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GERBERA GENOTYPES AS PERFORMED UNDER DIFFERENT SOIL AMENDMENTS

M. M. R. Rajib¹, S. A. Jui¹, M. M. Hossain¹, M. M. H. Saikat², M. A. Haque³

ABSTRACT

Cultivation of gerbera is a promising practice among the flower growers. Proper soil preparation can substantially improve their productivity. Finding the appropriate gerbera genotype performing better in a suitable soil combination is a potential field of study. On this aspect, an experiment was conducted to evaluate the growth and performance of Gerbera genotypes with soil amendments during the period from November 2014 to July 2015 at the field research site of Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur-1706, Bangladesh. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. There were five treatments viz. T0 (control), T1 (Cowdung), T2 (Mustard oil cake), T3 (Urea+ TSP+ MOP), T4 (Organic+ Inorganic) along with five genotypes (G1 = White double, G2 = Yellow double, G3 = Light orange single, G4 = Light pink spider G5= Deep red double). Significant variation among the genotypes and treatment were observed either in single or in combination. Genotype G3 produced the maximum leaf number, flower number (32.4), whereas genotype G5 had the maximum diameter of flower stalk and produced larger flower as well (9.2cm). However, genotype G1 showed the maximum vase life (9.47days). These all were happened when organic and inorganic fertilizers (T4) applied combined. Among all, G3 produced the maximum leaf and flowers numbers which was dwarf at the same time and in case of interaction effect, G3T4 was observed to produce maximum number of leaves and flowers.

Keywords: Soil amendments, Gerbera genotype, Plant nutrition, Organic, Inorganic

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INTRODUCTION

Gerbera (*Gerbera jamesonii*) belongs to the family Asteraceae is an herbaceous perennial flower crop, with long stalks and daisy-like flower, a native to South Africa. It was named in honor of the German botanist and naturalist Traugott Gerber. Gerbera grown throughout the world scattered from Africa to Madagascar into tropical Asia and South America (Pattanashetti *et al.*, 2012). Variety in color has made this flowering plant attractive for use in garden decorations and for cut flowers as it has a long vase life (Chung *et al.*, 2005; Chauhan, 2004). Gerbera is very popular and is the fourth (Sujatha *et al.*, 2002) most widely used cut flower in the world after rose, carnation, chrysanthemum, and tulip. There is a wide range of variation available in shape, size and color of gerbera flower. The annual production of flower sticks per plant is directly related to the cultivars (Singh and Mandhar, 2004). Thangam *et al.* (2009) also reported that gerbera variety Savannah recorded the highest values for leaf length, leaf breadth, flower stalk length and number of petals per flower whereas Rosalin recorded highest fresh and dry weight of leaves and flower stalk circumference. The flower diameter was the maximum in Dalma followed by Dana Ellen, Rosalin and Savannah. Dalma was the prolific bearer with 70.24 flowers/plant/year followed by Savannah and Rosalin.

In Bangladesh, gerbera was introduced recently and was gaining popularity quickly. It has great potential for local as well as export market. Cultivation of flower is reported to give 3-5 times and 1.5-2.0 times more returns than obtained from rice and vegetable cultivation, respectively (Dadlani, 2003). At present, 10,000 hectares of land covers flower cultivation taking the lead by Jessore district (Chowdhury, 2010) for commercial flower cultivation. Recently, several areas of Gazipur, Savar, Mymenshing are also using for gerbera cultivation.

Economic production of gerbera depends upon factors like soil organic status, irrigation, water quality, fertigation, plant density, plant protection measures, etc. But, nutritional requirement plays greater role in successful crop production. Soil alone as a growing medium does not fulfill all requirements for its higher yield and quality. The introduction of the soilless medium has brought radical change in its protected cultivation and is gaining importance day by day. Barad *et al.* (2010) concluded that for maximum growth, flower yield and quality of gerbera flowers cv. Sangria under net house conditions, the crop should be fertilized with 20:10:20 g/m² N:P:K (2:1:2) for better growth and yield. Amin *et al.* (2015)
concluded that the combination of 12.5 g P m\(^{-2}\) and 15 g K\(_2\)O m\(^{-2}\) influenced most of growth and flowering parameters of Gerbera.

Increasing awareness of environmental issues, need to dispose of rising amounts of waste along with the need to reduce the consumption of non-renewable materials have greatly encouraged the use of composted organic biomass in agriculture (Riaz et al., 2008; Tariq et al., 2012). It is very much encouraging to learn that the global trade of gerbera had increased. Hence in the present organic era, use of Integrated Nutrient Management (INM) needs to be effectively used both in increasing the production and improving the quality and longevity of flowers thereby accounting for an effective growth and quality. Bellubbi et al. (2015) was conducted with six kinds of organic substrates along with inorganic fertilizers to study the effect of INM practices in improving the growth and yield of gerbera (Gerbera jamasonii L.) Var. Rosalin. The results proved that 75% RDF (150:137:190 NPK g/m\(^2\) + 20 t/ha FYM) +Glomus fasciculatum + Trichoderma harzianum+ Panchagavya +Amrutpani + Dry mulch + Agnihothra ash improved the growth and flowering attributes in gerbera. Saijeen et al. (2009) also reported that all treatments (7 different media and organic fertilizers) with chemical fertilizer showed the best performance with maximum values in leaf and flower number. Among the five growing media evaluated, growth and flower quality were better in soil with vermicompost followed by soil with FYM reported by Thangam et al. (2009).

MATERIALS AND METHODS
The experiment was conducted in the nursery of the Department of Horticulture, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur from November 2014 to July 2015. A two factor experiment with three replications was laid out in Randomized Complete Block Design (RCBD). There were five treatments viz. T\(_0\) (control), T\(_1\) (Cowdung), T\(_2\) (Mustard oil cake), T\(_3\) (Urea+ TSP + MOP), T\(_4\) (Organic+ Inorganic) along with five genotypes (G\(_1\)=White double, G\(_2\)= Yellow double, G\(_3\)=Light orange single, G\(_4\)=Light pink spider G\(_5\)=Deep red double). For planting gerbera, pot was filled by 10 kg garden soil with recommended fertilizer dozes i.e. N:P:K – (20:10:20) g/m\(^2\) as per treatments. Pots were prepared one week before transplanting. Mother plants (large clumps) were divided into smaller units called suckers. Before transplanting in the pot, the roots and leaves of suckers were trimmed by keeping the central shoot intact.
Data were collected in respect of number of leaves per plant, days required to bud emergence, days required from bud to opening flower, flower stalk length, flower stalk diameter, flower diameter, number of flower per plants, vase life etc. Collected of data on various parameters under study were statistically analyzed using MSTAT-C program. The significance of the differences among the treatment means was evaluated by LSD test at 1% and 5% level of probability for the interpretation of results.

RESULTS AND DISCUSSION

Data on different growth parameters and flower characters were recorded and have been presented in table and graphs and possible interpretations are given under the following headings:

**Number of leaves per plant:** It was observed that the numbers of leaves per plant were significantly varied among genotypes (Figure 1a) and by the application of different doses of organic and chemical fertilizers. Leaf number increased gradually from 45 to 75 DAT. After that it increased in a consistent manner up to 105 DAT. The highest number of leaves produced by genotype G3 (17.47). Number of leaves in G4 and G5 were very close to 75 days, but gradually G4 produced higher number of leaves than G3 when it goes to 105 DAT. Mean while, the lowest number of leaves was produced by genotype G1 (11.07). Variations among the varieties were controlled by the genetic materials (Singh and Mandhar, 2004) along with environmental effects influence for its expression.

Similar growth trend was also observed in Figure 1b. However, the maximum number of leaves (17.00) was recorded in treatment T4, which is statically identical to mustard oilcake treatment, i.e. T2 (15.53). The lowest number of leaves was produced from T0 (9.00), where no fertilizers were applied. The chemical fertilizers along with organic manure may increase the availability of available nitrogen, phosphorus and potassium in the soil which resulted in more number of leaves (Ahmed et al., 2004). Plants produce food materials through the process of photosynthesis. Generally, the increasing number of leaves, photosynthesis is supposed to be increased. Adequate numbers of leaves are essential for normal growth and production of more flowers. Anuje et al. (2004) also carried out an experiment on effect of growing media on growth, flowering and yield of gerbera under polyhouse conditions and found similar result.
It was observed that the interaction of genotype and treatment had significant influenced on leaf number in 105 day after transplanting (Table 1). The highest number of leaves was found in G3T4 (20cm) which was statistically similar to G3T3 (18.67cm) G4T4 (18.67cm) G3T2 (18.00cm) and the lowest number of leaves was found in G5T0 (8.67cm).

![Figure 1](image1.png)

**Figure 1.** Number of leaves were influenced by different (a) genotypes and (b) different treatments (vertical bars indicate the level of significance at 1%)

**Table 1.** Interaction effect of genotypes and treatment combinations on leaf number

| Treatment Combination | Number of Leaves |
|-----------------------|------------------|
|                       | 45DAT | 75DAT | 105DAT |
| G1                    |       |       |        |
| T0                    | 5.00  | 8.00  | 9.00jk |
| T1                    | 6.67  | 9.33  | 10.67gk|
| T2                    | 7.00  | 10.00 | 11.33fk|
| T3                    | 7.00  | 10.67 | 11.33fk|
| T4                    | 7.33  | 12.00 | 13.00ej|
| G2                    |       |       |        |
| T0                    | 6.00  | 8.00  | 10.00hk|
| T1                    | 8.00  | 12.00 | 13.33di|
| T2                    | 7.67  | 12.67 | 16.00be|
| T3                    | 7.33  | 11.67 | 12.67ek|
| T4                    | 8.33  | 13.33 | 14.00ch|
| G3                    |       |       |        |
| T0                    | 8.33  | 9.00  | 9.67ijk|
| T1                    | 10.67 | 17.67 | 19.00ab|
| T2                    | 10.33 | 16.67 | 18.00bc|
| T3                    | 10.33 | 17.33 | 18.67ab|
| T4                    | 12.00 | 20.33 | 22.00a |
| G4                    |       |       |        |
| T0                    | 7.67  | 8.67  | 9.33ijk|
| T1                    | 9.00  | 15.00 | 16.67bc|
**Leaf length:** The leaf length of different gerbera genotypes were statistically significant (Table 2). The longest leaf was recorded from G5 (28.40cm) while the shortest leaf length (22.86cm) was recorded from G2. These results had similarities with the findings by Das et al. (2012).

The result presented in (Table 2) showed that integrated use of organic and inorganic fertilizers had positive influence on the leaf length. The highest leaf length was obtained from T4 (28.40cm) followed by T1-Cowdung (26.65cm) and T2 Mustard oil cake (26.68cm). The shortest leaf length was obtained from T0 (22.55cm), where no fertilizer dose was applied. Sindhu et al. (2010) also reported such result earlier from his experiment. The interaction effect of treatment and genotype was not significant.

**Leaf width:** Leaf width showed significant variation for different genotypes and treatments (Table 2), but their interaction effects are not significant. The highest leaf width (6.78 cm) was showed by the genotypes G5 (6.91cm) and G4 (6.50 cm). The lowest (5.20 cm) was showed by genotype G3. Partially similar results also reported by Das et al. (2012) from his experiments, where he investigate the growth and yield performance of different exotic Gerbera.

### Table 1

| Genotype     | Treatment   | Value 1 | Value 2 | Value 3 |
|--------------|-------------|---------|---------|---------|
| G1-White (double) | T0-Control | 8.67    | 14.67   | 16.33bc |
| G2-Yellow (double) | T1-Cowdung | 8.33    | 9.67    | 15.00bf |
| G3-Light orange (single) | T2-Mustard oil cake | 10.00   | 17.33   | 18.67ab |
| G4-Light pink (spider) | T3-Inorganic(Urea+TSP+MOP) | 7.00    | 8.00    | 8.67k   |
| G5-Deep red(double) | T4-Organic+Inorganic | 8.67    | 14.00   | 15.00bf |

**Level of Significance:** NS, **NS**

| LSD Value | %CV  |
|-----------|------|
| 1.592     |      |

**Level of Sinificance:** NS, **NS**

**LSD Value:** 1.592

**%CV:** 15.17%, 17.03%, 11.42%
The plant treated with T4 treatment produced widest leaf (6.96cm) which is statically similar to T2 (6.45cm). In T4 organic and inorganic fertilizer were applied combined, while in T2 only mustard oil cake was applied. The lowest was obtained from T0 (4.70cm) followed by T3 (5.70cm). The main reason for that was lack of nutrition level i.e., phosphorous (31.68 ppm), potassium (210 ppm) and particularly nitrogen (0.01%) which is responsible for vegetative growth in plants (Ahmed, 2004). Saijeen et al. (2009) also found best result while using organic manure with chemical fertilizer. The interaction effect between genotype and treatments was non-significant.

Table 2. Leaf length and leaf width as influenced by genotype and treatment

| Factor   | Leaf Length | Leaf Width |
|----------|-------------|------------|
| Genotype |             |            |
| G1       | 26.15ab     | 5.80b      |
| G2       | 22.86c      | 5.65b      |
| G3       | 26.45ab     | 5.20b      |
| G4       | 25.01bc     | 6.50a      |
| G5       | 28.40a      | 6.91a      |
| Treatment|             |            |
| T0       | 22.55c      | 4.70d      |
| T1       | 26.65ab     | 6.25bc     |
| T2       | 26.68ab     | 6.45ab     |
| T3       | 24.59bc     | 5.70c      |
| T4       | 28.40a      | 6.96a      |
| Level of Significance | ** | ** |
| LSD Value | 3.02 | 0.66 |
| %CV       | 11.97%     | 11.18%     |

Days required to bud emergence: The results for days required to first emergence were statistically significant among the genotypes and treatments, but their interaction effects were not significant. The range of days required to bud emergence was 65.47 to 103.40 days (Table 3). Genotypes G5 needed higher days for bud emergence that was 103.40 days and G3 required lower days for bud emergence (65.47 days). Environmental factors (light intensity, nutrient availability, etc.) along with the genetic factor may be responsible for this variation. Keditsu (2013) also reported similar result.

Integrated use of inorganic and organic fertilizer (T4) requires higher days (93.20 days) for bud emergence which is statically similar to the result of Cow dung (T1) and Mustard oil cake (T2) application that is 89.20 and 89.80 days, respectively. Proper vegetative growth completed here before starting of reproductive stage. Control treatment, T0 required lower days (83.60 days) for bud emergence where no fertilizer was applied. Here, proper vegetative growth was not completed due to nutrient deficiency.

Days required for bud to fully opening of flower: This days requirement was significant. The range of required days for bud to fully opening of flower was 6.76 to 9.06 days of
Gerbera genotypes (Table 3). Higher days required to tall genotype G5 at 9.06 days and lower days required for dwarf genotype G3 at 6.73 days. Riaz et al. (2014) also found earlier flower from dwarf and delayed flower from tall variety in zinnia. Keditsu (2013) also reported closely related results to this finding in different planting time.

In case of fertilizer treatments the range of days varied from 6.53 to 9.06 days. Higher days were required in T4 (9.06 days) where organic and inorganic fertilizers are applied in integrated manner. Lower days were required in T0 (6.53 days) where no fertilizers were applied. In case of treatment combinations, G5T4 (11 days) requires higher days for flower opening from bud, which was statistically similar to G2T4 (10 days) followed by G5T4 (9.67 days). Lower days were required in G1T0 (5.33 days) and G2T0 (6.33), which are statically identical which is statically identical.

Table 3. Effect of genotypes and treatments on days required to bud emergence and bud to fully opening of flowers

| Factor       | Days Required for Bud Emergence | Days required for bud to fully opening flower |
|--------------|---------------------------------|---------------------------------------------|
| Genotype     |                                 |                                             |
| G1           | 96.80b                          | 7.47c                                       |
| G2           | 94.00b                          | 8.13b                                       |
| G3           | 65.47d                          | 6.73d                                       |
| G4           | 81.80c                          | 6.86d                                       |
| G5           | 103.40a                         | 9.06a                                       |
| Treatment    |                                 |                                             |
| T0           | 83.60c                          | 6.53c                                       |
| T1           | 89.20ab                         | 7.73b                                       |
| T2           | 89.80ab                         | 7.93b                                       |
| T3           | 85.67bc                         | 7.00c                                       |
| T4           | 93.20a                          | 9.06a                                       |
| Level of Significance | **                     | **                                          |
| LSD Value   | 3.98                            | 0.53                                        |
| CV (%)      | 4.60%                           | 7.08%                                       |
Table 4. Interaction effect of Genotype and Treatment in days required for bud to fully opening flower

| Treatment Combination | Days required for bud to fully open flower |
|-----------------------|------------------------------------------|
|                       |                                          |
|                       | **G1**                                   |
|                       | **T₀** 6.33 gh                           |
|                       | **T₁** 7.33 defg                         |
|                       | **T₂** 8.00 def                          |
|                       | **T₃** 7.00 efg                          |
|                       | **T₄** 8.67 cd                           |
|                       | **G2**                                   |
|                       | **T₀** 7.00 efg                          |
|                       | **T₁** 8.33 de                           |
|                       | **T₂** 8.00 def                          |
|                       | **T₃** 7.33 defg                         |
|                       | **T₄** 10.00ab                           |
|                       | **G3**                                   |
|                       | **T₀** 5.33 h                            |
|                       | **T₁** 7.00 efg                          |
|                       | **T₂** 7.33 defg                         |
|                       | **T₃** 6.00 fg                           |
|                       | **T₄** 7.33 defg                         |
|                       | **G₄**                                   |
|                       | **T₀** 6.00 gh                           |
|                       | **T₁** 7.33 defg                         |
|                       | **T₂** 6.67 fg                           |
|                       | **T₃** 6.00 gh                           |
|                       | **T₄** 8.33 de                           |
|                       | **G₅**                                   |
|                       | **T₀** 8.00 def                          |
|                       | **T₁** 8.67 cd                           |
|                       | **T₂** 9.67 bc                           |
|                       | **T₃** 8.00 def                          |
|                       | **T₄** 11.00 a                           |
Level of Significance

| LSD Value | 1.187 |
| CV (%)    | 7.08% |

**Genotype**  
G₁= White (double)  
G₂= Yellow (double)  
G₃=Light orange (single)  
G₄=Light pink (spider)  
G₅=Deep red (double)  

**Treatment**  
T₀= Control  
T₁= Cowdung  
T₂= Mustard oil cake  
T₃= Inorganic (Urea+ TSP+MOP)  
T₄= Organic+ Inorganic  

*=Significant at 5% level of Probability  
**=Significant at 1% level of Probability

**Length of flower stalk:** Significant variation was observed in respect of stalk length among the genotypes in (figure 2a). The longest peduncle of 39.16 cm was produced by genotype G₅, which is statically similar with genotype G₂ (37.01 cm), while the shortest peduncle of 32.99 cm was produced by genotype G₄. The stalk length is a genetical factor therefore it is expected to vary among the cultivars as earlier observed by Sarkar and Ghimiray (2004).

Effect of fertilizer treatments found significant in case of flower stalk length in (figure 2b). Application of organic and inorganic fertilizer produced higher stalk length together in T₄ (39.6 cm). It is statically identical to T₂ (37.84 cm) where only mustard oil cake is applied. T₀ produced the shortest peduncle (30.7 cm), because no fertilizers are applied here. Cowdung and chemical fertilizer produced the similar result here. Gaurav, *et al.* (2002) reported the results closely related to the findings. The interaction effects are not significant here.

![Figure 2: Length of flower stalk as influenced by (a) genotypes and (b) fertilizer treatments](image-url)
**Diameter of Flower stalk:** Diameter of flower stalk varied significantly for different cultivars, Treatments and their interaction effect on potted gerbera (Table 5). The range of flower stalk diameter was 2.46 to 1.81 cm. Among the genotypes the maximum diameter of peduncle was recorded in G5 (2.46 cm) and the minimum flower stalk recorded in G3 (1.81 cm). Similar result was reported by Uddin *et al.* (2012) for peduncle diameter range that varied from 1.0 to 2.7 cm. Variation might be occurred due to the variation of genetic expression association with the environmental factor (photoperiod).

Among various treatments, the range of flower stalk varies from 1.34 cm to 2.74 cm. The highest diameter of peduncle was 2.74 cm in T4 (organic+ inorganic) and the lowest diameter was in T0 (2.34 cm), where no fertilizer was applied. Simply, the organic fertilizer treatment, performed better than the chemical one. Gaurav *et al.* (2002) reported the closely related results for flower stalk.

In case of interaction effect, the highest diameter of peduncle was recorded 3cm from G5T4 which was statistically identical to G1T4 (3.00 cm) and G5T2 (2.90 cm). The lowest diameter (1.00cm) of peduncle was obtained from G1T0 (Table 5).

**Table 5. Effect of different genotypes and fertilizer treatments on flower stalk diameter**

| Factor     | Leaf Length | Leaf Width |
|------------|-------------|------------|
| Genotype   |             |            |
| G1         | 26.15ab     | 5.80a      |
| G2         | 22.86c      | 5.65a      |
| G3         | 26.45ab     | 5.20b      |
| G4         | 25.01bc     | 6.50b      |
| G5         | 28.40a      | 6.91b      |
| Treatment  |             |            |
| T0         | 22.55c      | 4.70d      |
| T1         | 26.65ab     | 6.25bc     |
| T2         | 26.68ab     | 6.45ab     |
| T3         | 24.59bc     | 5.70c      |
| T4         | 28.40a      | 6.96a      |
| Level of Significance | **         | **         |
| LSD Value  | 3.02        | 0.66       |
| %CV        | 11.97       | 11.18%     |
Table 6. Interaction effect of genotypes and treatments on flower stalk diameter

| Treatment Combination | Flower stalk diameter |
|-----------------------|-----------------------|
|                       | T_0                    | 1.50mn                |
|                       | T_1                    | 2.40e-h               |
| G_1                   | T_2                    | 2.70b-c               |
|                       | T_3                    | 2.10hij               |
|                       | T_4                    | 3.00ab                |
| G_2                   | T_0                    | 1.50mn                |
|                       | T_1                    | 2.30f-i               |
|                       | T_2                    | 2.55d-g               |
|                       | T_3                    | 2.00ijk               |
|                       | T_4                    | 2.80bcd               |
| G_3                   | T_0                    | 1.30no                |
|                       | T_1                    | 2.00ijk               |
|                       | T_2                    | 1.75k|lm  |
|                       | T_3                    | 1.60l|mn  |
|                       | T_4                    | 2.40efgh              |
| G_4                   | T_0                    | 1.00o                 |
|                       | T_1                    | 1.65l|mn  |
|                       | T_2                    | 1.90j|kl  |
|                       | T_3                    | 1.35n                 |
|                       | T_4                    | 2.30f-i               |
| G_5                   | T_0                    | 1.40mn                |
|                       | T_1                    | 2.60c-f               |
|                       | T_2                    | 2.90abc               |
|                       | T_3                    | 2.20g-j               |
|                       | T_4                    | 3.20a                 |
**Level of Significance**

| LSD Value | 0.3115 |
| CV (%)    | 9.04%  |

| Genotype              | Treatment                  | *=Significant at 5% level of Probability |
|-----------------------|----------------------------|----------------------------------------|
| G1= White (double)    | T0= Control                |                                        |
| G2= Yellow (double)   | T1= Cowdung                |                                        |
| G3= Light orange (single) | T2= Mustard oil cake   |                                        |
| G4= Light pink (spider) | T3= Inorganic( Urea+ TSP+MOP) |                                        |
| G5= Deep red (double) | T4= Organic+ Inorganic     |                                        |

**Flower diameter**: It has been revealed that flower size varied significantly in genotypes, treatments and between interactions. In case of genotypes, it ranged from 9.2 to 6.71 cm (Figure 3a). The highest diameter 9.2 cm was observed in genotype G5. The lowest flower size of 6.71 cm was recorded in genotype G3 which was dwarf in respect of leaf breadth. Sujatha et al., (2002) conducted an experiment with 25 genotypes of gerbera and found flower diameter varied from 12.30-6.67 cm which was at par with the present investigation and also mentioned this difference due to the genetic factors. Riaz et al. (2014) also mentioned the availability of smaller flower from dwarf variety.

In case of treatments, the highest diameter of flower was recorded from T4 (Organic+ inorganic), which is 9.34 cm. The lowest diameter of flower was obtained from T0 (7.08 cm), where no fertilizer was applied (Figure 3b). Anuje et al. (2004) evaluated different media used for gerbera cultivation and reported that the medium consisted of cocopeat and farm yard manure in a 1:1 ratio resulted the maximum values for flower diameter.

Among the interaction effect flower diameter varies from 5.40 cm to 10.20 cm. The maximum flower diameter was recorded in G3T4 (10.20 cm), which was statistically similar to G5T0 (9.80 cm). The minimum flower diameter was recorded in G3T0 (5.40 cm).

![Figure 3. Flower diameter of different (a) genotypes and (b) treatments.](http://journals.e-palli.org)
Table 7. Interaction effect of genotypes and treatments on flower diameter

| Factor       | Flower Stalk Diameter |
|--------------|-----------------------|
| Genotypes    |                       |
| G₁           | 2.34ab                |
| G₂           | 2.23 b                |
| G₃           | 1.81 c                |
| G₄           | 1.64 c                |
| G₅           | 2.46 a                |
| Treatments   |                       |
| T₀           | 1.34 d                |
| T₁           | 2.19 b                |
| T₂           | 2.36 b                |
| T₃           | 1.85 c                |
| T₄           | 2.74 a                |
| Level of Significance | **        |
| LSD Value    | 0.19                  |
| CV (%)       | 9.04%                 |

**Number of flowers per plant:** Number of flowers per plant varied significantly with Genotypes, treatments and their interaction effect were also significant. In case of genotype, the highest number of flowers per plant (32.4) was recorded from G₃ (orange flower) (Figure 4a). The lowest (20.2) was recorded from G₅ (deep red). The G₅ can be consider as a tall genotype as it was produced the maximum leaf length and breadth, while the G₃ can be considered as dwarf variety as it gave the minimum leaf breadth with the maximum number of leaves. Riaz et al. (2014) also found the maximum flowers from dwarf and the minimum flowers from tall variety while studied with zinnia.

Among the treatment effect, the highest number of flower was observed in combined fertilizertreatment (T₄) which is 30.8 and the lowest (14.4) was recorded from T₀, where no fertilizer was applied (Figure 4b). Media containing more nitrogen, phosphorus and potassium produced more number of flowers in gerbera as reported by Thangam et al. (2009). China aster (Sonawane et al., 2009; Kumar et al., 2003), zinnia and marigold (Awang and Ismail, 1997) produced more number of flowers in media containing more amount of these nutrients.
Organic + inorganic may also have contributed in improvement in physico-chemical properties, soil health, and reduced the activities of complexing agents and in turn increased uptake of nitrogen, phosphorus, potash and some other nutrients in plants (Carter et al., 1973), which increased vegetative growth and balanced C:N ratio and might have increased the synthesis of carbohydrates as well, which ultimately promotes greater yield (Adilakshmi, 2008; Younis et al., 2008) and flowering. Gaurav et al. (2002) conducted an experiment to determine the optimum levels of N, P and K fertilizers required for the flower production of gerbera (Gerbera jamesonii cv. Ornella) and found the number of flowers per plant (30.62 and 29.00) from integrated use of organic + inorganic fertilizer combination.

In case of interaction effect the highest number of flowers per plant was obtained from G₃T₄ (40). It was statistically similar to G₃T₁(37) .The lowest number of flower was obtained from G₅T₀ (11).

![Bar chart showing number of flowers influenced by different genotypes and treatments](image)

**Table 8. Interaction effect of genotypes and treatments on flower number**

| Treatment Combination | Number of Flower |
|-----------------------|------------------|
| G₁ T₀                 | 14kl             |
| G₁ T₁                 | 24ghi            |
| G₁ T₂                 | 26efg            |
| G₁ T₃                 | 22hij            |
| G₁ T₄                 | 29de             |

Figure 4. Number of flower as influenced by different (a) genotypes and (b) treatments
| Genotype | Treatment | Level of Significance |
|----------|-----------|----------------------|
| G2       | T0        | 12kl                 |
|          | T1        | 21ij                 |
|          | T2        | 24ghi                |
|          | T3        | 23g-j                |
|          | T4        | 26efg                |
| G3       | T0        | 20j                  |
|          | T1        | 37ab                 |
|          | T2        | 34bc                 |
|          | T3        | 31cd                 |
|          | T4        | 40a                  |
| G4       | T0        | 15k                  |
|          | T1        | 28def                |
|          | T2        | 31cd                 |
|          | T3        | 26efg                |
|          | T4        | 34bc                 |
| G5       | T0        | 11l                  |
|          | T1        | 20j                  |
|          | T2        | 23g-j                |
|          | T3        | 22hij                |
|          | T4        | 25fgih               |

**Level of Significance**

LSD Value 3.362

CV (%) 6.21%

**=Significant at 1% level of Probability
Vase Life: The results of different genotypes considering vase life showed significant variation (Figure 5a). Genotype G1 showed the maximum vase life (9.47 days) followed by genotypes G2 (9 days). The lowest vase life was found in genotype G4 (7.7 days). Variation in vase life among cultivars may be attributed to variations in their genetical make up. Significant difference was observed in case of treatment effect (Figure 5b). Combined use of fertilizer (T4) gives better vase life (9.33 days) than single (i.e. only organic or inorganic) use of fertilizer. Thane et al. (2007) conducted an experiment on cut flower yield and quality of G. jamesonii and recorded vase life (8.95 days) from organic and inorganic fertilizers.

The interaction effect of Genotype and Treatment showed significant result. The highest vase life was recorded from G1T4 (11 days). The lowest vase life was recorded from G4T0 (6.00) which were statically similar with G3T0 (6.33).

![Figure 5. Vase life of Gerbera as influenced by different (a) genotypes and (b) treatments](image)

| Treatment Combination | Vase Life of Flower |
|-----------------------|---------------------|
| T0                    | 8.00f               |
| T1                    | 9.33cd              |
| G1                    | T2                  | 10.0b               |
|                       | T3                  | 9.00de              |
|                       | T4                  | 11.00a              |

Table 9. Interaction effect of genotypes and treatments on vase life of flower
| Genotype | Treatment | LSD Value | CV (%) |
|----------|-----------|-----------|--------|
| G1: White (double) | T0 = Control | 0.542 | 4.01% |
| G2: Yellow (double) | T0 = Cowdung | 0.542 | 4.01% |
| G3: Light orange (single) | T0 = Mustard oil cake | 0.542 | 4.01% |
| G4: Light pink (spider) | T0 = Inorganic (Urea + TSP + MOP) | 0.542 | 4.01% |
| G5: Deep red (double) | T0 = Organic + Inorganic | 0.542 | 4.01% |

**Level of Significance**

| Level of Significance | * |
|-----------------------|---|
| LSD Value             | 0.542 |
| CV (%)                | 4.01% |

- LSD Value
- CV (%)

**Genotype**
- G1: White (double)
- G2: Yellow (double)
- G3: Light orange (single)
- G4: Light pink (spider)
- G5: Deep red (double)

**Treatment**
- T0 = Control
- T1 = Cowdung
- T2 = Mustard oil cake
- T3 = Inorganic (Urea + TSP + MOP)
- T4 = Organic + Inorganic

*Significant at 1% level of Probability*
CONCLUSIONS

From the above mentioned findings and their discussion, it may be concluded that, among the five genotypes, G3 was dwarf with maximum leaf and flower numbers. On the other hand, tall genotype G5 showed the maximum leaf length and breadth, diameter of flower stalk and produced larger flower as well. Genotype G1 showed the maximum vase life (9.47 days) followed by genotype G2 (9 days). Among the treatment, T4 performed the best compare to other treatments, where organic and inorganic fertilizers were used together in recommended amount. In case of interaction effect, G3T4 was observed to produce maximum number of leaves and flowers. The maximum diameter of peduncle and flower was recorded from G3T4. The highest vase life was recorded from G1T4 (11 days) followed by G2T4 (10 days) and G2T2 (9.67 days). For earlier and maximum flower genotype G3, for larger flower genotype G1, G2 and G5, and for long vase life genotype G1 and G2 can be suggested with organic + inorganic fertilizer combination.

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