

## Response of GA<sub>3</sub> and corm division on floral attributes of gladiolus

### ABSTRACT

This A-study was conducted to assess the response of GA<sub>3</sub> and corm division on floral attributes of gladiolus cv. Punjab Dawn at Horticulture Research Farm of Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, India during two consecutive year (2017-2019). The treatments comprised of growth regulators with two concentration i.e. GA<sub>3</sub> 100 ppm and 200 ppm including control (distilled water) and corms which are cut having 1bud, 2 bud and 3 bud and whole having 4 bud, 5 bud and 6 bud. The experiment was laid out in Randomized Block Design and three replications. The flowering characteristics of Gladiolus are mainly affected by higher concentration of GA<sub>3</sub> (200 ppm) as well as whole corm under natural climatic condition. Regarding flowering parameters, it was found that GA<sub>3</sub> 200 ppm and whole corm i.e. 4 bud, 5 bud and 6 bud influence the quality and quantity parameters, viz. days to spike emergence, days to colour show, days to opening of florets, days to open florets without withering of basal floret, number of florets per spike, longevity of spike, length of spike and rachis (cm) and diameter of florets (cm) as compared to other treatments....

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**Keywords:** Corm, Growth regulators, GA<sub>3</sub>, Florets and Spike

### 1. INTRODUCTION

Gladiolus occupies a prestigious position among the bulbous cut flower. ~~Gladiolus name is derived from latin word 'gladius' which means sword and hence it is~~ commonly known as 'sword lily' because of the shape of its foliage [1] with beautiful spikes having brilliant colours of florets and different sizes [1].- It is an herbaceous perennial plant belonging the family Iridaceae. It is not only grown for cut flower but also for corms as propagating material ~~and -It is~~ commercially grown in West Bengal, Himachal Pradesh, Sikkim, Karnataka, Tamil Nadu, Punjab, Delhi, Jammu-Kashmir, Andhra Pradesh and Gujarat and also for market purpose of Lucknow, Meerut, Ghaziabad and Varanasi district of Uttar Pradesh (...). Flower growers of Uttar Pradesh region are growing gladiolus commercially due to its easy cultivation and get profit through their marketing.

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The uses of plant growth regulators has now became very popular in many ornamental plants including gladiolus for manipulating the vegetative and floral attributes in field as well as postharvest condition. It helps in modulating physio--morphological traits of plants even if used in very small concentrations (...). The application methods of Plant Growth Regulators (PGRs) include foliar application, pre-soaking, drenching, etc. Pre-planting soaking of corms in growth regulators ~~havehas~~ great potential in improving growth, quality and yield of flowers (...). Gibberellin has ~~many-a~~ regulatory impact on plant growth and development ~~by-#~~ ~~inducinged~~ floral parameters such as spike length, rachis length, and floral diameter and also hastened flowering [2, 3]. Therefore, the main purpose of this experiment work was to enhance quality and quantity of flowers to fulfil the domestic as well as global demand. Hence, an experiment was conducted to study the "Response of Gibberellic AcidGA<sub>3</sub> and corm division on floral attributes of gladiolus".

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### 2. MATERIALS AND METHODS

#### Study site

An experiment on "Response of Gibberellic Acid (GA<sub>3</sub>) and corm division on floral attributes in gladiolus cv. Punjab Dawn" was conducted at Horticulture Research Farm of Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, India during two successive year (2017-2019). The soil condition of this region is alluvial, well-drained and moderately

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fertile with low organic carbon, available nitrogen, and medium in available phosphorus and potassium. During the investigation, the temperature ranged in day time was 15°C-38.5°C and 6 °C-23 °C during night hour.

#### Sampling and protocol

There were two factors in this study, first was corm (cut as well as whole corm with different number of buds) and second was treatment of GA<sub>3</sub> (100 ppm and 200 ppm) and control (distilled water). Healthy and average size of corms were selected, scales of corms were removed to find out number of buds in corms and then radial cuts according to number of buds with sharp knife or secateurs.

Cut corms have 1 to 3 buds and whole corms with 4 to 6 buds that used for planting and treatment of corms with GA<sub>3</sub> 100 ppm, 200 ppm and controlled in distilled water before planting.

Dipping of corms in different concentration of GA<sub>3</sub> solution for 24 hours including control (distilled water) and next day treated corms were ready for planting.

#### Experimentation

Experimental plot were opened and prepared by several ploughings to obtained good field condition having proper drainage of water. The basal doses of manures and fertilizers were applied during final field preparation and remaining doses were applied during growth period. The trial was laid out in a Randomized Block Design (RBD) with 18 treatments having three replications. There were 54 (18m×3m) unit plots and size of each unit plot was 1.2m×1 m and distance between the block was 0.5 m.

#### Data analysis

Data were recorded in respect of the following parameters such as early days to spike emergence, colour show, opening of florets, open florets without withering of basal floret, number of florets per spike, longevity of spike, length of spike (cm) and rachis (cm) and diameter of florets (cm) at regular interval for two successive years 2017-2018 and 2018- 2019. The mean values of all the parameters were statistically analysed by adopting the standard procedures of Gomez and Gomez [4] at 5 % level of significance.

### 3. RESULTS AND DISCUSSION

#### Effect of GA<sub>3</sub> and corm division on days to spike emergence and colour show

Various flowering parameters were influenced significantly due to treatment of GA<sub>3</sub> as well as corm section (whole and cut) at different levels. ~~The data on days to spike emergence and colour show were recorded in the Table 1.~~ Early days to spike emergence was reported in the 5<sup>th</sup> bud showed early spike emergence (71.05 days) followed by 4<sup>th</sup> bud and 6<sup>th</sup> bud. In respect of GA<sub>3</sub> treatment, GA<sub>3</sub> (100 ppm) showed early spike emergence (72.73 days) which was at par with GA<sub>3</sub> 200 ppm (73.03) and control exhibited minimum days (78.39 days) to spike emergence (table 1).

#### Statistical analysis.....

Neetu *et al.* [5], Devadanam *et al.* [6] also noticed that higher concentration of GA<sub>3</sub> influenced early initiation of spike in gladiolus. ~~On the other hand, and~~ Bharti *et al.* [7] observed that early spike emergence was influenced by the size of corm (whole corm).

In respect of days to colour show, early days to colour was observed in 5<sup>th</sup> bud (84.29) and late in single bud (78.63) of corm. In context of treatment of GA<sub>3</sub> 200 ppm showed minimum days to colour show (84.94 days) and combine effect of treatment of GA<sub>3</sub> and corm division showed that minimum days to colour showed was observed in 4<sup>th</sup> bud and 200 ppm GA<sub>3</sub> (81.28 days) which was significantly higher than other treatment combination during experimentation. Statistical analysis..... Similar observation has also been made by Parween *et al.* [8] in gladiolus and Kapri *et al.* [9] in lily.

**Table 1: Effect of GA<sub>3</sub> and corm division on days to spike emergence and colour show**

| No. of buds | Spike Emergence     |     |     |      | Colour show         |     |     |      |
|-------------|---------------------|-----|-----|------|---------------------|-----|-----|------|
|             | GA <sub>3</sub> ppm |     |     |      | GA <sub>3</sub> ppm |     |     |      |
|             | 0                   | 100 | 200 | Mean | 0                   | 100 | 200 | Mean |
|             |                     |     |     |      |                     |     |     |      |

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|--------------|-------|-------|-----------------|------------------------|-------|-------|-----------------|------------------------|
| 1 bud        | 85.67 | 74.09 | 76.14           | 78.63                  | 94.61 | 88.33 | 89.23           | 90.72                  |
| 2 bud        | 79.93 | 76.23 | 73.38           | 76.51                  | 92.73 | 85.95 | 84.23           | 87.63                  |
| 3 bud        | 78.68 | 75.57 | 73.55           | 75.93                  | 90.03 | 85.81 | 88.09           | 87.97                  |
| 4 bud        | 71.41 | 71.91 | 72.07           | 71.79                  | 88.57 | 83.60 | 81.28           | 84.48                  |
| 5 bud        | 77.54 | 65.20 | 70.40           | 71.05                  | 84.36 | 84.41 | 84.10           | 84.29                  |
| 6 bud        | 77.11 | 73.39 | 72.67           | 74.39                  | 87.00 | 83.83 | 82.74           | 84.52                  |
| Mean         | 78.39 | 72.73 | 73.03           |                        | 89.55 | 85.32 | 84.94           |                        |
| Factors      |       | Buds  | GA <sub>3</sub> | Buds × GA <sub>3</sub> |       | Buds  | GA <sub>3</sub> | Buds × GA <sub>3</sub> |
| C.D.(P=0.05) |       | 2.03  | 1.015           | 6.09                   |       | 0.825 | 0.415           | 2.48                   |

### Effect of GA<sub>3</sub> and corm division on days to opening of florets

The data on number of days to opening of first floret, third floret and fifth floret open were observed in the Table 2. ~~In case of~~For the first floret, early opening of floret was observed in 6<sup>th</sup> bud (90.89 days) and 200 ppm GA<sub>3</sub> (90.94 days) and interaction between treatment of GA<sub>3</sub> and corm division, minimum days to full blooming was reported- in the 6<sup>th</sup> bud and 100 ppm GA<sub>3</sub> (89.01). In respect of third floret, early blooming was observed in the 6<sup>th</sup> bud (92.07 days) and in GA<sub>3</sub> treatment, minimum days to third floret blooming was reported with 200 ppm GA<sub>3</sub> (91.76 days). ~~in context of treatment combination of GA<sub>3</sub> and corm division, e~~Early blooming of third floret was observed in the 4<sup>th</sup> bud and 200 ppm GA<sub>3</sub> (89.69 days) ~~treated by GA<sub>3</sub> and corm division.~~ Early days to full bloom of fifth floret was observed in the 6<sup>th</sup> bud (94.08 days) and in treatment of 200 ppm GA<sub>3</sub> (94.28 days) and interaction of treatment showed early blooming of floret in 6<sup>th</sup> bud and 200 ppm GA<sub>3</sub> (91.64 days). Statistical analysis .... These findings are in agreement with the observations made by Dogra *et al.* [10] and Asil *et al.* [11] in gladiolus.

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Table 2: Effect of GA<sub>3</sub> and corm division on days to opening of florets

| No. of buds | Opening of First florets |       |                 |                       | Opening of Third florets |       |                 |                       | Opening of Fifth florets |       |                 |                       |
|-------------|--------------------------|-------|-----------------|-----------------------|--------------------------|-------|-----------------|-----------------------|--------------------------|-------|-----------------|-----------------------|
|             | GA <sub>3</sub> ppm      |       |                 |                       | GA <sub>3</sub> ppm      |       |                 |                       | GA <sub>3</sub> ppm      |       |                 |                       |
|             | 0                        | 100   | 200             | Mean                  | 0                        | 100   | 200             | Mean                  | 0                        | 100   | 200             | Mean                  |
| 1 bud       | 99.85                    | 93.11 | 94.42           | 95.79                 | 101.8                    | 93.17 | 95.95           | 97.00                 | 102.9                    | 94.46 | 97.65           | 98.35                 |
| 2 bud       | 95.16                    | 91.74 | 91.92           | 92.94                 | 97.95                    | 92.92 | 93.00           | 94.62                 | 99.95                    | 94.97 | 95.53           | 96.82                 |
| 3 bud       | 96.74                    | 92.31 | 89.61           | 92.88                 | 98.82                    | 93.56 | 91.38           | 94.58                 | 98.74                    | 97.22 | 93.86           | 96.61                 |
| 4 bud       | 94.46                    | 91.44 | 87.59           | 91.16                 | 95.74                    | 92.66 | 89.69           | 92.69                 | 95.32                    | 94.42 | 93.88           | 94.54                 |
| 5 bud       | 93.21                    | 91.53 | 91.31           | 92.02                 | 91.99                    | 94.53 | 89.78           | 92.10                 | 97.20                    | 94.06 | 93.14           | 94.80                 |
| 6 bud       | 92.87                    | 89.01 | 90.80           | 90.89                 | 94.67                    | 90.73 | 90.80           | 92.07                 | 98.15                    | 92.46 | 91.64           | 94.08                 |
| Mean        | 95.38                    | 91.52 | 90.94           |                       | 96.84                    | 92.93 | 91.76           |                       | 98.72                    | 94.60 | 94.28           |                       |
| Factors     |                          | Bud   | GA <sub>3</sub> | Bud × GA <sub>3</sub> |                          | Bud   | GA <sub>3</sub> | Bud × GA <sub>3</sub> |                          | Bud   | GA <sub>3</sub> | Bud × GA <sub>3</sub> |
| C.D. P=0.05 |                          | 0.86  | 0.43            | 2.59                  |                          | 2.56  | 1.14            | 2.30                  |                          | 0.78  | 0.39            | 2.34                  |

### Effect of GA<sub>3</sub> and corm division on days to open florets without withering of basal floret, number of florets per spike and longevity of spike

The data presented in Table 3 revealed that there was significant effect of corm division and GA<sub>3</sub> on the number of open florets without withering of floret per spike, number of florets per spike and longevity of spike. Maximum number of open florets without withering basal floret was recorded

with 6 bud (5.04) followed by and treatment of 200 ppm GA<sub>3</sub> (4.62) and combine effect of treatment i.e. 5 bud and 200 ppm GA<sub>3</sub> (5.12) exhibited maximum number of florets opening without withering of basal floret. Maximum number of florets per spike was recorded in 5 bud (12.91) followed by 6 bud (11.83) and 4 bud (11.09) and in context of GA<sub>3</sub> treatment, maximum number of florets per spike was observed in 200 ppm GA<sub>3</sub> (11.39). Treatment combination of GA<sub>3</sub> and corm division exhibited that maximum number of florets per spike was observed in 5 bud and 100 ppm GA<sub>3</sub> (12.83) and minimum was observed in 2 bud and control (9.37). Maximum number of floret per spike was also observed in GA<sub>3</sub> treated whole corm which might have higher food reserve in compared to small corms [12, 13] and GA<sub>3</sub> application that increase the number of leaves per plant and leaf size which might have enhanced the production of photosynthates that are necessary to enhance the reproductive growth [14]. Similar results are in line with the findings of Sudhakar and Kumar [15], Sarkar *et al.* [16] and Mahasen *et al.* [17] in gladiolus. Maximum longevity of spike was recorded in 6 bud [13.76] and in respect of gibberellins treatment, GA<sub>3</sub> 200 ppm (12.74) influence the spike longevity as well as freshness of florets. In combined effect of treatment, maximum longevity of spike was observed in 6 bud and 100 ppm GA<sub>3</sub> (14.47). The findings confirm the result of Reshma *et al.* [18] in gladiolus and Yadav *et al.* [19] in marigold. In study, length of spike and rachis was significantly influenced by various treatment of corm division as well as GA<sub>3</sub>.

**Table 3: Effect of GA<sub>3</sub> and corm division on days to open florets without withering of basal floret, number of florets per spike and longevity of spike**

| No. of buds   | Open florets without withering of basal floret |      |                 |                      | Number of florets per spike |       |                 |                      | Longevity of spike  |       |                 |                      |
|---------------|--|------|-----------------|----------------------|-----------------------------|-------|-----------------|----------------------|---------------------|-------|-----------------|----------------------|
|               | GA <sub>3</sub> ppm                            |      |                 |                      | GA <sub>3</sub> ppm         |       |                 |                      | GA <sub>3</sub> ppm |       |                 |                      |
|               | 0  | 100  | 200             | Mean                 | 0                           | 100   | 200             | Mean                 | 0                   | 100   | 200             | Mean                 |
| 1 bud         | 4.08   | 4.00 | 3.98            | 4.02                 | 9.93                        | 9.47  | 10.40           | 9.93                 | 11.27               | 11.64 | 11.00           | 11.30                |
| 2 bud         | 4.31   | 4.77 | 4.61            | 4.56                 | 9.37                        | 10.60 | 9.84            | 9.94                 | 11.14               | 11.92 | 11.18           | 11.41                |
| 3 bud         | 4.58   | 3.75 | 4.59            | 4.31                 | 9.90                        | 10.15 | 11.68           | 10.57                | 11.24               | 11.99 | 13.14           | 12.12                |
| 4 bud         | 3.92   | 4.58 | 4.67            | 4.39                 | 10.92                       | 11.19 | 11.16           | 11.09                | 13.29               | 12.98 | 13.60           | 13.29                |
| 5 bud         | 4.42   | 4.34 | 4.75            | 4.50                 | 13.25                       | 12.83 | 12.66           | 12.91                | 13.40               | 12.52 | 14.28           | 13.40                |
| 6 bud         | 5.00   | 5.00 | 5.12            | 5.04                 | 11.27                       | 11.58 | 12.64           | 11.83                | 13.53               | 14.47 | 13.28           | 13.76                |
| Mean          | 4.38   | 4.41 | 4.62            |                      | 10.77                       | 10.97 | 11.39           |                      | 12.31               | 12.58 | 12.74           |                      |
| Factors       |  | Bud  | GA <sub>3</sub> | Budx GA <sub>3</sub> |                             | Bud   | GA <sub>3</sub> | Budx GA <sub>3</sub> |                     | Bud   | GA <sub>3</sub> | Budx GA <sub>3</sub> |
| C.D. (P=0.05) |  | 0.20 | 0.09            | 0.60                 |                             | 0.46  | 0.23            | 1.38                 |                     | 0.57  | 0.23            | 1.70                 |

#### Effect of GA<sub>3</sub> and corm division on spike and rachis lengths

A brief look into Table 4 reveals that maximum length of spike was observed in 4 bud (54.59 cm) and 200 ppm GA<sub>3</sub> (50.96 cm) and in treatment interaction of 4 bud and 200 ppm GA<sub>3</sub> (57.24 cm). Maximum length of rachis was observed in 4 bud (31.55 cm) which was statistically at par with 5 bud (31.23) and 6 bud (31.15) and in respect of GA<sub>3</sub>, length of rachis (32.09 cm) increased with 200 ppm GA<sub>3</sub>. Combine effect of treatment significantly influenced length of rachis i.e. 4 bud and 200 ppm GA<sub>3</sub> (33.79 cm). Gibberellin has virtue of cell elongation and influencing photosynthetic activity which might have promote good length of spikes of gladiolus [20]. These findings can be correlated with Nag *et al.* [21] in gladiolus and Ali *et al.* [22] in tuberose.

**Table 4 . Effect of GA<sub>3</sub> and corm division on spike and rachis lengths (cm)**

| No. of buds | Spike length (cm)   |  | Rachis length (cm)  |  |
|-------------|---------------------|--|---------------------|--|
|             | GA <sub>3</sub> ppm |  | GA <sub>3</sub> ppm |  |
|             |                     |  |                     |  |

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|               | 0     | 100   | 200             | Mean                  | 0     | 100   | 200             | Mean                  |
|---------------|-------|-------|-----------------|-----------------------|-------|-------|-----------------|-----------------------|
| 1 bud         | 47.46 | 49.02 | 51.70           | 49.39                 | 29.90 | 29.88 | 32.08           | 30.62                 |
| 2 bud         | 49.42 | 46.96 | 47.78           | 48.05                 | 31.87 | 29.18 | 29.15           | 30.06                 |
| 3 bud         | 45.28 | 44.92 | 47.25           | 45.82                 | 28.63 | 28.39 | 30.93           | 29.31                 |
| 4 bud         | 51.28 | 55.25 | 57.24           | 54.59                 | 31.58 | 29.28 | 33.79           | 31.55                 |
| 5 bud         | 46.49 | 48.77 | 53.81           | 49.69                 | 29.91 | 30.24 | 33.54           | 31.23                 |
| 6 bud         | 45.89 | 55.78 | 47.97           | 49.88                 | 29.21 | 31.22 | 33.04           | 31.15                 |
| Mean          | 47.63 | 50.12 | 50.96           |                       | 30.18 | 29.69 | 32.09           |                       |
| Factors       |       | Bud   | GA <sub>3</sub> | Bud × GA <sub>3</sub> |       | Bud   | GA <sub>3</sub> | Bud × GA <sub>3</sub> |
| C.D. (P=0.05) |       | 1.64  | 0.82            | 4.93                  |       | 1.20  | 0.60            | 0.36                  |

**Effect of GA<sub>3</sub> and corm division on diameter of first, third and fifth florets Table 4: Effect of GA<sub>3</sub> and corm division to length (cm) of spike and rachis**

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Data pertaining to the flower diameter studies revealed a significant difference on diameter of first, third and fifth florets owing to various treatments of GA<sub>3</sub> and corm division. The maximum diameter of first, third and fifth floret was observed with 4 bud (9.63 cm, 9.45 cm and 9.20 cm) and higher concentration of GA<sub>3</sub> (9.42 cm, 9.09 cm and 8.89 cm) than control and in respect of treatment combination, maximum diameter of fifth floret was reported with 6 bud and 200 ppm GA<sub>3</sub> (9.78 cm), in context of third and fifth floret, maximum diameter was noted with 4 bud and 200 ppm GA<sub>3</sub> (9.64 cm and 9.47cm) and found significant to other treatments (Table 5). Similar observation has also been agreed with Neetu and Kumar [23] and Chaudhray et al. [24] in gladiolus and Maurya *et al.* [25] in china aster.

**Table 5: Effect of GA<sub>3</sub> and corm division on diameter (cm) of first, third and fifth florets**

| No. of buds   | Diameter of first florets (cm) |      |                 |                        | Diameter of third florets (cm) |      |                 |                        | Diameter of fifth florets (cm) |      |                 |                        |
|---------------|--------------------------------|------|-----------------|------------------------|--------------------------------|------|-----------------|------------------------|--------------------------------|------|-----------------|------------------------|
|               | GA <sub>3</sub> ppm            |      |                 |                        | GA <sub>3</sub> ppm            |      |                 |                        | GA <sub>3</sub> ppm            |      |                 |                        |
|               | 0                              | 100  | 200             | Mean                   | 0                              | 100  | 200             | Mean                   | 0                              | 100  | 200             | Mean                   |
| 1 bud         | 9.07                           | 8.73 | 9.20            | 9.00                   | 8.95                           | 8.74 | 8.80            | 8.83                   | 8.31                           | 8.40 | 8.99            | 8.57                   |
| 2 bud         | 9.50                           | 8.53 | 9.19            | 9.07                   | 9.06                           | 8.75 | 8.74            | 8.85                   | 8.36                           | 8.27 | 8.35            | 8.33                   |
| 3 bud         | 8.63                           | 9.19 | 9.27            | 9.03                   | 8.44                           | 8.79 | 9.03            | 8.75                   | 8.45                           | 8.68 | 9.26            | 8.79                   |
| 4 bud         | 9.73                           | 9.68 | 9.47            | 9.63                   | 9.14                           | 9.57 | 9.64            | 9.45                   | 8.88                           | 9.25 | 9.47            | 9.20                   |
| 5 bud         | 9.05                           | 9.17 | 9.62            | 9.28                   | 9.10                           | 8.92 | 9.28            | 9.10                   | 9.18                           | 9.30 | 8.72            | 9.06                   |
| 6 bud         | 9.35                           | 8.66 | 9.78            | 9.26                   | 8.55                           | 8.97 | 9.06            | 8.86                   | 8.78                           | 9.43 | 8.43            | 8.88                   |
| Mean          | 9.22                           | 8.99 | 9.42            |                        | 8.87                           | 8.95 | 9.09            |                        | 8.66                           | 8.89 | 8.87            |                        |
| Factors       |                                | Buds | GA <sub>3</sub> | Buds × GA <sub>3</sub> | Factor                         | Buds | GA <sub>3</sub> | Buds × GA <sub>3</sub> | Factor                         | Buds | GA <sub>3</sub> | Buds × GA <sub>3</sub> |
| C.D. (P=0.05) |                                | 0.28 | 0.15            | 0.84                   |                                | 0.22 | 0.11            | 0.68                   |                                | 0.18 | 0.09            | 0.51                   |

#### 4. CONCLUSION

Present observation demonstrated that treatment of higher concentration of GA<sub>3</sub> (pre-soaking) and whole corm showed positive correlation with most of the observation which would improve market desirable characteristics of gladiolus.

## REFERENCES

1. Singh AK, Kumar, Anuj, Ghimire NR. Studies of gladiolus cultivars for post-harvest characters. *Environment and Ecology*. 2013;31(2): 418-421
2. Sudhakar M, Kumar SR. Effect of growth regulators on growth, flowering and corm production of gladiolus (*Gladiolus grandiflorus* L.) cv. White Friendship. *Indian Journal of Plant Sciences*. 2012; 1(2-3): 133-136.
3. Sweetey R, Singh UC, Ichancha M. Efficacy of foliar spray of IAA, GA<sub>3</sub> and daminozide on growth and flowering of gladiolus (*Gladiolus grandiflorus* L.) cv. Oscar. *The Pharma Innovation Journal*. 2019;8(7): 287-289.
4. Gomez KA, Gomez AA. *Statistical procedures for agricultural research*. pp 20-8. 2nd Ed. John Wiley and Sons, New York;1984.
5. Neetu, Singh AK, Kumar R. Effect of different concentrations of GA<sub>3</sub> and varieties on growth and flowering of gladiolus. *Progressive Research*.2013;8(2):263-265.
6. Devadanam A, Sable PB, Shinde BN, Haldewad AM. Effect of foliar spray of plant growth regulators on growth and yield of tuberose (*Polianthes tuberosa* L.). *Journal of Maharashtra Agricultural Universities*. 2007;32(2):282-283.
7. Bharti, S, Fatmi, U and Singh D. Suitability of cut corms as planting material on flowering, corm and cormel production in gladiolus (*Gladiolus grandiflorus* L.) varieties. *International Journal of Current Microbial Applied Science*. 2017; 6(8): 2935-2939.
8. Parween N, Mishra S, Adil A, Pal A, Jha KK. Effect of GA<sub>3</sub> on reproductive growth and cormel production of gladiolus. *International Journal of Current Microbiology and Applied Sciences*. 2019;8(6):1739-1750.
9. Kapri M, Singh AK, Sisodia A, Padhi M. Influence of GA<sub>3</sub> and BA (Benzyladenine) on flowering and post-harvest parameters in lily. *Journal of Pharmacognosy and Phytochemistry*. 2018;7(3):1916-1918.
10. Dogra S, Pandey RK, Bhat DJ. Influence of gibberellic acid and plant geometry on growth, flowering and corm production in gladiolus (*Gladiolus grandiflorus*) under Jammu agroclimate. *International Journal of Pharma and Bio Sciences*. 2012;3(4): 1083-1090.
11. Asil MH, Roiein Z, Abbasi J. Response of tuberose (*Polianthes tuberosa* L.) to gibberellic acid and benzyladenine. *Horticulture, Environment, and Biotechnology*. 2011; 52(1): 46.
12. Laishram N, Hatibarua P. Effect of corm splitting and GA<sub>3</sub> application on growth and flowering of gladiolus cv. 'Pusa Jyotsna'. *Annals of Horticulture*. 2013; 6(2): 383-388.
13. Rashid MHA. Influence of size and plant growth regulators on corm and cormel production of gladiolus (*Gladiolus grandiflorus* L.). *Progressive Agriculture*. 2018;29(2):91-98.
14. Siraj YS, Al-Safar MS. Effect of GA treatment and nitrogen on growth and development of gladiolus corms. *Pakistan Journal of Botany*. 2006;9: 2516-2519.
15. Sudhakar M, Kumar SR. Effect of growth regulators on growth, flowering and corm production of gladiolus (*Gladiolus grandiflorus* L.) cv. White Friendship. *Indian Journal of Plant Sciences*. 2012;1(2-3):133-136.
16. Sarkar I, Chakraborty S. Varietal performances on important floral attributes of 15 indigenous and exotic varieties of gladiolus in North Eastern Himalayan Region. *Journal of Agricultural Science and Technology*. 2014;1(1):80-85.
17. Mahasen M, Onaa AF, Taufiquea T, Mehrajb H, Uddina AJ. Suitability of cut corm as planting materials on flowering and corm-cormel production of gladiolus cultivars. *Journal of Bioscience and Agriculture Research*. 2015; 4(01): 10-19.

18. Reshma VS, Panchbhai DM, Kumar P, Adarsh MN. Effect of GA<sub>3</sub> spray on gladiolus (*Gladiolus* spp.) varieties under dry conditions of Vidharba Region. International Journal of Pure and Applied Bioscience. 2017;5(3):123-129.
19. Yadav KS, Singh AK and Sisodia A. Effect of growth promoting chemicals on growth, flowering and seeds attributes in marigold. Annals of Plants and Soil Research. 2015;17(3):253-25.
20. Chopde N, Patil A, Bhande MH. Growth, yield and quality of gladiolus as influenced by growth regulators and methods of application. Plant Archives. 2015;15(2):691-694.
21. Nag K, Jagre A, Kumar A. To assess the effect of GA<sub>3</sub> on growth, flowering and quality of gladiolus (*Gladiolus grandifloras* L.). International Journal of Current Microbiology and Applied Sciences. 2018;Special Issue-7:4036-4045.
22. Ali H, Arshad M, Jan IU, Zamin M, Khan J, Ullah, I, Ali M. Influence of various concentrations of gibberellic acid and micronutrients for enhancing growth and flowering of tuberose (*Polygonatum tuberosum*). Sarhad Journal of Agriculture. 2019; 35(2): 550-556.
23. Neetu, Kumar R. Effect of on growth, flowering and corm production of gladiolus cultivars. The Bioscan. 2016;11(4):2219-2222.
24. Chaudhary, P, Moond, SK and Bola, P. Effect of bioregulators on vegetative growth and flower production of gladiolus (*Gladiolus hybridus*). International Journal of Current Microbial Applied Science. 2018; 7: 463-470.
25. Maurya R, Singh SP, Singh AK. Effect of GA<sub>3</sub>, alar and BA on flowering and vase life of China aster (*Callistephus chinensis*). International Journal of Current Microbiology and Applied Sciences. 2017; 6(12):3148-3151.