"Effectofplantgrowthregulatorsandmicronutrientsongrowth,floweringandcormproductioningladiolus(*Gladiolusgrandiflorus*L.)cv.NovaLux"

Introduction:

Gladiolus (*Gladiolus grandiflorus*L.), commonly known as "Sword Lily". It is a significantmonocotyledonousfloweringperennialbulbousplantbelongingtothefamilyIridaceae. Oftenreferred as "Queen of Bulbous" flower. Gladiolus is highly esteemed for its role in the cutflower industry. The genus "Gladiolus" includes 260 species, with 250 species native to sub-Saharan Africa and 10 species from Eurasia. The chromosome number is n=15, with mostSouth African species being diploid (2n=30). The name "gladiolus" is derived from the Latinword "gladius" meaning "sword" referring to the sword-shaped leaves of the plant. Theflowers open sequentially from the bottom to the top of the spike. The commercial cultivationof gladiolus is prominent in countries like India, Japan, the Netherlands, the United Kingdom,and the United States. Domestic Flower Markets: Delhi, Kolkata, Bangalore, Mumbai, andHyderabad are major markets for gladiolus in India. Position in World Trade: Gladiolus holdsthefourthpositionintheglobaltradeofbulbousflowers**(Kumar*etal.*,2007)**.Leadingstatesare Kerala(16.5%),TamilNadu(13.3%),Karnataka(11.4%),MadhyaPradesh(11.1%),UttarPradesh(7%),andproductionwiseLooseFlowers14.15thousandtonnes,CutFlowers:246.62thousandtonnes**(NHBdata,2020-21)**.Gladiolusremainsavitalcropinfloriculture,contributingsignificantlytobothdomesticandinternationalflowermarketsduetoitsaestheticappealand economicvalue.

MATERIALSANDMETHODS:

Thepresentstudywasconductedtoinvestigatethe"Effectsofplantgrowthregulatorsandmicronutrientsontheeffectofgrowth,flowering,andyieldattributesofGladiolus(*Gladiolus grandiflorus*L.)cv.NovaLux".Theexperiment was carried out during the 2022-2023 session at the experimental field of theDepartment of Horticulture, Janta College, Bakewar, Etawah (U.P.). Healthy, uniform-sizedcorms were treated with Bavistin (0.2%) and planted in October.The experiment followed arandomizedblockdesignwithtentreatmentsandthreereplications.Thespacingbetweenrowsand plants was maintained at 25 cm. During studies different treatments: T_1: Control (RDF),T_2:ZnSO□(0.2%),T_3:ZnSO□(0.5%),T_4:FeSO□(0.2%),T_5:FeSO□(0.5%),T_6:GA□(200 ppm),T_7: ZnSO□ (0.2%) + FeSO□ (0.2%) + GA□ (200 ppm),T_8: ZnSO□ (0.5%) + FeSO□ (0.5%) +GA□(200ppm),T_9:ZnSO□(0.5%)+FeSO□(0.2%)+GA□(200ppm),T_{10}:ZnSO□(0.2%)+FeSO□ (0.5%) + GA□ (200 ppm).The following parameters were recorded during course ofstudiesareNumberofsproutspercorm,Plantheightat30daysafterplanting(DAP),Numberof leaves per plant, Width of leaves per plant, Days to spike initiation, Number of spikes perplant,Daystoopeningofthefirstfloret,Lengthofspike(cm),Diameterofcorm(cm),Numberof

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corms per plot, Average weight of a single corm (g). The data collected were statisticallyanalyzedfollowingthemethoddescribedbyPanseandSukhatme(1985),withresultsevaluatedata5% levelof significance.

Thisstudyaimstodeterminetheoptimalcombinationofplantgrowthregulatorsandmicronutrients to enhance the vegetative growth, flowering, and yield of gladiolus, providingvaluableinsightsfor floriculturepractices.

RESULTSANDDISCUSSION

InfluenceofPlantGrowthRegulatorsandMicronutrientsonVegetativeCharactersofGladiolus:

The data on various vegetative growth, flowering, and corm yield traits were recorded andanalyzed, as depicted in Table 1. The results revealed that maximum number of sprouts perCorm, in treatment T_9 (ZnSO□ 0.5% + FeSO□ 0.2% + GA□ 200 ppm) is 3.32 followed by T_7(ZnSO□0.2%+FeSO□0.2%+GA□200ppm)2.67.whileminimumwasobservedintreatmentT_1 (Control) 1.68. These results conform to the findings of Chopde*et al*. (2015) and Deepika*et al*. (2019), who reported that foliar application of GA□, FeSO□ and ZnSO□ promotes thenumberofsproutspercorm.ThemaximumplantheightisnotedintreatmentT_{10}(ZnSO□0.2% + FeSO□ 0.5% + GA□ 200 ppm) 59.53 cm followed by T_2 (ZnSO□ 0.2%) 56.82 cm whereas the minimum was taken in T_1 (Control) 41.35 cm. These findings align with the results of Mishra*et al*. (2018) and Patel *et al*. (2017), who reported that the application of GA□ @ 200 ppm andFeSO□0.5%+ZnSO□0.25%significantlyincreasesplantheight. ThehighestnumberofleavesperplantwasobservedinT_{10}(ZnSO□0.2%+FeSO□0.5%+GA□200ppm)9.13followedby T_7(ZnSO□0.2% +FeSO□0.2%+GA□200ppm)8.88, whilelowestwas notedinT_1(Control) 6.64.Theseresultsconformtothefindingsof Lahijie(2012),KumarandHaripriya(2010),andTamrakar *et al*. (2018), who reported that foliar application of GA□, FeSO□ and ZnSO□promotes the number of leaves per plant.

The maximum width of Leaves per plant wereobserved in treatment T_{10} (ZnSO□ 0.2% + FeSO□ 0.5% + GA□ 200 ppm) 9.13 cm followed byT_7 (ZnSO□ 0.2% + FeSO□ 0.2% + GA□ 200 ppm) 8.88 cm whereas minimum was recorded inT_1(Control):6.64cm.Thesefindingsareinlinewiththoseof Dogra*etal*.(2012),whoreportedthat maximum leaf width was recorded at 300 ppm GA□. Deepika *et al*. (2019) and Tamrakar*et al*. (2018) also reported significant increases in leaf width under the foliar application ofFeSO□and ZnSO□(0.5%) andGA□@200 ppm,respectively.

Table1:InfluenceofPlantGrowthregulatorsandMicronutrientsonVegetativeCharacters of Gladiolus

	VegetativeCharacteristics

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TreatmentsCombinations	Number ofsprout percorms	Height of plant in cm(30DAP)	Number of leavesperplantat30DAP	width of leavesperplantat30DAP
T_1–Control(RDF)	1.68	41.35	6.64	2.58
T_2-$ZnSO_4$(0.2%)	2.01	56.82	7.78	3.08
T_3-$ZnSO_4$(0.5%)	2.26	56.53	8.73	3.01
T_4-$FeSO_4$(0.2%)	2.17	51.36	7.20	2.75
T_5-$FeSO_4$(0.5%)	2.51	55.80	8.81	2.99
T_6-GA_3(200ppm)	2.38	53.00	8.76	3.07
T_7 - $ZnSO_4$(0.2%)+$FeSO_4$ (0.2%)+GA_3(200ppm)	2.67	55.50	8.88	3.10
T_8-$ZnSO_4$(0.5%)+$FeSO_4$ (0.5%)+GA_3(200ppm)	2.19	54.95	8.29	3.28
T_9-$ZnSO_4$ (0.5%)+$FeSO_4$(0.2%)+ GA_3(200ppm)	3.32	54.06	8.21	3.50
T_{10}- ZnSO4(0.2%) +$FeSO_4$ (0.5%)+GA_3(200ppm)	2.48	59.53	9.13	3.23
S.E.(m)	**0.27**	**1.97**	**0.42**	**0.16**
CDat5%	**0.83**	**5.92**	**1.27**	**0.49**

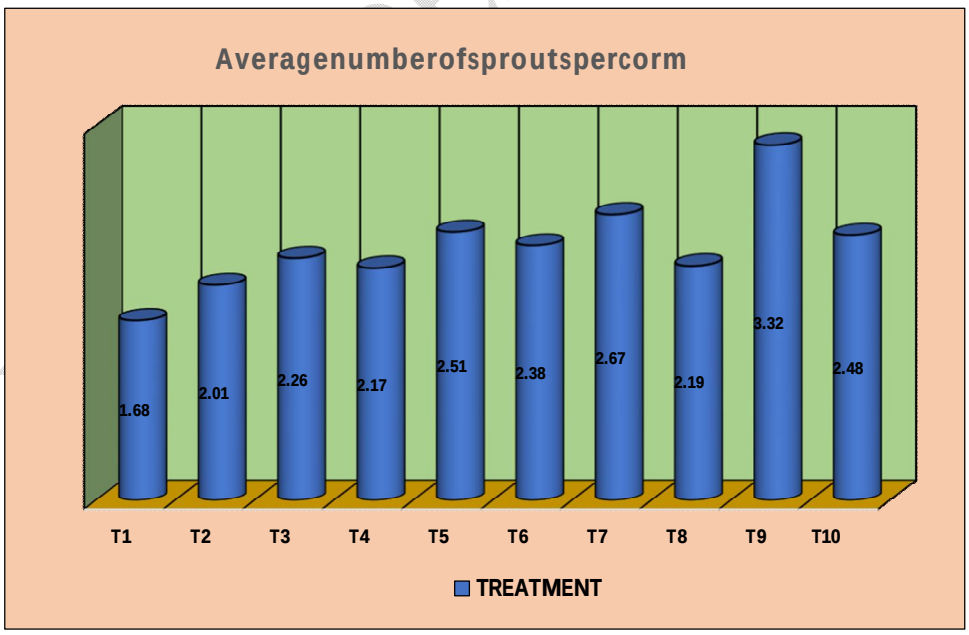

Fig 1 :Average number of sprouts per corm

Fig 2:Average height of plant (cm) at 30 DAP of corm

Influence of Plant Growth Regulators and Micronutrients on Flowering Characters ofGladiolus:

The results are shown that the minimum days to spike emergence In treatment treatedwith T_{10} (ZnSO□ 0.2% + FeSO□ 0.5% + GA□ 200 ppm) 71.62 DAP followed by T_5 (FeSO□0.5%) 71.88 DAP, while maximum was observed in treatment T_1 (Control) 77.21 DAP. Theseresults are consistent with the findings of Dhumal *et al*. (2018), who reported that soakingtuberosebulbsin160ppmGA□solutionfor24hoursbeforeplantingsignificantlyreducedth edays to spike emergence. The maximum number of spikes per plant were observed in T_9(ZnSO□0.5%+FeSO□0.2%+GA□200ppm)3.66,followedbyT_{10}(ZnSO□0.2%+FeSO□0.5 % + GA□ 200 ppm) 2.81 while minimum was taken in T_1 (Control) 1.88. These findingsalign with Padmalatha and Reddy (2013), who reported that GA□ 150 ppm was effective inincreasingthenumberofspikesperplantingladiolus.Minimumdaystakentofirstfloretopennotedi nT_{10}(ZnSO□0.2%+FeSO□0.5%+GA□200ppm)80.10DAP,followedbyT_8(ZnSO□0.5%+FeS O□0.5%+GA□200ppm)80.25DAPwhereasmaximumwasobservedintreatmentT_1 (Control) 85.29 DAP.These results conform to the findings of Lahijie (2012) and Rashmiand Bhagwan Deen (2017), who reported that GA□ @ 200 ppmsignificantly reduced the daystofirstfloretopening.HighestlengthofspikesrecordedintreatmentT_8(ZnSO□0.5%+FeSO□0 .5% + GA□ 200 ppm) 75.36 cm followed by T_1 (Control) 65.10 cm.These findings areconsistentwithShoura*etal*.(2018),whorevealedthatGA□applicationincreasedthelengthofthe spikecomparedtoothertreatmentsReddy*etal*.(2012)alsoreportedsimilarresults.

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Table2:InfluencedofPlantGrowthregulatorsandMicronutrientsonFloweringCharacters of Gladiolus:

TreatmentsCombinations	FloweringCharacteristics			
	Days to initiation ofspike	Number of spike perplant	Daystoopeningoffi rstfloret	Length of spike(cm)
T_1–Control (RDF)	77.21	1.88	85.29	65.10
T_2-$ZnSO_4$(0.2%)	73.81	2.14	80.70	69.07
T_3-$ZnSO_4$(0.5%)	73.40	2.29	81.66	69.81
T_4-$FeSO_4$(0.2%)	72.70	2.29	81.99	71.62

T_5-$FeSO_4$(0.5%)	71.88	2.29	81.03	71.29
T_6-GA_3 (200ppm)	73.99	2.70	82.18	71.51
T_7 - $ZnSO_4$ (0.2%)+$FeSO_4$ (0.2%)+GA_3(200ppm)	74.70	2.47	82.14	72.10
T_8- $ZnSO_4$ (0.5%)+$FeSO_4$ (0.5%)+GA_3 (200ppm)	72.95	2.21	80.25	75.36
T_9 - $ZnSO_4$ (0.5%) +$FeSO_4$ (0.2%)+GA_3(200ppm)	72.84	3.66	81.92	71.40
T_{10}- ZnSO4(0.2%) + $FeSO_4$ (0.5%)+GA_3 (200ppm)	71.62	2.81	80.10	70.92
S.E.(m)	**1.00**	**0.24**	**0.81**	**1.59**
CDat 5%	**2.99**	**0.73**	**2.43**	**4.78**

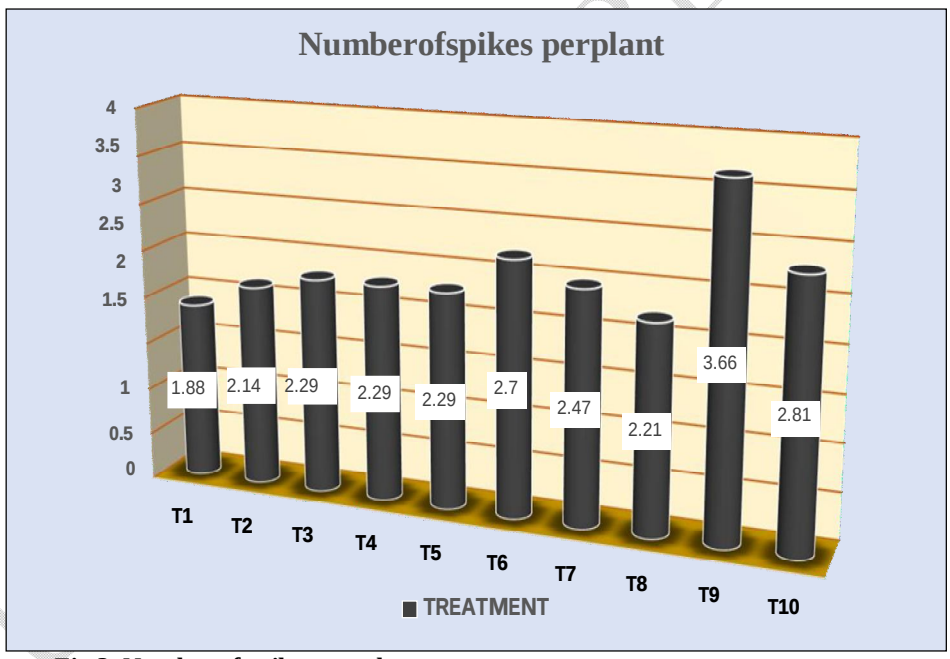

Fig 3 :Number of spikes per plant

Fig 4 :Average length of spike (cm)

InfluenceofPlantGrowthRegulatorsandMicronutrientsonCormYieldTraitsofGladiolus:

The data on corm yield traits were recorded and analyzed, as depicted in Table 3. The resultsare indicated that maximum diameter of corm Were observed in treatment T_9 (ZnSO□ 0.5%

+FeSO□0.2%+GA□200ppm)10.36cmfollowedbyT_8(ZnSO□0.5%+FeSO□0.5%+GA□200ppm) 9.43 cm while minimum was taken in treatment T_1 (Control) 6.83 cm. These results areconsistent with the findings of Rashmi and Bhagwan Deen (2017), who reported that thediameterofcormswassignificantlyimprovedbytheuseofGA□@200ppmcomparedtoothertreatments. The maximum number of corms per plant were recorded in treatment treated withT_7(ZnSO□0.2%+FeSO□0.2%+GA□200ppm)andT8(ZnSO□0.5%+FeSO□0.5%+GA□200ppm)27.00whereasminimumwasnotedinT_1(Control)15.66.Thesefindingscorroboratewith Devi *et al*. (2006), who reported that the application of GA□, specifically 100 ppm,improved the number of corms per plant. The maximum weight of corms was recorded intreatment treated with T8 (ZnSO□ 0.5% + FeSO□ 0.5% + GA□ 200 ppm) 211.20 g followed byT9 (ZnSO□ 0.5% + FeSO□ 0.2% + GA□ 200 ppm): 209.61 g while minimum was found in T2(ZnSO□ 0.2%) 157.97 g. These results align with Rashid (2018), who reported that maximumcorm weight was achieved by soaking corms in GA□ @ 500 ppm for 12 hours and then shadedrying.`

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Table3:InfluenceofPlantGrowthRegulatorsandMicronutrientsonCormYieldTraitsofGladiolus:

TreatmentsCombinations	CormsCharacteristics		
	Diameterofcorm(cm)	Numberofcormsperplant	Averageweightofsinglecorm(g)
T_1–Control(RDF)	6.83	15.66	162.95
T_2-$ZnSO_4$(0.2%)	7.20	18.33	157.97
T_3-$ZnSO_4$(0.5%)	6.90	20.33	164.19
T_4-$FeSO_4$(0.2%)	7.23	20.66	166.16
T_5-$FeSO_4$(0.5%)	7.90	23.00	178.86
T_6-GA_3(200ppm)	8.23	24.00	194.30
T_7-$ZnSO_4$(0.2%)(0.2%)+$FeSo_4$ GA_3(200ppm)	7.96	27.00	205.82
T_8-$ZnSO_4$(0.5%)(0.5%)+$FeSo_4$ GA_3(200ppm)	9.43	27.00	211.20
T_9 - $ZnSO_4$(0.5%) +$FeSO_4$(0.2%)+GA_3(200ppm)	10.36	26.00	209.61
T_{10}-$ZnSO_4$(0.2%)(0.5%)+$FeSO_4$ GA_3(200ppm)	9.06	24.00	202.57
S.E.(m)	**0.23**	**1.78**	**7.70**
CDat 5%	**0.69**	**5.34**	**23.07**

Conclusion:

Based on the findings of the present investigation, it can be concluded that the application ofZnSO□ (0.2%) + FeSO□ (0.5%) + GA□ (200 ppm) is highly beneficial for enhancing thecommercialtraitsofGladioluscv.NovaLux.Thiscombinationofplantgrowthregulatorsandmicronutrients resulted in: Increased number of sprouts per corm: Higher number of sproutswas observed with this treatment. Improved plant height: The tallest plants were achievedunder this treatment. Enhanced number of leaves and leaf width: More leaves and widerleaveswererecorded. EarlierspikeemergenceandFirstfloretopening:Thistreatmentledtoearlierflowering.Longerspikelength:Thelongestspikeswereobservedwiththiscombination. Larger corm diameter: The diameter of corms was significantly improved.Higher Number of corms per plot and greater corm weight: Both metrics were maximizewiththistreatment. Overall, this combination of ZnSO□, FeSO□, and GA□ supports better growth, flowering, andyieldparameters,makingithighlyeffectiveforimprovingthecommercialviabilityofGladiolus cv. NovaLux.

References:

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