Effect of plant growth regulators on yield and corm production of gladiolus (Gladiolus hybridus Hort.) cv. white prosperity

Anant Ram Singh, Satendra Kumar and Rehan

DOI: https://doi.org/10.22271/chemi.2021.v9.i1am.11652

Abstract
The present investigation entitled “Effect of plant growth regulators on yield and corm production of gladiolus (Gladiolus hybridus Hort.) cv. White Prosperity” was conducted at Horticulture Research Center (HRC), College of Agriculture, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut-250110 (U. P.) during the rabi season of 2018-2019. The investigation revealed that plant growth regulators showed significant results on gladiolus as GA$_3$ at 400 ppm or 800 ppm concentration was significantly superior to other treatments in improving the weight of corm per plant. NAA at 200, 400 and 600 ppm increases the weight of cormels per plant. BA at 100 ppm increased diameter of corm, number of cormels per plant, number of corm per plant and yield of corms and cormels. When the different treatments of application were compared, it was found that corm dipping + foliar spraying treatment was significantly superior to other treatments.

Keywords: Gladiolus, plant growth regulators, dipping, spraying

Introduction
Gladiolus (Gladiolus hybridus Hort.) is an ornamental cormelous plant native to South Africa. It belongs to monocot family Iridaceae and sub-family Ixioideae. Iridaceae family contains some 106 genera, containing mostly bulbous ornamentals. Gladiolus takes its name from Latin word ‘Gladius’ because of sword like shape, therefore this is also known as ‘Sword lily’. Gladiolus is grown as flower bed in gardens and used in floral arrangements for interior decoration as well as making high quality bouquets (Lepcha et al. 2007) [6]. Gladiolus is cultivated in most of the tropical and subtropical countries of the world. Its spikes takes 60 to 100 days after planting to be harvested depending upon the cultivars and time of year (Jenkins et al. 1970) [5].
The major gladiolus growing area in India are Kalimpong (West Bengal), New Delhi, Srinagar, Jammu & Kashmir, Pune, Ludhiana, Bengaluru and Uttarakhand. This phenomenal growth of floriculture in India during the last couple of decade has led the world floriculture experts to visualize for country as a major player in floriculture trade in future. The propagating material of gladiolus is called “corm” which is a food-storing underground stem. When the new daughter corm is forming on the top of old one, small new corms called cormels or cormlets are produced from the base. These corms and cormels are the chief means of gladiolus propagation. Cormels are usually graded in to three sizes: large more than 1.0 cm diameter, medium 0.5 cm to less than 1.0 cm, and small less than 0.5 cm. Cormels are treated before storage with hot water solution to eradicate latent fungi, insect and nematodes (Larson, 1992) [5].
To enhance yield and quality of any flower crop various cultural management practices like good planting material, suitable time of planting, spacing, irrigation included plant protection measure are required. The planting material corm is important factor which governs the growth and development of gladiolus. Plant growth regulators or phytohormones are organic substances produced naturally in higher plants, controlling growth or other physiological functions at a site remote from its Place of production and active in minute amounts. The application of plant growth regulators is one of the most important factors in improving the growth, yield and flower quality (Nuvale et al. 2010) [8].

P-ISSN: 2349-8528
E-ISSN: 2321-4902
www.chemijournal.com
IJCBS 2021; 9(1): 2810-2815
© 2021 IJCS
Accepted: 20-12-2020

Corresponding Author:
Anant Ram Singh
Department of Horticulture, College of Agriculture, Sardar Vallabhbhai Patel University of Agri. & Tech. Meerut, Uttar Pradesh, India
Gibberellic acids has an important role in different plant processes, including seed germination, stem elongation, leaf expansion and flower development (Olszewski et al. 2002) and was found highly effective for increasing the sprouting percentage of corm, increased cormel production and cormel size in gladiolus (Padmalatha et al. 2013).

**Material and Methods**

An experiment was conducted at Horticulture Research Centre of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (UP) during the "rabi" season (October 2018-April 2019). The experiment was laid out in randomized block design (RBD) with 28 treatments in three replications. The growth regulators viz., GA₃, NAA and BA were used each at three different concentrations applied as corm dipping, foliar spraying and corm dipping + foliar spraying. A control of untreated corms was also maintained with three replications. The experimental field was prepared by repeated tractor plough followed by harrowing. Weeds and crop residue were removed and the land was levelled. Thus pulverized field was later divided into plots. Irrigation channel, bunds and path were left around the experimental field according to the requirement. Analysis for estimation of growth and flowering characters was done.

**Corm characters**

At the time of harvesting the following corm characters were recorded.

**Number of corms per plant**

The number of corms per plant were counted for four plants and then averaged.

**Diameter of corms (cm)**

Diameter of corm was measured for four plants with the help of vernier calipers.

**Number of cormels per plant**

The numbers of cormels per plant were counted for four plants and then average was worked out.

**Weight of corms per plant (g)**

The weight of corm/plant was measured with the help of electronic balance (Simandzu, Japan) and mean values were expressed in g.

**Weight of cormels per plant (g)**

The weight of cormels/plant was measured with the help of electronic balance (Simandzu, Japan) and mean values were expressed in g.

**Yield of corms and cormels (q/ha)**

The yield of corm and cormels per plant q/ha were recorded with the help of electronic balance and mean values were expressed in q/ha.

**Statistical analysis**

The experimental data were analyzed statistically by the techniques of analysis of variance described by Snedecor and Cochran (1967). The significance of the treatments was tested with the help of “F” (variance ratio) test. Critical difference was calculated by the following formula.

\[
CD \text{ at } 5\% = \sqrt{2 \times EMS \times \frac{t}{r}}
\]

Where,

- \( CD \) = Critical difference
- \( EMS \) = Error means sum of square
- \( r \) = Number of replications
- \( t \) = \( t \) value at 5\% level of significance at error degree of freedom.

**Result and Discussion**

The data on the number of corms per plant as presented in table showed that the maximum corms per plant (1.82) was recorded under BA at 100 ppm applied as corm dipping and minimum number of corms per plant (1.05) was harvested at GA₃ at 400 ppm applied as corm dipping. These results are similar to the findings of Baskaran et al. (2014) in gladiolus. The minimum number of corms per plant (34.20) was recorded under the control. Out of the growth regulating chemicals the maximum cormels per plant (50.14) was recorded under the treatment BA at 100 ppm applied as foliar spraying alone and the minimum number of cormels per plant (34.68) was obtained under the treatment of NAA at 600 ppm applied as foliar spraying alone. The similar results have been also reported by Kumar et al. (2009) and Baskaran et al. (2014) in gladiolus.

A perusal of the data presented in table indicate that the weight of corm (45.78 g) was recorded minimum under control while GA₃ at 400 ppm maximized the weight of corm (60.87 g) when applied as corm dipping alone. The similar results with the application of GA₃ have been also reported by Misra et al. (1993), Singh et al. (2002) and Yadav and Bhatia (2018) in gladiolus. The weight of corms per plant (5.69 g) being minimum was recorded under control while NAA at 400 ppm maximized weight of corms per plant (9.23 g) when applied as corm dipping alone. The similar result has been also reported by Patil and Gohil (2005) in gladiolus. The diameter of corm (3.23 cm) was recorded minimum under control and maximum diameter of corms (4.07 cm) was recorded under the treatment of NAA at 400 ppm applied as corm dipping alone. Similar results were reported by Kumar et al. (2009) in gladiolus.

It is evident from the data presented in the given table that the yield of corms and cormels (104.32 q/ha) was recorded minimum under control. However, maximum yield of corms and cormels (173.70 q/ha) was recorded under the treatment of BA at 100 ppm applied as foliar spraying alone. The similar results were also reported by Bairwa and Mishra (2017) in marigold.

| S. No. | Treatments | Number of corms per plant |
|--------|------------|---------------------------|
| 1.     | Control    | 1.03                      |
| 2.     | GA₃ 200 ppm| 1.10                      |
| 3.     | GA₃ 400 ppm| 1.05                      |
| 4.     | GA₃ 800 ppm| 1.25                      |
| 5.     | NAA 200 ppm| 1.77                      |

**Table 1:** Effect of plant growth regulators on number of corms per plant in gladiolus cv. White Prosperity

"2811"
| S. No. | Treatments                  | Number of cormels per plant |
|-------|-----------------------------|------------------------------|
| 1.    | Control                     | 34.20                        |
| 2.    | Corm dipping                |                              |
| 3.    | GA 200 ppm                  | 42.47                        |
| 4.    | GA 400 ppm                  | 36.43                        |
| 5.    | GA 800 ppm                  | 35.04                        |
| 6.    | NAA 200 ppm                 | 38.48                        |
| 7.    | NAA 400 ppm                 | 49.66                        |
| 8.    | NAA 600 ppm                 | 42.73                        |
| 9.    | BA 25 ppm                   | 35.58                        |
| 10.   | BA 50 ppm                   | 37.70                        |
| 11.   | BA 100 ppm                  | 38.23                        |
|       | Foliar spraying             |                              |
| 12.   | GA 200 ppm                  | 44.87                        |
| 13.   | GA 400 ppm                  | 38.85                        |
| 14.   | GA 800 ppm                  | 41.51                        |
| 15.   | NAA 200 ppm                 | 37.44                        |
| 16.   | NAA 400 ppm                 | 36.42                        |
| 17.   | NAA 600 ppm                 | 34.68                        |
| 18.   | BA 25 ppm                   | 37.65                        |
| 19.   | BA 50 ppm                   | 46.24                        |
| 20.   | BA 100 ppm                  | 50.14                        |
|       | Corm dipping + foliar spraying |                  |
| 21.   | GA 200 ppm                  | 43.50                        |
| 22.   | GA 400 ppm                  | 35.29                        |
| 23.   | GA 800 ppm                  | 45.29                        |
| 24.   | NAA 200 ppm                 | 40.27                        |
| 25.   | NAA 400 ppm                 | 48.70                        |
| 26.   | NAA 600 ppm                 | 46.44                        |
| 27.   | BA 25 ppm                   | 38.67                        |
| 28.   | BA 50 ppm                   | 35.63                        |
| 29.   | BA 100 ppm                  | 48.40                        |
|       | C.D. at 5%                  | 0.59                         |
|       | SE(m)±                      | 0.20                         |

Table 2: Effect of plant growth regulators on number of cormels per plant in gladiolus cv. White Prosperity
### Table 3: Effect of plant growth regulators on weight of corms per plant (g) in gladiolus cv. White Prosperity

| S. No. | Treatments | Weight of corms per plant (g) |
|--------|------------|-----------------------------|
| 1.     | Control    | 45.78                       |
|        | Corm dipping |                             |
| 2.     | GA₃ 200 ppm | 58.19                       |
| 3.     | GA₃ 400 ppm | 60.87                       |
| 4.     | GA₃ 800 ppm | 54.69                       |
| 5.     | NAA 200 ppm | 53.67                       |
| 6.     | NAA 400 ppm | 59.15                       |
| 7.     | NAA 600 ppm | 55.67                       |
| 8.     | BA 25 ppm   | 49.76                       |
| 9.     | BA 50 ppm   | 48.45                       |
| 10.    | BA 100 ppm  | 46.88                       |
|        | Foliar spraying |                         |
| 11.    | GA₃ 200 ppm | 57.31                       |
| 12.    | GA₃ 400 ppm | 51.40                       |
| 13.    | GA₃ 800 ppm | 54.60                       |
| 14.    | NAA 200 ppm | 54.71                       |
| 15.    | NAA 400 ppm | 50.15                       |
| 16.    | NAA 600 ppm | 53.26                       |
| 17.    | BA 25 ppm   | 48.92                       |
| 18.    | BA 50 ppm   | 58.89                       |
| 19.    | BA 100 ppm  | 57.06                       |
|        | Corm dipping + foliar spraying |             |
| 20.    | GA₃ 200 ppm | 52.38                       |
| 21.    | GA₃ 400 ppm | 56.13                       |
| 22.    | GA₃ 800 ppm | 49.39                       |
| 23.    | NAA 200 ppm | 57.48                       |
| 24.    | NAA 400 ppm | 55.15                       |
| 25.    | NAA 600 ppm | 55.81                       |
| 26.    | BA 25 ppm   | 51.25                       |
| 27.    | BA 50 ppm   | 46.67                       |
| 28.    | BA 100 ppm  | 46.71                       |
|        | C.D. at 5%  | 0.16                        |
|        | SE(m)±      | 0.05                        |

### Table 4: Effect of plant growth regulators on weight of cormels per plant (g) in gladiolus cv. White Prosperity

| S. No. | Treatments | Weight of cormels per plant (g) |
|--------|------------|---------------------------------|
| 1.     | Control    | 5.69                            |
|        | Corm dipping |                                 |
| 2.     | GA₃ 200 ppm | 7.30                            |
| 3.     | GA₃ 400 ppm | 6.87                            |
| 4.     | GA₃ 800 ppm | 7.35                            |
| 5.     | NAA 200 ppm | 6.65                            |
| 6.     | NAA 400 ppm | 9.23                            |
| 7.     | NAA 600 ppm | 8.78                            |
| 8.     | BA 25 ppm   | 6.71                            |
| 9.     | BA 50 ppm   | 5.77                            |
| 10.    | BA 100 ppm  | 5.80                            |
|        | Foliar spraying |                              |
| 11.    | GA₃ 200 ppm | 7.70                            |
| 12.    | GA₃ 400 ppm | 6.84                            |
| 13.    | GA₃ 800 ppm | 7.72                            |
| 14.    | NAA 200 ppm | 6.56                            |
| 15.    | NAA 400 ppm | 6.87                            |
| 16.    | NAA 600 ppm | 6.05                            |
| 17.    | BA 25 ppm   | 6.85                            |
| 18.    | BA 50 ppm   | 8.15                            |
| 19.    | BA 100 ppm  | 8.76                            |
|        | Corm dipping + foliar spraying |                 |
| 20.    | GA₃ 200 ppm | 7.67                            |
| 21.    | GA₃ 400 ppm | 8.46                            |
| 22.    | GA₃ 800 ppm | 8.17                            |
| 23.    | NAA 200 ppm | 7.11                            |
| 24.    | NAA 400 ppm | 8.48                            |
| 25.    | NAA 600 ppm | 7.42                            |
| 26.    | BA 25 ppm   | 7.16                            |
| 27.    | BA 50 ppm   | 6.56                            |
| S. No. | Treatments       | Diameter of corms (cm) |
|--------|------------------|------------------------|
| 1.     | Control          | 3.23                   |
| 2.     | GA3 200 ppm      | 3.91                   |
| 3.     | GA3 400 ppm      | 4.05                   |
| 4.     | GA3 800 ppm      | 3.72                   |
| 5.     | NAA 200 ppm      | 3.50                   |
| 6.     | NAA 400 ppm      | 4.07                   |
| 7.     | NAA 600 ppm      | 3.83                   |
| 8.     | BA 25 ppm        | 3.55                   |
| 9.     | BA 50 ppm        | 3.50                   |
| 10.    | BA 100 ppm       | 3.39                   |
| 11.    | Corm 200 ppm     | 3.91                   |
| 12.    | Corm 400 ppm     | 3.82                   |
| 13.    | Corm 800 ppm     | 3.91                   |
| 14.    | NAA 200 ppm      | 4.01                   |
| 15.    | NAA 400 ppm      | 3.65                   |
| 16.    | NAA 600 ppm      | 3.92                   |
| 17.    | BA 25 ppm        | 3.30                   |
| 18.    | BA 50 ppm        | 4.04                   |
| 19.    | BA 100 ppm       | 4.00                   |
| 20.    | Corm dipping     | 3.84                   |
| 21.    | Corm 200 ppm     | 4.01                   |
| 22.    | Corm 400 ppm     | 3.37                   |
| 23.    | Corm 800 ppm     | 3.77                   |
| 24.    | NAA 200 ppm      | 3.69                   |
| 25.    | NAA 400 ppm      | 3.72                   |
| 26.    | NAA 600 ppm      | 3.72                   |
| 27.    | BA 25 ppm        | 3.35                   |
| 28.    | BA 100 ppm       | 3.26                   |

Table 5: Effect of plant growth regulators on Diameter of corms (cm) in gladiolus cv. White Prosperity

| S. No. | Treatments       | Yield of corms and cormels (q/ha) |
|--------|------------------|------------------------------------|
| 1.     | Control          | 104.32                             |
| 2.     | GA3 200 ppm      | 146.49                             |
| 3.     | GA3 400 ppm      | 136.84                             |
| 4.     | GA3 800 ppm      | 130.16                             |
| 5.     | NAA 200 ppm      | 128.43                             |
| 6.     | NAA 400 ppm      | 144.40                             |
| 7.     | NAA 600 ppm      | 157.65                             |
| 8.     | BA 25 ppm        | 119.46                             |
| 9.     | BA 50 ppm        | 112.99                             |
| 10.    | BA 100 ppm       | 111.78                             |
| 11.    | Foliar spraying  | 153.27                             |
| 12.    | GA3 200 ppm      | 144.06                             |
| 13.    | GA3 400 ppm      | 127.62                             |
| 14.    | GA3 800 ppm      | 144.06                             |
| 15.    | NAA 200 ppm      | 127.56                             |
| 16.    | NAA 400 ppm      | 122.52                             |
| 17.    | NAA 600 ppm      | 117.64                             |
| 18.    | BA 25 ppm        | 122.55                             |
| 19.    | BA 50 ppm        | 162.27                             |
| 20.    | BA 100 ppm       | 173.70                             |

Table 6: Effect of plant growth regulators on yield of corms and cormels (q/ha) in gladiolus cv. White Prosperity
Conclusion
On the basis of above finding, it can be concluded that GA\(_3\) at 400 ppm or 800 ppm concentration was significantly superior to other treatments in improving the weight of corm per plant. NAA at 200, 400 and 600 ppm increases the weight of cormels per plant. BA at 100 ppm increased diameter of corm, number of cormels per plant, number of corm per plant and yield of corms and cormels. When the different treatments of application were compared, it was found that corm dipping + foliar spraying treatment was significantly superior to other treatments.

References
1. Bairwa S, Mishra JS. Effect of NAA, BA and Kinetin on yield of African marigold (Tagetes erecta Linn.). International Journal of Current Microbial Applied Science 2017;6(6):1236-1241.
2. Baskaran V, Abirami K, Dam RS. Effect of plant growth regulators on yield and quality in gladiolus under Bay Island conditions. Journal of Horticulture Science 2014;9(2):213-216.
3. Jenkins JM, Milholland RD, Lilly JP, Beute MK. Commercial gladiolus production in North Carolina. North Carolina Agriculture Extension Circle 1970;44:1-34.
4. Kumar SK, Chandra shekar R, Padma M, Shiv Shankar A. Effect of plant growth regulators on dormancy, corm and cormel production in gladiolus. Journal of Ornamental Horticulture 2009;12:182-187.
5. Larson. Introduction to Floriculture. Academic Press 1992;2:147.
6. Lepcha B, Nautiyal MC, Rao VK. Variability studies in gladiolus under mid hill conditions of Uttarakhand. Journal of Ornamental Horticulture 2007;10(1):169-172.
7. Misra RL, Tripathi DK, Chaturvedi OP. Implication of gibberellic acid sprayings on the standing crop of gladiolus var. Sylvia. Progressive Horticulture 1993;25(3-4):147-150.
8. Nuvale MU, Aklade SA, Desai JR, Nannvare PV. Influence of plant growth regulators on growth, flowering and yield of chrysanthemum cv. 'IIHR-6. International Journal of Pharma Bio Science 2010;1:1-4.
9. Olszewski N, Sun TP, Gubler F. Gibberellins signaling: Biosynthesis, catabolism and response pathways. Plant Cell 2002;14:61-80.
10. Padmalatha T, Reddy GS, Chandrasekhar R, Shankar AS, Chaturvedi A. Effect of pre-planting soaking of corms with chemicals and plant growth regulators on dormancy breaking and corm and cormel production in gladiolus. International Journal of Plant, Animal and Environmental Science 2013;3(1):28-33.
11. Patil RV, Gohil SN. Effect of plant growth regulators on growth, corm and cormels production of gladiolus (Gladiolus hybridus Hort.) cv. Sancerree. Ecology, Environment and Conservation Paper 2005;12(4):733-734.
12. Singh MK, Parmar AS, Rathore SVS. Corm production in gladiolus as affected by size of cormels and GA\(_3\) application. Proceedings of the National Symposium on Indian Floriculture in the New Millenium, 2002, 246-248.
13. Snedecor GW, Cochran WG. Statistical Methods. The Iowa State University Press, 1967, 308-310.
14. Yadav S, Bhatia SK. Effect of plant growth regulators on sprouting, vegetative characters, flowering and corm production in Gladiolus sp. cv. Sancerre. International Journal of Pure Applied Bio Science 2018;6(2):1142-1147.