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Effect of integrated nutrient management on growth and flowering of gladiolus Cv. *Nova Lux*

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Abstract
A field experiment was conducted to asses the response of nutrient management on growth and flowering of Gladiolus *(Gladiolus grandifloras)* cv. Nova Lux during the Rabi season of 2023- 24. The experiment comprises treatment combinations of organic and inorganic fertilizers. The treatment combinations were T_1 (Control), T_2 (100% RDF), T_3 (50% RDF + 50% FYM), T_4 (50%RDF + 50% Vermi compost), T_5 (50% RDF + 50% Bio- fertilizer), T_6 (40% RDF + 30% Vermi compost + 30% Bio-fertilizer), T_7 (30% RDF + 50% Neem Cake + 20% FYM) and T_8 (100% Poultry manure). The experiment was outlined in randomized block design with eight treatments and three replications. The data revealed that application of inorganic fertilizer with a combination of organic fertilizer and bio-fertilizer T_6 (40% RDF + 30% Vermi compost + 30% Bio fertilizer) increases the growth and flowering attributes of gladiolus *i.e.*, Plant height, Number of leaves, Spike length, Number of florets per spike, Corm weight, Corm diameter, Corm yield per plot and Corm yield per hectare.

Keywords: Organic manures, Inorganic fertilizer and Gladiolus

Introduction
Gladiolus (*Gladiolus grandiflorus* L.), popularly known as the "Queen of Bulbous Flowers," belongs to family Iridaceae and is believed to have originated in South Africa and Asia Minor. The organic manures play an important role in crop production owing to their in utility for nutritive as well as non nutritive values. It acts on the soil physically, chemically and biologically in many beneficial ways. Organic matter promotes formation of soil crumbs that make the soil friable and there by facilitate the proper movement of air and water (Aiswath *et al.,* 2003) [2]. The use of organic manure and bio-fertilizer has significant potential to boost yield and enhance both flower and corm production. Supplying nutrients in smaller, frequent doses promotes better growth and flower production compared to large, infrequent applications. Excessive reliance on inorganic fertilizers disrupts the ecosystem. (Rathore *et al.* 2010) [7] noted that chemical fertilizers are commonly used in Gladiolus cultivation due to their rapid nutrient release. However, while they improve crop growth, they also negatively impact flower quality, soil health, water resources, and the environment. The application of chemical fertilizer with combination of organic manures and bio-fertilizer has been found to significantly enhance plant growth, flowering, and corm yield, making it an ideal choice for successful cultivation (Gupta *et al.,* 2008) [5]. Additionally, vermicompost acts as a chelating agent while providing essential micro-nutrients like iron and zinc in a highly bio-available form.

Materials and Methods
The experiment was conducted to asses the effect of integrated nutrient management in gladiolus cv. Nova Lux in open field condition at Horticulture Research Farm, Kamla Nehru Institute of Physical and Social Sciences, Faridipur, Sultanpur District, Uttar Pradesh, India. The area is situated on the north of Prayagraj on the right bank of Gomti river at Rewa Road at a distance of about 5 km from Sultanpur city. It is situated at 26^0 15' N Latitude and 85^0 05'E Longitude.This region has sub-tropical climate with extreme of summer and winter the temperature down to as low as 10 - 12^0C during winter season especially in the month of December and January. The temperature rises up to 40- 43^0C during summer season. The average rainfall in this area is around 800-1200mm annually. The experiment was laid out in a randomized block design with eight treatments and three replications. The different treatments that were used in the experiment are as follows: T_1 (Control), T_2 (100% RDF), T_3 (50% RDF + 50% FYM (50t/ha)), T_4 (50%RDF + 50% Vermi compost (5t/ha)), T_5 (50% RDF + 50% Bio- fertilizer (4kg/ha)), T_6 (40% RDF + 30% Vermi compost + 30% Bio fertilizer), T_7 (30% RDF + 50% Neem cake (250g/ha) + 20% FYM (50t/ha)) and T_8 (100% Poultry manure(5-20t/ha)). Planting was done in the month of October with uniform sized healthy corms which was pretreated with Bavistin (0.2%) for half an hour.The distance was kept row to row at 30 cm and plant to plant at 20 cm.The organic and inorganic fertilizer were applied as basal dose as per treatment schedule. Data regarding growth and flowering parameter were recorded after planting.

Results and Discussion
Among the various treatments studied on vegetative parameters like plant height, number of leaves, spike length, number of florets, corm weight, corm diameter, corm yield per plot and corm yield per hectare. The maximum plant height 63.62 cm at 30 DAP and 78.00 cm at 60 DAP respectively, observed in T_6 (RDF 40% + 30% vermin compost + 30% bio fertilizer) which is at par with plant height 60.53cm in T_7 (RDF 30% + Neem cake (50%) + FYM 20%) at 30 DAP and plant height 67.66 cm in T_5 (50% RDF + 50% Bio- fertilizer) at 60 DAP.The minimum value of plant height 49.50cm at 30 DAP and 51.66 cm at 60 DAP were found inT_1 (Control) (Table 1).The maximum number of leaves per plant 06.00 at 30 DAP and 09.00 at 60 DAP respectively, recorded in T_6 (40 % RDF + 30% Vermi compost + 30% Bio fertilizer) which is at par with 05.50 in T_2 (100% RDF) at 30 DAP and 08.00 in T_3 (50% RDF

+50% FYM) at 60 DAP. The minimum number of leaves per plant 04.25 at 30 DAP and 06.00 at 60 DAP were found in T_1 (Control) (Table 1). The different treatments studied on flowering parameter as like spike length and number of florets per spike. The maximum spike length 33.33 cm and number of florets 08.00 was recorded in T_6 (40 % RDF + 30% Vermi compost + 30% Bio fertilizer) which is at par with 32.16 cm in T_3 (50% RDF + 50% FYM) for spike length and 07.66 in T_7 (30% RDF + 20% FYM + 50% Neem cake) for number of florets. The data pertaining to minimum spike length 29.33 cm and number of florets per spike 05.66, respectively, observed in T_1 (Control) (Table 1). Although, data revealed that there is no significant variation among the treatments, but replacement of half dose of inorganic fertilizers with the organic or bio-fertilizer has sustained the growth and flowering without negative impact. It means slow releasing organic and bio-fertilizer has maintained the availability of nutrients thus increases the vegetative growth and flowering. These finding were found in Ali *et al (*2013) [1] and Basant *et al* (2020) [3] in gladiolus and tuberose respectively. Mandavi *et al* (2018) and Devi *et al* (2019) has found significant effect of nutrient management in gladiolus. The application of bio-fertilizer combination with organic and inorganic sources increase the availability of nitrogen and other nutrient elements and enhance the level of macro-nutrients which have positive impact on floral characteristics and ultimately increased the spike length. The results were in confirmation with the findings of Ali *et al* (2013) [1] and Meena *et al* (2018) [6] in gladiolus. The data recorded on yield and yield attributing characters are corm weight, corm diameter and corm yield per plot and corm yield per hectare. The maximum corm weight 149.00g, corm diameter 44.00mm, corm yield per plot 02.33kg and corm yield 13.51 tonnes per ha. were observed in T_6 (40 % RDF + 30% Vermi compost + 30% Bio fertilizer)which is at par with corm weight142.66 g, corm diameter 39.50 mm, corm yield per plot 01.99 kg and corm yield per hectare 12.25 tonnes, in T_7 (30% RDF + 20% FYM + 50% Neem cake).The minimum corm weight 97.66g, corm diameter 30.33 mm, corm yield per plot 01.65 kg and corm yield 11.27 tonnes per ha.were found in T_1 (Control) (Table 1). This may be due to the improved soil texture and structure because of the combined effect of organic and bio-fertilizer by enhancing soil fertility, increasing nutrient availability and promoting a healthy microbial eco-system, ultimately leading to sustainable production system therefore, in our own corm, the effect is significant in gladiolus because the combined application of manures and fertilizers enhanced nitrogen and phosphorus availability in the rhizosphere, leading to increased weight and size of corms. Similarly, the growth and enlargement of cormels may be attributed to the release of growth-promoting hormones and enzymes by microbes, which stimulate vegetative growth and enhance photosynthetic and metabolic activities. Thisfacilitates the transport and utilization of photosynthetic products (Khan & Zaidi, 2002). Consequently, plants supplied with sufficient nitrogen and phosphorus maintained continuous vegetative growth, expanding the photosynthetic area and promoting the accumulation and partitioning of assimilates to developing corms. As a result, larger corms and a greater number of corms was produced. These findings align with those of Dubey and Mishra (2005) [4], Singh and Bijimol (2000) [9], and Kathiresan and Venkatesha (2002) [8] in gladiolus.

Table 1: Effect of various nutrient sources on vegetative and flowering parameters.

Treatments	Plant Height (cm) at 30 DAP	Plant Height (cm) at 60 DAP	Number of Leaves at 30 DAP	Number of Leaves at 60 DAP	Spike Length (cm)	Number of Florets	Corm Weight (g)	Corm Diameter (mm)	Corm Yield Per Plot (kg)	Corm Yield (t/ha).
T_1	49.50	51.66	04.25	06.00	29.33	05.66	97.66	30.33	01.65	11.27
T_2	52.20	64.33	05.50	06.33	31.16	07.00	113.66	31.00	01.91	11.65
T_3	56.79	64.00	05.08	08.00	32.16	06.00	134.00	34.66	01.81	11.65
T_4	53.37	62.33	04.75	06.00	30.83	06.00	121.66	39.00	01.86	11.51
T_5	60.26	67.66	05.08	07.33	29.41	07.66	112.66	30.50	01.91	11.78
T_6	63.62	78.00	06.00	09.00	33.33	08.00	149.00	44.00	02.33	13.51
T_7	60.53	64.33	05.00	09.00	31.16	07.66	142.66	39.50	01.99	12.25
T_8	53.43	63.33	04.75	06.00	30.25	07.66	121.33	32.00	01.85	11.36
C.D	NS	04.67	NS	NS	NS	NS	04.85	02.22	00.15	01.18
SE (d)	11.90	02.15	00.78	01.23	02.81	01.72	02.24	01.02	00.07	00.54

Conclusion

Based on the findings of the present investigation, it has been observed that there is no significant variations were observed among the treatments particularly between sole inorganic and organic application. Although, combination of organic, inorganic and biofertiliser and has neither significant effect on increase in growth and flowering parameters nor decrease but they exhibited the same response regarding growth and flowering like recommended dose of fertilizers which may be due to organic fertilizers are slow releasing as compared to inorganic which are highly mobile. Therefore, it can be concluded that replacing the half quantity of inorganic fertiliser with the organic ones are more sustainable for the environmental and soil factors without affecting the yield. Moreover, reducing dependency on inorganic fertilizers in favour of organic manure proved beneficial, significantly enhancing soil structure, water-holding capacity, nutrient availability, microbial activity, soil health, and reducing soil erosion.

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