IMPROVEMENT OF PETAL COLORATION AND FLOWER PRODUCTION OF POTTED GERBERA THROUGH FOLIAR FEEDING AND TRADITIONAL MULCHES

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All praises are due to Allah who kindly enables the author to complete the present work

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MY BELOVED TEACHER

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CERTIFICATE

*This is to certify that the thesis entitled **"Improvement of petal coloration and flower production of potted gerbera through foliar feeding and traditional mulches"** submitted to the Department of Horticulture and Postharvest Technology, Faculty of Agriculture, 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 bonafide research work carried out by **Md. Romen Kabir Bhuiyan, Registration No. 07-02631**, under my supervision and guidance. No part of this thesis has been submitted for any other degree or diploma.*

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

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ABSTRACT

An experiment was conducted to study the improvement of petal coloration and flower production of potted gerbera through foliar feeding and traditional mulches at Horticulture Farm, Sher-e-Bangla Agricultural University, Dhaka during the period from May, 2008 to December, 2008. The trial consisted of Factor A: Mulching viz. M_0; control; M_1; straw and M_2; black polythene and Factor B: Foliar feeding viz. F_0; control; F_1; wuxol and F_2; agro-grow. Mulching and foliar feeding had significant effect on flower color, yield and yield contributing characters of potted gerbera. Incase of mulching, longest plant (37.8 cm), highest leaf length (27.7 cm), maximum number of leaf (37.3 / plant) and maximum number of flower (15.3 / plant) was recorded from M_1 while these parameters were lowest at M_0. For foliar feeding, longest plant (36.0 cm), highest leaf length (26.1 cm), maximum number of leaf (32.6 / plant) and maximum number of flower (14.0/plant) was recorded from F_1 while all the above parameters were lowest at F_0. For combined effect longest plant (40.1 cm), highest leaf length (30.8cm), maximum number of leaf (43.5/plant) and maximum number of flower (17.5 / plant) was recorded from M_1F_1 while all the above parameters were lowest with M_0F_0. Treatment combinations of straw mulch with wuxol were more effective for quality production of potted gerbera.

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ABBREVIATIONS AND ACRONYMS

AEZ	=	Agro-Ecological Zone
ANOVA	=	Analysis of variance
cv.	=	Cultivar
cm	=	Centimeter
CRD	=	Complete Randomized Design
DBA	=	Days Before Anthesis
Dept	=	Department
DAA	=	Days After Anthesis
DMRT	=	Duncan's Multiple Range Test
DAT	=	Days after transplanting
et al.	=	And others
Hort.	=	Horticulture
i.e.	=	That is
J.	=	Journal
K	=	Potash
LSD	=	Least Significant Difference
L	=	Litre
ml	=	Milliter
N	=	Nitrogen
P	=	Phosphorus
Res.	=	Research
Rh	=	Relative humidity
SAU	=	Sher-e-Bangla Agricultural University
Sci.	=	Science
Viz.	=	Namely
^{0}C	=	Degree Celsius
%	=	Percentage
@	=	At the rate of
PT	=	Postharvest Technology

CHAPTER I

INTRODUCTION

Gerbera *(Gerbera jamesonii L.)* 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 'Barbeton daisy' or 'Transvaal daisy'. *Gerbera jamesonii* belongs to the family Asteraceae. It grows well in tropical and subtropical regions, but in a temperate climate it should be protected from frost and cultivated in glasshouses. Genus *Gerbera L.* consists of 30 species, which are of Asiatic and African origin. Among the different species, *Gerbera jamesoii* 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. It is a diploid species with the somatic chromosome number 2n = 50. 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 crop.

Its magnificent inflorescence with a variety of colour has made it attractive for use in garden decorations, such as herbaceous borders, bedding, and pots and for cut flowers as a long vase life (Bose *et al.,* 2003). Gerbera plant also is used in the preparation of traditional Chinese medicine; tu-er-feng, derived from whole plants of gerbera, is used for curing cold with cough and for rheumatism (Ye *et al.,* 1990). 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 with maintained seed temperature at approximately 20-23°C. Gerbera Seed typically germinate with in 7-14 days. These plants grow slowly. Most new gerbera developed for pot plant production are 6-8 inches in height and produce flowers up to 4 inches. Range of colors available has increased to include a wide array of pastel colors. Size of the distance between the plants

; measured from heart to heart of the pot centre. A pot size of 3.5 / 4.5 litre and 18-20 cm eep is recommended.

iood drainage is essential for gerbera cultivation. There is no released variety of gerbera ith high yield potential and better quality in Bangladesh. Lack of variety is one of the nain constraints towards its production.

'lant breeder have done a wonderful job of developing outstanding flower colors, ncluding purple, rose, pink, white, and various bicolor and introduced double and semi-ouble flowering forms, adding to the beauty of this flower. Cut flowers production of ;erbera has increased dramatically in recent years in Bangladesh.

iuccess of this crop in the market place will depend ultimately on the aggressiveness of he grower to pursue retail and wholesale floral markets. Quality must be demonstrated ind price set to undersell the competition. Only a limited number of gerbera daisies can be ibsorbed by local market outlets. Retailing through "pick-your-own" farm stands and armers markets may be the best ways for the small grower to become familiar with growing the crop, developing a quality product, and establishing a good reputation in the narket.

n this aspect several objectives may be outlined as below:

i. To determine the growth pattern of gerbera in Bangladesh condition that may be lead to an understanding of its phenotypic characters such as growth and flower production.
ii. To find out the influence of moisture management and artificial feeding on the flower growth and coloration.
iii. To find out the appropriate time of flower collection and commercial production of gerbera in Bangladesh.

With the appropriate method and suitable cultivars, these precise technique guaranteed success and uniformity of flowering and so ensure its rapid commercial adoption in Bangladesh.

CHAPTER II

REVIEW OF LITERATURE

Gerbera *(Gerbera jamesonii)* is a herbaceous perennial crop with long leafless stalk and daisy like flowers. It is a popular cut flower grown thought the world in a wide range of climatic conditions. A native of South Africa. A few number of research works have been done all over the world by different workers on the performance of gerbera genotypes and no information is available under climatic conditions of Bangladesh. Nevertheless, some of the important and informative works so far been done abroad on these aspects have been presented in this chapter.

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. The temperature inside the greenhouse could be controlled from

24.7 to 30.5 deg C when the ambient temperature varied from 27.4 to 35.5 deg C. The lowest temperatures of 8.0 and 6.7 deg C were recorded during April and March, respectively. The RH in the greenhouse varied from 44 to 77%, while the outside RH ranged from 20 to 67% when the rate of ventilation was 1018 cubic meter per minute.

An experiment was carried out by Acharya (2003) in Behar Agricultural College, India and reported that mulching significantly increased the yield of gerbera.

Narayanan *et al,*. (2003) carried out an experiment and reported that foliar feeding (N, P, K) on gerbera at the of 15 lb ac^{-1} as a solution at the pre flowering stage gave 6% more flower than control.

To study the effect of mulches on the growth and yield of gerbera an experiment was carried out by Hill *et al.* (2002) in Connecticut Agricultural Experiment Station, New Haven USA. They reported that temperature and moisture regimes of soil were greatly influenced by mulching. They also stated that mulching influenced the growth of gerbera producing well developed root system, highest plant height, spread of plant, stalk length, number of leaves, diameter of flower and number of flower.

In Poland during the period 1997-98 Kalisz and Cebula (2001) conducted an experiment to conclude the effect of soil mulched with polythene film, straw and perforated polythene film on the growth and yield of gerbera. Soil coverings were given directly immediately after planting the seedlings. They observed that plant height, diameter of flower, the number of leaves, number of flower and leaf length build-up by the application of straw covers considerably improved plant growth. Among the treatments, straw mulch recorded the highest (40.0 cm, 6.9 cm, 40.3/plant, 20.5/plant and 10.1 cm in 1997 and 1998, respectively) and the control treatment recorded the lowest yields.

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.

Ozcelik *et al.*, (1999) conducted the use of different growing media in greenhouse gerbera cut flower production. Perlite, peat, pumice and rockwool were used either alone or in combination for cut gerbera cv. Conga production in a greenhouse trial in Antalya, Turkey in 1994-95. Effects of these growing media on flower yield and quality were investigated. After 15 months, the highest total flower yield (59.31 flowers/plant) was obtained from the plants grown in peat + pumice (1: 1, v/v), followed by plants grown in peat (57.71 flowers/plant). Effects on flower quality were generally less significant than effects on 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.

A greenhouse study was carried out in Belgium to investigate the effects of supplementary light on gerbera cv. Tiffany (small flowers) and cv. Optima (large flowers), *Labeke et al.*, (1999). 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).

Subhan (1999) carried out an experiment with mulching on gerbera in Indonesian Institute of Horticulture, Indonesia and reported that mulching increased the diameter of flower and yield of gerbera per plant.

Effects of soil heating to 18^0 C in 6 gerbera cultivars growing in a sand : peat (3:1 v/v) substrate in an experimental heated greenhouse in Madrid, Spain were studied by Benavente *et al.,* (1998). Flowers were harvested once or twice/week between August 1994 and March 1997. Overall results (in heated and unheated soil) indicated that yields were highest in cv. Fame (4.23 flowers/plant per month) and lowest in Impala (1.84 flowers/plant per month). In a comparison of planting location within the greenhouse, yields were higher in plants on the west side of the greenhouse compared with the east side. The effects of soil heating on yields varied by cultivar and season. Soil heating increased cut flower yields by 10-40% in cultivars Impala and Cerise, had no significant effect on yields of cultivars Avanti, Fame and Party, and lowered yields slightly in cv. Olympic.

Huang and Harding (1998) studies quantitative analysis of correlations among flower traits in gerbera hybrida, and Genetic variability. A sample of 36 flower traits consisting of six morphological categories in the Davis population of gerbera was restructured into phenotypic and genetic principal component traits. First 5 phenotypic principal component traits accounted for 62% of the total phenotypic variance of the 36 traits and have moderate to high heritabilities. First 5 genetic principal component traits accounts for 97% of total genetic variance and all have high heritability. Morphological structure of these component traits suggest an underlying process identified by the first genetic principal component involving largely trans and disk floret traits. Results of this study indicate that the quantitative, genetic structure of the gerbera flower is controlled by a few independent components and that principal component analysis is a useful tool to reveal variation in this structure. These composite traits are heritable and are expected to respond to selection.

Choudhury *et al.,* (1998) carried out an experiment to observe the performance of some gerbera *(Gerbera jamesonii)* cultivars under the agro-climatic condition of Jorhat, Assam. Ten cultivars of gerbera were evaluated for growth and flowering parameters at Jorhat during 1996-97. Cultivars Popular, Evening Bells, Red Monarch and General Kaiser were promising under Jorhat conditions.

Aswath *et al.,* (1998) showed dry storage as an aid in selection for longevity in gerbera. Flowers *of 23* varieties of *Gerbera hybrida* were dry stored for *24* and *48* hours. The structural strength and turgor strength of the stem was separately measured using parameters such as total voids, percentage, porosity and void ratio. The varieties were classified into three groups based on magnitude of stem bend and recovery. A probable crossing programme between genotypes of class I and II was suggested to achieve structurally strong stems with high water absorption capacity. The character percentage was found to be governed by dominant and epistatic genes. Water absorption is directly related to percentage inner conduit and is thus considered an important character for selecting varieties for long transportation periods. Correlation studies indicated that puncturing the stem, cutting the stem and keeping the stem in warm water helped in high absorption of water, which in turn allows the flower stalk to return to a normal position after dry storage.

Oh *et al.,* (1998) while conducting an experiment in Seoul Korea Republic, to investigate the effect of different mulches on growth of gerbera and they found that straw mulch increased the growth of gerbera and ensure the optimum soil temperature for proper growth and development as well as higher yield contributing characters and yield considering the control condition.

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 is 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.

Aswath *et al.,* (1998) carried out an experiment to trial role of biochemical component in vase life of gerbera. In trials carried out in 1992-94 on 23 gerbera cultivars, the biochemical components (total sugars, reducing sugars, non-reducing sugars, phenols and orthodihydric phenols) of the fresh stem and exudates were analyzed. Total sugars and reducing sugars classified based on their biochemical components. The presence of phenols was found in greater quantities higher up the stem. The cultivars were differed among cultivars while phenols were absent in exudates. A correlation was found between total sugars of the fresh stem and vase life, indicating external application of sugar may increase vase life.

Mahanta *et al., (*1998) conducted an experiment for correlation and path coefficient analysis in gerbera *(Gerbera jamesonii).* Character association analysis among 14 different characters in a set of 10 gerbera genotypes revealed highly significant positive correlations with number of flowcrs/clump and leaf area at both the phenotypic and genotypic level and number of suckers at the genotypic level only. The path analysis revealed that leaf area, girth of stalk and days to flower bud opening had high direct effects. The significant positive correlation of leaf area with flower number/clump could thus be attributed to the high positive direct effect of the characters. The non-significant associations of plant height, number of leaves, days to flower bud visibility, size of flower and shelf life with number of flowers/clump were lar1gely due to their high negative direct effect on the dependent variable. Thus, the characters leaf area, girth of stalk and days to flower bud opening could be considered for selection to improve upon the number of flowers/clump, area, girth of stall and days to flower bud opening had high direct effects. The significant positive correlation of leaf area with flower number/clump could thus be attributed to the high positive direct effect of the characters.

Vijaya and Subbaiah (1997) observed that plant height, number of leaves, leaf length, leaf width, number of flower, diameter of flower and the height of flower stalk of gerbera increased with foliar feeding than control.

Kaur *et al.,* (1996) showed effect of modified environments on plant growth and flowering production of gerbera. From 15 May 1991 to 15 October 1991, seedlings of *Gerbera Jamesoii* were maintained under Rambo-plastic nets permitting 85% and 75% natural light intensity. Plants grown under plastic nets produced twice the number of leaves (37) and flowers (10) with better stem length and flower diameter, as compared to plants grown under natural light intensity. The chlorophyll content of leaves was maximum (2.417 mg/g of fresh weight) from the plants grown under net permitting 75% of natural light intensity and was minimum (1.551 mg/g of fresh weight) from plants grown under natural conditions throughout the growing period. It is concluded that increased rate of plant growth and flower production is the result of reduced light intensity only, because air temperature under nets did not differ from the open due to free movement of air through nets. In the second experiment, seedlings were covered with plastic (as complete cover, overhead cover, without cover for control) from November 1990 to February, 1991. The highest number of flowers (32/plant) was produced by the plants maintained under complete cover but the difference in flower yield and flower quality was only numerically significant.

In an experiment was conducted on the effect of mulches (black paper, black polythene and straw) on gerbera by Poll and Gaven (1996) observed that mulches increases yields of gerbera.

Wernett *et al.,* (1996) conducted an experiment of postharvest longevity of cut-flower Gerbera and Heritability of vase life. Intensive selection to improve vase life was performed on a sample population of Gerbera x hybrida from a broad source of germplasm. Progeny of a 5 x 5 diallel cross yielded estimates of narrow sense heritability ($h^2 = 0.28$) and broad sense heritability ($H^2 = 0.28$) for vase life based on a mean of 1.96 measurements per plant. Additive gene action is postulated to control this character since the difference between total genotypic variance and additive genetic variance components was small. Repeatability (r = 0.57) based on a single measurement per plant was moderately high.

Wernett *et al.,* (1996) studied the postharvest longevity of cut-flower gerbera and response to selection for vase life components. A broad source of Gerbera x hybrida germplasm was evaluated for vase life. Senescence mode, i.e. bending or folding of stems or wilting of ligulae, was also recorded for flowers evaluated. Intensive selection was practiced to improve vase life. About 10% of the plants from a sample population were selected for having flowers with long vase life. Progeny means for vase life resulting from a topcross between these plants and cv. Appleblossom were used to select 5 plants (about 1.5% of the sample population) whose flowers had a long vase life. A diallel cross using these 5 plants as parents resulted in a progeny population with a mean vase life 3.4 days longer than that of the initial sample population. Increases in vase life means for days to bending, folding and wilting were 03, 3.5 and 1.2 days, respectively. Plants with flowers which senesced due to wilting had the longest mean vase life before and after breeding. Changes in the proportions of senescence modes in the diallel generation relative to the parental generation, were observed; bending decreased, while folding and wilting increased. Frequencies of bending, folding and wilting were compared with vase life means for 10 progenies. The proportion of bending generally decreased as vase life increased.

Maloupa *el al.*, (1996) observed the effects of substrate and irrigation frequency on growth, gas exchange and yield of gerbera cv. Fame. To evaluate the performance of gerbera cv. Fame plants grown in bags containing perlite, 1: 1 peat : perlite or pumice at two irrigation frequencies (8 or 16 times per day), plant growth, photosynthetic rate, stomatal conductance, leaf transpiration, leaf water potential, evapotranspiration and flower yield were measured 4-6 n-ionths from planting. Comparison was made with plants grown in soil. The number of flowers produced per month was highest in the peat + perlite medium and lowest on pumice. Irrigation frequency had little effect on any of the parameters measured. Photosynthetic rate was higher in plants grown on soil than in those, grown on the other media. Evapotranspiration was highest in plants grown on peat + perlite.

Wernett *el al.,* (1996) carried out an experiment of post harvest longevity of gerbera as a cut flower and heritability of its vase life. Intensive selection to improve vase life was performed on a sample population of Gerbera x hybrida from a broad source of germplasm. Progeny of a 5 x 5 diallel cross yielded estimates of narrow sense heritability ($h^2 = 0.28$) and broad sense heritability ($H^2 = 0.28$) for vase life based on a mean of 1.96 measurements per plant. Additive gene action is postulated to control this character since the difference between total genotypic variance and additive genetic variance components was small. Repeatability ($r = 0.57$) based on a single measurement per plant was moderately high. Heritability ranged from 22 to 39%.

Dwivedi and Bajpai (1995) observed through using 0-90 kg N ha^{-1} as urea and foliar feeding (N, P, K) that flower yield increased with the increased rate of foliar feeding application and the yield was highest with foliar feeding and lowest with urea.

Tourjee *et al.,* (1995) evaluated of complex segregation analysis of gerbera flower colour. The distribution of hue (CIELAB colour notation) classes among flowers of the Davis, California, USA population of gerbera *(Gerbera jamesonii)* appears bimodal. This suggests that the genetic control of hue is determined by the segregation of a gene with large effect modified by additional genes with smaller effects. Complex segregation analysis (CSA), routinely employed in human genetic epidemiology, was used to study both qualitative and quantitative variation. CSA applies pedigree analysis through the consideration of transmission probabilities to optimize likelihood functions of various genetic models. Applying this technique to study flower hue in a sample representing generations 14, 15 and 16 of the Davis population, allowed identification of a putative dominant major gene with genotypic values for the dominant homozygote, heterozygote and recessive homozygote of 32, 32 and 71 degrees, respectively. This corresponds to the modes of the hue frequency distribution for the population. The putative major gene represents 0.66 of the total variation. The residual parent offspring correlation measures the genetic contribution to the remainder of the variance.

Eck *et al.*, (1995) observed the colours of florets of several gerbera *(Gerbera jamesonii* Bolis ex Adlam) cultivars measured with a colorimeter. The colour variation between several gerbera cultivars were analyzed with a tristimulus colorimeter. A pilot study with a three cultivars (Joyce, Beauty and Marleen) showed that the flower colour variation between cultivars and colour effects during the growing season can be calculated quantitatively on the basis of data measured by the colorimeter. On the basis of these results the colour differences between 16 gerbera cultivars were measured. A consistent number of cultivars were distinct on the basis of colorimetric data and visual colour assessments. The consequences of the use of a colorimeter for gerbera breeding and the granting of plant breeders' rights are discussed.

Amariute *et al.*, (1995) conducted an experiment to observe physiological and biochemical changes of cut gerbera inflorescences during vase life. Some physiological and biochemical changes in cut *Gerbera jamesonii* cv. Red Marleen inflorescences were evaluated during vase life in distilled water and preservative solution (2.5% sucrose + 150 ppm 8-HQS + 200 ppm KCI). Ligula cell membrane permeability measured as electrolyte leakage from ligulas was 1.4 times greater in inflorescences held in distilled water than in those held in preservative solution. Conductivity of the preservative solution diminished during the first day of vase life and then increased. Conductivity of the control (distilled water) increased by 334 uS on day 7 of vase life compared with that observed on the day 1. The rate of respiration, fresh weight and vase life of inflorescences held in preservative solution were greater than in those held in distilled water. The colour of ligulas intensified during vase life due to an increase in anthocyanin and carotenoid pigment contents. After 5 days the colour intensity was greater in inflorescences held in water than in those held in preservative solution.

Fakhri *el al.*, (1995) observed the effects of substrate and frequency of irrigation on yield and quality of three *Gerbera jamesonii* cultivars. The effects of substrate (perlite 1-5 mm, peat + perlite in a 1:1 mixture or washed pumice 5-10 mm) irrigated 8 or 16 times/day for

1 min on yield and flower quality of gerbera cultivars Fame, Rosabella and Sunspot were compared during a 6-month growth period with plants grown in soil and drip-Irrigated for 10 min/day. Peat + perlite gave better or similar flower yield and quality compared with soil; pumice gave the lowest performance, though still satisfactory. Plant growth and yield were unaffected by irrigation frequency and the high frequency resulted the surplus nutrient solution being lost in drainage. Fame (single yellow) gave the largest yield (5.96-6.20 flowers/plant in peat + perlite) arid flower diameter (11.2-12.15 cm), whereas Sunspot (single orange) had the lowest yield (3.42-5.46 flowers) and the longest sterns (57.8-70.1 cm).

Martinez *et al.,* (1995) studied effects of substrate warming in soilless Culture on gerbera crop performance under seasonal variations. Gerbera cv. Fame was grown in perlite (3-5 mm) or attapulgite [palygorskite] substrates which were or were not heated to a minimum temperature of 19^0 C. After 2 years of use, both materials monitored good stability and bulk density did not change substantially with change in water status of the substrate. Air capacity was high for both materials but decreased in attapulgite after 2 years with heating. Easily available water and water buffer capacity were very limited, especially for attapulgite. Substrate heating increased total water consumption by 130-140% in attapulgite and 35% in perlite. When no heating was used perlite consumed 22% more water than attapulgite. Increased water consumption by plants growing in heated substrates continued after the winter and spring heating season had ended..Seasonal adaptation of plants was analyzed in terms of transpiration, stomatal conductance and leaf water potential. Significant differences were found in flower production between substrates at the end of the production cycle (7 May) - 35.3 and 26.1 flowers/plant in perlite and attapulgite and 36.6 and 26.1 flowers in heated and unheated Substrates, respectively. Between October and March yields were: perlite 25.3 flowers, attapulgite 19.0 flowers, heated substrate 25.9 flowers, unheated substrate 17.8 flowers/plant.

Doom *et al.,* (1994) conducted an experiment to effect of dry storage on scapc bending in cut *Gerbera jamesonii* flowers. The effect of dry storage on scape bending in cut flowers was investigated in *9 Gerbera jamesonii* cultivars (Cora, Donatella, Liesbeth, Mickey, Nikita, Regina, Rosamunde, Simonetta and Terrafame). Freshly cut flowers placed in water for 14 days in summer or winter showed no bending, except for cultivars Cora and Liesbeth. During the summer, dry storage (4 days at 1^0 C) had no effect on most cultivars but increased the curvature in cultivars Cora and Liesbeth, whereas in winter dry storage increased bending in all cultivars tested. Amongst the cultivars tested, no differences were found in water potential after dry storage nor in the water balance during vase life. The scape curvature after dry storage in winter was not correlated with FW of the flower head or the uppermost 12 cm of the scape, nor with scape diameter at 12 cm from the flower head. The percentage DW of the scapes, however, was lowest in Cora and Liesbeth, which may explain why they are apt to bend.

Tourjee *et al.,* (1994) studied the development of *Gerbera jamesonii* as a floricultural crop is traced from its collection as a novelty in South Africa to its establishment as a commercial crop in the 1930s. The origin of the cultivated germplasm, *Gerbera jamesonii* and *Gerbera viridifolia,* is discussed, as is breeding work carried out following its introduction to Europe, and later, the USA. Breeding for cold hardiness in temperate climates was an early objective. The relative contribution of *Gerbera jamesonii* and *Gerbera viridifolia* to the modern crop is unknown, but much of the cultivated germplasm can be traced to material that passed through the Cambridge Botanic Gardens, UK, and La Rosarie, Antibes, France.

Hembry *et al.,* (1994) conducted an experiment in Horticulture Research International, Warwick, UK to evaluate a range of ground cover mulches including black paper, black polythene and straw for their effect on weed control. They found excellent weed control and maximum yield of gerbera when growth with mulches but control performance the reverse situation where weeds were generally grown.

Gattorsen (1992) conducted an experiment to evaluate the effects of straw mulch on the yield of gerbera and found that double layer produced the higher yield than single layer mulching.

Wahi *et al.,* (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.

A study was conducted by Dambre *et al.,* (1990) to observe assimilation lighting of gerbera on substrate. In a glasshouse trial with the gerbera cultivars Rosamunde, Terra Fame and Beauty grown on rockwool on the ebb-and-flow system, with a 16-hours day, assimilation lighting (10 W/m^2 at plant height) was applied or not from Oct. onwards. Data for both groups are presented on the effects on average flower numbers/plant, and average flower stalk, length, flower diameter and weight, assessed at monthly intervals from October to early February. Flower numbers/plant of Rosamunde and Beauty were enhanced in December and January and flower quality and weight of all cultivars were improved from November or, December onwards, compared with plants receiving no assimilation lighting. Only with Beauty, however, were the additional costs of lighting justified by the greater returns.

Thangaraj *et al.,* (1990) studies on the vase life of gerbera *(Gerbera jamesonii* Bolus). Freshly cut flowers of 24 accessions, placed in glass tubes with no water, were held at room temperature for 24 hours. Data are tabulated on weight loss, flower stalk bending, petal drooping, petal necrosis and vase life. The following accessions were found suitable for use as cut flowers: GJ 8, GJ 10) GJ 16, GJ 18, GJ 23 and GJ 44.

Put *et al*., (1990) carried out an experiment of micro-organisms from freshly harvested cut flower stems and developing during the vase life of chrysanthemum, gerbera and rose cultivars. A wide variety of micro organisms, bacteria and fungi, was isolated from freshly harvested cut flower stems and from vase contents of chrysanthemum cv. spider, gerbera cultivars appelbloesem and fleur, and rose cv. sonia. fungal species were isolated much more frequently than previously recorded. Bacterial genera, present on the stems, were also present in the corresponding vase water. The dominant initial stem microflora, Enterobacter, Bacillus spp. and fungi, lost their dominance in the vase water, which after 3 days of vase life showed a predominance of *Pseudomonas spp*. The longer the vase life, the greater were the changes in the microflora of the vase water, which later again showed a predominance of *Enterobacter spp.* and often also *of Bacillus spp.* After 10 days of vase life, fungal growth increased markedly in chrysanthemum and gerbera vase water and, to a lesser extent, the antagonistic activities of many of the microbial species of the mixed vase flora will have led to the initial predominance of *Pseudomonas spp.* and to typical changes in the dominant flora during the course of the flowers' vase life.

Dufault *et al.,* (1990) observed that nitrogen and potassium fertility and plant populations influence field production of gerbera. Gerbera seedlings (cv. Florist Strain Yellow) were planted in the field in drip-irrigated beds mulched with white-on-black plastic film (white side up) at plant densities of 24000, 36000 or 72000 plants/ha. N and K fertilizers were each applied at 55, 110 or 220 kg/ha. In the 1st year of a 2-year Study, the number of marketable flowers increased as both N and K rates increased up to 110 kg/ha, but as the N rate was increased to 220 kg/ha cut flower production increased. In the 2nd year, marketable and cut yields increased as N rate increased but increasing K rate had no effect on yields. Marketable and cut yields also increased as plant density increased from 24000 to 72000 plants/ha in both years. Flower size and quality were unaffected by planting density. N and K rates had no effect on flower size, quality or vase life in either year.

Gagnon and Dansereau (1990) reported that influence of light and photoperiod on growth and development of gerbera. *Gerbera jamesonii* cv. Happipot during autumn/winter 1987 and on *Gerbera Jamesonii cv.* Tempo during winter/spring 1988. Both cultivars were grown under 30, 50 or 90 u mol m-2 -1 with a 16-h photoperiod or 60 u mol m^{-2} s^{-1} with a 20-hours photoperiod. Light treatments were provided by 400-W HPS lamps. Control plants were kept under ambient light conditions. The growth, development and flowering of *Gerbera jamesonii cv.* Happipot were significantly increased under all light treatments compared with the control. Highest plant width, height, shoot DW and number of buds and flowers and lowest number of days to flowering were obtained under the 90 u mol m-2 s-l for 16 hours treatment. Light treatments had no significant effect on plant width and height for cv. Tempo. However shoot DW and leaf area were significantly higher under the 60 mol m^{-2} s^{-1} for 20 hours light treatment than in the control. The 60 mol m^{-2} s^{-1} for 16 hours light treatment resulted in significantly higher flower number in cv. Tempo than in the control. The 90 u mol m^{-2} s^{-1} for 16 hours light treatment reduced the number of days to flowering (production time) by 23 days and 11 days for cv. Happipot and Tempo, respectively. The various light treatments had more effect on plant growth, development and flowering in the autumn-winter study than in the winter-spring study and this was probably due to increased ambient light conditions during the winter-spring study.

Roy *et al.,* (1990) carried out an experiment, to study the effect of water hyacinth, rich straw and sawdust mulches on the growth of gerbera. They reported that mulches increased crop growth rate and leaf area index. Straw mulch significantly increased growth and yield.

Accati and Jona (1989) carried out an experiment to find out influencing gerbera cut flower longevity. More than 300 gerbera cultivars exist and they differ in weight, diameter and form of inflorescence which may be either simple, semi-double or double. Stem diameter and weight differ from one cultivar to another as do vase life and behaviour through senescence. The influence of these parameters was investigated and none was found to be critical in extending vase life. Because few experiments have been carried out on the use of chemicals for extending gerbera vase life, this field was investigated. A mixture of 300 p.p.m. 8-hydroxyquinoline sulphate, 300 p.p.m. BNA (sodium benzoate) 10-4 MAOA (aminooxyacetic acid), 10-4 M 3,4,5-T and 20 g/litre sucrose appeared to be the best keeping-solution. Furthermore, since various cultivars exhibit different osmotic pressures, this character was related to longevity and osmotic pressure of the preservative solution was adapted to the level of the stem osmotic pressure.

CHAPTER III

MATERIALS AND METHODS

This chapter deals with the materials and methods that's used in execution of the experiment.

3.1 Site of the experiment: The experiment was conducted at the Horticulture Farm, Sher-e-Bangla Agricultural University, Dhaka, during the period from May 2008 to December 2008. Location of the site is 23° 74´ N latitude and 90° 35´ E longitude with an elevation of 8.2 meter from sea level (Anonymous, 1981).

3.2 Climate and weather: Climate of the experimental site is 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 I.

3.3 Planting materials: Seedlings were collected from Bangladesh Green Rouf Movment nursery, Rampura, Polashbag, Dhaka.

3.4 Treatments of the experiment: There were two factors in this experiment. They were as follows:

Factor A: Mulching

I. M0, control
II. M1, Straw mulch
III. M2, black polythene mulch

Factor B: Foliar feeding

I. F0, control

II. F1, Wuxol (2.5 ml/L, recommended dose by the producer, 10 days interval were spryed).

III. F2, Agrogrow (2 ml/L, recommended dose by the producer, 10 days interval were spryed.)

3.5 Pot preparation: Soil and cowdung were mixed and pot were filled 7 days after transplanting. Pots were placed on 2nd May 2008.l. The weeds and stubbles were completely removed from the soil (Plate 1).

3.6 Design and layout of the experiment: Two-factor experiment was laid out in the Complete Randomized Design (CRD) with three replications.36 pots were used in the experiment. The size of the each pot were 20 cm × 18 cm.

3.7 Planting of Suckers: Suckers were planted at 7 cm depth in pot on 10th May, 2008 under shade. Total number of pots was used in 36 and total number of suckers was 36.

3.8 Weeding: Weeding was done in all the pots as and when required to keep the plant free from weeds.

3.9 Irrigation: Frquency of watering depended upon the moisture status of the soil. However, water logging was avoided, as it is harmful to plants.

3.10 Disease and pest management : Diseases can be a major factor limiting gerbera production. 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. Mite was controlled by spraying Dithane M-45 @ 1.5 ml/l. the insecticides was sprayed one time after 7 days of planting of suckers.

3.11 Harvesting of flowers: Spikes were harvested from 2nd July 2008 when the flower reached commercial stage.

3.12 Data collection: Data were collected from each pot. Data were collected in respect of the following parameters

3.12.1 Measurement of plant height, leaf length, leaf width, length of flower stalk,diameter of flower bud and diameter of flower: Plant height, leaf length, leaf width, length of flower stalk,diameter of flower bud and diameter of flower of each plant of each pot was measured in cm and the mean was calculated.

3.12.2 Number of leaves and flowers per plant: Number of leaves and flowers per plant was recorded by counting all the leaves and flowers from each plant of each pot and the mean was calculated.

3.12.3 Petal color measurement: Petal color at three different locations of the outer epidermis (ø 10 mm) was measured using a handy-type tristimulus colorimeter, NR-3000 (NIPPON Denshoku), followed by L* (lightness), a*, and b* (two Cartesian co-ordinates), based on the CIElab scale with the standard CIE observer (10^0 visual field) and the CIE standard illuminant D_{65} (CIE, 1986; McGuire, 1992), (Plate 3 & 4). Beans whose effective axes were at the angle of 45 ± 2^0 from the normal of the specimen surface in illuminated petal. Metric chroma, C* and hue angle, h_{ab} (CIElab notation), were calculated according to the following equations: $C^* = (a^{*2} + b^{*2})^{0.5}$ and $h_{ab} = tang^{-1}$ (b*/a*) (Gonnet, 1998). Total colorimetric difference (polar notation) was also calculated to know the changes of petal colors between normal (NS) and off-season (F) flowers with the following equation: $\Delta E^* = [\Delta (L^*_{NS} - L^*)^2 + \Delta (C^*_{NS} - C^*_F)^2 + \Delta (H^*_{NS} - H^*_F)^2]^{0.5}$, with $\Delta (H^*_{NS} - H^*_F) = 2\sin[(h_{NS} - h_F)/2] \times (C^*_{NS} \times C^*_F)^{0.5}$ (Seve, 1991).

Plate 1. Preparation of pot

Plate 2. Mulching of Potted gerbera

Plate 3. Colorimeter (Nippon Denshoku, NR- 3000)

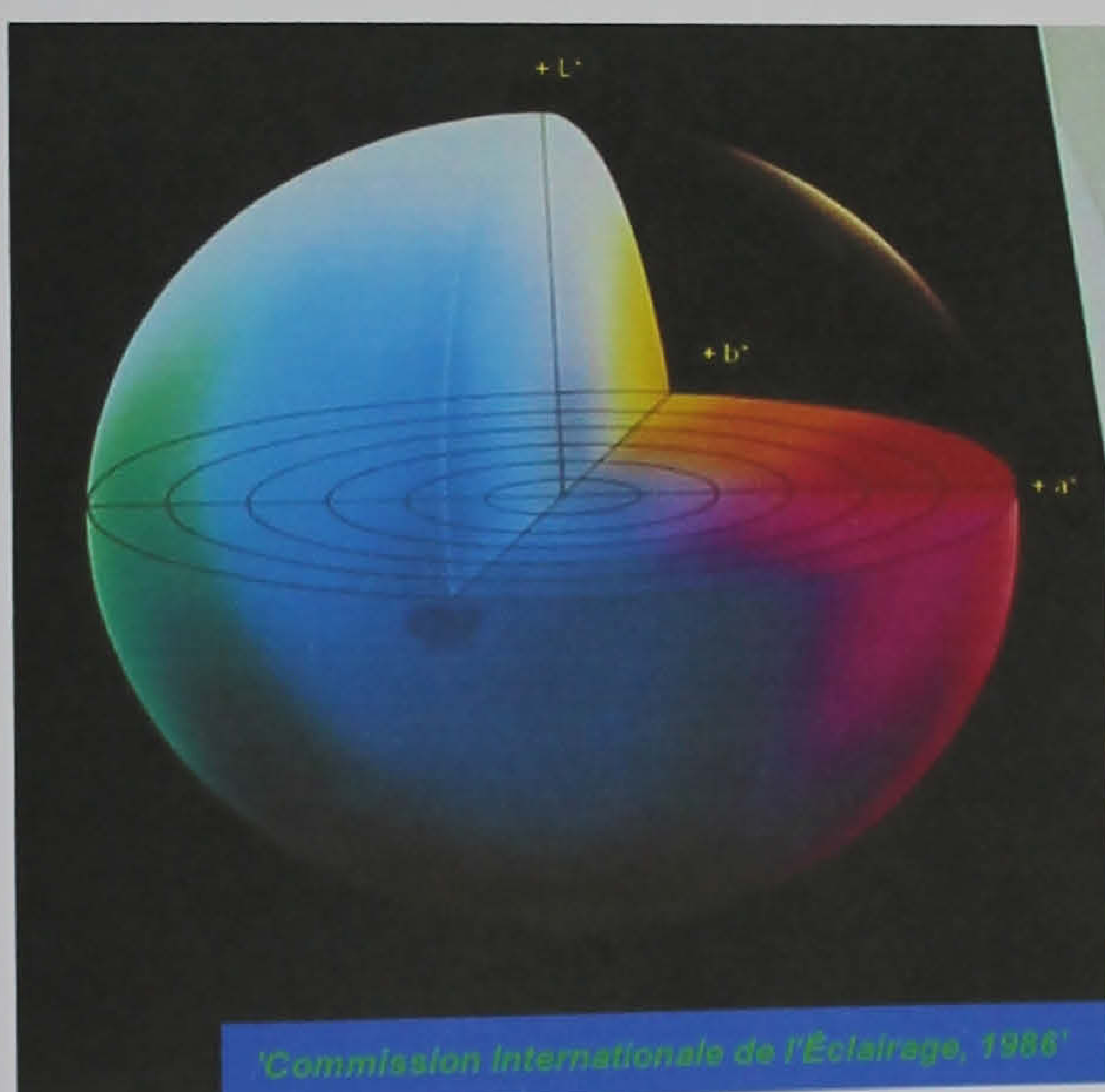

Plate 4. CIELab color scale

3.13 Statistical analysis: Collected data for various characters were statistically analyzed using MSTAT computer package programme. 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 were evaluated by Duncan's Multiple Range (DMRT) test (Gomez and Gomez, 1984).

CHAPTER IV

RESULTS AND DISCUSSION

Present experiment was conducted to determine the improvement of petal coloration and flower production of potted gerbera through foliar feeding and traditional mulches have been presented and discussed in this chapter. Some of the data have been expressed in table (s) and others in figure (s) for ease of discussion, comprehension and understanding. A summary of the analyses of variances in respect of all the parameters have been shown in Appendix II. Results are presented under the following heads.

4.1 Results

4.1.1 Plant height (cm)

Significant effect of mulching was found with plant height (Appendix II). Among the mulches longest (37.8 cm) plant height was found in M_1 which was statistically significant with M_0 and M_2, while the shortest (29.0 cm) plant height was observed in M_0 at 60 DAT (Figure 1). Though the plant height was lowest in M_1 at 10 DAT that was statistically similar with M_0 and M_2. Effect of straw mulch (M_1) may be accounted for conserving sufficient soil moisture resulting in maximum plant height. Straw mulch (M_1) adds some organic matter to the soil which improves the water holding capacity of the soil. As a result more nutrients were in available form in straw mulch (M_1) than other mulches. On the contrary, plants grown without mulch (M_0) may suffer from water stress and cannot accomplish full vegetative growth. Similar opinion were also put expressed by Kalisz and Cebula (2001), Oh *et al.,* (1998) and Hill *et al.,* (2002)

Plant height at 10, 20, 30, 40, 50 and 60 DAT, foliar feeding showed statistically significant variation (Appendix II). It was observed that plant height was highest (36.0 cm) in F_1 at 60 DAT and the lowest (30.8 cm) was recorded from F_0 (Figure 2).Woxul (F_1) content N, P, K and other micronutrients in liquid and available form, so it is a balance nutrient mixture for vigorous and healthy plant growth than agro grow (F_2), as agro-grow (F_2)

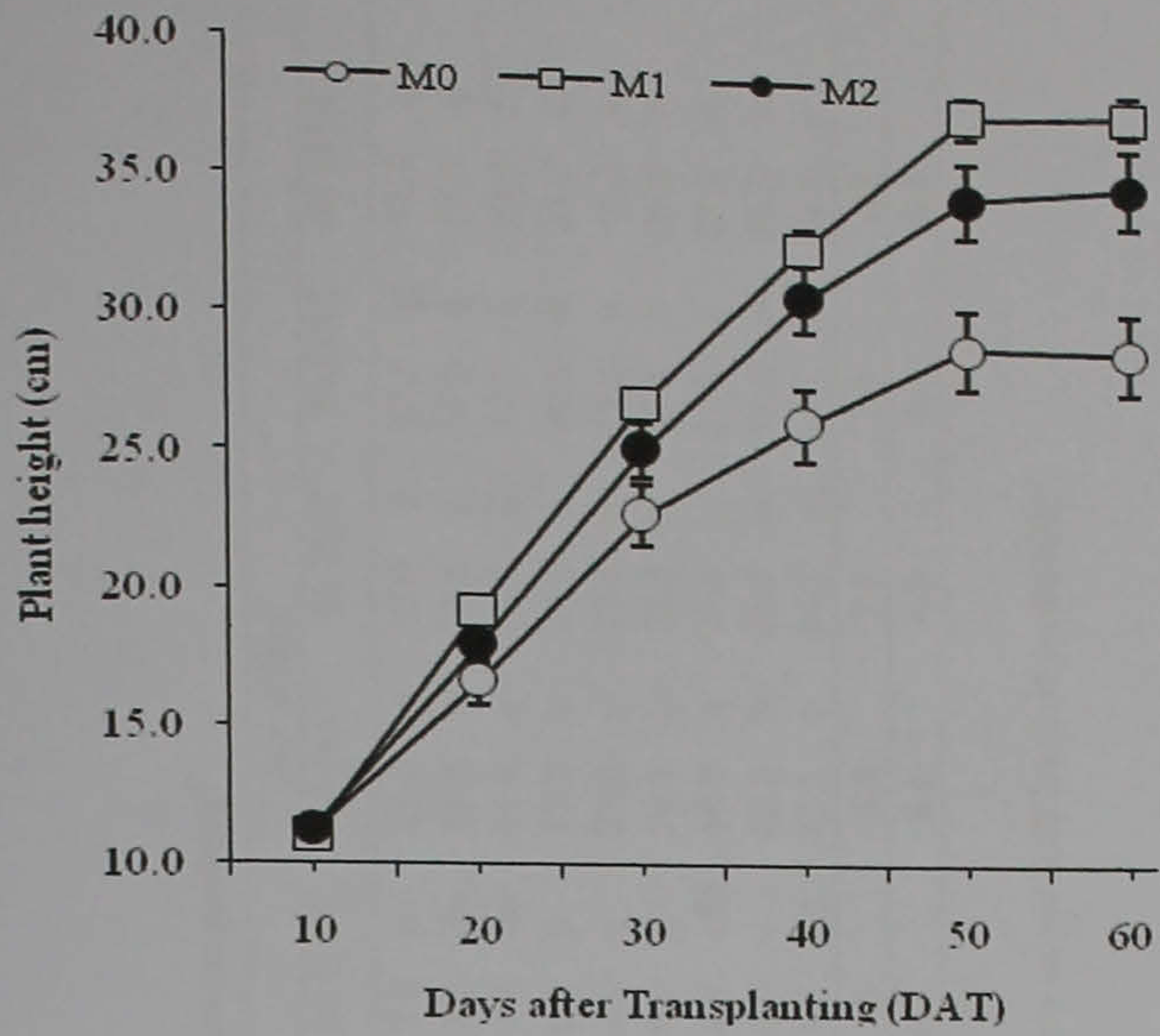

Figure1. Effect of mulching on plant height of potted gerbera with days after transplanting, M_0, control; M_1, Straw mulch; M_2, Black polythene mulch

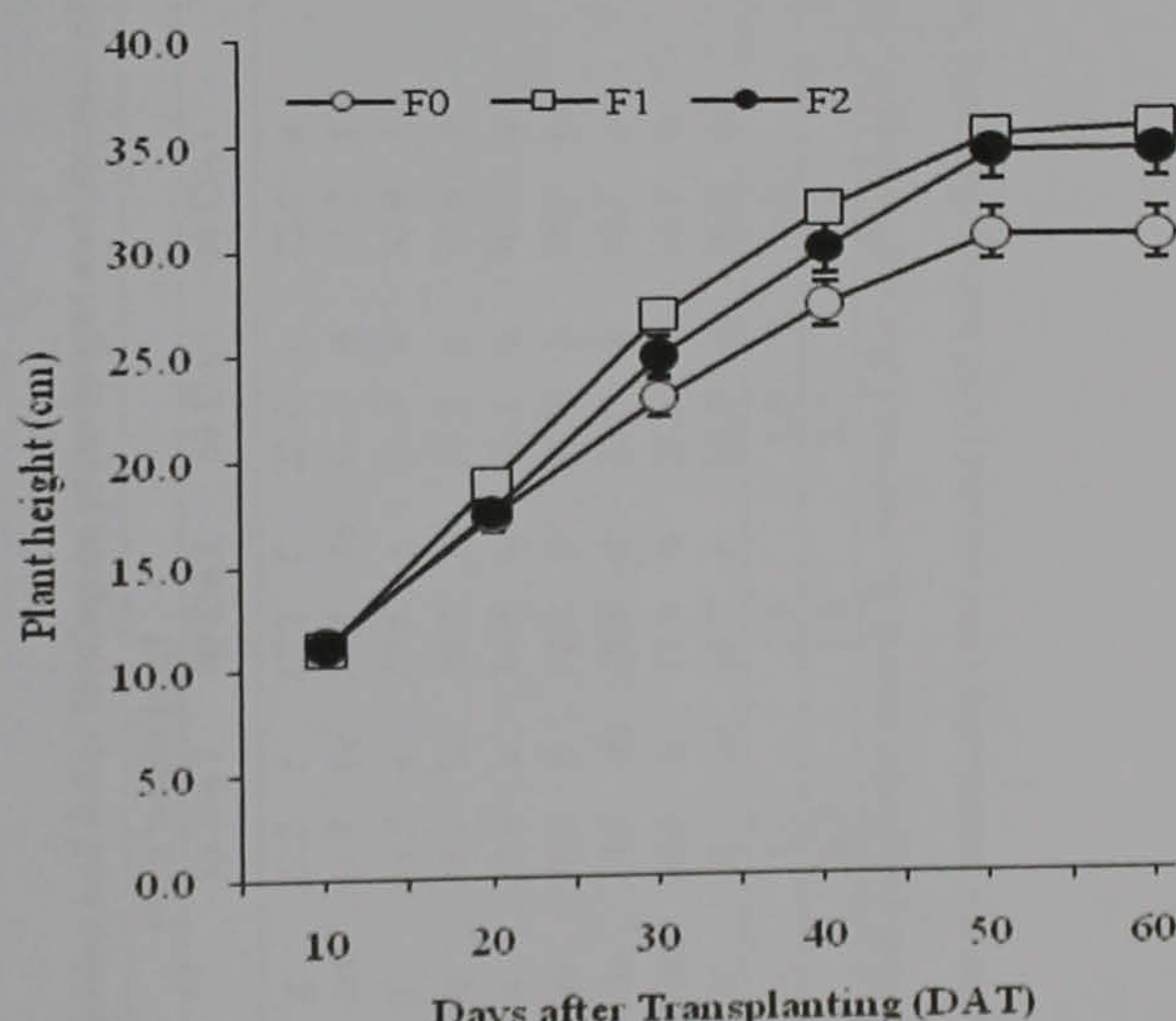

Figure 2. Effect of foliar feeding on plant height of potted gerbera with days after transplanting, F_0, control; F_1, wuxol; and F_2, agro-grow

Table 1. Combined effect effect of mulching and foliar feeding on plant height and number of leaves per plant of potted gerbera[Y]

Treatments[x]	Plant height (cm)						No of leaf					
	10DAT	20DAT	30 DAT	40 DAT	50 DAT	60 DAT	10DAT	20 DAT	30 DAT	40 DAT	50 DAT	60 DAT
M_0F_0	11.1 a	15.6 g	19.3 f	22.7 f	25.0 e	25.0 g	3.3 c	7.0 e	11.0 e	13.0 g	15.5 g	13.8 g
M_0F_1	11.3 a	17.9 cde	25.7 bc	28.5 de	31.5 d	31.2 f	3.5 bc	7.5 de	11.8 e	14.3 g	17.5 g	15.3 g
M_0F_2	11.3 a	16.5 f	23.5 e	27.5 e	30.9 d	30.9 f	3.3 c	7.5 de	11.8 e	16.8 f	21.3 f	19.8 f
M_1F_0	11.1 a	18.8 b	25.7 bc	30.7 c	35.0 c	35.0 d	4.0 a	10.5 b	17.5 c	24.8 d	30.8 d	28.3 d
M_1F_1	10.9 a	20.5 a	28.6 a	34.8 a	40.1 a	40.1 a	3.5 bc	13.0 a	23.0 a	32.8 a	43.5 a	41.3 a
M_1F_2	11.1 a	18.6 bc	26.5 b	32.5 b	37.8 b	38.1 b	3.5 bc	10.5 b	19.3 bc	28.8 b	37.8 b	35.5 b
M_2F_0	11.5 a	17.8 de	24.1 de	28.9 d	32.5 d	32.5 e	3.5 bc	8.0 cde	14.0 d	21.0 e	27.0 e	25.3 e
M_2F_1	11.2 a	18.5 bcd	26.6 b	32.9 b	35.3 c	36.8 c	3.8 ab	9.0 c	20.0 b	28.5 bc	36.8 bc	35.0 bc
M_2F_2	11.2 a	17.8 e	25.1 cd	30.7 c	36.0 bc	36.0 cd	3.8 ab	8.5 cd	17.5 c	26.5 cd	34.8 c	32.8 c
$LSD_{(0.05)}$	**0.6**	**0.7**	**1.1**	**1.1**	**1.8**	**1.2**	**0.3**	**1.3**	**2.0**	**2.1**	**2.5**	**2.5**
CV (%)	**3.9**	**2.8**	**3.2**	**2.6**	**3.7**	**2.5**	**9.7**	**9.7**	**8.6**	**6.3**	**6.0**	**6.3**

[x] M_0, No mulch; M_1, Straw mulch; M_2, Black polythene mulch; F_0, without foliar application; F_1,Wuxol ; and F_2, Agro-grow

[Y]In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

Contents Indole- 3-acetic acid which is frequently used as a rooting hormone but it also helps cell division and cell elongation. There is an agreement with the other authors like Vijaya and Subhan (1997).

Combined effect of mulching and foliar feeding was found to be significant (Appendix II). Highest (40.1 cm) plant height was observed by the treatment combination of M_1F_1 and the lowest (25.0 cm) was obtained from M0F0 (Table 1).

4.1.2 Number of leaves per plant

Mulching significantly influenced the number of leaves / plant (Appendix II). Different mulches showed gradual increasing trend with number of leaves / plant at 10, 20, 30, 40 and 50 DAT, number of leaves / plant was reduced at60 DAT in all the treatments due to removal of rotten leaves (Figure 3). Maximum (37.3 / plant) number of leaves was recorded from M_1 and the minimum (18.1 / plant) number of leaves was obtained from M_0 at 50 DAT. Similar results were found by Kalisz and Cebula (2001) and Hill *et al.,* (2002).

Effect of foliar feeding on the number of leaves / plant was also found to be significant (Appendix II). Maximum (32.6 / plant) number of leaves was recorded from F_1 and the minimum (24.4 / plant) number of leaves was obtained from F_0 at 50 DAT. At 60 DAT, the number of leaves / plant was reduced in all the treatments due to removal of rotten leaves (Figure 4). The results of this trial are in agreement with the findings of Vijaya and Subhan (1997).

Interaction between mulching and foliar feeding on the number of leaves / plant was found to be significant (Appendix II). Maximum (43.5 / plant) number of leaves was recorded from M_1F_1 and the minimum (15.5 / plant) was obtained from M_0F_0 at 50 DAT. At 60 DAT, the number of leaves / plant was reduced in all the treatments due to removal of rotten leaves (Table 1)

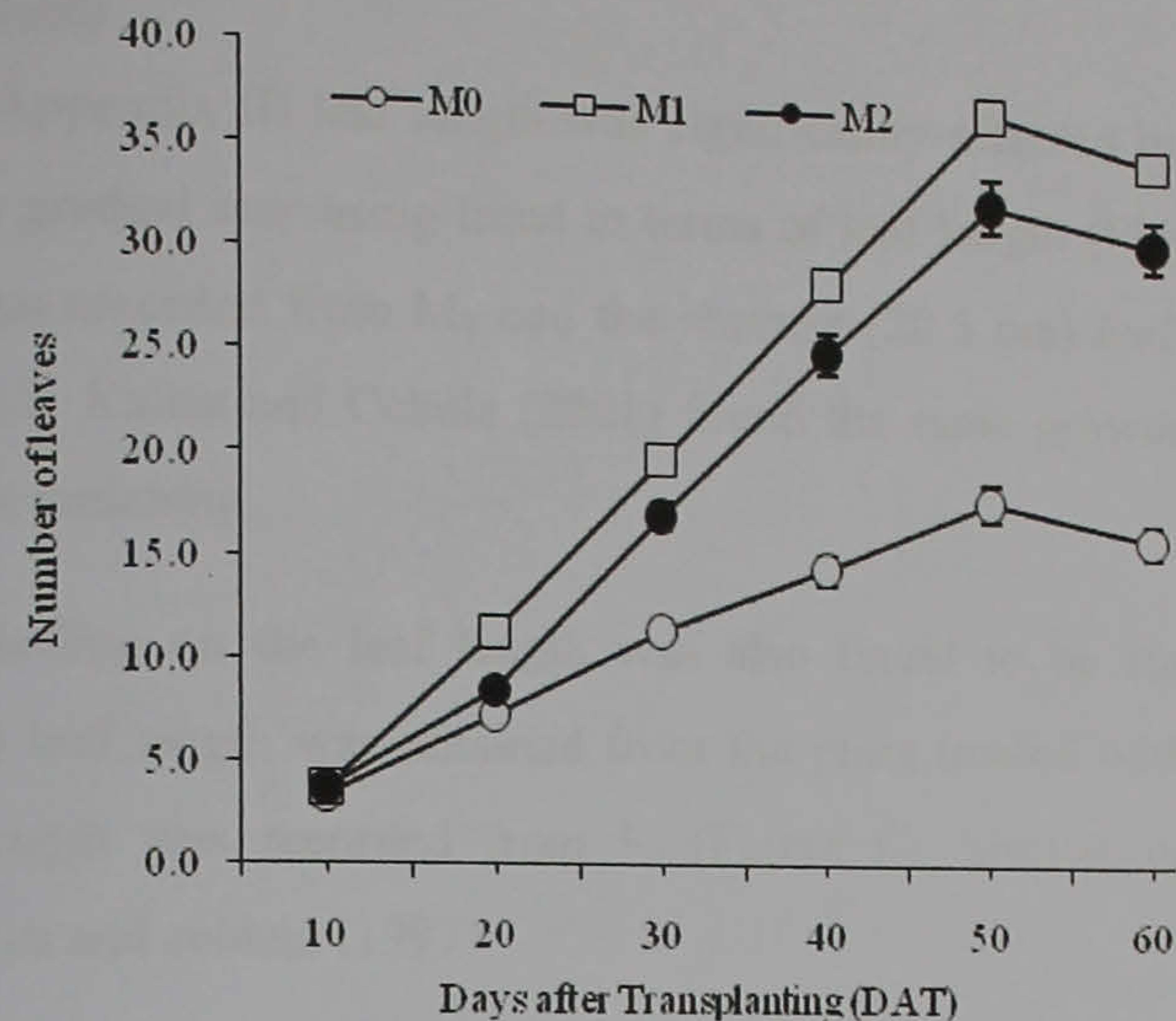

Figure 3. Effect of mulching on number of leaves per plant of potted gerbera, M_0, control; M_1, Straw mulch; M_2, Black polythene mulch

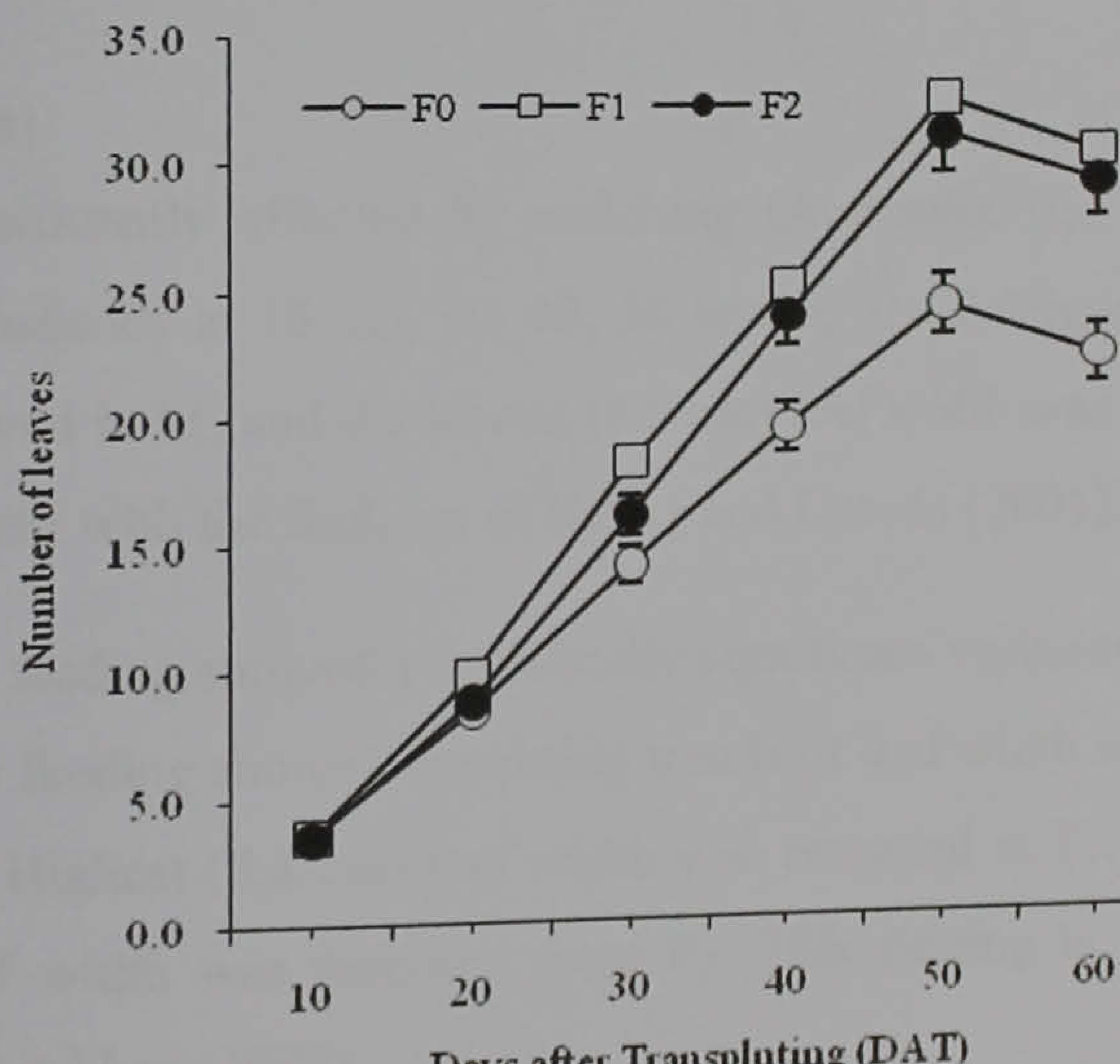

Figure 4. Effect of foliar feeding on number of leaves per plant of potted gerbera with days after transplanting, F_0, control; F_1, wuxol; and F_2, agro-grow

4.1.3 Leaf length (cm)

As evident from (Appendix II) leaf length was significantly affected by mulching. Different mulches showed a gradual increasing trend in terms of leaf length (Figure 5). Longest (27.7 cm) leaf length was recorded from M_1 and the shortest (20.5 cm) leaf length was obtained from M_0 at 60 DAT. Kalisz and Cebula (2001) found the same growth pattern of leaf from gerbera at different mulching.

Effect of foliar feeding on the leaf length was also found to be significant (Appendix). Highest (26.1 cm) leaf length was obtained from the plant treated with F1 and the shortest (21.9 cm) leaf length was recorded from F_0 (Figure 6). Similar opinion was also put forwarded by Vijaya and subhan (1997).

Interaction between mulching and foliar feeding on leaf length was found to be significant (Appendix). However, large leaf length treated with M_1F_1 produced highest (30.8cm), while the lowest (19.6 cm) was obtained from M0F0 (Table 2).

4.1.4 Leaf width (cm)

Leaf width was significantly affected by mulching (Appendix II). Leaf width showed a gradual increasing tendency at 10, 20, 30, 40, 50 and 60 DAT (Figure 7). Highest (9.2 cm) leaf width was observed in M_1 and the lowest (6.9 cm) leaf width was recorded from M_0. The results are in agreement with the findings of Kalisz and Cebula (2001).

Application of foliar feeding showed a statistically significant variation in terms of leaf width (Appendix II). Foliar feeding showed increasing trends of leaf width at 10, 20, 30, 40, 50 and 60 DAT (Figure 8). Highest (8.8 cm) leaf width was recorded in F_1. On the other hand the lowest (7.5 cm) leaf width was recorded from F_0. This finding is in agreement with the reports of Vijaya and subhan (1997).

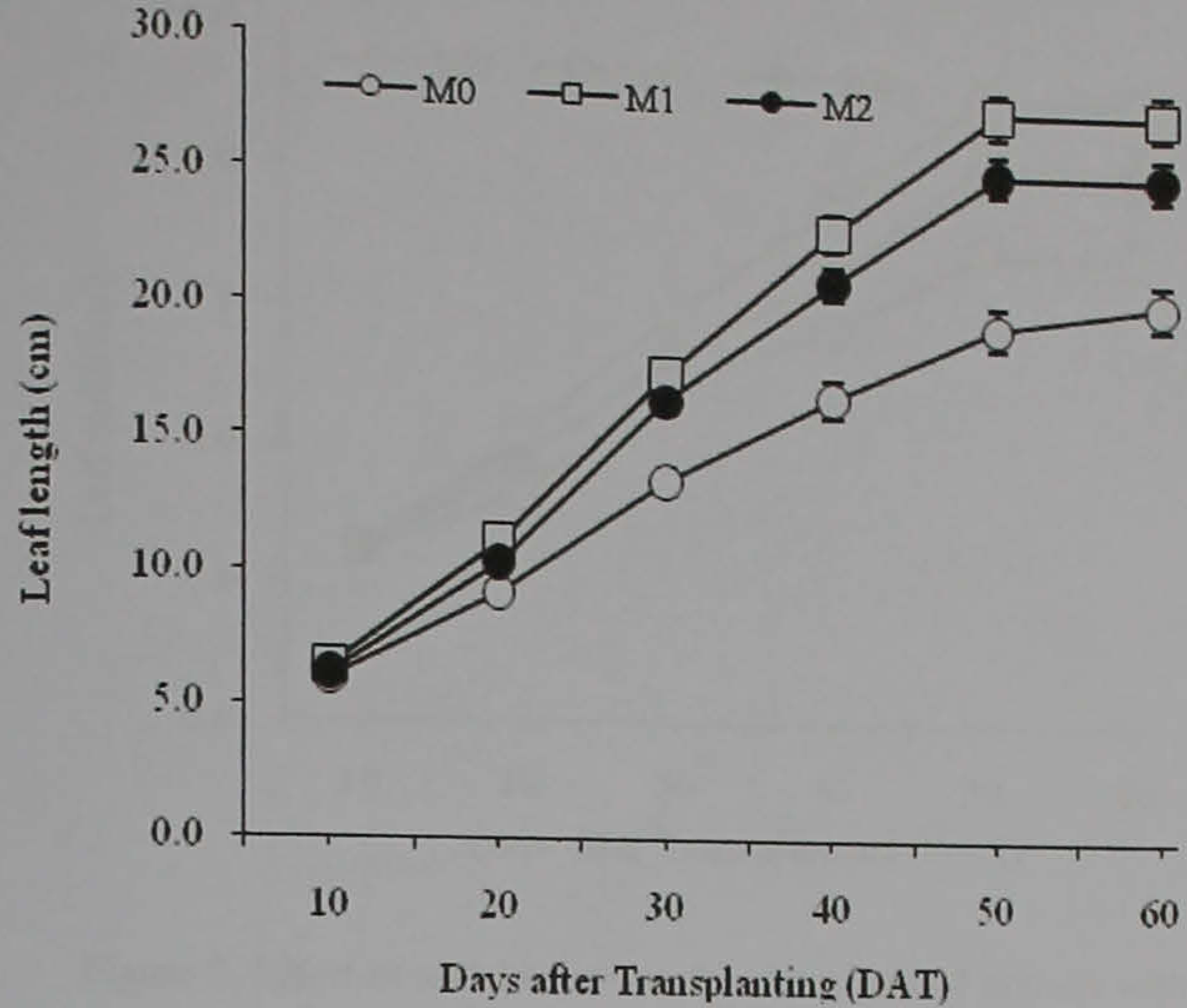

Figure 5. Effect of mulching on leaf length of potted gerbera with days after transplanting, M_0, control; M_1, Straw mulch; M_2, Black polythene mulch

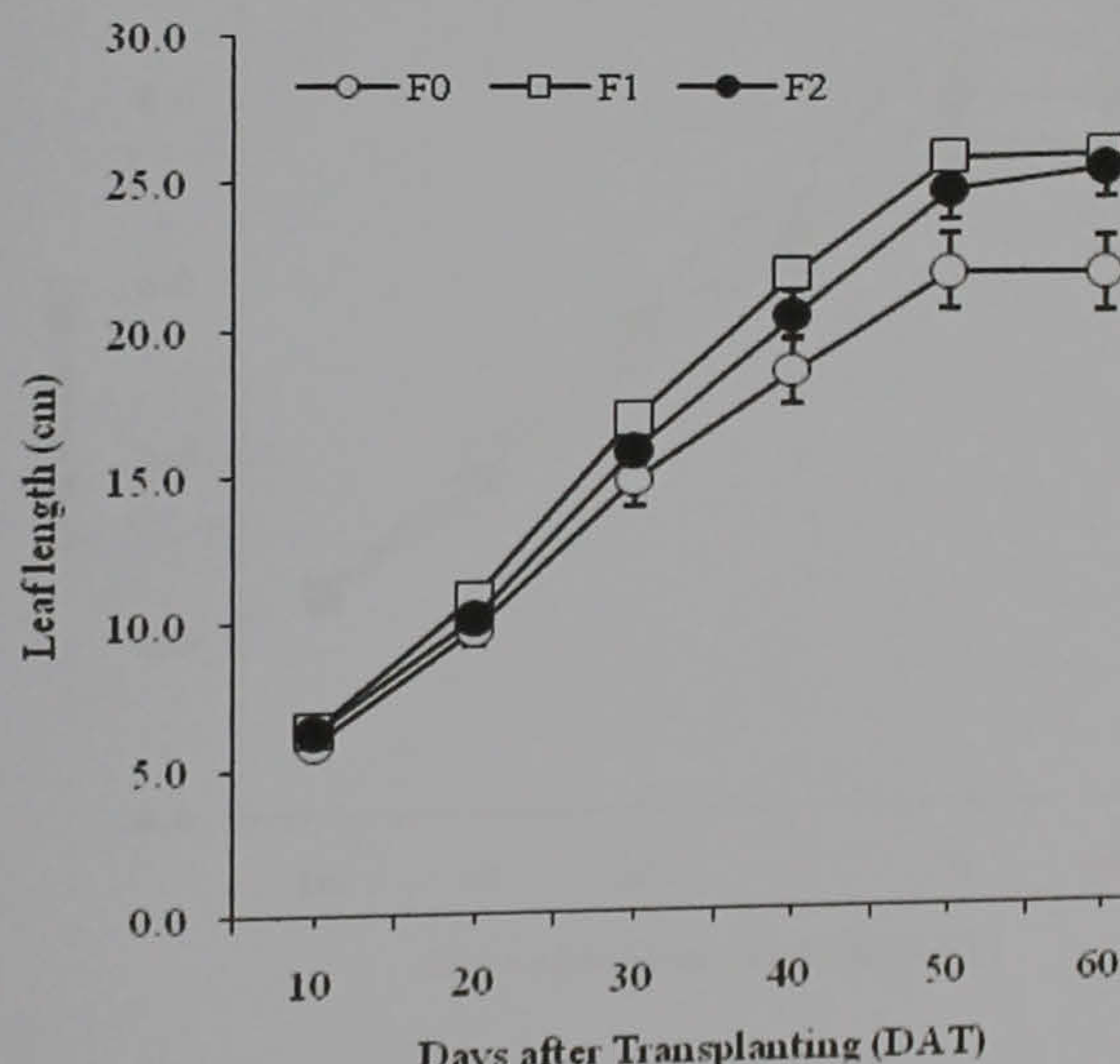

Figure 6. Effect of foliar feeding on leaf length of potted gerbera with days after transplanting, F_0, control; F_1, wuxol; and F_2, agro-grow

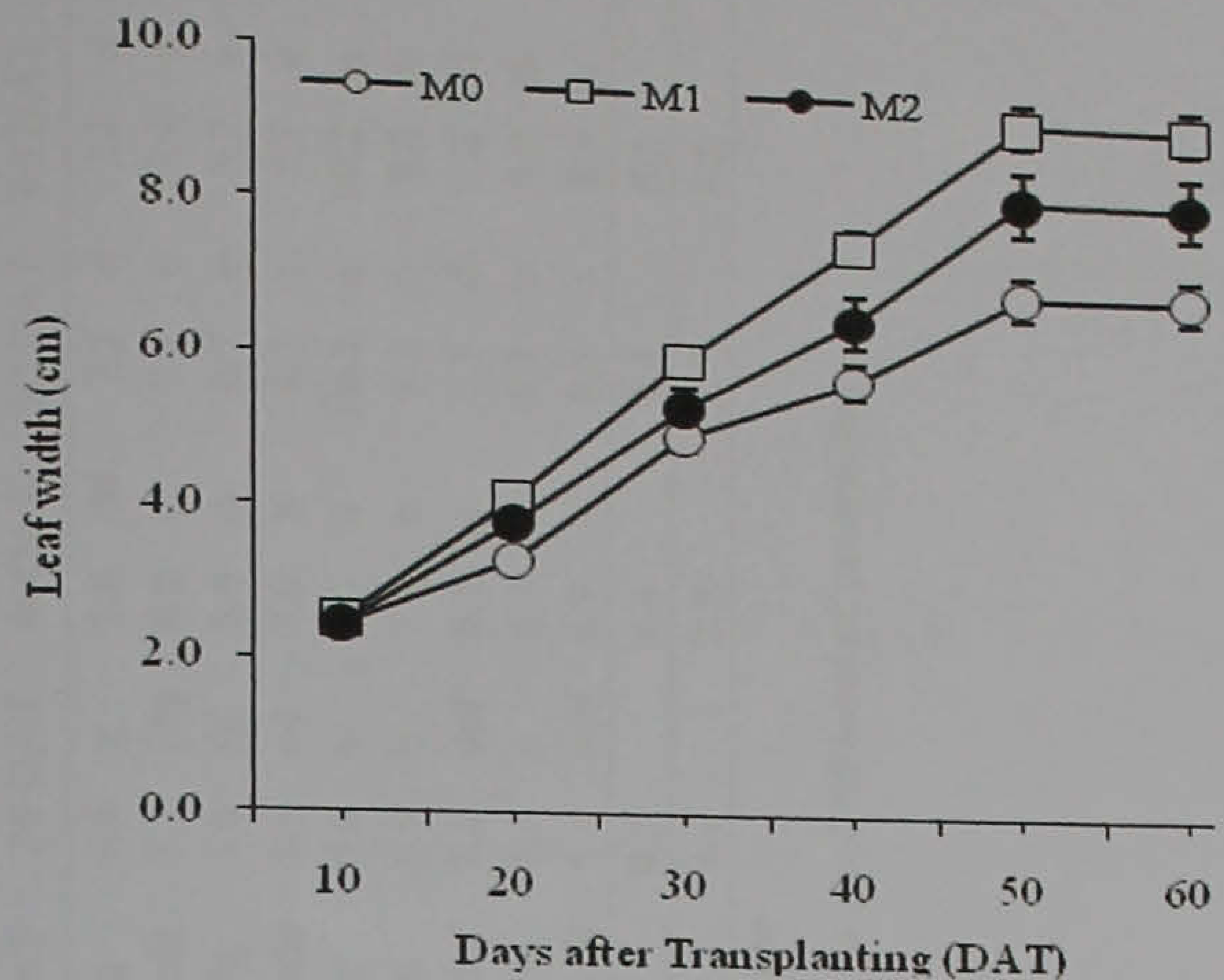

Figure 7. Effect of mulching on leaf width of potted gerbera with days after transplanting, M_0, control; M_1, Straw mulch; M_2, Black polythene mulch

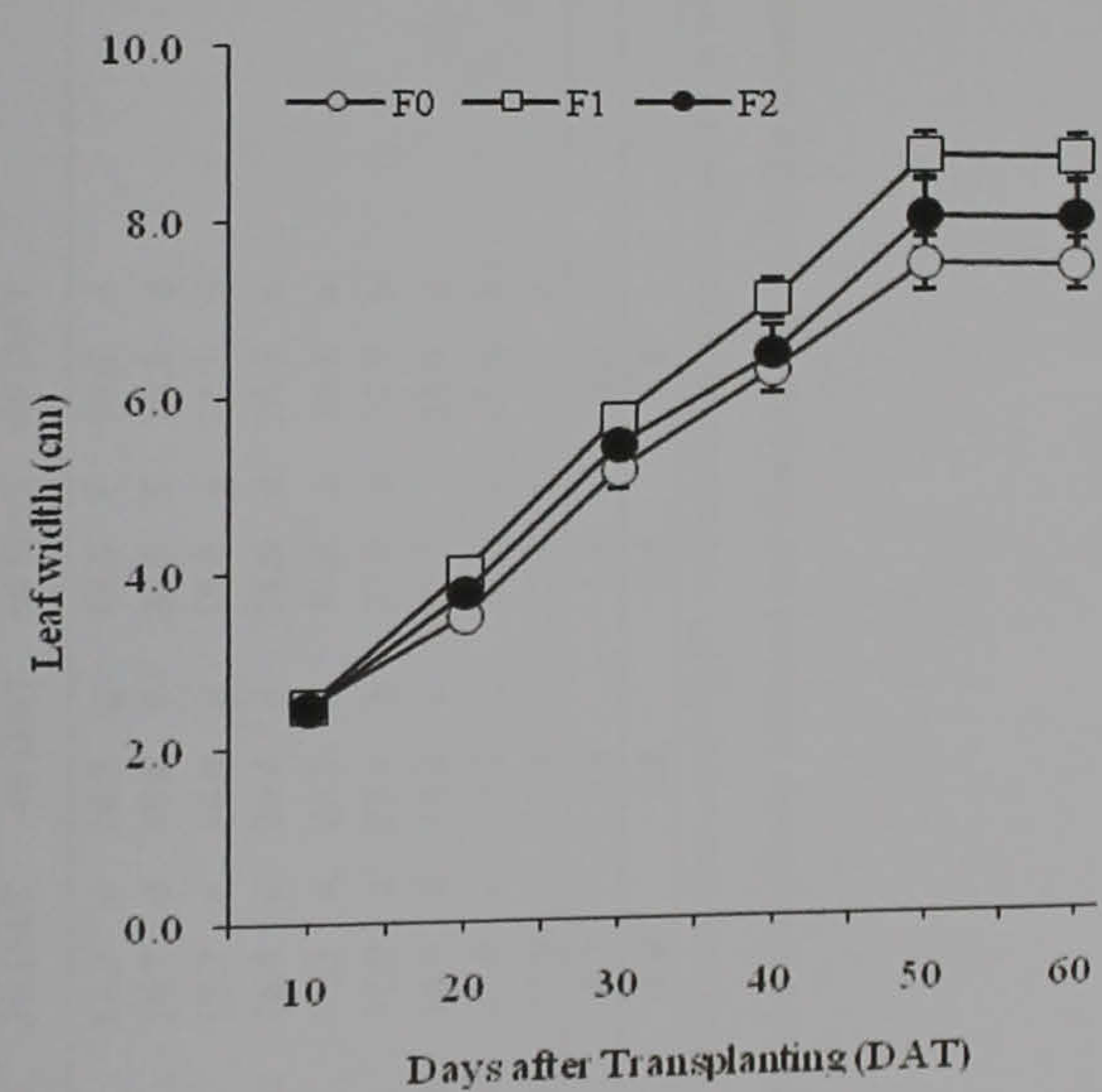

Figure 8. Effect of foliar feeding on leaf width of potted gerbera with days after transplanting, F_0, control; F_1, wuxol; and F_2, agro-grow

Table 2. Combined effect of mulching and foliar feeding on leaf length and leaf width of potted gerbera[Y]

Treatments[x]	Leaf length (cm)						Leaf width (cm)					
	10DAT	20 DAT	30 DAT	40 DAT	50 DAT	60 DAT	10DAT	20 DAT	30 DAT	40DAT	50 DAT	60 DAT
M_0F_0	5.4 a	9.3 e	13.3 e	16.5 g	19.6 f	19.6 d	2.4 ab	3.2 g	4.8 g	5.8 cd	7.1 d	7.1 d
M_0F_1	6.3 a	9.8 d	14.7 d	17.8 f	20.5 f	20.8 d	2.5 ab	3.4 efg	5.1 efg	6.0 c	7.1 d	7.1 d
M_0F	6.3 a	8.7 f	12.7 e	16.0 g	18.6 g	21.1 d	2.4 ab	3.3 fg	5.0 fg	5.6 d	6.7 e	6.7 e
M_1F_0	6.1 a	10.2 cd	16.4 c	20.4 d	24.6 d	24.5 c	2.6 ab	3.7 cde	5.5 cd	7.0 b	8.3 c	8.3 c
M_1F_1	6.8 a	12.5 a	19.3 a	25.7 a	30.6 a	30.8 a	2.6 a	4.6 a	6.6 a	8.7 a	10.2 a	10.2 a
M_1F_2	6.2 a	10.9 b	17.0 c	23.1 b	27.9 b	27.9 b	2.4 ab	4.1 b	5.9 b	7.0 b	9.2 b	9.2 b
M_2F_0	6.2 a	10.0 cd	14.9 d	18.9 e	21.6 e	21.6 d	2.5 ab	3.6 def	5.2 def	6.1 c	7.3 d	7.2 d
M_2F_1	6.1 a	10.3 cd	17.0 c	22.2 c	26.6 c	26.6 bc	2.3 b	4.0 bc	5.5 c	6.7 b	9.1 b	9.0 b
M_2F_2	6.3 a	10.9 b	17.9 b	22.4 bc	27.9 b	27.8 b	2.6 ab	3.9 bcd	5.4 cde	6.9 b	8.3 c	8.3 c
$LSD_{(0.05)}$	**2.1**	**0.5**	**0.7**	**0.8**	**1.0**	**2.4**	**8.1**	**0.3**	**0.3**	**0.4**	**0.3**	**0.3**
CV (%)	**9.9**	**3.1**	**3.0**	**2.8**	**2.8**	**6.8**	**0.3**	**6.0**	**4.1**	**3.9**	**2.7**	**2.5**

[x] M0, No mulch; M1, Straw mulch; M2, Black polythene mulch; F0, without foliar application; F1, Wuxol ; and F2, Agro-grow

[Y] In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

Combined effect of mulching and foliar feeding was found to be significant (Appendix II). Highest (10.2 cm) leaf width was observed by the treatment combination of M_1F_1 and the lowest (6.7 cm) leaf width was obtained from M_0F_2 (Table 2).

4.1.5 Length of flower stalk (cm)

Though at 6 days before anthesis (DBA) the length of flower stalk was same but later on at 5, 4, 3, 2 and 1 days before anthesis (DBA) different mulches showed a statistically significant variation in terms of length of flower stalk (Appendix II). Different mulches showed a gradual increasing trend in terms of length of flower stalk (Figure 9). Highest (34.0 cm) length of flower stalk was found in M_1 treatment and the lowest (23.5 cm) length of flower stalk was found in M_0 treatment 1 day before anthesis (DBA). Increased length of flower stalk from straw mulch (M_1) was probably due to better vegetative and reproductive growth. Similar result was found by Hill *et al.*, (2002).

Foliar feeding showed a gradually increasing trend from 6 days before anthesis (DBA) to 1 day before anthesis (DBA) even during the time of anthesis, this showed a statistically significant variation in terms of the length of flower stalk at different foliar feeding (Appendix II). The highest (31.7 cm) length of flower stalk was observed in F_1 and the lowest (28.4 cm) was recorded from F_0 (Figure 10). This finding is in agreement with the reports of Vijaya and Subhan (1997).

Combine effect of mulching and foliar feeding showed statistically significant variation in terms of the length of flower stalk (Appendix II). The highest (36.8 cm) length of flower stalk was observed in the treatment combination M_1F_1 which is statistically similar with M_1F_2 (34.5 cm) and the lowest (22.8 cm) length of flower stalk was found in M_0F_2 (Table 3) at 1 day before anthesis (DBA).

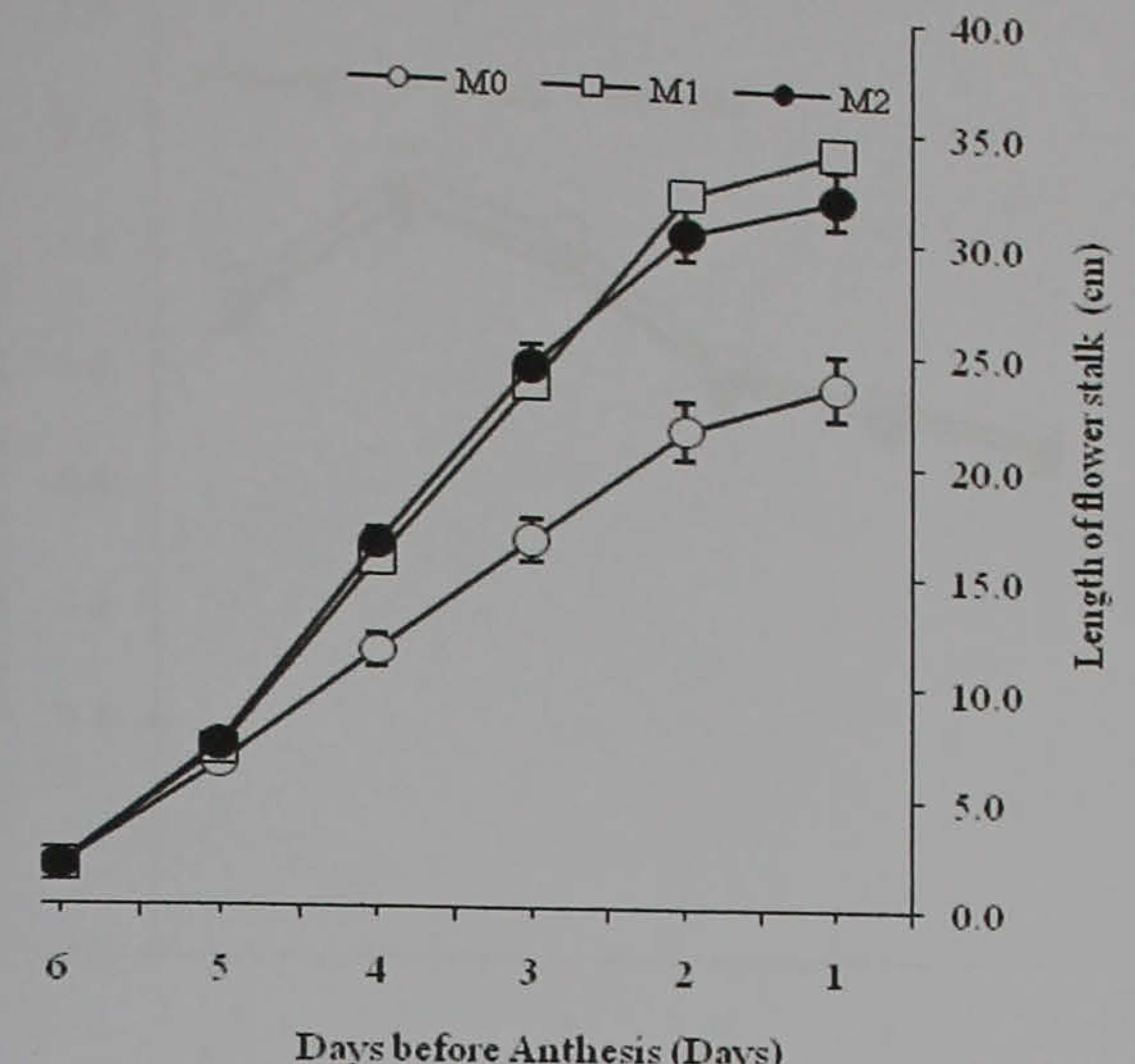

Figure 9. Effect of mulching on length of flower stalk of potted gerbera with days before anthesis, M_0, control; M_1, Straw mulch; M_2, Black polythene mulch

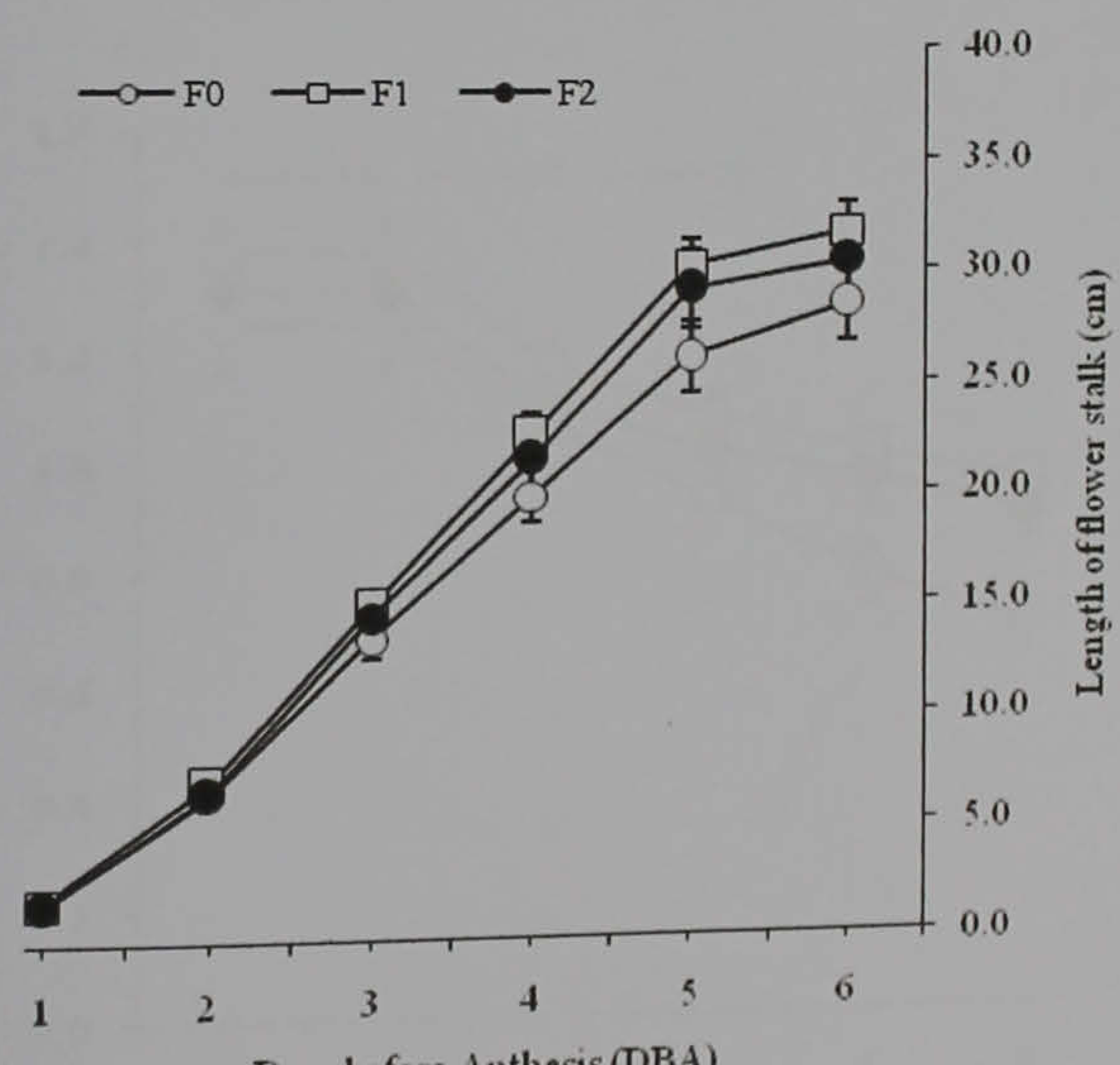

Figure 10. Effect of foliar feeding on length of flower stalk of potted gerbera with days before anthesis, F_0, control; F_1, wuxol; and F_2, agro-grow

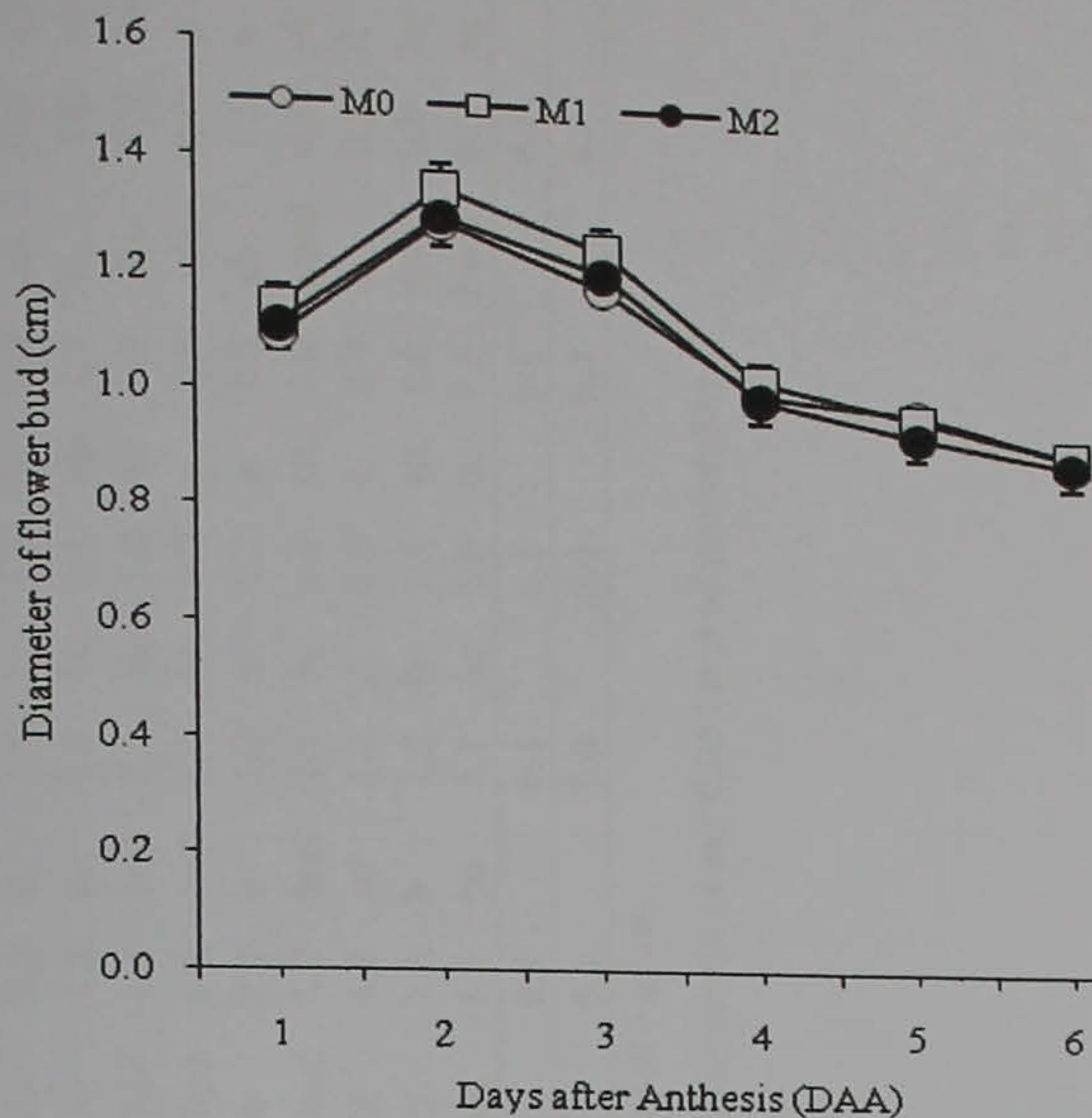

Figure 11. Effect of mulching on diameter of flower bud of potted gerbera with days after anthesis, M_0, control; M_1, Straw mulch; M_2, Black polythene mulch

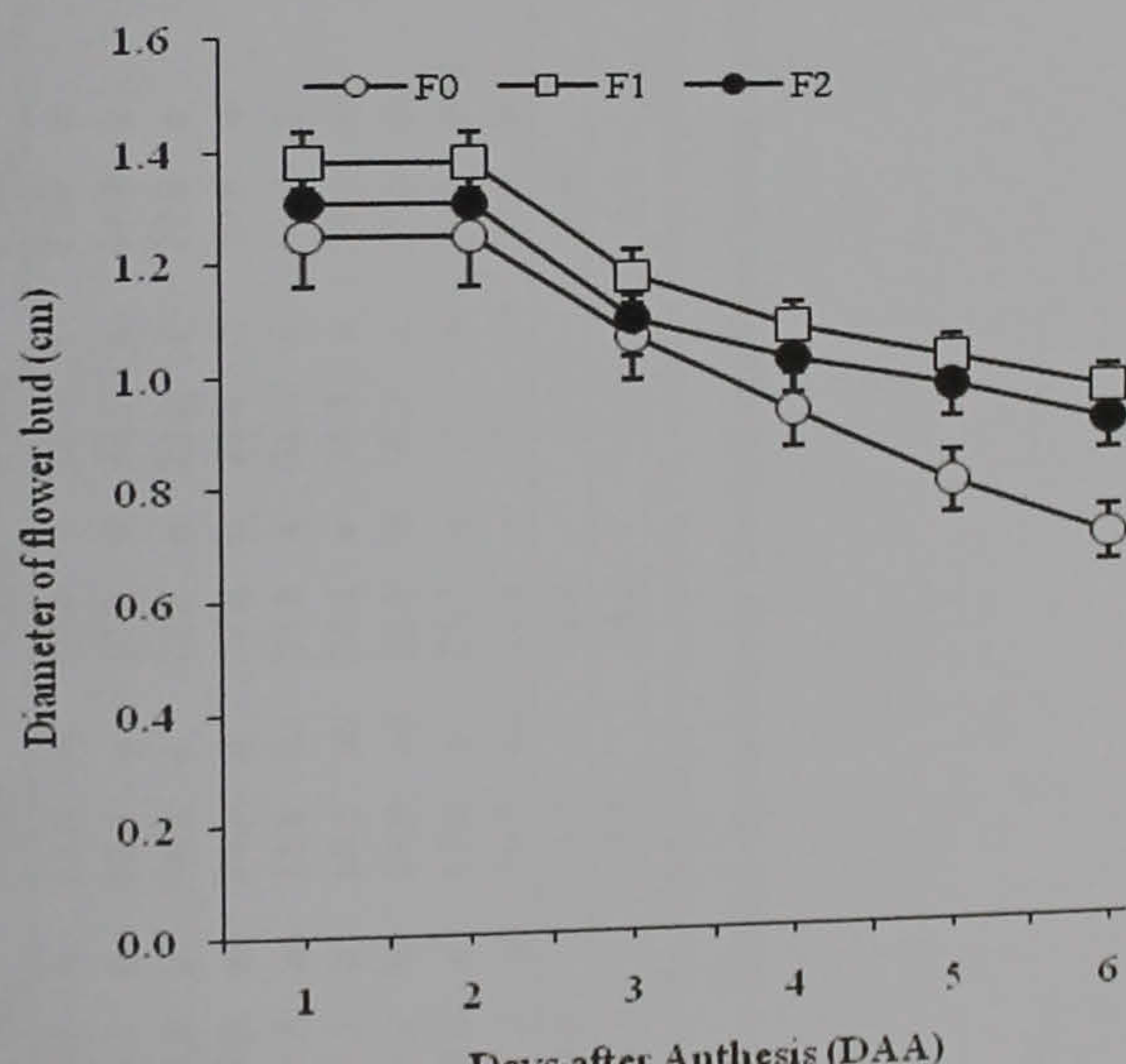

Figure 12. Effect of foliar feeding on diameter of flower bud of potted gerbera with days before anthesis, F_0, control; F_1, wuxol; and F_2, agro-grow

Table 3. Combined effect of mulching and foliar feeding on length of flower stalk and diameter of flower bud of potted gerbera[Y]

Treatments[x]	Length of flower stalk (cm)						Diameter of flower bud (cm)					
	1 Day	2 Day	3 Day	4 Day	5 Day	6 Day	1Day	2 Day	3 Day	4 Day	5 Day	6 Day
M_0F_0	1.8 ab	6.5 b	11.5 ef	16.0 e	20.0 f	23.0 e	1.3 cd	1.1 d	1.1 c	1.0 bc	0.9 de	0.9 cd
M_0F_1	2.0 a	6.3 b	12.3 e	17.8 d	23.3 e	24.8 e	1.3 bc	1.2 bc	1.1 bc	1.1 ab	1.1 a	1.0 ab
M_0F_2	1.6 b	6.3 b	10.5 e	15.5 e	21.0 f	22.8 e	1.3 bcd	1.2 bcd	1.1 bc	1.0 bc	1.0 abc	0.9 cd
M_1F_0	1.9 ab	7.0 ab	14.0 d	20.8 c	27.8 d	30.8 d	1.3 bcd	1.2 bcd	1.1 bc	0.9 c	0.9 cde	0.9 d
M_1F_1	1.8 ab	7.3 ab	15.8 bc	24.8 a	34.5 a	36.8 a	1.5 a	1.4 a	1.3 a	1.2 a	1.0 ab	1.0 a
M_1F_2	1.8 ab	6.5 b	16.5 ab	24.5 a	33.5 a	34.5 ab	1.3 bcd	1.2 bcd	1.1 bc	1.0 bc	1.0 abcd	0.9 cd
M_2F_0	1.6 b	6.3 b	15.0 cd	22.8 b	30.3 c	31.5 cd	1.2 d	1.2 cd	1.1 c	0.9 c	0.9 e	0.9 d
M_2F_1	1.9 ab	8.0 a	17.0 a	25.3 a	32.5 b	33.5 bcd	1.4 b	1.3 b	1.2 b	1.1 ab	1.0 abc	0.9 bc
M_2F_2	1.9 ab	7.3 ab	16.5 ab	24.5 a	32.8 ab	33.8 bc	1.3 bc	1.2 bc	1.1 bc	1.0 bc	1.0 bcde	0.9 bc
$LSD_{(0.05)}$	**0.4**	**1.2**	**1.2**	**1.6**	**1.9**	**2.8**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**
CV (%)	**9.8**	**9.5**	**5.9**	**5.2**	**4.6**	**6.4**	**4.6**	**5.0**	**5.0**	**7.0**	**5.3**	**4.7**

[x] M_0, No mulch; M_1, Straw mulch; M_2, Black polythene mulch; F0, without foliar application; F_1, Wuxol ; and F_2, Agro-grow

[Y] In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

4.1.6 Diameter of flower bud (cm)

Flower bud at different mulches exhibited significant variation (Appendix II). Diameter of flower bud was almost similar in all the treatment. First day after anthesis (DAA) it was found that diameter of flower bud was lower than 2 days after anthesis (DAA). But 2 days after anthesis (DAA) the diameter of flower bud gradually decreased (Figure 11).

Foliar feeding showed significant variation in the diameter of flower bud (Appendix). Flower bud was observed in 1 day after anthesis in all the treatments (Figure 12) but 2, 3, 4, 5 and 6 days after anthesis the diameter of flower bud gradually decreased.

Combined effect of mulching and foliar feeding was found to be significant in terms of the diameter of flower bud (Appendix II). Highest (1.5 cm) diameter of flower bud was found in M_1F_2 treatment and the lowest (1.2 cm) was found in M_2F_0 1 day after anthesis (DAA). But 6 days after anthesis (DAA) the highest (1.0 cm) diameter of flower bud was found in M1F1 and M0F1 and the lowest (0.9 cm) was found in remaining treatment (Table 3).

4.1.7 Diameter of flower (cm)

Diameter of flower was significantly affected by mulching (Appendix II). Diameter of flower showed a gradual increasing trend at 1, 2, 3, 4, 5 and 6 days after anthesis (Figure 13). Highest (6.6 cm) diameter of flower was observed in M1 and the lowest (6.4 cm) was recorded from M_0. These findings are in agreement with the reports of Subhan (1999), Kalisz and Cebula (2001) and the Hill *et al,.* (2002).

Effect of foliar feeding on the diameter of flower was also found to be significant (Appendix). Highest (6.7 cm) was found in F_1 and the lowest (6.5 cm) diameter of flower was found in F_0 and F_2 (Figure 14). Similar result was found by Vijaya and Subhan (1997).

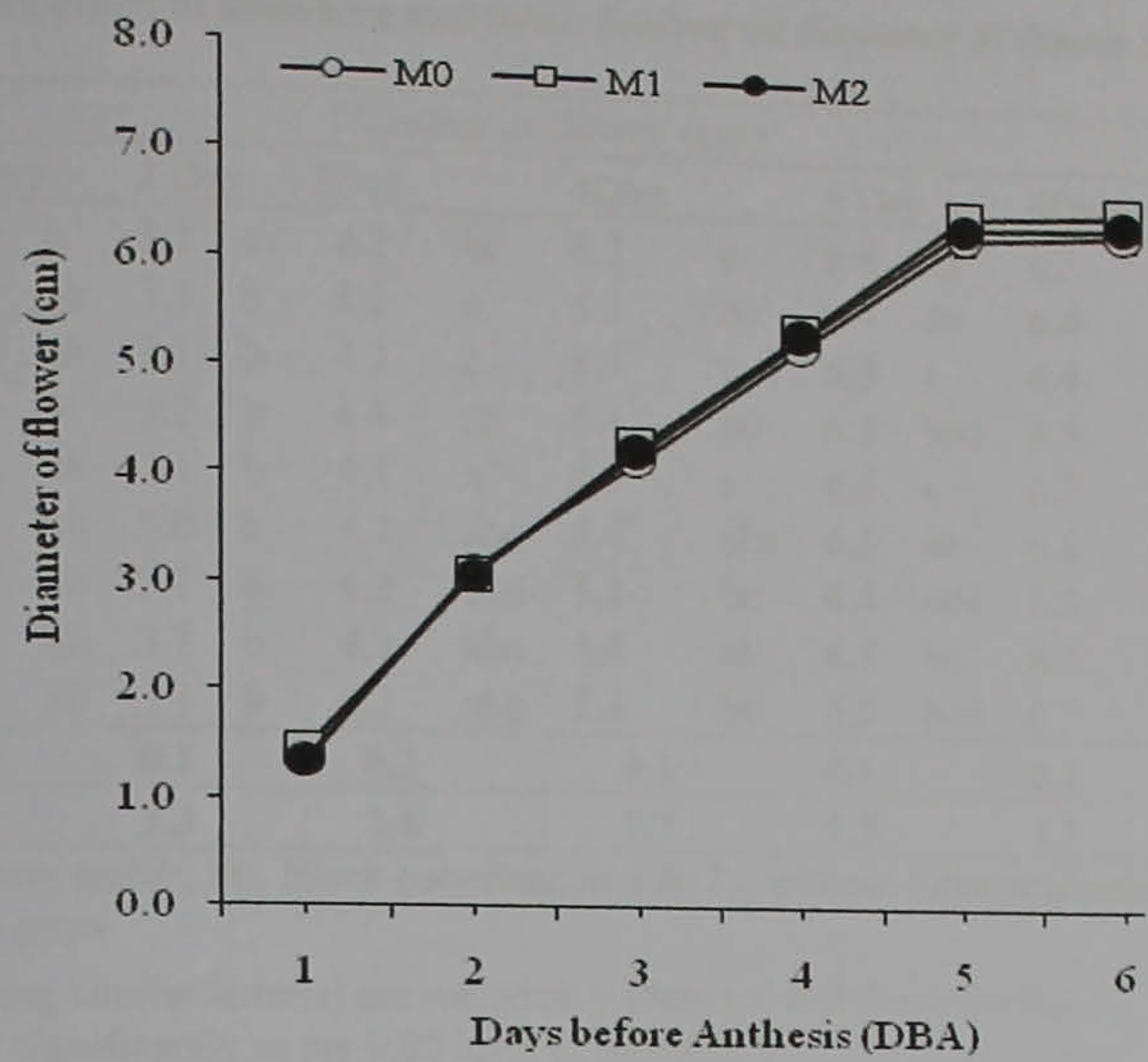

Figure 13. Effect of mulching on diameter of flower of potted gerbera with days before anthesis, M_0, control; M_1, Straw mulch; M_2, Black polythene mulch

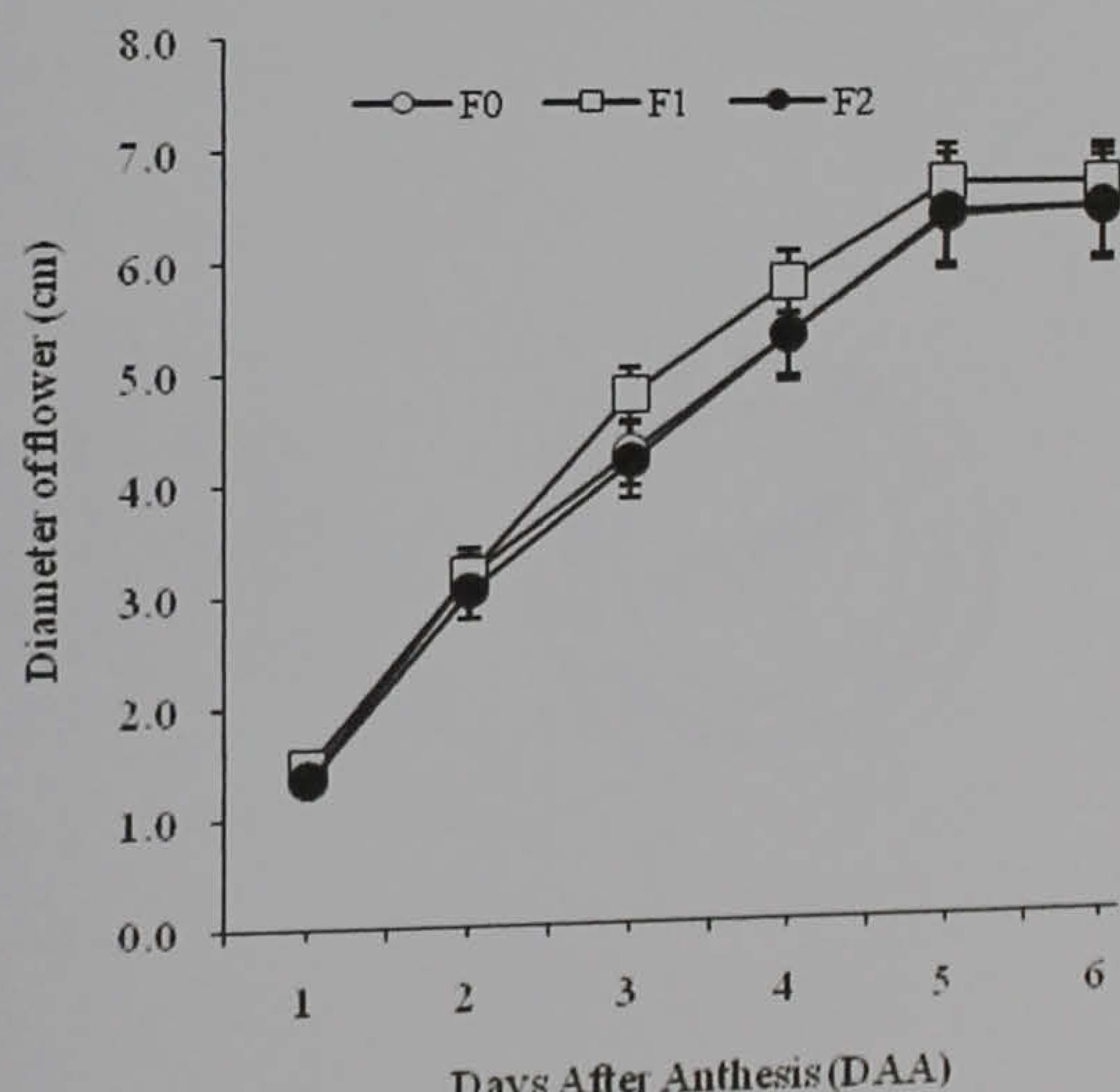

Figure 14. Effect of foliar feeding on diameter of flower of potted gerbera with days after anthesis , F_0, control; F_1, wuxol; and F_2, agro-grow

Table 4. Combined effect effect of mulching and foliar feeding on diameter of flower of potted gerbera[Y]

Treatments[x]	Diameter of flower (cm)											
	1 Day		2 Day		3Day		4Day		5 Day		6Day	
M_0F_0	1.3	b	3.3	a	4.2	bc	5.3	c	6.4	de	6.5	cd
M_0F_1	1.5	ab	3.1	b	4.2	c	5.3	bc	6.4	de	6.4	cd
M_0F_2	1.3	ab	3.1	b	4.2	c	5.3	c	6.3	e	6.4	d
M_1F_0	1.5	a	3.2	b	4.4	ab	5.4	bc	6.5	bcd	6.5	bc
M_1F_1	1.5	ab	3.1	b	4.4	a	5.5	a	6.6	a	6.7	a
M_1F_2	1.4	ab	3.0	b	4.2	abc	5.4	abc	6.5	ab	6.6	ab
M_2F_0	1.3	ab	3.1	b	4.3	abc	5.4	bc	6.4	cde	6.5	cd
M_2F_1	1.4	ab	3.1	b	4.3	abc	5.4	ab	6.5	bc	6.5	bc
M_2F_2	1.4	ab	3.1	b	4.2	abc	5.4	bc	6.5	bcd	6.5	cd
$LSD_{(0.05)}$	**0.3**		**0.1**		**0.2**		**0.1**		**0.1**		**0.1**	
CV (%)	**9.8**		**3.3**		**2.6**		**1.7**		**1.3**		**1.1**	

x M_0, No mulch; M_1, Straw mulch; M_2, Black polythene mulch; F_0, without foliar application; F_1,Wuxol ; and F_2, Agro-grow

[Y]In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

Combine effect of mulching and foliar feeding was found to be significant in terms of diameter of flower (Appendix II). Highest (6.7 cm) diameter of flower was found in M_1F_1 which was statistically similar in $M_1F_2$and the lowest (6.4 cm) diameter of flower was found in M_0F_1 and M_0F_2 (Table 4).

4.1.8 Number of flower per plant

Number of flower per plant was affected significantly by mulching (Appendix II). Maximum (15.3 / plant) number of flower per plant was recorded from M_1 while minimum (10.0 / plant) number of flower per plant was recorded from M0 (Table 5). This is in agreement with the others Kalisz and Cebula (2001), Poll and Gaven (1996), Gattorsen (1992), Hembry *et al.*, (1994), subhan (1999), Acharya (2003), Oh *et al.,* (1998) and Hill *et al.,* (2002).

Foliar feeding significantly influenced the production of flower per plant (Appendix II). Plant treated with F_1 produced maximum (14.0 / plant) number of flower per plant. While minimum (11.3 / plant) number of flower per plant was obtained from the F_0 treatment (Table 6). Similar opinions were also put forwarded by Dwivedi and Bajpai (1995), Vijaya and Subhan (1997) and Narayanan *et al.,* (2003).

Combine effect of mulching and foliar feeding was found to be significant in terms of number flower per plant (Appendix II). Maximum (17.5 / plant) number of flower per plant was recorded from M_1F_1 and minimum (9.5 / plant) number of flower per plant was recorded from M_0F_0 (Table7).

4.1.9 Petal coloration

Mulching showed al the treatments in terms of the petal coloration (h_{ab}, L*, a*, b*, c*) were statistically similar except b* for M_0 (Table5). Highest (78.5) hue angle (h_{ab}) was recorded from M_0 and the lowest (30.0) hue angle (h_{ad}) was recorded from M_2. Highest (54.2) L* was recorded from M_0 and lowest (49.2) L* was obtained from M_2.

Table 5. Effect of mulch on flower production and coloration of potted gerbera[Z]

Treatments[x]	Total number of flower		CIELAB color coordinate [y]									
			L*		a*		b*		C*		h_{ab}	
M_0	10.0	c	54.2	a	72.9	a	22.3	b	79.0	a	78.5	a
M_1	15.3	a	53.8	a	71.9	a	52.8	a	87.3	a	38.3	a
M_2	13.4	b	49.2	a	70.5	a	42.0	a	80.9	a	30.0	a

[X] M_0, no mulch; M_1, Straw mulch; and M_2, Black polythene mulch

[y] L*, Lightness; a* and b*, chromatic components; and C*, chromas (brightness), hab, hue angle (degree) = tang (b*/a*)

Table 6. Effect of different foliar application on flower production and coloration of potted gerbera[Z]

Treatments[x]	Total number of flower		CIELAB color coordinate [y]									
			L*		a*		b*		c*		h_{ab}	
F_0	11.3	c	54.8	a	77.7	a	32.7	a	81.2	a	29.7	b
F_1	14.0	a	49.5	a	74.8	a	41.6	a	88.0	a	30.8	b
F_2	13.4	b	52.8	a	62.8	b	42.9	a	78.0	a	86.3	a

[x] F_0, without foliar application; F_1, wuxol; and F_2, agro-grow

[y] L*, Lightness; a* and b*, chromatic components; and C*, chromas (brightness), hab, hue angle (degree) = tang (b*/a*)

Table 7. Interaction effect of mulching and different foliar application on flower production and coloration of potted gerbera[Z]

Treatments[x]	Total number of flower		CIELAB color coordinate [y]									
			L*		a*		b*		C*		h_{ab}	
M_0F_0	9.5	g	50.8	bc	77.3	a	7.0	d	77.9	a	14.0	b
M_0F_1	10.0	fg	50.8	bc	78.5	a	33.0	bcd	89.0	a	29.5	b
M_0F_2	10.5	f	61.0	ab	63.0	c	27.0	cd	70.0	a	192.2	a
M_1F_0	12.8	d	63.5	ab	79.3	a	55.5	ab	85.6	a	51.2	b
M_1F_1	17.5	a	49.0	c	74.5	abc	42.0	abc	87.9	a	28.4	b
$M1F_2$	15.5	b	48.8	c	62.0	c	61.0	a	88.3	a	35.2	b
M_2F_0	11.5	e	50.0	c	76.5	ab	35.5	abc	80.0	a	23.9	b
M_2F_1	14.5	c	48.8	c	71.5	abc	49.8	abc	87.0	a	34.7	b
M_2F_2	14.3	c	48.8	c	63.5	bc	40.8	abc	75.7	a	31.4	b
$LSD_{(0.05)}$	0.9		1.6		2.1		1.1		2.6		1.8	
CV (%)	5.1		7.6		3.7		6.3		2.5		3.7	

[x] M_0, no mulch; M_1, straw mulch; M_3, Black polythene mulch;F_0, without foliar application; F_1, Wuxol; and F2, Agro-grow

[y] L*, Lightness; a* and b*, chromatic components; and C*, chromas (brightness), h_{ab}, hue angle (degree) = tang (b*/a*)

[Z]In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

Highest (72.9) a* was recorded from M_0 and the lowest (70.5) a* was obtained from M_2. The highest (52.8) b* was recorded from M_1 and the lowest (22.3) b* was obtained from M_0. The highest (87.3) c* was recorded from M_1 and the lowest (79.0) c* was obtained from M_0.

Foliar feeding showed all the treatments in terms of the petal coloration ($h_{ab,}$ L*, a*, b*, c*) were statistically similar except hue angle (h_{ab}) for F_0 and F_1 and a* for F_2 (Table 6). Highest (86.3) hue angle (h_a) *was* recorded from F_2 and lowest (29.7) hue angle (*hab*) was recorded from F_0. Highest (54.8) L* was recorded from F0 and the lowest (49.5) L* was obtained from F1. Highest (77.7) a* was recorded from F0 and lowest (62.8) a* was obtained from F_2. Highest (42.9) b* was recorded from F_2 and lowest (32.7) b* was obtained from F_0. Highest (88.0) c* was recorded from F1 and the lowest (78.0) c* was obtained from F2.

Interaction between mulching and foliar feeding on the petal coloration was found to be significant. The highest (192.2) hue angle (h_{ab}) was recorded from M_0F_2 and lowest (14.0) hue angle (h_{ab}), was recorded from M_0F_0. Highest (63.5) L* was recorded from M_1F_0 and lowest (48.8) L* was obtained from $M_1F_{2,}$ M_2F_1 and M_2F_2. Highest (79.3) a* was recorded from M_1F_0 and lowest (62.0) a* was obtained from M_1F_2. Highest (61.0) b* was recorded from M_1F_2 and lowest (7.0) b* was obtained from M_0F_0. Highest (89.0) c* was recorded from M_0F_1 and lowest (70.0) c* was obtained from M_0F_2 (Table 7).

Highest (72.9) a* was recorded from M_0 and the lowest (70.5) a* was obtained from M_2. The highest (52.8) b* was recorded from M_1 and the lowest (22.3) b* was obtained from M_0. The highest (87.3) c* was recorded from M_1 and the lowest (79.0) c* was obtained from M_0.

Foliar feeding showed all the treatments in terms of the petal coloration ($h_{ab,}$ L*, a*, b*, c*) were statistically similar except hue angle (h_{ab}) for F_0 and F_1 and a* for F_2 (Table 6). Highest (86.3) hue angle (h_a) *was* recorded from F_2 and lowest (29.7) hue angle (*hab*) was recorded from F_0. Highest (54.8) L* was recorded from F0 and the lowest (49.5) L* was obtained from F1. Highest (77.7) a* was recorded from F0 and lowest (62.8) a* was obtained from F_2. Highest (42.9) b* was recorded from F_2 and lowest (32.7) b* was obtained from F_0. Highest (88.0) c* was recorded from F1 and the lowest (78.0) c* was obtained from F2.

Interaction between mulching and foliar feeding on the petal coloration was found to be significant. The highest (192.2) hue angle (h_{ab}) was recorded from M_0F_2 and lowest (14.0) hue angle (h_{ab}), was recorded from M_0F_0. Highest (63.5) L* was recorded from M_1F_0 and lowest (48.8) L* was obtained from $M_1F_{2,}$ M_2F_1 and M_2F_2. Highest (79.3) a* was recorded from M_1F_0 and lowest (62.0) a* was obtained from M_1F_2. Highest (61.0) b* was recorded from M_1F_2 and lowest (7.0) b* was obtained from M_0F_0. Highest (89.0) c* was recorded from M_0F_1 and lowest (70.0) c* was obtained from M_0F_2 (Table 7).

Plate 5. Different colors of potted gerbera

4.2 Discussion

Straw mulch (M_1) adds some organic matter to the soil which improves the water holding capacity of the soil. As a result more nutrients were in available form in straw mulch (M_1) than other mulches. Increase of temperature and conservation of more soil moisture in the straw mulch covered pot might have encouraged better plant growth and development. Straw mulch conserved sufficient soil moisture that may have encouraged more growth of gerbera producing the tallest plant. Straw mulch probably conserved adequate soil moisture, which increased plant height, number of leaves, number of flower and chlorophyll content of the plant and ultimately producing maximum number of flower of gerbera. On the contrary, plants grown without mulch (M_0) may suffer from water stress and cannot accomplish full vegetative growth. As woxul (F_1) content N, P, K and other micronutrients in liquid and available form, so it is a balance nutrient mixture for vigorous and healthy plant growth, as a result yield of flower per pot were increased.

CHAPTER V

SUMMARY AND CONCLUSION

There has been a slow progress in gerbera production in our country due to lack of information and records which serve as guides in the development of technology for profitable production. Farmers still practice the traditional method of the crop, resulting in low production and poor quality of flower. The improvement of gerbera production depends upon soil and climatic condition as well as cultural practice.

In order to maximize the better production of gerbera through appropriate mulching foliar feeding application, a research was conducted to investigate the improvement of petal coloration and flower production of pot gerbera through traditional mulches and foliar feeding at the horticulture farm, Sher-e-Bangla Agricultural University, Dhaka during the period from May, 2008 to December, 2008. Experiment included different mulches viz. M_0 (control), M_1 (straw), M_2 (black polythene) and different foliar feeding viz. F_0 (control), F_1 (Wuxol), F_2 (agro-grow). The two factor experiment was laid out in Complete Randomized Design (CRD) with three replications. The size of the each pot was 20 cm × 18 cm. Suckers were planted on 10^{th} may, 2008. Each pot had single plant and single plant was selected and marked for the collection of data.

Data were taken for plant height (cm), leaf length (cm), leaf width (cm), number of leaves per plant, length of flower stalk (cm), diameter of flower bud (cm), diameter of flower (cm), number of flower per plant, petal coloration (h_{ab}, L*, a*, b*, c*). All the collected data were statistically analysed for evaluation of the treatments effect. The summary of the results and conclusion have been described in this chapter.

Influence of mulching, foliar feeding and their interaction, in respect of the coloration, yield and yield contributing character were found to be significant.

Regarding the flower characteristic longest (37.8 cm) plant height was recorded by M_1, while shortest (29.0 cm) plant height was recorded from M_0 in the application of different mulches. In the foliar feeding, highest (36.0 cm) plant height was recorded from F1 and lowest (30.8 cm) from F_0. In mulch with foliar feeding highest (40.1 cm) plant height was recorded from M_1F_1 and lowest (25.0 cm) from M_0F_0.

Leaf length on mulch, the longest (27.7 cm) leaf length was recorded from M_1 and shortest (20.5 cm) leaf length was obtained from M_0. Foliar feeding on the leaf length, highest (26.1 cm) leaf length was obtained from F_1 and shortest (21.9 cm) from F_0. Mulching with foliar feeding on leaf length, highest (30.8cm) leaf length was found in M_1F_1, while lowest (19.6 cm) leaf length was obtained from M_0F_0.

Highest (9.2 cm) leaf width was obtained from the mulch M1 and lowest leaf width (6.9 cm) was recorded from M_0. Highest (8.8 cm) leaf width was recorded in F_1. On the other hand lowest (7.5 cm) leaf width was recorded from F_0 in terms of foliar feeding. Mulching with foliar feeding was found to be highest (10.2 cm) for leaf width of treatment combination of M_1F_1 and lowest (6.7 cm) leaf width was obtained from M_0F_2.

In case of Number of leaves per plant on mulches maximum (37.3 / plant) number of leaves was recorded from M_1 and minimum (18.1 / plant) was obtained from M_0. In foliar feeding maximum (32.6 / plant) number of leaves was recorded from F_1 and minimum (24.4 / plant) number of leaf was obtained from F_0. In mulching with foliar feeding maximum (43.5 / plant) number of leaves was recorded from M1F1 and minimum (15.5 / plant) from M0F0.

Length of flower stalk on different mulches highest (34.0 cm) length of flower stalk was found in M_1 treatment and lowest (23.5 cm) length of flower stalk were found M_0 treatment. In the foliar feeding the length of flower stalk, highest (31.7 cm) length of flower stalk was observed in F_1 and lowest (28.4 cm) from F_0. Mulch with foliar feeding had highest (36.8 cm) length of flower stalk was observed in the treatment combination M_1F_1 and lowest (22.8 cm) length of flower stalk was found M_0F_2.

In case of diameter of flower on mulching highest (6.6 cm) diameter of flower was observed in M_1 and lowest (6.4 cm) in M_0. In case of foliar feeding the diameter of flower highest (6.7 cm) diameter of flower was found in F_1 and lowest (6.5 cm) diameter of flower was found in F_0 and F_2. Mulching with foliar feeding had highest (6.7 cm) diameter of flower was found in M_1F_1 and lowest (6.4 cm) diameter of flower was found in M_0F_1 and M_0F_2.

Number of flower per plant on mulching maximum (15.3 / plant) number of flower per plant was recorded from M_1 while minimum (10.0 / plant) number of flower per plant was recorded from M_0. In the foliar feeding maximum (14.0 / plant) number of flower per plant was obtained from the F_1. While minimum (11.3 / plant) number of flower per plant was obtained from the F_0 treatment. In mulching with foliar feeding maximum (17.5 / plant) number of flower per plant was recorded from M_1F_1 and minimum (9.5 / plant) number of flower per plant was recorded from M_0F_0.

Petal coloration on mulching with highest (78.5) hue angle (h_{ab}) was recorded from M_0 and the lowest (30.0) hue angle (h_{ab}) was recorded from M_2. Highest (54.2) L* was recorded from M_0 and lowest (49.2) L* was obtained from M_2. Highest (72.9) a* was recorded from M_0 and lowest (70.5) a* was obtained from M_2. Highest (52.8) b* was recorded from M_1 and lowest (22.3) b* was obtained from M_0. Highest (87.3) c* was recorded from M_1 and lowest (79.0) c* was obtained from M_0. Petal coloration on the foliar feeding highest (86.3) hue angle (h_{ab}) was recorded from F_2 and lowest (29.7) hue angle (h_{ab}) was recorded from F_0. Highest (54.8) L* was recorded from F_0 and lowest (49.5) L* was obtained from F_1. Highest (77.7) a* was recorded from F_0 and lowest (62.8) a* was obtained from F_2. Highest (42.9) b* was recorded from F_2 and lowest (32.7) b* was obtained from F_0. Highest (88.0) c* was recorded from F_1 and lowest (78.0) c* was obtained from F_2. Mulching with foliar feeding in terms of petal coloration highest (192.2) hue angle (h_{ab}) was recorded from M_0F_2 and lowest (14.0) hue angle (h_{ab}) recorded from M_0F_0. Highest (63.5) L* was recorded from M_1F_0 and lowest (48.8) L* was obtained from M_1F_2, M_2F_1 and M_2F_2. Highest (79.3) a* was recorded from M_1F_0 and lowest (62.0) a* was obtained from M_1F_2. Highest (61.0) b* was recorded from M_1F_2 and lowest (7.0) b* was obtained from M_0F_0. Highest (89.0) c* was recorded from M_0F_1 and lowest (70.0) c* was obtained from M_0F_2.

Conclusion

Among the treatment combination straw mulch (M_1) with wuxol (F_1) wasconsidered for yield and yield contributing characters of gerbera.

Considering the findings of the present experiment, further studies in the following areas may be suggested:

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

II. Other different combination of mulching and foliar feeding may be included for further study.

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Appendix I: Monthly recorded of year temperature, rainfall, relative humidity and sunshine hours during the period from May, 2008 to December, 2008

Year	Month	Average air temperature (^0C)			Total rainful (mm)	Average relative humidity (%)	Total sunshine hours
		Maximum	Minimum	Maen			
2008	May	36.7	20.3	29.3	205	70	7.7
	June	35.4	22.5	28.7	577	80	4.2
	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

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

Appendix II. Analysis of variance of the data on plant height, number of leaves per plant, leaf length, leaf width, number of flower per plant, length of flower stalk, diameter of flower bud and diameter of flower of potted gerbera

Treatments source of variance	Degree of freedom	Mean sum of square							
		Plant height (cm)	Leaf			Flower			
			Number /plant	Length (cm)	width (cm)	Number /plant	Length of flower stalk (cm)	Diameter of bud (cm)	Diameter of flower (cm)
Mulching (M)	2	240.867**	1170.250**	163.048**	15.234**	85.194**	400.194**	0.001**	0.114**
Foliar feeding (F)	2	91.355**	229.083**	61.600**	4.705**	25.194**	32.028**	0.035**	0.020*
Interaction of M × F	4	2.716*	41.958**	11.640*	1.229**	4.819**	7.778*	0.003*	0.011*
Error	27	0.738	3.046	2.775	0.042	0.426	3.731	0.002	0.005

* Indicates significant at 5% level of probability; ** Indicates significant at 1% level of probability