identical (14.94) with C_2 (Pink colored flower). On the other hand, the lowest (12.48) from C_1 (white colored peduncle) (Table 8).

Table 8. Effect of light intensity and different cultivars on days to initiation of flower bud, flowers per plant and leaf area index on potted gerbera [x]

Treatment [y]	Days to initiation of flowers bud	Flowers/plant	Leaf area index
L_0	18.63 a	14.10 b	36.48 b
L_1	16.00 b	15.64 a	38.36 a
L_2	16.31 b	11.99 c	30.96 c
$LSD_{(0.05)}$	0.445	0.266	0.880
Level of significance	0.01	0.01	0.01
C_1	16.69 b	12.48 c	33.67 b
C_2	15.70 c	14.94 a	36.61 a
C_3	18.84 a	13.55 b	34.84 b
C_4	14.66 d	13.39 b	34.66 b
C_5	19.02 a	15.20 a	36.54 a
$LSD_{(0.05)}$	0.574	0.343	1.136
Level of significance	0.01	0.01	0.01
CV(%)	3.51	6.56	3.35

[x] In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly at 0.05 level of significance

[y] L_0; Full sunlight, L_1; 40% reduced sunlight, L_2; 60% reduced sunlight and C_1; White colored flower, C_2; Pink colored flower, C_3; Light pink colored flower, C_4; Yellow colored flower, C_5; Orange colored flower

Table 9. Effect of light intensity and different cultivars Effect of light intensity and cultivars on days to initiation of flower bud, flowers per plant and leaf area index on potted gerbera [x]

Treatment [y]	Days to initiation of flowers bud	Flowers/plant	LAI
L_0C_1	18.34 bc	13.56 ef	34.84 de
L_0C_2	18.17 c	16.70 b	38.54 ab
L_0C_3	21.64 a	14.01 de	37.28 bc
L_0C_4	15.81 de	13.03 f	35.83 cd
L_0C_5	19.20 bc	13.20 f	35.89 cd
L_1C_1	15.85 de	13.39 ef	37.25 bc
L_1C_2	14.02 f	15.71 c	38.47 ab
L_1C_3	16.38 d	14.22 d	37.74 abc
L_1C_4	14.31 f	15.92 c	38.61 ab
L_1C_5	19.44 b	18.98 a	39.71 a
L_2C_1	15.87 de	10.50 i	28.92 f
L_2C_2	14.92 ef	12.40 g	32.82 e
L_2C_3	18.50 bc	12.42 g	29.49 f
L_2C_4	13.85 f	11.22 h	29.54 f
L_2C_5	18.42 bc	13.41 ef	34.01 de
$LSD_{(0.05)}$	0.995	0.594	1.968
Level of significance	0.01	0.01	0.01
CV(%)	3.51	6.56	3.35

[x] In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly at 0.05 level of significance

[y] L_0; Full sunlight, L_1; 40% reduced sunlight, L_2; 60% reduced sunlight and C_1; White colored flower, C_2; Pink colored flower, C_3; Light pink colored flower, C_4; Yellow colored flower, C_5; Orange colored flower

In case of interaction effect of light intensity and cultivar of potted gerbera, the highest number of flowers per plant (18.98) was recorded from L_1C_5 (40% reduced sunlight and orange colored flower), again the lowest (10.50) from L_2C_1 (60% reduced sunlight and white colored flower) (Table 9).

4.10 Leaf area

Different light intensity, cultivars and their interaction effect on potted gerbera showed significant variation for leaf area (Appendix IX). In case of light intensity, the highest leaf area (38.36 cm^2) was found from L_1 (40% reduced sunlight) which was closely followed (36.48 cm^2) by L_0 (full sunlight) and the lowest (30.96 cm^2) was recorded from L_2 (60% reduced sunlight) (Table 8). Under partial shade condition stimulation of cellular expansion and cell division in leaf could be one of the possible factors that contribute to the individual leaf area increase (Schoch, 1982)

For different cultivars of gerbera, the highest leaf area (36.61 cm^2) was recorded from C_2 (pink colored flower), which was statistically identical (36.54 cm^2) with C_5 (orange colored flower), while the lowest (33.67 cm^2) from C_1 (white colored flower) (Table 8).

In case of interaction effect of light intensity and cultivar of potted gerbera, the highest leaf area (39.71 cm^2) was recorded from L_1C_5 (40% reduced sunlight and orange colored flower), whereas the lowest (28.92 cm^2) from L_2C_1 (60% reduced sunlight and white colored flower) (Table 9).

CHAPTER V

SUMMARY AND CONCLUSION

The experiment was conducted during the period from July, 2009 to February 2010 to find out the influence of light intensity on different cultivars of potted gerbera. Different cultivars of gerbera were as used as planting materials of the experiments. The experiment consisted of two factors: Factor A: Light intensity: 3 levels; L_0: Full sunlight; L_1: 40% reduced sunlight; L_2: 60% reduced sunlight; and Factor B: Cultivars: 5 Gerbera Cultivars namely, C_1: White colored flower; C_2: Pink colored flower; C_3: Light pink colored flower; C_4: Yellow colored flower and C_5: Orange colored flower. There were 15 (3 × 5) treatments combination. The two factors experiment was laid out in Complete Randomized Design (CRD) with three replications.

Significant variation was recorded for different growth characters and flower character due to different light intensity, cultivars and their interaction effect on potted gerbera. In case of light intensity, at 20, 50, 80, 110, 140, 170 and 200 DAT the maximum number of leaves per plant (12.04, 19.52, 23.39, 28.51, 31.38, 35.80 and 37.30) was found from L_1 and the minimum number of leaves per plant (9.85, 16.72, 20.62, 22.43, 25.89, 28.60 and 32.14) was recorded from L_2. At 20, 50, 80, 110, 140, 170 and 200 DAT the longest leaf (8.84 cm, 10.96 cm, 15.40 cm, 18.62 cm, 24.72 cm, 28.93 cm and 30.44 cm) was found from L_1 and the shortest leaf (5.96 cm, 7.78 cm, 10.15 cm, 13.30 cm, 17.98 cm, 19.04 cm and 22.31 cm) was recorded from L_2. In case of light intensity, at 20, 50, 80, 110, 140, 170 and 200 DAT the longest breadth of leaf (4.43 cm, 7.58 cm, 8.76 cm, 9.23 cm, 11.76 cm, 15.19 cm and 16.25 cm) was found from and the shortest leaf (3.00 cm, 3.80 cm, 5.68 cm, 8.21 cm, 9.94 cm, 11.09 cm and 13.54 cm) was recorded from L_2. In case of light intensity, at 1, 2, 3, 4, 5 and 6 days after bud initiation, the highest diameter of flower bud (1.26 cm, 1.77 cm, 1.83 cm, 2.27 cm, 2.36 cm and 2.69 cm) was found from L_1 and the lowest (0.99 cm, 1.19 cm, 1.30 cm, 1.39 cm, 1.60 cm and 1.85 cm) was recorded from

L_2. At 1, 2, 3, 4, 5 and 6 days after flower bloom, the highest diameter of flower (1.87 cm, 2.23 cm, 4.14 cm, 4.39 cm, 5.99 cm, 6.04 cm) was found from L_1 and the lowest (1.23 cm, 1.75 cm, 2.86 cm, 3.45 cm, 3.48 cm and 3.53 cm) was recorded from L_2. At 1, 2, 3, 4, 5 and 6 days after peduncle initiation, the longest peduncle (1.58 cm, 9.41 cm, 17.99 cm, 22.74 cm, 24.22 cm and 28.53 cm) was found from L_1 and the shortest peduncle (1.41 cm, 7.12 cm, 12.85 cm, 17.02 cm, 20.74 cm and 22.61 cm) was recorded from L_2. In case of light intensity, at 1, 2, 3, 4, 5 and 6 days after peduncle initiation, the highest diameter of peduncle (0.60 cm, 0.65 cm, 0.77 cm, 1.14 cm, 1.26 cm and 1.69 cm) was found from L_1 and the lowest (0.48 cm, 0.57 cm, 0.68 cm, 0.89 cm, 0.99 cm and 1.27 cm) was recorded from L_2. For light intensity, the maximum days from flower bud initiation to flower bloom (18.63 days) was found from L_0 and the lowest (16.00 days) from L_1. In case of light intensity, the maximum number of flowers per plant (15.64) was found from L_1 and the lowest (11.90) was recorded from L_2. For, the highest leaf area (38.36 cm^2) was found from L_1 and the lowest (30.96 cm^2) was recorded from L_2.

For different cultivar of gerbera, at 20, 50, 80, 110, 140, 170 and 200 DAT, the maximum number of leaves per plant (12.84, 20.80, 24.60, 31.80, 31.60, 46.00 and 46.78) was recorded from C_5, while the minimum number of leaves per plant (10.50, 17.93, 21.56, 23.91, 28.54, 27.87 and 30.60) from C_1. At 20, 50, 80, 110, 140, 170 and 200 DAT, the longest leaf (8.09 cm, 9.87 cm, 13.93 cm, 20.43 cm, 24.75 cm, 26.24 cm and 28.63 cm) was recorded from C_5, while the shortest leaf length (6.73 cm, 8.87 cm, 11.76 cm, 12.87 cm, 16.21 cm, 22.18 cm, and 23.40 cm) from C_1. At 20, 50, 80, 110, 140, 170 and 200 DAT, the longest breadth of leaf (4.02 cm, 6.65 cm, 7.80 cm, 8.83 cm, 11.35 cm, 13.82 cm and 15.71 cm) was recorded from C_2, while the shortest breadth of leaf (3.50 cm, 5.05 cm, 6.74 cm, 8.70 cm, 10.61 cm, 12.64 cm and 14.59 cm) from C_1. At 1, 2, 3, 4, 5 and 6 days after flower bloom, the highest diameter of flower (1.71 cm, 2.16 cm, 3.77 cm, 4.35 cm, 5.28 cm and 5.68 cm) was recorded from C_5 again the lowest diameter of flower (1.43 cm, 1.82 cm, 3.01

cm, 3.56 cm, 4.39 cm and 5.19 cm) from C_1, at 1, 2, 3, 4, 5 and 6 days after peduncle initiation, the longest peduncle (1.53 cm, 9.19 cm, 16.86 cm, 21.67 cm, 23.48 cm and 26.79 cm) was recorded from C_5, again the shortest peduncle length (1.47 cm, 6.45 cm, 13.84 cm, 17.01 cm, 22.01 cm, 24.82 cm) from C_1. At 1, 2, 3, 4, 5 and 6 days after peduncle initiation, the highest diameter of peduncle (0.56 cm, 0.64 cm, 0.76 cm, 1.09 cm, 1.21 cm and 1.75 cm) was recorded from C_5, which was statistically identical (0.57 cm, 0.63 cm, 0.74 cm, 1.07 cm, 1.16 cm and 1.64 cm) with C_2. The highest days from flower bud initiation to flower bloom (19.02 days) was recorded from C_5, again the lowest (14.66 days) from C_4. For number of flowers per plant (15.20) was recorded from C_5 and the lowest (12.48) from C_1. The highest leaf area (36.61 cm^2) was recorded from C_2, while the lowest (33.67 cm^2) from C_1.

In case of interaction effect of light intensity and cultivar of potted gerbera, at 20, 50, 80, 110, 140, 170 and 200 DAT the maximum number of leaves per plant (12.84, 20.80, 24.60, 31.80, 32.75, 46.00 and 46.78) was recorded from L_1C_5, while the minimum number of leaf per plant (8.70, 15.63, 18.87, 20.30, 24.63, 25.10 and 27.22) from L_2C_1. In case of interaction effect of light intensity and cultivar of potted gerbera, at 20, 50, 80, 110, 140, 170 and 200 DAT the longest leaf (10.10 cm, 12.43 cm, 18.99 cm, 29.10 cm, 33.78 cm, 32.28 cm and 32.96 cm) was recorded from L_1C_5, whereas the shortest leaf (5.05 cm, 7.26 cm, 8.79 cm, 10.10 cm, 13.44 cm, 16.08 cm and 18.65 cm) from L_2C_1. In case of interaction effect of light intensity and cultivar of potted gerbera, at 20, 50, 80, 110, 140, 170 and 200 DAT the longest breadth of leaf (4.71 cm, 9.54 cm, 9.93 cm, 10.48 cm, 11.94 cm, 16.61 cm and 16.68 cm) was recorded from L_1C_5, whereas the shortest (2.69 cm, 3.30 cm, 5.09 cm, 7.87 cm, 9.27 cm, 10.16 cm and 12.77 cm) from L_2C_1. In case of interaction effect of light intensity and cultivar of potted gerbera, at 1, 2, 3, 4, 5 and 6 days after bud initiation the highest diameter of flower bud (1.76 cm, 2.02 cm, 2.07 cm, 2.87 cm, 3.80 cm 3.82 cm) was recorded from L_1C_5 and the lowest (0.77 cm, 1.01 cm, 1.11 cm, 1.16 cm, 1.19 cm and 1.28 cm) from L_2C_1. For different cultivar of gerbera, at 1, 2, 3, 4, 5 and 6 days after bud initiation, the highest diameter of flower bud (1.39 cm, 1.62 cm, 1.65 cm, 2.02 cm, 2.62 cm and 2.69 cm) was recorded from C_5, again the lowest diameter of flower bud (0.92 cm, 1.35 cm, 1.48 cm, 1.46 cm, 1.54 cm and 1.63 cm) from C_1. In case of interaction effect of light intensity and cultivar of potted gerbera, at 1, 2, 3, 4, 5 and 6 days after flower bloom, the highest diameter of flower (2.08 cm, 2.38 cm, 5.02 cm, 5.11 cm, 6.91 cm and 6.92 cm) was recorded from L_1C_5 again the lowest (1.04 cm, 1.54 cm, 2.45 cm, 3.01 cm, 3.08 cm and 4.09 cm) from L_2C_1. At 1, 2, 3, 4, 5 and 6 days after peduncle initiation the longest peduncle (1.62 cm, 10.68 cm, 19.27 cm, 24.86 cm, 24.91 cm and 30.12 cm) was recorded from L_1C_5, whereas the shortest peduncle (1.37 cm, 5.32 cm, 10.93 cm, 13.94 cm, 19.08 cm and 21.01 cm) from L_2C_1. At 1, 2, 3, 4, 5 and 6 days after peduncle initiation the highest diameter of peduncle (0.64 cm, 0.69 cm, 0.82 cm, 1.27 cm, 1.32 cm and 2.26 cm) was recorded from L_1C_5, whereas the lowest (0.41 cm, 0.52 cm, 0.62 cm, 0.79 cm, 0.90 cm and 1.03 cm) from L_2C_1. The highest days from flower bud initiation to flower bloom (21.64 days) was recorded from L_0C_3, whereas the lowest (13.85 days) from L_2C_4. The highest number of flowers per plant (18.98) was recorded from L_1C_5, while the lowest (10.50) from L_2C_1 and the highest leaf area (39.71 cm^2) was recorded from L_1C_5, whereas the lowest (28.92 cm^2) from L_2C_1.

Conclusion and Recommendation

In the experiment it was concluded that 40% reduced sunlight was more effective than full sunlight and 60% reduced sunlight, Among the cultivars C_2 that was pink colored flower bore maximum leaf number per plant, leaf length, leaf width, diameter of flower bud, diameter of flower, peduncle length, peduncle diameter, number of flowers per plant, leaf area and days from flower bud initiation to flower bloom that was more or less identical with variety C_5 (orange colored flower). Considering the findings of the present experiment, farther studies in the following areas may be suggested:

I. Further study is needed in different agro-ecological zones (AEZ) of Bangladesh for regional adaptability.

II. Other different combination of variety and light intensity and other management practices may include for farther study.

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APPENDICES

Appendix I: Monthly recorded of year temperature, rainfall, relative humidity and sunshine hours during the period from July, 2009 to February, 2010

Year	Month	Average air temperature (^{0}C)			Total rainfall (mm)	Average relative humidity (%)	Total sunshine hours
		Maximum	Minimum	Mean			
2009 to 2010	July	36.0	24.6	28.5	563	83	3.1
	August	36.0	23.6	28.8	319	81	4.0
	September	34.8	24.4	28.9	279	81	4.4
	October	34.8	18.0	27.1	227	77	5.8
	November	32.3	16.3	23.7	0	69	7.9
	December	29.0	13.0	20.4	0	79	3.9
	January	24.5	12.4	18.4	0	68	3.1
	February	27.1	16.7	21.9	30	67	3.0

Source: Bangladesh Meteorological Department (Climate Division) Agargaon, Dhaka-1207.

Appendix II. Analysis of variance of the data on leaf number at different days after transplanting of gerbera as influenced by light intensity and cultivar

Source of variation	Degrees of freedom	Mean square						
		Leaf number (cm) at						
		20 DAT	50 DAT	80 DAT	110 DAT	140 DAT	170 DAT	200 DAT
Factor A (Light intensity)	2	18.306**	31.614**	30.304**	140.304**	129.476**	200.898**	104.783**
Factor B (Cultivar)	4	1,189*	1.207**	2.033*	17.904**	3.163*	113.913**	175.731**
Interaction (A×B)	8	1.582**	2.656**	1.985*	3.480**	4.058**	68.531**	57.261**
Error	30	0.335	0.209	0.653	1.126	1.024	3.855	6.239

**: Significant at 0.01 level of significance; *: Significant at 0.05 level of significance

Appendix III. Analysis of variance of the data on leaf length at different days after transplanting of gerbera as influenced by light intensity and cultivar

Source of variation	Degrees of freedom	Mean square						
		Leaf length (cm) at						
		20 DAT	50 DAT	80 DAT	110 DAT	140 DAT	170 DAT	200 DAT
Factor A (Light intensity)	2	31.200**	37.936**	103.521**	111-.336**	174.729**	371.758**	251.937**
Factor B (Cultivar)	4	3.420**	1.781**	6.906**	86.270**	119.336**	34.022**	50.119**
Interaction (A×B)	8	1.052**	2.257**	15.336**	51.288**	41.685**	8.814**	14.727**
Error	30	0.079	0.068	0.099	3.660	3.087	0.676	1.183

**: Significant at 0.01 level of significance; *: Significant at 0.05 level of significance

Appendix IV. **Analysis of variance of the data on breadth of leaf at different days after transplanting of gerbera as influenced by light intensity and cultivar**

Source of variation	Degrees of freedom	Mean square						
		Breadth of leaf (cm) at						
		20 DAT	50 DAT	80 DAT	110 DAT	140 DAT	170 DAT	200 DAT
Factor A (Light intensity)	2	7.968**	53.762**	36.39**	3.952**	13.616**	64.241**	31.348**
Factor B (Cultivar)	4	0.358**	4.665**	1.860**	0.021**	0.951**	2.200**	2.009**
Interaction (A×B)	8	0.187**	5.121**	1.250**	0.410**	0.321**	2.863**	1.092*
Error	30	0.019	0.127	0.036	0.005	0.068	0.099	0.388

**: Significant at 0.01 level of significance; *: Significant at 0.05 level of significance

Appendix V. **Analysis of variance of the data on diameter of flower bud at different days after flower bud initiation of gerbera as influenced by light intensity and cultivar**

Source of variation	Degrees of freedom	Mean square					
		Diameter of flower bud (cm) at					
		1 day	2 day	3 day	4 day	5 day	6 day
Factor A (Light intensity)	2	0.295**	1.248**	1.054**	2.876**	2.275**	2.729**
Factor B (Cultivar)	4	0.458**	0.137**	0.049**	0.192**	1.762**	1.864**
Interaction (A×B)	8	0.156**	0.042**	0.063**	0.426**	1.047**	0.651**
Error	30	0.013	0.003	0.002	0.003	0.063	0.040

**: Significant at 0.01 level of significance; *: Significant at 0.05 level of significance

Appendix VI. Analysis of variance of the data on diameter of flower at different days after flower bud initiation of gerbera as influenced by light intensity and cultivar

Source of variation	Degrees of freedom	Mean square					
		Diameter of flower (cm) at					
		1 day	2 day	3 day	4 day	5 day	6 day
Factor A (Light intensity)	2	1.547**	0.872**	6.362**	3.491**	24.221**	11.515**
Factor B (Cultivar)	4	0.142**	0.173**	0.952**	0.818**	1.070	0.512**
Interaction (A×B)	8	0.037**	0.051**	0.663**	0.301**	0.934**	0.335**
Error	30	0.003	0.004	0.025	0.014	0.025	0.013

**: Significant at 0.01 level of significance; *: Significant at 0.05 level of significance

Appendix VII. Analysis of variance of the data on peduncle length at different days after flower bud initiation of gerbera as influenced by light intensity and cultivar

Source of variation	Degrees of freedom	Mean square					
		Peduncle length (cm) at					
		1 day	2 day	3 day	4 day	5 day	6 day
Factor A (Light intensity)	2	0.109**	23.450**	100.377**	123.803**	50.243**	136.225**
Factor B (Cultivar)	4	0.006**	11.703**	14.188**	35.059**	3.578**	6.011**
Interaction (A×B)	8	0.002*	2.999**	3.720**	8.897**	1.423*	3.194**
Error	30	0.001	0.096	0.092	0.304	0.624	0.289

**: Significant at 0.01 level of significance; *: Significant at 0.05 level of significance

Appendix VIII. Analysis of variance of the data on diameter of peduncle at different days after flower bud initiation of gerbera as influenced by light intensity and cultivar

Source of variation	Degrees of freedom	Mean square					
		Diameter of peduncle (cm) at					
		1 day	2 day	3 day	4 day	5 day	6 day
Factor A (Light intensity)	2	0.051**	0.026**	0.033**	0.232**	0.332**	0.672**
Factor B (Cultivar)	4	0.003**	0.002**	0.004**	0.034**	0.012**	0.385**
Interaction (A×B)	8	0.004**	0.002**	0.002*	0.006**	0.010**	0.209**
Error	30	0.001	0.0001	0.001	0.001	0.002	0.010

**: Significant at 0.01 level of significance; *: Significant at 0.05 level of significant

Appendix IX. Analysis of variance of the data on at different days after flower bud initiation of gerbera and days from bud initiation to flower bloom, flower per plant and leaf area as influenced by light intensity and cultivar

Source of variation	Degrees of freedom	Days for bud initiation to blooming	Flowers/ Plant	LAI
Factor A (Light intensity)	2	31.007**	50.428**	221.894**
Factor B (Cultivar)	4	33.130**	11.576**	14.670**
Interaction (A×B)	8	3.596**	6.408**	5.033**
Error	30	0.356	0.127	1.393

**: Significant at 0.01 level of significance; *: Significant at 0.05 level of significant