*Original Research Article*

# Integrated Effect of Bio-Fertilizers, Organic and Inorganic Fertilizers on Flowering, Corms and Cormel Yield Attributes of Gladiolus (*Gladiolus Grandiflorus* L.) cv. Nova Lux


## ABSTRACT

An Investigation entitled **"Integrated Effect of Bio-Fertilizers, Organic and Inorganic Fertilizers on Flowering, Corms and Cormel Yield Attributes of Gladiolus (Gladiolus Grandiflorus L.) cv. Nova Lux"** was conducted at the Horticultural Research centre of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) during the year 2021-2022 in Randomized Block Design (RBD) with three replications to assess the effect of different biofertilizer. Total fourteen treatment combination $T_1$(Control), $T_2$(200 qt. FYM + 300KgN +200 Kg P2O5+200 Kg K2O/ha)(RDF), $T_3$(RDF + 30% FYM), $T_4$(RDF + 30% Vermicompost), $T_5$(70% RDF+30% FYM), $T_6$(70% RDF + 30% Vermicompost), $T_7$(75% RDF + Azospirillum), $T_8$(75% RDF+ 25% FYM + Azospirillum), $T_9$(75%RDF + 25% FYM + Azospirillum + PSB + Azotobacter), $T_{10}$(75% RDF + 25% Vermicompost + Azospirillum + PSB + Azotobacter), $T_{11}$(RDF + ZnSO4 (0.3%) + PSB, $T_{12}$(RDF + FeSO4(0.4%) + Azotobacter), $T_{13}$(RDF + ZnSO4 (0.3%) + Azotobacter + PSB + Azospririllum), $T_{14}$(RDF + FeSO4 (0.4%) + Azotobacter +PSB) and they were tried to access the vegetative, nutrition and parameter of gladiolus. Out of these, treatment T10(75% RDF + 25% Vermicompost + Azospirillum + PSB + Azotobacter)Was observed as the most superior treatment in terms of minimum days taken to 50% sprouting, plant height(cm), number of leaves per plant, length of longest leaf (cm), width of longest leaf (cm), days taken for opening of first spike, days taken to opening of florets, number of flower per plant, diameter of flower(cm), length of rachis(cm), length of spike (cm), diameter of spike(cm), longevity of spike(days), diameter of corm(cm), number of corms per plant, weight of corms, weight of corms per plant, number of cormels per plant, weight of cormels per plant(g), number of spikes per plant, number of spikes per plot, number of spikes per hectare, yield of corms per hectare, yield of cormels per hectare, yield of corms and cormels per hectare, available N,P and K and benefits: cost ratio, however, the above parameters were found minimum under control during both the years of experimentation.



*Keywords: Biofertilizers, Corms, Cormel, Yield, Organic and Inorganic Fertilizers*


## 1. Introduction

Pliny the Elder (2379 AD) first used the term "gladiolus" to refer to the blade's sword-like form (Latin word gladiolus means sword). Tetraploids from South Africa and diploid sp. from Europe are its sources. It contains basic chromosome 15 in its genetic makeup. Gladiolus are found in 260 different species. The majority of species in the genus are heteroploids, with chromosome numbers ranging from 2n = 30 to 120. (diploids, triploids, tetraploids, pentaploids, hexaploids, octaploids, and hyperaneuploids).

The Latin word gladiolus, which means "little sword," gave gladiolus flowers their name. It alludes to the plant's leaves and inflorescences, which have a sword-like form and look. Gladiolus flowers are sometimes referred to as irises or corn lilies due to their look. Additionally, a gladiolus bloom is referred to by the term xiphium. It is derived from the Greek word "sword," xiphios. Gladiolus is the name given to gladiolus flowers in commerce.

Gladiolus is a delicate herbaceous perennial that may be cultivated from both seeds and bulbs. Six to eight dry scales or sheaths, which are the bases of elder leaves created during the previous growth season, cover the bulb. The node is the location where the scale connects to the corm. The number of buds per node varies. Each bud has the capacity to develop into a shoot. The flowers are 2 cymbals with 6 funnel-shaped perianth segments and pistils. Stamens in the number of 3 are placed opposite the petals, and stamens with separate and basal filaments. The fallopian tubes are tricuspid, synchronous with the lower ovary. The fruits are 3-chambered oval 2 capsules with

winged seeds. When fully ripe, it turns brown and divides into three vertical lines. It is a significant commercial flower crop that plays a key role in domestic and international markets as a cut flower. Flowers are used in bouquets, floral arrangements, and home décor. This flower ranks second in the Netherlands and other European nations in the trade of cut flowers for bulb plants, and fourth globally in the trading of decorative plants for cut flowers. Gladiolus, a potential flowering plant, is a part of India's 200 crore rupee floriculture industries. Gladioli are estimated to grow on about 11,660 hectares (**Anonymous 2020-21**) across India.

Gladiolus blossoms are a well-known symbol of nostalgia and romantic love. A gladiolus flower also represents honour, loyalty, endurance, composure, integrity, and moral fortitude in the language of flowers. Gladiolus is a perennial floral plant that develops from structures resembling bulbs.

The consumption of traditional inorganic fertilisers can be decreased with the help of bio-fertilizers, also known as microbial inoculants. Many of them can function as bio-fertilizers because they can fix nitrogen, aid in accessing nutrients like phosphate and nitrogen from organic fertilisers and soil reserves, boost drought resistance, enhance plant health, or raise salt tolerance **(Vessey, 2003; Arora, 2013).**

## 2. MATERIALS AND METHODS

The present investigation entitled “Influence of bio-fertilizers on vegetative growth, flower quality and bulb yield of gladiolus (*Gladiolus grandiflorus* L.)” was carried out during *Rabi season* 2020-2021 at Horticulture Research Center of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh.

### 2.1 Experimental Design and Treatments

The experiment made use of the gladiolus Nova Lux cultivar. The NBRI in Lucknow provided the Nova Lux corms, which were in good health. IARI, New Delhi, is the organisation that produced Nova Lux. Three replications of the experiment were used in its Randomized Block Design layout. There are 14 different treatment combinations in each replication. With the use of a rope and measuring tape, the experimental plan was put out in the field, and the treatments were distributed as perverted randomised units in each replication. A single corm was sowed with a consistent depth of 5 to 6 cm at a spacing of 30 cm between plants and 20 cm between rows. The corms' necks were kept pointing upward toward the soil's surface. Corms were buried and then covered with earth. Inorganic fertilisers (Urea, SSP, and MOP), micronutrients (Fe and Zn), organic manures (FYM and Vermicompost), and bio-fertilizers were all included in the study's total of 14 treatments (Azotobacter, Azospirillum and PSB). The specifics of the treatment allocation are as follows: $T_1$(Control), $T_2$(200 qt. FYM + 300KgN +200 Kg P2O5+200 Kg K2O/ha)(RDF), $T_3$(RDF + 30% FYM), $T_4$(RDF + 30% Vermicompost), $T_5$(70% RDF+30% FYM), $T_6$(70% RDF + 30% Vermicompost), $T_7$(75% RDF + Azospirillum), $T_8$(75% RDF+ 25% FYM + Azospirillum), $T_9$(75%RDF + 25% FYM + Azospirillum + PSB + Azotobacter), $T_{10}$(75% RDF + 25% Vermicompost + Azospirillum + PSB + Azotobacter), $T_{11}$(RDF + ZnSO4 (0.3%) + PSB, $T_{12}$(RDF + FeSO4(0.4%) + Azotobacter), $T_{13}$(RDF + ZnSO4 (0.3%) + Azotobacter + PSB + Azospririllum), $T_{14}$(RDF + FeSO4 (0.4%) + Azotobacter +PSB). In order to properly mineralize the soil before planting corms, the complete estimated dose of farmyard manure for each treatment combination was spread as a base dose and blended in to the individual specified plots before two weeks. However, at the three and six leaf stages, soil was combined with vermicompost and bio-fertilizers such PSB, Azatobacter, and Azospirillum. The treatment combinations were followed while applying inorganic fertilisers. A basal dosage of single superphosphate and muriate of potash was administered at the time of planting. At the three and six leaf stages, the crop received a top dressing of nitrogen.

### 2.2 Attributes of Study

#### 2.2.1 Flowering Yield Attributes

##### 2.2.1.1 Number of spikes per plant

Flowering spike per corm of the selected five randomly plants was counted during the entire experimental period. The number of flowering spikes produced by selected plants and average was calculated.

##### 2.2.1.2 Number of spikes per plot

The number of spikes per plot was computed from each plot and average was worked out.

#### 2.2.1.3 Number of spikes per hectare

The number of spikes was counted from five randomly selected plants in each plot and mean values were expressed in hectare.

### 2.2.2 Corm and Cormel Attributes

#### 2.2.2.1 Diameter of corm (cm)

Diameter of corm from each plot was recorded with the help of Vernier callipers and average expressed in centimetre.

#### 2.2.2.2 Number of corms per plant

The total number of corms per plant was counted from five randomly selected plants in each plot after harvesting with suitable methods and carefully average was computed accordingly.

#### 2.2.2.3 Weight of Single corm (g)

Weight of corm from each plot was measured with the help of electronic balance and the average was worked out and expressed in gram.

#### 2.2.2.4 Weight of corms per plant (g)

Corms of five randomly selected plants of gladiolus were dug out separately after drying of leaves taken plot-wise and weight of corms per plant were taken. The average was worked out and recorded in gram unit.

#### 2.2.2.5 Number of cormels per plant

The number of cormels per plant was counted after harvesting of five randomly selected plants from each plot and the mean value worked out.

#### 2.2.2.6 Yield of corms per hectare (q/ha)

Corms should be weighted (g) from five randomly selected plants in each plot with the help of electrical balance and the weight unit is converted from grams to quintals per hectare.

#### 2.2.2.7 Yield of cormels per hectare (q/ha)

Cormels should be weighted (g) of five randomly selected plants from each plot with the help of electric balance and mean values were expressed in quintals per hectare.

#### 2.2.2.8 Yield of corms and cormels per hectare (g/ha)

Corms and cormels were weighted (g) separately from each five randomly selected plants with the help of electric balance and the average was performed in quintals per hectare.

## 3. RESULTS AND DISCUSSION

### 3.1 Flowering Yield Attributes

The number of spikes per plant ranges from 1.34 to 2.23 was revealed, respectively. The maximum spikes per plant i.e., 2.23 were recorded into the treatment T13 (RDF + $ZnSO_4$ (0.3%) + Azotobacter + PSB + Azospirillum) which in the treatment T13 (RDF + $ZnSO_4$ (0.3%) + Azotobacter + PSB + Azospirillum) significantly superior to treatment T12 (RDF+ $FeSO_4$ (0.4%) + Azotobacter) viz. (1.89), while the minimum spikes per plant 1.34 were recorded in Ti (control). The number of spikes per plot ranged from 180.76 to 305.45, respectively. The maximum number of spikes per plot (305.45) were recorded under treatment T10 (75% RDF+ 25% Vermicompost + Azospirillum + PSB + Azotobacter), whereas minimum number of spikes per plot (180.76) was noted under treatment $T_1$ (control). The maximum number of spikes per hectare 135242 was showed in the treatment T10 (75% RDF + 25 % Vermi-compost+ Azospirillum + PSB + Azotobacter), while minimum number spikes per hectare (90420) was observed under treatment T1 (control).

### 3.2 Corm and Cormel Attributes

The diameter of corm ranges from 5.67 to 6.95 cm. The maximum diameter of corm (6.95cm) was showed under treatment T10 (75% RDF + 25% Vermi-compost + Azospirillum + PSB + Azotobacter) which was statistically higher than treatment $T_14$ (RDF + FeSO4 (0.4%) + Azotobacter + PSB) viz. (6.40 cm) during year of investigation. However, the minimum diameter of corm (5.67 cm) was observed in control. The maximum number of corms per plant recorded (2.45) in T10 (75% RDF + 25% Vermi-compost + Azospirillum + PSB + Azotobacter) during the year of investigation. The minimum number of coms per plant (1.35) were recorded with $T_1$ (control). the maximum weight of corm was recorded range of 57.36 g to 69.78 g at final harvest, respectively. The maximum weight of corm (69.78 g) was noted with an application of treatment T10 (75% RDF + 25% Vermi-compost + Azospirillum + PSB + Azotobacter) which was significantly higher than T9 (75% RDF + 25% FYM + Azospirillum + PSB + Azotobacter) viz. (67.87 g). The control plants, however, had the minimum (57.36 g). The weight of corms per plant varied from 44.07 to 71.89 g. Among the treatments applied in the experimental plot, the maximum weight of corms per plant (71.89 g) was recorded with T10 (75% Vermi-compost + Azospirillum + PSB + Azotobacter) which was followed by treatment T9 (75% RDF + 25% FYM + Azospirillum + PSB + Azotobacter) viz. (68.44g). In the case has given the minimum weight of corms per plant (44.07 g) observed under control treatment. Treatment T13 (75 RDF + ZnSO4 (0.3%) + Azotobacter+ PSB+ Azospirillum) had highest value for number of cormels per plant i.e., 54.93 and statistically at par with treatment T14 (RDF + FeSO4 (0.4%) +Azotobacter + PSB) viz. 53.65. While the minimum number of cormels per plant (31.56) was recorded under treatment $T_1$ (control). The yield of corms per hectare varied from74.10 q/ha to 91.52 q/ha . The maximum yield of corms per hectare (91.52 q/ha) was noted in treatment T10 (75% RDF + 25% Vermi-compost + Azospirillum + PSB + Azotobacter) which was statistically at par with treatment T13 (RDF + ZnSO4 (0.3%) + Azotobacter + PSB + Azospirillum) viz. (88.69 q/ha), while the minimum corm yield (74.10 q/ha) was observed under treatment T1 (control). The yield of cormels per hectare ranges from 38.45 q/ha to 68.41 q/ha. The maximum yield of cormels per hectare (68.41 q/ha) was record in treatment T10 (75% RDF + 25% Vermi-compost + Azospirillum + PSB + Azotobacter) viz. (65.78 q/ha) was noticed under treatment T9 (75 % RDF+ 25% FYM+ Azospirillum + PSB + Azotobacter), while the minimum yield of cormels per hectare (38.45 q/ha) was reported under T1 (control). the yield of corms and cormels per hectare ranges from 106.67 q/ha to 146.34 q/ha. The maximum yield of corms and cormels per hectare (146.34 q/ha) was recorded in treatment T10 (75% RDF + 25% Vermi-compost + Azospirillum + PSB + Azotobacter) which was statistically at par with treatment T12 (RDF + FeSO4 (0.4%) + Azotobacter) viz. (142.45 q/ha), while the minimum yield of corms and cormels per hectare (106.67 q/ha) was reported under treatment $T_1$ (control)

**Table 1. Integrated Effect of Bio-Fertilizers, Organic and Chemical Fertilizers on Flowering and Quality Attributes of Gladiolus (*Gladiolus Grandiflorus* L.) cv. Nova Lux**

| Sr. No. | Notation | Treatment | Flowering Yield Attributes | | | Corm and Cormel Attributes | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | No. of spikes per plant | No. of spikes per plot | No. of spikes per hectare | Diameter of corm (cm) | No. of corms per plant | No. of cormels per plant | Weight of corms per plant (g) | Weight of Single corm (g) | Yield of corms per hectare (q/ha) | Yield of cormels per hectare (q/ha) | Yield of corms and cormels per Hectare (g/ha) |
| **1.** | **T1** | Control | 1.34 | 180.76 | 90420 | 5.67 | 1.35 | 31.56 | 44.07 | 57.36 | 74.10 | 38.45 | 106.67 |
| **2.** | **T2** | 200 qt. FYM+300KgN+200KgP2O5+200KgK2O/ha (RDF) | 1.56 | 208.24 | 104120 | 5.56 | 1.56 | 35.98 | 51.56 | 59.65 | 76.75 | 43.24 | 114.57 |
| **3.** | **T3** | RDF+ 30%FYM | 1.65 | 237.47 | 111145 | 6.97 | 1.56 | 41.48 | 54.98 | 59.68 | 78.98 | 48.34 | 117.76 |
| **4.** | **T4** | RDF+ 30%Vermicompost | 1.37 | 252.09 | 118735 | 6.45 | 1.87 | 42.78 | 54.98 | 61.85 | 79.98 | 50.13 | 122.87 |
| **5.** | **T5** | 70%RDF+30%FYM | 1.28 | 235.67 | 126040 | 6.21 | 1.56 | 42.45 | 55.44 | 61.87 | 80.34 | 52.67 | 123.56 |
| **6.** | **T6** | 70% RDF+ 30% Vermicompost | 1.67 | 251.65 | 117820 | 6.04 | 1.87 | 46.97 | 56.74 | 62.56 | 81.65 | 51.67 | 122.45 |
| **7.** | **T7** | 75% RDF+ Azospirillum | 1.89 | 259.67 | 125838 | 6.73 | 1.45 | 45.71 | 57.55 | 62.56 | 83.87 | 56.78 | 126.56 |
| **8.** | **T8** | 75%RDF+ 25%FYM + Azospirillum | 1.85 | 250.54 | 127514 | 6.56 | 1.45 | 46.18 | 64.51 | 61.45 | 81.18 | 55.67 | 131.90 |
| **9.** | **T9** | 75%RDF+25%FYM+Azospirillum+PSB+ Azotobacter | 1.65 | 285.40 | 132206 | 6.76 | 2.35 | 50.45 | 68.44 | 67.87 | 89.50 | 65.78 | 133.67 |
| **10.** | **T10** | 75%RDF+25%Vermicompost+ Azospirillum+PSB+ Azotobacter | 1.56 | 305.45 | 132242 | 6.95 | 2.45 | 45.35 | 71.89 | 69.78 | 91.52 | 68.41 | 146.34 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **11.** | **T11** | RDF+ZnSO4(0.3%) + PSB | 1.67 | 235.32 | 124445 | 5.67 | 1.78 | 49.04 | 59.33 | 60.65 | 78.90 | 55.87 | 124.34 |
| **12.** | **T12** | RDF+FeSO4(0.4%) + Azotobacter | 1.89 | 225.40 | 115678 | 6.10 | 1.88 | 53.45 | 62.44 | 60.06 | 86.98 | 60.87 | 142.45 |
| **13.** | **T13** | RDF+ZnSO4 (0.3%) + Azotobacter +PSB+ Azospririllum | 2.23 | 274.50 | 130256 | 6.55 | 2.10 | 54.93 | 66.45 | 66.95 | 88.69 | 54.78 | 129.53 |
| **14.** | **T14** | RDF+FeSO4 (0.4%) +Azotobacter +PSB | 1.56 | 260.50 | 129664 | 6.40 | 2.00 | 53.65 | 65.04 | 63.45 | 87.78 | 61.76 | 128.45 |
| **SE(m)** | | | 0.03 | 3.96 | 1545 | 0.06 | 0.01 | 0.33 | 0.57 | 0.63 | 1.62 | 0.93 | 2.46 |
| **C.D. At 5%** | | | 0.08 | 11.58 | 4517 | 0.16 | 0.04 | 0.96 | 1.66 | 1.85 | 4.75 | 2.73 | 7.20 |
| **C.V. (%)** | | | 2.99 | 2.77 | 2.22 | 1.53 | 1.36 | 1.24 | 1.66 | 1.75 | 3.39 | 2.96 | 3.37 |

## Conclusion

Based upon the results recorded in the investigation it could be concluded that the treatment $T_{10}$ (75 % RDF + 25% Vermicompost + Azospirillum + PSB + Azotobacter), was found best treatment with reference to flowering and quality attributes in gladiolus cv. Nova lux as compared to control and other treatments. In order to achieve the highest yield and better quality for the commercial cultivation of gladiolus crop, it is advised to apply a combination of chemical fertilisers, organic manure, micronutrients, and bio-fertilizers, i.e., treatment T10(75 percent RDF + 25 percent Vermicompost + Azospirillum + PSB + Azotobacter).

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