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Effects of Nitrogen, Phosphorous and Potassium Level on Yield Attributes and Economics of Gladiolus (*Gladiolus grandiflorus* L.) cv. Nova Lux

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ABSTRACT: Gladiolus (*Gladiolus grandiflorus* L.) is a significant flower crop in India. The crop's yield and productivity have been significantly lower than both regional and national standards due to various factors. The primary factor is the lack of location-specific fertilizer recommendations, among others. Thus, a field experiment was conducted for two consecutive seasons at the Horticulture Research Farm, Faculty of Agriculture Sciences and Associated Industries, Rama University, Kanpur, during the academic years 2020-2021 and 2021-2022. (U.P.). A Randomized Block Design was utilized in the experiment, with 13 treatments and three replications with various doses of N, P_2O_5, and K_2O. The main objectives of the experiment were to evaluate how N, P_2O_5, and K_2O affected the yield characteristics and economics of Gladiolus (*Gladiolus grandiflorus* L.) Cv. Nova Lux. According to the results of the current study, Treatment T_{11}(NPK @150:100:120) had the best effects on yield attributes like Number of Spikes [1.29 (202021), 1.31 (2021-22) and 1.30 (Pooled)], Weight of Spike [57.54 (2020-21), 59.02 (2021-22) and 57.85 (Pooled)] g, Number of florets per spike [17.33 (2020-21), 17.49 (2021-22) and 17.41 (Pooled)], Fresh weight of florets [3.32 (2020-21), 3.44 (2021-22) and 3.38 (Pooled)] g, dry weight of florets [0.73 (2020-21), 0.76 (2021-22) and 0.74 (Pooled)] g, Yield of Spikes per hectare [49.48 (2020-21), 52.49 (2021-22) and 50.99 (Pooled)] q/ha, Vase life of Spike [7.83 (2020-21), 7.92 (2021-22) and 7.88 (Pooled)] days, Number of Corms per plant [2.10 (2020-21), 2.11 (2021-22) and 2.10 (Pooled)] & Diameter of corms [5.42 (2020-21), 5.49 (2021-22) and 5.46 (Pooled)] cm. Treatment T_{11} (NPK @150:100:120) was also found with highest gross returns (370000.02 Rs/ha), Net returns (270893.02 Rs/ha) & B:C ratio of 2.73 when compared to the other treatments. However, Lowest Benefit Cost ratio (1.92) was recorded in treatment T_0, i.e., control.

Keywords: Economics, Gladiolus, *Gladiolus grandiflorus* L., Nitrogen, Nova Lux, Phosphorous, Potassium, Yield.

INTRODUCTION

When it comes to commercially grown flower crops around the world, gladiolus (*Gladiolus grandiflorus* L.) is a major player in the cut flower industry. The "queen of bulbous flower," belonging to family Iridaceae, is most well known by its common names "sword lily", "maize flag" and "gladioli*"*. *Gladiolus aurantiacus* L., *Gladiolus blansus* L., *Gladilous byzantinus* L., *Gladiolus primulinus* L., *Gladiolus tristis* L., etc., are only a few of the many species in this genus. It is believed that there are roughly 260 different species, with about 250 natives to sub Saharan Africa (mostly South Africa) and 10 to Eurasia (Ameh *et al.*, 2011). It is a popular herbaceous plant for borders, beds, rockeries, containers, and bouquets (Satapathy *et al.*, 2016).

Gladiolus is mostly grown in the United States (specifically the states of Florida and California), the Netherlands, Italy, France, Bulgaria, Brazil, Australia, Israel, and India (Kumar *et al.*, 2017). The northern plains of Delhi—including the states of Haryana, Punjab, and Uttar Pradesh—as well as Maharashtra and Karnataka are where it is most cultivated in India for commercial uses (FAO, 2013). India dedicates 11,16,000 ha to gladiolus farming, yielding 102,911,000 tons (NHB, 2014-15).

The three most important nutrients for a crop's vegetative growth, flower yield, and quality attributes are nitrogen, phosphorus, and potassium. Recent ideas about environmentally friendly technologies, the rising price and inconsistent availability of inorganic fertilizers, and the selective use of chemicals that has resulted in declining soil fertility and health all present challenges (Sathyanarayana *et al.,* 2017). Gladiolus growth and development are profoundly impacted by the macronutrients like nitrogen, phosphorus, and potassium. However, the crop may not yield as expected if these nutritional components are used in extremely low or excessive concentrations. In addition, the high dose application of these nutrients raises the cost of production and decreases the farm's net profit. The key to fruitful cut flower growing is the careful balancing of these three nutrients. Application of a precise dose of nitrogen, phosphorus, and potassium greatly improves the growth, development, flower features, and vase life of gladiolus (Dhakal *et al.,* 2017).

Chopde *et al*. (2015) while testing the effect of nitrogen and potassium on gladiolus corm growth and production found that the corm weight (66.48 g) and cormel weight (8.04 g) were substantially highest with 450 kg nitrogen/ha and 225 kg potassium/ha respectively. Zamin *et al*. (2020) while conducting an experiment in Islamabad, Pakistan also found that combination of nitrogen and potash @100N + 200K kg/ha resulted in the maximum number of florets per spike (11.42). However, 100kg/ha nitrogen resulted in the longest spike (88.10cm). Sabastian *et al*. (2017) also conducted an experiment with *Gladiolus grandiflorus* cv. "White Prosperity" and observed minimum days to spike emergence (60.65), first opening of florets (78.13) and maximum floret size (10.22 cm) with incorporation of Phosphorous @ 200 kg/ha. In a similar experiment, Kumar *et al*. (2019) used Gladiolus (*Gladiolus grandiflorus*) cv. white prosperity to determine the effects of integrated nutrition management on vase life and corm production in which T_{12} (75% RDF + VC +Azotobacter +PSB) was found to have the best response in terms of spike length, floret opening rate, floret droop, floret opening time, and spike longevity.

Farmers in Uttar Pradesh are increasingly interested in growing gladiolus bulbs because of the significant profits they may generate from doing so. However, farmers don't know how much synthetic fertilizer to use to grow healthy corms and cormels of the highest grade. Not even flower cultivating farmers use synthetic fertilizer when starting new plants from seed. Because of this, they can't get their hands on properly sized corms and cormels for use in flower cultivation. Hence, there is a significant chance of increasing the yield of robust gladiolus corm and cormel production under the agro-ecological conditions of Uttar Pradesh by utilizing a suitable amount of N, P_2O_5 and K_2O fertilizers. As a result, researchers have placed a premium interest on finding ways to increase gladiolus production. Yet, there are scant few studies on optimizing NPK fertilizers in Uttar Pradesh's agro-climatic conditions.

Therefore, in light of the foregoing, the current study, named "Effects of Nitrogen, Phosphorous and Potassium level on yield attributes and economics of Gladiolus (*Gladiolus grandiflorus* L.) cv. Nova Lux" was carried out at Rama University, Kanpur, Uttar Pradesh.

MATERIALS AND METHODS

This research was conducted in 2020–2021 and 2021-22 on Gladiolus (*Gladiolus grandiflorus* L.) cv. Nova Lux at a planting distance of 30 cm×50 cm. It was conducted at the main experimental station Rama University Kanpur, Uttar Pradesh, India. The Kanpur district lies at latitudes of 25°34' and 26° 11' and longitudes of 81°S19' and 82°27' and has an altitude of 137 Mt. from mean sea level.

The experiment was set up in a randomized block design, with three replicates for each of the thirteen different treatment permutations. Table 1 details the treatments combinations. N, P_2O_5, and K_2O were administered in different proportions in each treatment. Yield attributes like Number of Spikes, Weight of Spike (g), Number of florets per spike, Fresh weight of florets **(**g**),** dry weight of florets **(**g), Yield of Spikes per hectare (q/ha), Vase life of Spike **(**days), Number of Corms per plant, Diameter of corms (cm) were all successfully measured and economics of each treatment was estimated to determine the best treatment combination for gladiolus cultivation.

RESULTS AND DISCUSSION

The yield attributes of Gladiolus (*Gladiolus grandiflorus* L.) Cv. Nova Lux were studied statistically and economics of each treatment were estimated. The results showed that the incorporation of N, P_2O_5, and K_2O significantly improved all the parameters. The evidence suggests that the variances were statistically significant since F Cal > F Tab.

A. Yield Attributes

Number of spikes: During both the years (2020-21 and 2021-22) of study (Table 2, Fig. 1), it was observed that the treatment T_{11}(NPK @150:100:120) recorded the maximum Number of spikes per plant [1.29 (2020-21), 1.31 (2021-22) and 1.30 (Pooled)] over all other treatments where-as T_0 (Control) had the lowest recorded Number of spikes per plant, which was [0.98 (2020-21), 0.95 (2021-22) and 0.97 (Pooled)] during both the years of study as well as pooled analysis. The rise in the number of spikes per plant may be attributable to the optimum concentration of N, P_2O_5, and K_2O. Dalvi *et al.* (2008) showed that a higher nitrogen content led to more vegetative growth and storage of food stores that are redirected for flower bud differentiation, resulting in an increase in spikes per plant. Potassium on the other hand initiates the phosphorous availability to the plants there by helping in increasing the number of spikes per plant indirectly (Thompson, 2011). Similar results were also reported by Dhakal *et al*. (2017); Chandana and Dorajeerao (2014) on gladiolus.

Weight of Spike (g): It was observed that the treatment T_{11}(NPK @150:100:120) recorded the maximum weight of spike (g) per plant (Table 3, Fig. 2) [57.54 (2020-21), 59.02 (2021-22) and 57.85 (Pooled)] g over all other treatments during both the years of study as well as pooled analysis. However, treatment T_0 (Control) had the lowest recorded weight of spike (g), which was [39.64 (2020-21), 37.66 (2021-22) and 38.65 (Pooled)] g during both the years of study as well as pooled analysis. It is well established that potassium has little impact on spike weight or overall yield. However, high nitrogen & phosphorous applications had an impact on spike weight (Mukesh *et al.,* 2001). Due to increased carbohydrate accumulation and a rapid rate of photosynthesis in both the vegetative and reproductive sections of gladiolus plants, the highest weight of spike was attained. Talukdar and Sangita (2003); Sharma *et al*. (2007) also reported similar outcomes.

Number of florets per spike: The maximum Number of florets per spike (Table 4; Fig. 3) [17.33 (2020-21), 17.49 (2021-22) and 17.41 (Pooled)] was found under treatment T_{11}(NPK @150:100:120) over all other treatments where-as T_0 (Control) had the lowest recorded Number of florets per spike, which was [14.79 (2020-21), 14.71 (2021-22) and 14.75 (Pooled)] during both the years of study as well as pooled analysis. The increase in the number of florets per spike may be related to the nitrogen concentration and its effect on vegetative properties, since nitrogen is a major component of chlorophyll and is involved in vital physiological processes such as photosynthesis. Sharma *et al.* (2003) reported comparable results. Similar results were obtained by Dhakal *et al.* (2017); Chandana and Dorajeerao (2014); Sharma *et al.* (2007) when working on Tuberose and gladiolus, respectively.

Fresh weight of florets (g): The data regarding Fresh weight of florets (g) is shown in Table 5, Fig. 4. From the data it was observed that, treatment T_{11}(NPK @150:100:120) recorded the maximum fresh weight [3.32 (2020-21), 3.44 (202122) and 3.38 (Pooled)] g where-as T_0 (Control) had the lowest recorded fresh weight [2.68 (2020-21), 2.56 (2021-22) and 2.62 (Pooled)] g during both the years of study as well as pooled analysis. It is possible that this can be attributed to the role that nitrogen plays as a primary element in amino acids, proteins, vitamins, hormones, and enzymes, all of which have the ability to immediately affect cell division, cell elongation, and increase in meristematic activity. This would have resulted in an increase in size of florets and hence the fresh weight of florets. Similar result was also concluded by McAfee (2008).

Dry weight of florets (g): Table 6, Fig. 5 displays the collected data in terms of dry weight of florets (g) during the year 2020-21 and 2021-22, it was observed that, treatment T_{11}(NPK @150:100:120) recorded the maximum Dry weight of florets (g) [0.73 (2020-21), 0.76 (2021-22) and 0.74 (Pooled)] g over all other treatments where-as T_0 (Control) had the lowest recorded dry weight of florets (g), which was [0.59 (2020-21), 0.56 (2021-22) and 0.58 (Pooled)] g during both the years of study as well as pooled analysis. Potassium helps in water economy, energy metabolism and enzymes activity, which have positive effect on flower weight. Zhao *et al.* (2001) also found Potassium deficiency reduced dry matter accumulation. The experiment conducted by Bajwa and Rehman (2005) also showed that balance dose of potassium with other nutrients (Like N and P) increase fresh and dry flower weight of zinnia because luxury consumption of K does not increase yield if the accompanying N and P are not sufficient.

Yield of Spikes per hectare (q/ha): The data regarding Yield of Spikes per hectare (q/ha) is shown in Table 7; Fig. 6. T_{11}(NPK @150:100:120) recorded the maximum yield of spikes per hectare (q/ha) [49.48 (2020-21), 52.49 (2021-22) and 50.99 (Pooled)] q/ha over all other treatments. However, treatment T_0 (Control) had the lowest recorded yield of spikes per hectare (q/ha), which was [25.91 (2020-21), 23.86 (2021-22) and 24.88 (Pooled)] q/ha during both the years of study as well as pooled analysis. Basnet *et al.* (2018) also discovered extremely comparable results. Phosphorus is also required for the process of cell division, the formation of meristematic tissues, and the creation of robust root systems, all of which contribute to enhanced plant growth, as demonstrated by the preceding facts. Phosphorus is required for the process of cell division; therefore, its application could have also affected the length and weight of the spikes and hence yield of spike. The addition of potassium to the soil may also have contributed to the increased length and weight of the gladiolus plants' spikes. Deshmukh *et al.* (2012) on Tuberose, Chandana and Dorajeerao (2014) on Gladiolus, and Sharma *et al.* (2007) while working on Tuberose all achieved results that were similar.

Vase life of Spike (days): Treatment T_{11} (NPK @150:100:120) recorded the maximum vase life of spike (Table 8, Fig. 7) [7.83 (2020-21), 7.92 (2021-22) and 7.88 (Pooled)] days over all other treatments where-as T_0 (Control) had the lowest recorded vase life of spike, which was [5.59 (2020-21), 5.51 (2021-22) and 5.55 (Pooled)] days during both the years of study as well as pooled analysis. Application of phosphorus might have helped in increasing vase life of spikes. Phosphorus regulates root growth and is a component of nucleic acid phytin ATP, which plays a crucial function in a plant's healthy growth and development, resulting in increased flower production and vase life. These findings closely resemble those of Kumar and Singh (2011) for calendula, Khan *et al.* (2012); Verma *et al.* (2015) for gladiolus.

Number of Corms per plant: The data regarding Number of Corms per plant is shown in Table 9, Fig. 8. It was observed that, treatment T_{11}(NPK @150:100:120) recorded the maximum number of corms per plant [2.10 (2020-21), 2.11 (2021-22) and 2.10 (Pooled)] over all other treatments. However, treatment T_0 (Control) had the lowest recorded number of corms per plant, which was [1.64 (2020-21), 1.60

(2021-22) and 1.62 (Pooled)] during both the years of study as well as pooled analysis. Additional corm production can be achieved with the use of phosphorus and potassium, which stimulate vegetative growth by increasing cell division, cell elongation, and chlorophyll synthesis. It is found consistent with the findings of Kumar and Mishra (2011) in gladiolus and Kadu *et al.* (2009) in tuberose Cv. Single

Diameter of corms (cm): According to the data mentioned at Table 10, Fig. 9, it was observed that, treatment T_{11}(NPK @150:100:120) recorded the maximum diameter of corms (cm) [5.42 (2020-21), 5.49 (2021-22) and 5.46 (Pooled)] cm over all other treatments where-as T_0 (Control) had the lowest recorded diameter of corms (cm), which was [3.95 (2020-21), 3.91 (2021-22) and 3.93 (Pooled)] days during both the years of study as well as pooled analysis. Corm diameter may have increased as a result of improved plant development and subsequently higher photosynthetic activity. This improvement resulted from appropriate fertilisation. Yadav (2018); Mahadik and Chopde (2015) also came to similar conclusive conclusions.

Economics: The economics of treatments is an important goal in determining the best treatments that improve income and are acceptable. Table 11 shows the cost of cultivation, gross returns, net returns, and B: C ratio as affected by various treatments. Because of the variable application of N, P_2O_5 and K_2O, the cost of cultivation varied from 102815 Rs./ha to 87600 Rs/ha. Treatment T_{11} (NPK @150:100:120) had the highest gross returns (370000.02 Rs/ha) when compared to the other treatments where-as Treatment T_0, i.e., Control, had the lowest gross returns (256000.01 Rs./ha) when compared to the other treatments Highest Net returns (270893.02 Rs./ha) was recorded in treatment T_{11} (NPK @150:100:120) whereas both treatment T_{11} and T_{10} were found with same B:C ratio of 2.73. However, Lowest Benefit Cost ratio (1.92) was recorded in treatment T_0, i.e., control. Similar results on economics and cost benefit ratio were also found by Avilala *et al.* (2020); Bolagam *et al.* (2019); Beck *et al.* (2018); Tirkey *et al.* (2017) while working on gladiolus.

Table 1: Effect of N, P_2O_5 and K_2O on number of spikes of Gladiolus.

a- Highest value, i- lowest value

Treatment Symbol	Number of spikes		
	2020-21	2021-22	Pooled
T_0	0.98i	0.95i	0.97i
T_1	1.07h	1.17h	1.12h
T_2	1.11g	1.19gh	1.15gh
T_3	1.13fg	1.20fg	1.17fg
T_4	1.10gh	1.19gh	1.15gh
T_5	1.16ef	1.22ef	1.19ef
T_6	1.20d	1.25d	1.23d
T_7	1.21cd	1.26cd	1.24cd
T_8	1.19de	1.24de	1.22de
T_9	1.24bc	1.28bc	1.26bc
T10	1.28a	1.30ab	1.29ab
T11	1.29a	1.31a	1.30a
T12	1.27ab	1.30ab	1.28ab
F-test	**	**	**
S.E. (m) (±)	0.01	0.01	0.01
C.D. @ 5%	0.04	0.02	0.05
C.D. @ 1%	0.05	0.03	0.07
Treatment*Year	**		

Table 2: Effect of N, P_2O_5 and K_2O on Weight of Spike (g) of Gladiolus.

Treatment Symbol	Weight of Spike (g)		
	2020-21	2021-22	Pooled
T_0	39.64g	37.66j	38.65j
T_1	42.87f	46.60i	44.74i
T_2	45.38e	49.33gh	47.36gh
T_3	46.08e	50.09g	48.08g
T_4	44.86e	48.67h	46.76h
T_5	48.13d	51.78f	49.96f
T_6	50.98c	54.00de	52.49de
T_7	51.59c	54.91d	53.25d
T_8	50.24c	53.51e	51.87e
T_9	53.75b	56.57c	55.16c
T10	56.68a	59.02ab	57.85ab
T11	57.54a	60.11a	58.82a
T12	55.99a	58.37b	57.18b
F-test	**	**	**
S.E. (m) (±)	0.54	0.43	0.77
C.D. @ 5%	1.57	1.26	2.4
C.D. @ 1%	2.12	1.71	3.37
Treatment*Year	**		

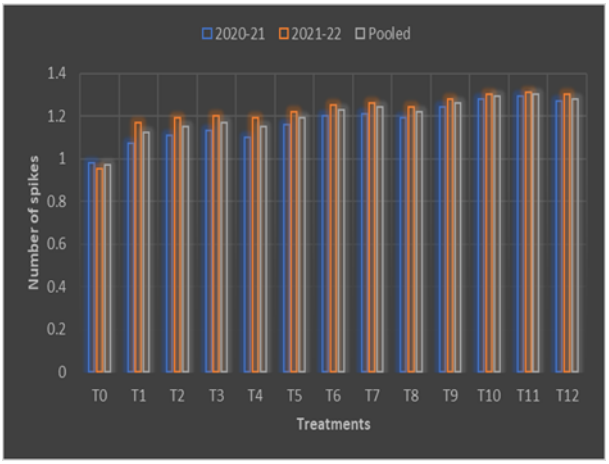

Fig. 1. Effect of N, P_2O_5 and K_2O on number of spikes of Gladiolus.

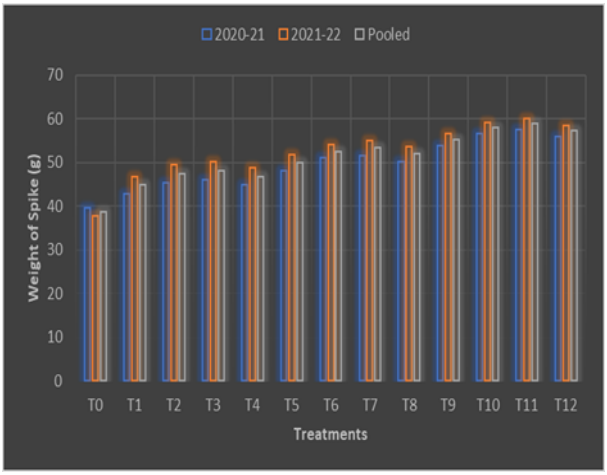

Fig. 2. Effect of N, P_2O_5 and K_2O on weight of spikes (g) of Gladiolus.

Table 3: Effect of N, P_2O_5 and K_2O on Number of florets per spike of Gladiolus.

Treatment Symbol	Number of florets per spike		
	2020-21	2021-22	Pooled
T_0	14.79g	14.71g	14.75g
T_1	15.15f	15.69f	15.42f
T_2	15.54e	16.12e	15.83e
T_3	15.62e	16.21e	15.92e
T_4	15.47e	16.01e	15.74e
T_5	15.94d	16.44d	16.19d
T_6	16.39c	16.77c	16.58c
T_7	16.48c	16.86c	16.67c
T_8	16.26c	16.67c	16.47c
T_9	16.80b	17.09b	16.95b
T10	17.23a	17.41a	17.32a
T11	17.33a	17.49a	17.41a
T12	17.12a	17.32a	17.22a
F-test	**	**	**
S.E. (m) (±)	0.1	0.07	0.1
C.D. @ 5%	0.3	0.21	0.31
C.D. @ 1%	0.4	0.29	0.43
Treatment*Year	**		

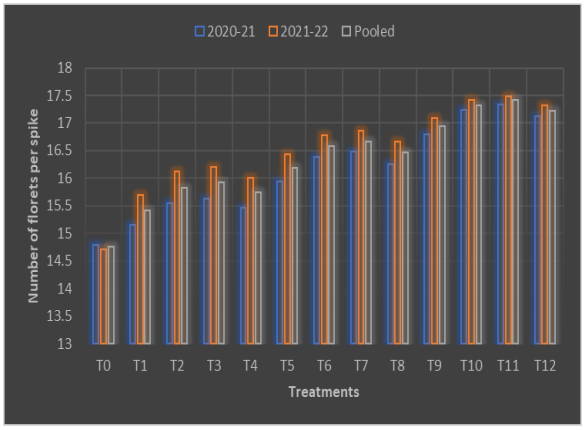

Fig. 3. Effect of N, P_2O_5 and K_2O on Number of florets per spike of Gladiolus.

Table 4: Effect of N, P_2O_5 and K_2O on Fresh weight of florets (g) of Gladiolus.

Treatment Symbol	Fresh weight of florets (g)		
	2020-21	2021-22	Pooled
T_0	2.68i	2.56j	2.62i
T_1	2.83h	2.97i	2.90h
T_2	2.92g	3.06h	2.99g
T_3	2.95fg	3.09gh	3.02fg
T_4	2.90gh	3.04h	2.97g
T_5	3.02ef	3.15fg	3.09ef
T_6	3.11d	3.22e	3.17d
T_7	3.13cd	3.26de	3.19cd
T_8	3.09de	3.21ef	3.15de
T_9	3.20bc	3.31cd	3.26bc
T10	3.29a	3.39ab	3.34a
T11	3.32a	3.44a	3.38a
T12	3.27ab	3.37bc	3.32ab
F-test	**	**	**
S.E. (m) (±)	0.03	0.02	0.03
C.D. @ 5%	0.07	0.06	0.11
C.D. @ 1%	0.1	0.08	0.15
Treatment*Year	**		

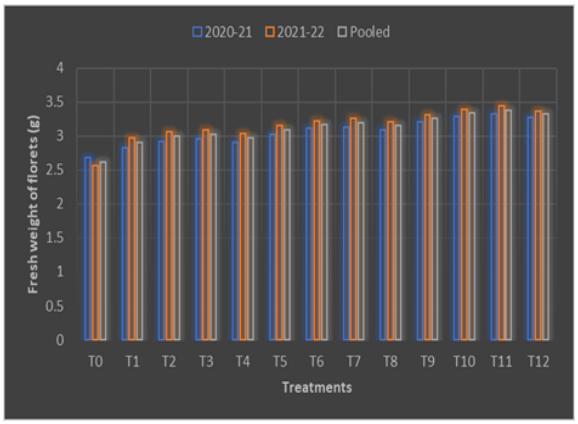

Fig. 4. Effect of N, P_2O_5 and K_2O on Fresh weight of florets (g) of Gladiolus.

Table 5: Effect of N, P_2O_5 and K_2O on Dry weight of florets (g) of Gladiolus.

Treatment Symbol	Dry weight of florets (g)		
	2020-21	2021-22	Pooled
T_0	0.59i	0.56j	0.58i
T_1	0.62h	0.65i	0.64h
T_2	0.64g	0.67h	0.66g
T_3	0.65fg	0.68gh	0.66fg
T_4	0.64gh	0.67h	0.65g
T_5	0.66ef	0.69fg	0.68ef
T_6	0.68d	0.71e	0.70d
T_7	0.69cd	0.72de	0.70cd
T_8	0.68de	0.71ef	0.69de
T_9	0.70bc	0.73cd	0.72bc
T10	0.72a	0.75ab	0.73a
T11	0.73a	0.76a	0.74a
T12	0.72ab	0.74bc	0.73ab
F-test	**	**	**
S.E. (m) (±)	0.01	0.004	0.007
C.D. @ 5%	0.02	0.01	0.02
C.D. @ 1%	0.02	0.02	0.03
Treatment*Year	**		

Fig. 5. Effect of N, P_2O_5 and K_2O on Dry weight of florets (g) of Gladiolus.

Table 6: Effect of N, P_2O_5 and K_2O on Yield of Spikes per hectare (q/ha) of Gladiolus.

Treatment Symbol	Yield of Spikes per hectare (q/ha)		
	2020-21	2021-22	Pooled
T_0	25.91h	23.86j	24.88j
T_1	30.58g	36.35i	33.47i
T_2	33.60f	39.14gh	36.37gh
T_3	34.71f	40.07g	37.39g
T_4	32.89f	38.61h	35.75h
T_5	37.22e	42.12f	39.67f
T_6	40.79d	45.00de	42.89de
T_7	41.63d	46.12d	43.87d
T_8	39.86d	44.23e	42.04e
T_9	44.44c	48.28c	46.36c
T10	48.37ab	51.14ab	49.76ab
T11	49.48a	52.49a	50.99a
T12	47.39b	50.58b	48.99b
F-test	**	**	**
S.E. (m) (±)	0.66	0.47	1.03
C.D. @ 5%	1.94	1.38	3.18
C.D. @ 1%	2.63	1.87	4.46
Treatment*Year	**		

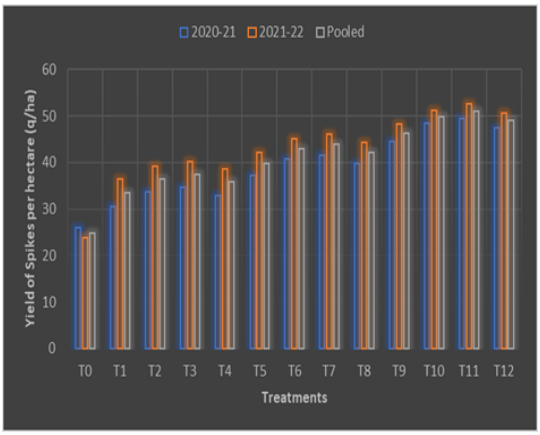

Fig. 6. Effect of N, P_2O_5 and K_2O on Yield of Spikes per hectare (q/ha) of Gladiolus.

Table 7: Effect of N, P_2O_5 and K_2O on Vase life of Spike (days) of Gladiolus.

Treatment Symbol	Vase life of Spike (days)		
	2020-21	2021-22	Pooled
T_0	5.59i	5.51g	5.55i
T_1	6.27h	6.11f	6.19h
T_2	6.56g	6.42e	6.49g
T_3	6.64fg	6.53e	6.59fg
T_4	6.48gh	6.36e	6.42gh
T_5	6.85ef	6.78d	6.82ef
T_6	7.14d	7.13c	7.14d
T_7	7.24cd	7.22c	7.23cd
T_8	7.06de	7.03c	7.05de
T_9	7.45bc	7.47b	7.46bc
T10	7.74a	7.81a	7.77a
T11	7.83a	7.92a	7.88a
T12	7.66ab	7.72a	7.69ab
F-test	**	**	**
S.E. (m) (±)	0.08	0.08	0.05
C.D. @ 5%	0.22	0.24	0.16
C.D. @ 1%	0.3	0.33	0.21
Treatment*Year	NS		

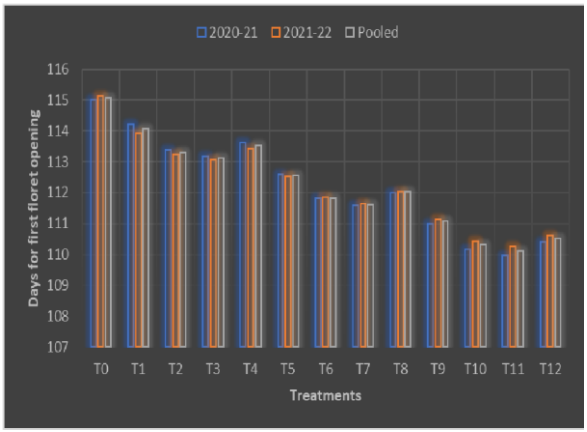

Fig. 7. Effect of N, P_2O_5 and K_2O on Vase life of Spike (days) of Gladiolus.

Table 8: Effect of N, P_2O_5 and K_2O on Number of corms per plant of Gladiolus.

Treatment Symbol	Number of corms per plant		
	2020-21	2021-22	Pooled
T_0	1.64h	1.60h	1.62g
T_1	1.73g	1.74g	1.74f
T_2	1.79f	1.81fg	1.80ef
T_3	1.80f	1.82efg	1.81ef
T_4	1.77fg	1.79fg	1.78ef
T_5	1.84e	1.88def	1.86de
T_6	1.90d	1.94cd	1.92cd
T_7	1.91cd	1.96bcd	1.94cd
T_8	1.88de	1.93cde	1.91cd
T_9	1.95bc	2.01bc	1.98bc
T10	2.00a	2.07ab	2.04ab
T11	2.10a	2.11a	2.10a
T12	1.99ab	2.06ab	2.03ab
F-test	**	**	**
S.E. (m) (±)	0.01	0.02	0.01
C.D. @ 5%	0.04	0.06	0.04
C.D. @ 1%	0.05	0.08	0.05
Treatment*Year	NS		

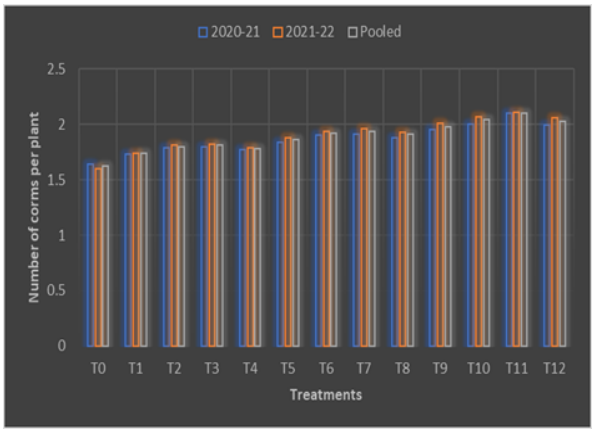

Fig. 8. Effect of N, P_2O_5 and K_2O on Number of corms per plant of Gladiolus.

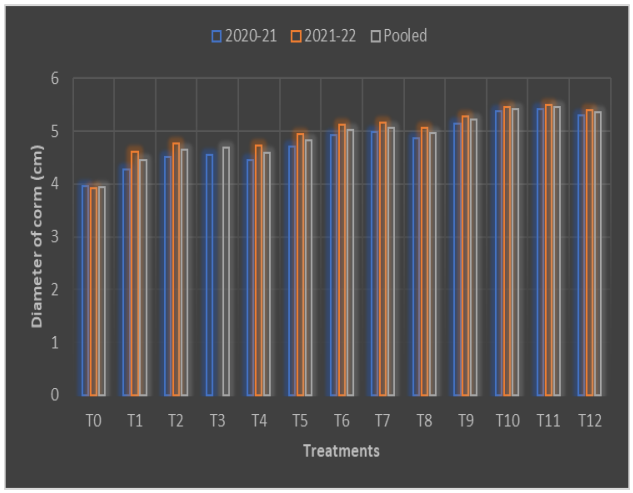

Fig 9. Effect of N, P_2O_5 and K_2O on diameter of corms (cm) of Gladiolus.

Table 9: Effect of N, P_2O_5 and K_2O on diameter of corms (cm) of Gladiolus.

Treatment Symbol	Diameter of corm (cm)		
	2020-21	2021-22	Pooled
T_0	3.95i	3.91i	3.93i
T_1	4.28h	4.61h	4.45h
T_2	4.51g	4.77g	4.64g
T_3	4.55fg	4.83fg	4.69fg
T_4	4.44gh	4.73gh	4.59gh
T_5	4.71ef	4.95ef	4.83ef
T_6	4.92d	5.11d	5.02d
T_7	4.98cd	5.16cd	5.07cd
T_8	4.87de	5.07de	4.97de
T_9	5.14bc	5.28bc	5.21bc
T10	5.37a	5.45a	5.41a
T11	5.42a	5.49a	5.46a
T12	5.30ab	5.40ab	5.35ab
F-test	**	**	**
S.E. (m) (±)	0.06	0.05	0.05
C.D. @ 5%	0.17	0.13	0.16
C.D. @ 1%	0.23	0.18	0.23
Treatment*Year	*		

Table 10: Effect of N, P_2O_5 and K_2O on economics of Gladiolus.

Treatments	T_0	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	T_{11}	T_{12}
Cost of cultivation (Rs/ha)	87600	93722	95864	97889	101597	94177	96319	98344	102052	94940	97082	99107	102815
Approx number of spikes	64666.67	74666.67	76666.67	78000.00	76666.67	79333.34	82000.00	82666.67	81333.34	84000.00	86000.00	86666.67	86000.00
Selling price per spike=Rs 3	194000.01	224000.01	230000.01	234000.01	230000.01	238000.01	246000.01	248000.01	244000.01	252000.01	258000.01	260000.01	258000.01
Additional corm produced (Total number of corms-number of corms planted)	41333.34	49333.34	53333.34	54000	52000	57333.34	61333.34	62666.67	60666.67	65333.34	69333.34	73333.34	68666.67
Selling price per corm=Rs 0.5	62000.00	74000.00	80000.00	81000.00	78000.00	86000.00	92000.00	94000.00	91000.00	98000.00	104000.01	110000.01	103000.01
Gross return (Rs)	256000.01	298000.01	310000.02	315000.02	308000.02	324000.02	338000.02	342000.02	335000.02	350000.02	362000.02	370000.02	361000.02
Net Return (Rs)	168400.01	204278.01	214136.02	217111.02	206403.02	229823.02	241681.02	243656.02	232948.02	255060.02	264918.02	270893.02	258185.02
B:C	1.92	2.18	2.23	2.22	2.03	2.44	2.51	2.48	2.28	2.69	2.73	2.73	2.51

CONCLUSIONS

From the results of the current experiment, it can be inferred that Treatment T_{11}(NPK @150:100:120), had the best effects. It was deemed to have the best yield attributes including Number of Spikes, Weight of Spike (g), Number of florets per spike, Fresh weight of florets **(**g**),** dry weight of florets **(**g), Yield of Spikes per hectare (q/ha), Vase life of Spike **(**days), Number of Corms per plant and Diameter of corms (cm).

Also, Highest Net returns (270893.02 Rs/ha) was recorded in treatment T_{11} (NPK @150:100:120) whereas both treatment T_{11} and T_{10} were found with same B:C ratio of 2.73. However, Lowest Benefit Cost ratio (1.92) was recorded in treatment T_0, i.e., control.

FUTURE SCOPE

The primary objectives of gladioli growers are to optimize yield, increase daughter corm production, and maximize net returns. This study presents novel empirical findings regarding the reactions of varying concentrations of Nitrogen, Phosphorous, and Potassium. To optimize the yield and cost benefit ratio of gladiolus cv. Nova Lux cultivation in the prayagraj agro-climate, it is recommended to utilize NPK @150:100:120. Our experiments have shown that this particular combination resulted in the most significant increases. The following methods and outcomes are expected to improve Gladiolus production while minimizing the impact on cultivated land degradation.

In light of the dynamic nature of cultivated Gladiolus varieties, it is recommended that the experimental design be replicated in the coming years to assess the impact of fertilization on novel and sought-after varieties in the market.

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Conflicts of Interest. None.

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