Impact of Integrated Nutrient Management (INM) on Flowering and Corm Production in Gladiolus

Abstract
A field experiment was carried out to evaluate the impact of Integrated Nutrient Management (INM) on flowering and corm production of gladiolus during rabi season of 2010-11 at OUAT Bhubaneswar. The result of the study revealed that INM practices involving inorganic fertilizer, Vermicompost and Bio-fertilizer (Azospirillum and Phosphate solubilising bacteria) in different combinations had no significant influence on sprouting of corms. However, it had significant influence on flowering and corm production in gladiolus. Application of 75% RDF (100:50:60 Kg NPK/ha) in combination with Vermicompost and Biofertilizers increased spike length (70.53 cm), rachis length (55.55 cm), number of florets per spike (13.12), and number of florets remained open at time (7.46) as compared to other treatments. As far as corm characters were concerned, combined application of 75% RDF, Vermicompost and Biofertilizers resulted in maximum weight (75.66 g) and diameter (6.59 cm) of daughter corm as well as number (58.36) and weight (32.43 g) of cormels per plant.

Keywords: Corm; Cormel; Flowering; Gladiolus; INM

Introduction
Gladiolus occupies a significant place among various flower crops of the world commercially grown for cut flower production. It is commonly known as sword lily, corn flag, gladioli and regarded as “queen of bulbous flower” which belongs to family Iridaceae. Due to its magnificent inflorescence with varying range of colour with attractive shades and forms has gained popularity in the international floriculture trade. It is grown in herbaceous border, bed, rockery, pot and also for cut flowers.

Flowering and corm production in gladiolus are affected by non-availability of various nutrients. Integrated Nutrient Management (INM) practices involving complementary use of chemical fertilizers, organic maure, Bio-fertilizers and other organics in judicious combination appear to be a feasible option to maintain and sustain a higher level of soil fertility and productivity thus causing less environmental problems. Biofertilizers have been found beneficial in flower crops like gladiolus, tuberose, rose, chrysanthemum and marigold [1]. Keeping in view the need and importance, present study was carried out to study the impact of integrated nutrient management on flowering and corm production in gladiolus under Odisha conditions.

Materials and Methods
The present experiment was undertaken at OUAT Bhubaneswar during the year 2010-11. Before planting of corms, soil samples were collected from several randomly selected spots up to a depth of 15 cm and were mixed together to draw a composite sample. After proper processing of the soil sample, analysis was done to know the characteristics with respect to its physical and chemical properties (Table 1).
Table 1: Physical and chemical characteristics of soil.

A: Mechanical Composition of Soil

| S.No | Constituents | Percentage (air dry basis) | Methods Followed |
|------|--------------|----------------------------|------------------|
| 1    | Sand         | 67                         | Bouyoucos Hydrometer, [8] |
| 2    | Silt         | 15                         |                  |
| 3    | Clay         | 18                         |                  |
| 4    | Textural Class | Sandy Loam          | International triangle |

B: Chemical Composition of the Soil

|   | Available Nitrogen | 270 kg/ha | Alkaline permanganate method, [9] |
|---|--------------------|-----------|----------------------------------|
| 1 | Available Phosphorus | 43 Kg/ha | Bouy’s-1-P, [10]                |
| 2 | Available Potash    | 278 kg/ha | NH4OAC method, [11]             |
| 3 | Organic Carbon      | 6.39%     | Walkley and Black wet extraction method, [9] |
| 4 | pH                 | 6.54      | Potentiometric method, [11]     |

Table 2: Impact of Integrated Nutrient Management (INM) on flowering in gladiolus.

| S. No | Treatments   | Length of Spike (cm) | Length of Rachis (cm) | Length of Floret (cm) | Width of Floret (cm) | Number of Florets per Spike | Number of Florets remained Open at a Time |
|-------|--------------|----------------------|-----------------------|-----------------------|----------------------|-----------------------------|---------------------------------------------|
| 1     | T1 (Control) | 48.9                 | 36.91                 | 6.47                  | 5.64                 | 6.29                        | 5.2                                         |
| 2     | T2 (50% RDF) | 57.66                | 42.33                 | 7.61                  | 5.53                 | 9.55                        | 5.6                                         |
| 3     | T3 (50% RDF + VC) | 59.13       | 46.96                 | 8.28                  | 5.77                 | 9.74                        | 5.8                                         |
| 4     | T4 (50% RDF + VC + BF) | 67.06     | 53.59                 | 8.55                  | 5.94                 | 10.26                       | 6.23                                        |
| 5     | T5 (75% RDF)  | 68.2                 | 54.7                  | 8.68                  | 6.21                 | 12.83                       | 6.33                                        |
| 6     | T6 (75% RDF + VC) | 68.93      | 54.94                 | 8.59                  | 6.51                 | 9.53                        | 6                                           |
| 7     | T7 (75% RDF + VC + BF) | 70.53     | 55.55                 | 8.43                  | 7.53                 | 13.12                       | 7.46                                        |
| 8     | T8 (100% RDF) | 62.8                 | 50.32                 | 8.23                  | 5.37                 | 10.22                       | 5.36                                        |
| 9     | T9 (100% RDF + VC) | 65.33      | 51.68                 | 8.38                  | 7.62                 | 7.48                        | 5.93                                        |
| 10    | T10 (100% RDF + VC + BF) | 66.96    | 53.47                 | 8.55                  | 7.51                 | 7.37                        | 6.06                                        |

SE m ± 1.24 | 0.73 | 0.07 | 0.07 | 0.13 | 0.21 | 0.21 |

CD (P = 0.05) | 3.69 | 2.17 | 0.2 | 0.22 | 0.4 | 0.63 |
Table 3: Impact of Integrated Nutrient Management (INM) on corm and cormel parameters in gladiolus.

| S. No | Treatment                      | Weight of Daughter Corm (g) | Diameter of Daughter Corm (cm) | Number of Cormels | Weight of Cormels (g) |
|-------|--------------------------------|-----------------------------|--------------------------------|-------------------|----------------------|
| 1     | T1 (Control)                   | 51.49                       | 5.36                           | 19.43             | 15.57                |
| 2     | T2 (50% RDF)                   | 71.69                       | 5.43                           | 28.03             | 18.48                |
| 3     | T3 (50% RDF + VC)              | 72.51                       | 5.58                           | 45.03             | 24.67                |
| 4     | T4 (50% RDF + VC+ BF)          | 74.91                       | 5.89                           | 53.87             | 31.48                |
| 5     | T5 (75% RDF)                   | 68.53                       | 6.1                            | 27.98             | 23.47                |
| 6     | T6 (75% RDF + VC)              | 68.47                       | 6.24                           | 42.24             | 31.73                |
| 7     | T7 (75% RDF + VC+ BF)          | 75.66                       | 6.59                           | 58.36             | 32.43                |
| 8     | T8 (100% RDF)                  | 65.8                        | 5.96                           | 35.55             | 25.68                |
| 9     | T9 (100% RDF + VC)             | 69.49                       | 6.21                           | 38.44             | 30.14                |
| 10    | T10 (100% RDF + VC+ BF)        | 72.72                       | 6.34                           | 48.66             | 31.67                |

SE m ± 0.16 0.07 0.26 0.77 0.59
CD (P = 0.05) 0.5 0.22 0.77 0.59

It was observed that length of florets was found to be maximum (8.68 cm) in T5 (75% RDF) followed by T6 (75% RDF + VC), T4 (50% RDF + VC+ BF) and T10 (100% RDF + VC+ BF). Maximum width of florets (7.62 cm) was recorded under treatment T9 (100% RDF + VC) followed T7 (75% RDF +VC+BF) and T10 (100% RDF+VC+BF).

Beneficial effect of vermicompost and bio-fertilizers in combination with chemical fertilizers at an optimum level on flower size of carnation has been reported by Bhalla et al. [5].

The data presented in Table 3 revealed that weight and diameter of daughter corm were significantly influenced due to different levels of nutrients applied. It was found that T7 (75% RDF +5t/ha VC+ 10kg/ha Azospirillum and 10 kg/ha PSB) recorded maximum weight (75.66g) and diameter of daughter corm (6.24 cm) among all the treatments. Increase in diameter and weight of corm due to application of bio fertilizers might be due to the fact that it increased nutrients availability to the plants, which might have increased photosynthetic activity of the plants, thereby, hastening the movement of photosynthetic sink towards the source (corm). Moreover, it might have also increased auxin concentration in the roots resulting in thicker and well branched roots. The result of the present study is in conformity with Srivastava & Govil [6] and Kathiresan & Venkatesha [7] who also reported similar findings in tuberose and gladiolus respectively.

It was observed that various levels of nutrients significantly influenced the number and weight of cormels produced by individual plants. It was found that number (58.36) and weight of cormels per plant (32.43g) were significantly higher in T7 (75% RDF +5t/ha VC+ 10kg/ha Azospirillum and 10 kg/ha PSB).

Earlier report [7,12] indicated that better availability and uptake of nutrients facilitated by bio fertilizers and vermicompost might have resulted in better growth, production of photosynthates and diversion of photosynthates to reproductive and storage organs as a result there was an increase in weight and diameter of corms as well as number and weight of cormels per plant in gladiolus.

Acknowledgement

None.

Conflict of Interest

None.

References

1. Maurya PR, Benival SV (2003) Use of biofertilizers in horticultural crops. Newsletter Agrobios 12-13.
2. Padanagur VG, Mokashi AN, Patil VS (2005) Flowering flower quality and yield of Tuberose as influenced by vermicompost, farmyard manure and Fertilizers. Karnataka Journal of Agricultural Sciences. 18(3): 729-734.
3. Baskaran V, Misra RL, SK Singh, Abinami K (2014) Response of biofertilizers and commercial formulations on growth, yield and corm production of gladiolus. Indian Hor 71(2): 237-241.

4. Barman D, Datta M, De LC, Banik S (2003) Efficiency of phosphate-solubilizing and phytohormones producing bacteria on the growth and yield of tuberose in acid soil of Tripura. Indian J Hort 60(3): 303-306.

5. Bhalla R, Shiva Kumar MH, Jain R (2007) Effect of organic manures and biofertilizers on growth and flowering in standard carnation. J Ornamental Hort 10(4): 229-234.

6. Srivastava R, Govil M (2005) Influence of biofertilizers on growth and flowering in gladiolus CV American Beauty. ICESC.

7. Karthiresan C, Venkatesha J (2002) Effect of biofertilizers with the levels of N and P on gladiolus. Floriculture research trend in India. Proceedings of National Symposium on Indian Floriculture in the New Millennium, Bangalore. 118-121.

8. Bouyoucos GJ (1962) Hydrometer method improved for making particle size analysis of soils. Agron J 54: 464-465.

9. Page AL, Miller RH, Keeny DR (1982) Methods of soil analysis. Madison Wisconsin, USA.

10. Subbiah BV, Asiya GL (1956) A rapid procedure for determination of available nitrogen in soil. Current Science 25: 259-260.

11. Jackson ML (1973) Soil chemical analysis. Prentice Hall of India New Delhi.

12. Dart PJ (1986) Nitrogen fixation associated with non legumes in Agriculture. Plant and soil 90(1/3): 303-334.