

## Foliar Application of Gibberelic Acid on Growth and Flowering of Gerbera Cultivars

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### Abstract

An experiment was conducted at Rooftop Garden under Zabotech lab, Department of Horticulture, Sher-e-Bangla Agricultural University, Bangladesh during November 2012 to July 2013 to find out growth and yield performance of potted Gerbera against foliar application of different concentration of Gibberelic acid ( $GA_3$ ). Three varieties viz.  $V_1$  (red),  $V_2$  (brick red),  $V_3$  (pink) and four  $GA_3$  concentrations viz.  $G_0$ : 0 ppm,  $G_1$ : 100 ppm,  $G_2$ : 150ppm,  $G_3$ : 200 ppm were evaluated in the experiment. Maximum number of flower (22.1), flower bud diameter (3.6 cm), peduncle length (29.3 cm), peduncle diameter (1.9 mm) and flower head diameter (8.6 cm) were found from  $V_2$  while  $G_2$  provided maximum number of flower (24.0), longest peduncle (28.3), maximum peduncle diameter (1.7) but  $G_2$  and  $G_3$  both provided maximum flower bud diameter (3.1 cm) and flower head diameter (8.1 cm).  $V_2G_2$  was found as the best treatment combination.

**Key words:** *Gerbera jamesonii*, Gibberelic acid and different concentration

### I. Introduction

Gerbera (*Gerbera jamesonii*) belonging to the *Asteraceae* family that ranks among the top ten cut flowers of the world (Parthasarathy and Nagaraju 1999). In Bangladesh, public attraction is gradually increasing particularly in urban areas about gerbera. Genetic diversity that exists in Bangladesh would facilitate selection of gerbera and hormonal balance plays a major role for flower yield like plant growth regulators increases growth, flowering and yield of many ornamental plants. Application of gibberellin may reduce flower and fruit drop due to the suppression of ABA biosynthesis (Steffens 1988). Therefore, an application of exogenous gibberellins might improve flower retention. Thus, keeping in view the potentialities of growth regulators like Gibberelic acid, the study was undertaken to find out the suitable concentration of  $GA_3$  for better growth and yield of gerbera.

### II. Materials and Method

**Location and duration of the experiment:** This experiment was conducted at Rooftop Garden under Zabotech lab, Department of Horticulture, Sher-e-Bangla Agricultural University, Bangladesh during November 2012 to July 2013.

**Experimental design and treatments:** Two factorial experiment was laid out in complete randomized design (CRD) with five replications. Three varieties were exerted and these were symbolized by  $V_1$  (red),  $V_2$  (brick red) and  $V_3$  (pink). On the other hand, Gibberelic acid ( $GA_3$ ) was sprayed at different concentrations and these were symbolized by  $G_0$ : 0 ppm;  $G_1$ : 100 ppm;  $G_2$ : 150 ppm and  $G_3$ : 200 ppm.

**Genetic materials and fertilization:** Same aged seedlings were collected from local nursery, Dhaka. Soil and cow-dung (1:1) were mixed and pots were filled 7 days before transplanting. Recommended chemical fertilizers (NPK as 5, 10 and 5 g respectively in each pot) were mixed with the soil.

**Data collection:** Data were collected on number of leaves, leaf length, leaf breadth, days to first flower bud initiation, days to first flowering, number of flower, flower bud diameter, peduncle length, peduncle diameter and flower head diameter from each pot within the period. Number of leaves, leaf length and leaf breadth were measured at every 30 days interval from 30 DAT and continued up to 210 DAT. Peduncle diameter were measured by using Digital Caliper-515 (DC-515).

**Statistical analysis:** All parameters were statistically analyzed by using MSTAT-C program. Mean for all the treatments was calculated, analysis of variance for each of the characters was performed by F-test and difference between treatments was evaluated by Least Significant Difference (LSD) at 5% level of significance (Gomez and Gomez 1984).

### III. Results and Discussion

**Number of leaves:** Maximum number of leaves was found from V<sub>3</sub> (37.4) while minimum from V<sub>1</sub> (35.4) at 210 days after transplanting (Figure 1a). On the other hand, G<sub>2</sub> (spraying of 150 ppm GA<sub>3</sub>) provided maximum number (38.5) of leaves which was statistically similar with G<sub>3</sub> (38.3) whereas minimum from G<sub>0</sub> (34.2) at 210 days after transplanting (Fig. 1b). Application of Gibberellic acid increases the leaf number of strawberry (Jamal Uddin et al., 2012). Gibberellic acid resulted in cell division and cell elongation can cause in enhanced vegetative growth. In combination between variety and GA<sub>3</sub> spraying, V<sub>3</sub>G<sub>2</sub> (38.5) provided maximum number of leaves whereas minimum (35.3) from V<sub>1</sub>G<sub>1</sub>, V<sub>1</sub>G<sub>2</sub> and V<sub>2</sub>G<sub>3</sub> at 210 days after transplanting (Table 3).

**Leaf length:** Leaf length was varied significantly among the gerbera varieties, GA<sub>3</sub> spraying and their combination. Longest leaf was found from V<sub>2</sub> (27.8 cm) while shortest from V<sub>1</sub> (23.0 cm) (Figure 1c). G<sub>2</sub> (27.1 cm) provided longest leaf whereas shortest from G<sub>0</sub> (21.0 cm) (Figure 1d). Length of leaf increased by using GA<sub>3</sub> (Cardoso et al. 2012). In combination between variety and GA<sub>3</sub> spraying, V<sub>2</sub>G<sub>2</sub> (30.9 cm) provided longest leaf whereas minimum from V<sub>1</sub>G<sub>0</sub> (35.3) at 210 days after transplanting (Table 3).

**Leaf width:** The widest leaf was observed from V<sub>2</sub> (12.6 cm) while narrowest from V<sub>3</sub> (11.9 cm) at 210 days after transplanting (Figure 1e). Among the different concentration of GA<sub>3</sub> spraying widest leaf was found from G<sub>2</sub> (12.9 cm) while narrowest from G<sub>0</sub> (11.8 cm) at 210 days after transplanting (Fig. 1f). On the other hand V<sub>2</sub>G<sub>2</sub> provided widest (13.8 cm) leaf whereas narrowest from V<sub>3</sub>G<sub>3</sub> (11.2) at 210 days after transplanting (Table 3).

**Days to flower bud initiation:** Days to flower bud initiation varied significantly among the variety, GA<sub>3</sub> spraying and their combination. Early flower bud initiation occurred in V<sub>2</sub> (68.2 days) while V<sub>1</sub> (81.2 days) showed the late flower bud initiation which was statistically similar to the V<sub>3</sub> (80.7 days) (Table 1). G<sub>2</sub> treatment (72.6 days) provided early flower bud initiation which was statistically similar with the G<sub>3</sub> (73.0 days) and G<sub>1</sub> (74.3 days) but late flower bud initiation from G<sub>0</sub> (86.9 days) (Table 2). From the current study it was observed that application of GA<sub>3</sub> influenced significantly for the early flower bud initiation but not significantly affected by their concentration. Inflorescences were emerged earlier than control, when those plants were treated with GA<sub>3</sub> (Matsumoto 2006). In combination of variety and GA<sub>3</sub> spraying, V<sub>2</sub>G<sub>2</sub> provided early flower bud initiation (61.0 days) while V<sub>1</sub>G<sub>0</sub> (109.0 days) was the late flower bud initiating combination (Table 3).

**Days to flowering:** Days to flowering varied significantly among the variety, GA<sub>3</sub> spraying and their combination. Early flowering occurred in V<sub>2</sub> (80.9 days) while V<sub>1</sub> (93.5 days) showed the late

flowering which was statistically similar to the V<sub>3</sub> (92.6 days) (Table 1). G<sub>3</sub> treatment (85.3 days) provided early flowering which was statistically similar with the G<sub>2</sub> (85.5 days) and G<sub>1</sub> (86.5 days) but late flower bud initiation from G<sub>0</sub> (98.7 days) (Table 2). From the current study it was observed that application of GA<sub>3</sub> influenced significantly for early flowering but not significantly affected by their concentration. Jamal Uddin et al. (2012) found that GA<sub>3</sub> application caused early flowering in strawberry. Application of GA<sub>3</sub> induced early flowering (Hernandez 1997 and Awan et al. 1999). GA<sub>3</sub> seemed to decrease ABA concentration and to boot t-ZR (trans-Zeatin Riboside) up in leaf that might be related to flower buds initiation and early flowering (Phengphachanh et al. 2012). In combination of variety and GA<sub>3</sub> spraying, V<sub>2</sub>G<sub>2</sub> provided early flowering (74.8 days) while V<sub>1</sub>G<sub>0</sub> (121.1 days) was the late flowering combination (Table 3).

**Number of flower:** No of flower varied significantly among the varieties, different concentration of GA<sub>3</sub> and their combinations. V<sub>2</sub> (22.1) provided maximum number of flower/plant which was statistically similar with V<sub>3</sub> (22.0) whereas minimum from V<sub>1</sub> (20.0) (Table 1). Gerbera cultivar produced 20-35 flower stick per plant annually on an average (Li Zhang et al. 2008, Singh and Mandhar 2004) which have strongly support the findings of the current study. For the foliar application of different concentration of GA<sub>3</sub>, G<sub>2</sub> (24.0) provided maximum number of flower while minimum from G<sub>0</sub> (18.6) (Table 2). Foliar application of GA<sub>3</sub> increases number of flower in strawberry (Jamal Uddin et al. 2012). Flower abscissions are usually due to high level of ethylene in the flower (Malik et al. 2003, Beno-Moualem et al. 2004) and the lower concentration of auxin and gibberellin (Aneja and Gianfagna 1999, Malik and Singh 2006). In combination of variety with different concentration of GA<sub>3</sub> spraying, V<sub>2</sub>G<sub>2</sub> (27.8) showed the tendency for more flowering while minimum from V<sub>2</sub>G<sub>0</sub> (16.8) (Table 4).

**Flower bud diameter:** Flower bud diameter varied significantly among the varieties and the combination between variety and foliar spraying of GA<sub>3</sub>. In case of variety, maximum flower bud diameter was observed from V<sub>2</sub> (8.6 cm) whereas minimum from V<sub>1</sub> and V<sub>3</sub> (7.7 cm) (Table 1). Significant variation did not find among the different concentration of foliar spraying of GA<sub>3</sub>. However, maximum flower bud diameter was observed from G<sub>2</sub> (8.1 cm) and G<sub>3</sub> (8.1 cm) while minimum from G<sub>0</sub> (7.9 cm) (Table 2). In combination among variety and different concentration of GA<sub>3</sub> spraying, maximum flower bud diameter was found from V<sub>2</sub>G<sub>2</sub> (9.2 cm) while minimum from V<sub>1</sub>G<sub>0</sub> (2.4) and V<sub>1</sub>G<sub>2</sub> (2.4 cm) (Table 4).

**Peduncle length:** Peduncle length of flower varied significantly among the varieties, different concentration of GA<sub>3</sub> spraying and their combinations. Longest peduncle was found from V<sub>2</sub> (29.3 cm), G<sub>2</sub> (28.3 cm) and V<sub>2</sub>G<sub>2</sub> (33.3 cm) (Table 1, 2 and 3 respectively) while shortest from V<sub>3</sub> (24.6 cm), G<sub>0</sub> (23.4 cm) and V<sub>1</sub>G<sub>0</sub> (21.7 cm) (Table 1, 2 and 3 respectively). Mehraj et al. (2013) found that peduncle of brick red gerbera ranges from 26.7 cm to 36.1 cm that supports the findings of the current study.

**Peduncle diameter:** Peduncle diameter of flower varied significantly among the varieties, different concentration of GA<sub>3</sub> spraying and their combinations. Maximum peduncle diameter was found from V<sub>2</sub> (1.9 mm), G<sub>2</sub> (1.7 mm) and V<sub>2</sub>G<sub>2</sub> (2.2 mm) (Table 1, 2 and 3 respectively) while minimum from V<sub>3</sub> (1.4 mm) and G<sub>0</sub> (1.5 mm) (Table 1, and 2 respectively). On the other hand, minimum (1.4 mm) was observed from V<sub>1</sub>G<sub>0</sub>, V<sub>1</sub>G<sub>1</sub>, V<sub>3</sub>G<sub>0</sub>, V<sub>3</sub>G<sub>1</sub> and V<sub>3</sub>G<sub>3</sub> (Table 4).

**Flower head diameter:** Flower head diameter varied significantly among the varieties and the combination between variety and foliar spraying of GA<sub>3</sub>. In case of variety, maximum flower head diameter was observed from V<sub>2</sub> (8.6 cm) whereas minimum from V<sub>1</sub> and V<sub>3</sub> (7.7 cm) (Table 1). Significant variation was not found among the different concentration of foliar spraying of GA<sub>3</sub>. However, maximum flower bud diameter was observed from G<sub>2</sub> (8.1 cm) and G<sub>3</sub> (8.1 cm) while minimum from G<sub>0</sub> (7.9 cm) and G<sub>1</sub> (8.0 cm) (Table 2). In combination among variety and different

concentration of GA<sub>3</sub> spraying, maximum flower bud diameter was found from V<sub>2</sub>G<sub>2</sub> (9.2 cm) while minimum from V<sub>1</sub>G<sub>0</sub> (7.4) (Table 4).

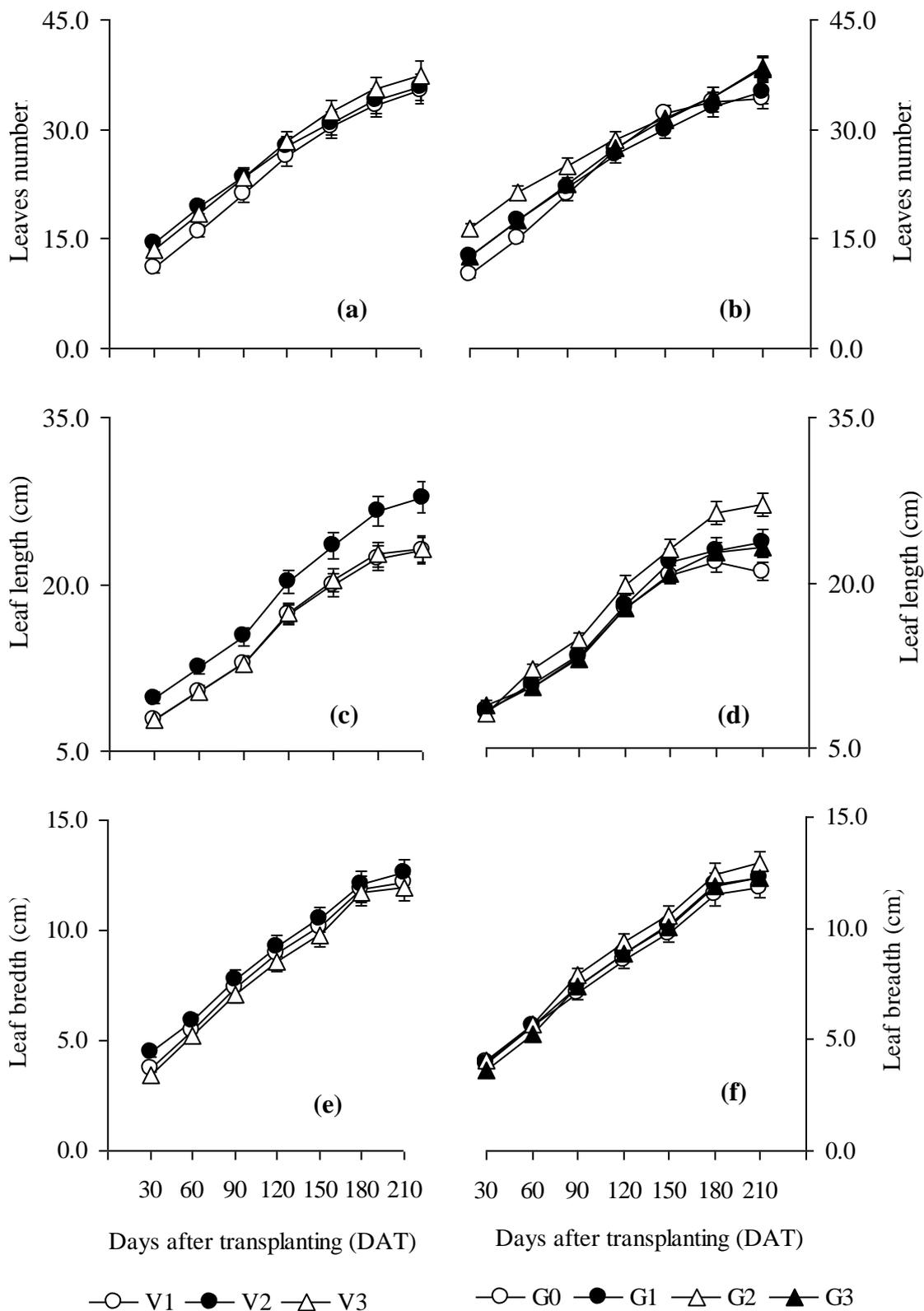


Figure 1. Performance of leaf number (a & b); leaf length (c & d); leaf breadth (e & f) on gerbera variety (a, c & e) and GA<sub>3</sub> concentration (b, d & f)

Table 1. Performance of gerbera variety to different attributes<sup>x</sup>

Variety	Days to first flower bud initiation	Days to first flowering	No of flower /plant	Flower bud diameter (cm)	Peduncle length (cm)	Peduncle diameter (cm)	Flower head diameter (cm)
V <sub>1</sub>	81.2 a	93.52 a	20.0 b	2.7 b	25.7 b	1.5 b	7.7 b
V <sub>2</sub>	68.2 b	80.93 b	22.1 a	3.6 a	29.3 a	1.9 a	8.6 a
V <sub>3</sub>	80.7 a	92.59 a	22.0 a	2.7 b	24.6 c	1.4 b	7.7 b
LSD0.05	6.0	6.0	0.7	0.2	0.9	0.1	0.2
CV%	10.9	9.4	11.4	11.1	4.6	10.4	11.2

<sup>x</sup>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

Table 2. Performance of gerbera variety against different concentration of GA<sub>3</sub> spraying to different attributes<sup>x</sup>

GA <sub>3</sub> Concentrations	Days to first flower bud initiation	Days to first flowering	No of flower /plant	Flower bud diameter (cm)	Peduncle length (cm)	Peduncle diameter (cm)	Flower head diameter (cm)
G <sub>0</sub>	86.9 a	98.7 a	18.6 d	2.9 a	23.4 c	1.5 b	7.9 a
G <sub>1</sub>	74.3 b	86.5 b	20.6 c	2.9 a	27.0 b	1.6 ab	8.0 a
G <sub>2</sub>	72.6 b	85.5 b	24.0 a	3.1 a	28.3 a	1.7 a	8.1 a
G <sub>3</sub>	73.0 b	85.3 b	22.3 b	3.1 a	27.4 ab	1.6 ab	8.1 a
LSD0.05	6.9	6.9	0.8	0.3	1.0	0.1	0.3
CV%	10.9	9.4	11.4	11.1	4.6	10.4	11.2

<sup>x</sup>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

Table 3. Performances of gerbera variety in combination with different concentration of GA<sub>3</sub> spraying to different attributes<sup>x</sup>

Combinations	Leaf At 210 Days after transplanting (DAT)			Days to first	
	Number	Length (cm)	Breadth (mm)	Bud initiation	Flowering
V <sub>1</sub> G <sub>0</sub>	35.5 e	21.8 k	12.1 f	109.0 a	121.1 a
V <sub>1</sub> G <sub>1</sub>	35.3 f	22.7 h	11.9 h	73.0 bcde	84.9 bcd
V <sub>1</sub> G <sub>2</sub>	35.3 f	24.2 f	12.9 c	72.8 bcde	85.7 bcd
V <sub>1</sub> G <sub>3</sub>	35.5 e	23.4 g	12.4 e	70.0 cde	82.4 cd
V <sub>2</sub> G <sub>0</sub>	37.3 c	27.2 c	11.4 i	73.5 bcd	84.9 bcd
V <sub>2</sub> G <sub>1</sub>	34.5 g	27.8 b	12.4 e	70.5 cde	82.9 cd
V <sub>2</sub> G <sub>2</sub>	36.3 d	30.9 a	13.8 a	61.0 e	74.8 d
V <sub>2</sub> G <sub>3</sub>	35.5 e	25.3 e	13.4 b	67.8 de	81.1 cd
V <sub>3</sub> G <sub>0</sub>	35.3 f	22.2 j	11.9 h	78.3 bcd	90.2 bc
V <sub>3</sub> G <sub>1</sub>	38.0 b	22.2 j	12.5 d	79.3 bcd	91.7 bc
V <sub>3</sub> G <sub>2</sub>	38.5 a	26.1 d	12.0 g	84.0 b	96.0 b
V <sub>3</sub> G <sub>3</sub>	38.0 b	22.3 i	11.2 j	81.3 bc	92.4 bc
LSD0.05	0.1	0.1	0.2	12.0	12.0
CV%	7.3	4.8	1.9	10.9	9.4

<sup>x</sup>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

Table 4. Performance of gerbera variety in combination with different concentration of GA3 spraying to different attributes<sup>x</sup>

Combinations	Flower				Peduncle	
	Number	Bud diameter (cm)	Head diameter (cm)	Length (cm)	Diameter (mm)	
V <sub>1</sub> G <sub>0</sub>	18.8 g	2.4 e	7.4 d	21.7 g	1.4 c	
V <sub>1</sub> G <sub>1</sub>	20.8 ef	3.1 bc	7.7 cd	26.8 cde	1.4 c	
V <sub>1</sub> G <sub>2</sub>	21.0 de	2.4 e	8.1 bc	27.5 cd	1.6 c	
V <sub>1</sub> G <sub>3</sub>	19.5 fg	2.7 cde	7.7 cd	26.7 cde	1.5 c	
V <sub>2</sub> G <sub>0</sub>	16.8 h	3.5 b	8.5 b	26.0 de	1.9 b	
V <sub>2</sub> G <sub>1</sub>	18.8 g	3.1 bc	8.1 bc	28.1 bc	1.6 c	
V <sub>2</sub> G <sub>2</sub>	27.8 a	4.1 a	9.2 a	33.3 a	2.2 a	
V <sub>2</sub> G <sub>3</sub>	25.3 b	3.6 ab	8.6 b	29.7 b	1.9 b	
V <sub>3</sub> G <sub>0</sub>	20.3 ef	2.8 cde	7.8 cd	22.4 c	1.4 c	
V <sub>3</sub> G <sub>1</sub>	22.3 cd	2.5 de	7.5 d	26.0 de	1.4 c	
V <sub>3</sub> G <sub>2</sub>	23.3 c	2.8 cde	7.8 cd	24.2 f	1.5 c	
V <sub>3</sub> G <sub>3</sub>	22.3 cd	2.9 cd	7.9 cd	25.6 ef	1.4 c	
LSD0.05	1.4	0.5	0.5	1.8	0.2	
CV%	11.4	11.1	11.2	4.6	10.4	

<sup>x</sup> 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

#### IV. Conclusion

It was revealed from the study that brick red variety was the best among three varieties used in the experiment; and foliar application of 150 ppm Gibberellic acid increases the number of flower in addition with peduncle length diameter and flower head diameter. It can be concluded that foliar application of 150 ppm Gibberellic acid on brick red variety provide the best result in terms of yield and flowering of Gerbera.

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