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QUALITY OF CORMS AS INFLUENCED BY CORM WEIGHT AT VARIOUS LEVELS OF NUTRITION IN GLADIOLUS CV. AMERICAN BEAUTY

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Abstract

The effect of mother corm weight and NPK levels was found to be significant on quality of daughter corms and cormels in gladiolus cv. American Beauty. The number of corms per mother corm was at the highest when the mother corms with more than 35 g average weight were planted. The weight of corms per mother corm obtained by planting of mother corms with a weight range of 25 g to 35 g was maintained on par with the planting of heavier mother corms (above 35 g) by increasing NPK level from 30N:20P:9K g m^{-2} to 40N: 30P: 13.5K g m^{-2}. Similarly, the combination of 25 g to 35 g mother corm weight + application of 40N: 30P: 13.5K g m^{-2} was on par with heavier mother corms (above 35 g) + 30N:20P:9K g m^{-2}.

Key words : Gladiolus, corm weight, factorial randomized block design, flower quality, spike length.

Introduction

The gladiolus has a long and noble history. The Latin word '*Gladius'* means sword and hence it is often called as 'sword lily' because of its leaf shape. Gladiolus belongs to the family Iridaceae. It is native to South Africa and was introduced into the rest of tropical Africa towards the end of 16^{th} century (Innes, 1985) and to India during early part of 19^{th} century. It stands fourth in the international cut flower trade after carnation, rose and chrysanthemum. Gladiolus being highly responsive crop to nutrition requires large doses of macro nutrients *viz*., nitrogen, phosphorus and potassium (Shankar and Dubey, 2005). Gladiolus is propagated from corms and cormels which possesses stored food in the form of underground stem. As indicated by Ogale *et al.* (1995) a direct relation between corm size, flower production and the corms and cormels yield exist in this crop. The flower quality and spike length of gladiolus can be improved by adopting proper package of cultural practices like, timely planting, proper planting distances between rows and plants, weeding and proper irrigation (Lehri *et al*., 2011). It is essential to find out the best corm size on the basis of both corm diameter and weight in order to standardize conventional propagation methods for getting more corm and cormels production besides good quality spikes.

Materials and Methods

The present investigation was conducted at HCRI, Venkataramannagudem, Andhra Pradesh during the year 2015-2016. The experiment was laid out in factorial randomized block design with three replications. The first factor was corm weight (S), which was taken at 3 levels (S_1: 15 g – 25 g, S_2: 25 g – 35 g and S_3: above 35 g) and the second factor was NPK dose which was also taken at 3 levels (D_1: 20N: 10 P: 4.5 g m^{-2}, D_2: 30N: 20P: 9K g m^{-2} and D_3: 40N: 30P :13.5 K g m^{-2}), thus making 9 treatment combinations in symmetrical factorial concept. The net plot size was 1.8 m × 1.5 m. Nutrients were applied in the form of urea, single super phosphate and muriate of potash, as per treatment combinations. Entire dose of phosphorus and potassium was applied for all the treatment plots as a full dose at the time of bed preparation before planting, however, the nitrogen was applied into three equal splits at 15 DAP, 30 DAP and 45 DAP. All the recommended cultural and plant protection measures were followed.

Results and Discussion

Leaf area (cm^2)

The differences observed in leaf area among the various grades of corm weights and NPK levels and their interactions were found to be significant at all stages of crop growth (table 1 and fig. 1). The mean leaf area increased from 150.17 at 30 days after sowing (DAP) to 705.11 at 90 DAP. The maximum leaf area (775.89 cm^2) at 90 DAP was recorded by S_3 (above 35 g corms) and the minimum leaf area (636.11 cm^2) was observed in S_1 (15 g – 25 g) corms. Among NPK levels, the maximum leaf area (727.56 cm^2) at 90 DAP was observed in D_3 (40N: 30P: 13.5K g m^{-2}) and it was on par with D_2 (30N:20P:9K g m^{-2}) (708.33 cm^2) whereas, the minimum leaf area (679.44 cm^2) was recorded in D_1 (20N: 10P: 4.5K g m^{-2}) on par with D_2 (30N: 20P: 9K g m^{-2}) (708.33 cm^2). The interaction effect was also found to be significantly superior in the combination of S_3 (above 35 g) corms + D_3 (40N: 30P: 13.5K g m^{-2}) (802.67 cm^2) which was on par with the S_3 (above 35 g) corms + D_2 (30N: 20P: 9K g m^{-2}) (775 cm^2).

More number of leaves and more leaf area was obtained by big sized corms probably because of the reason that the large sized corms contained a large amount of stored food compared to small and medium sized corms thus may result in the production of more number of leaves with increased quantities of stored assimilates in the corms. It will increase leaf area by utilizing the available stored food. More number of leaves and more leaf area signs of vigorous nature of plant and they can contribute a large amount of photosynthetic assimilates.

Nitrogen is the most important constituent of chlorophyll and is a component of amino acids and enzymes, thus it might have increased the meristematic activities, cell division, cell number and cell enlargement of the plant this result more vegetative growth. Similar, results are in conformity with the findings of Kumar and Misra (2003). Gupta *et al*. (2008) reported that number of leaves per plant increased with the application of 2.5 kg FYM m^{-2}.

A comparative examination of leaf area and number of leaves per plant indicated that more the number of leaves per plant more was the leaf area both being lesser at lower nutrient doses as compared to higher nutrient doses. The increase in these parameters with increase in the doses of nutrients was significant only up to D_2 level *i.e.* application of 30N:20P and 9K per m^2. The additional increase up to D_3 could not significantly increase the values in respect of leaf area. There might be more number of leaves but all of them could have been smaller so as to result in relatively on par leaf area with higher dose of nutrient application. As compared to higher levels of nitrogen, phosphorus and potassium significant increase in leaf area was seen only up to D_2 level *i.e.* application of 30N: 20P and 9K per m^2 clearly establishing its optimality under local agro-climatic conditions. Similar findings were reported by Parthiban and Khadar (1991), Haitbura and Misra (1999), Mahgoub *et al.* (2006), Patel *et al.* (2010), Kumar and Misra (2011) and Shaukat *et al.* (2012) in gladiolus. These findings are in accordance with Javid *et al.* (2005) in zinnia (*Zinnia elegans*) cv. Giant Dahlia Flowered Blue Point Series, Devi and Singh (2010) in tuberose, Kumar and Misra (2011) and Shaukat *et al.* (2012) in gladiolus.

Number of corms per mother corm

There were significant differences with respect to number of corms per mother corm among the various corm grades and NPK levels as well as their interactions (table 2). The highest number of corms per mother corm (3.78) was observed by S_3 (above 35 g) corms and the least number of corms per mother corm (1.57) was observed in S_1 (15 g – 25 g) corms. Among NPK levels, the highest number of corms per mother corm (2.88) was observed in D_3 (40N: 30P: 13.5K g m^{-2}) which was on par with D_2 (30N: 20P: 9K g m^{-2}) (2.85) and the least number of corms per mother corm (2.40) was recorded in D_1 (20N: 10P: 4.5K g m^{-2}). With respect to number of corms per mother corm S_3 (above 35 g) corms + D_3 (40N: 30P: 13.5K g m^{-2}) recorded maximum value (2.96) whereas, the minimum (1.00) was recorded in the combination of S_1 (15 - 25 g) corms + D_1 (20N: 10P: 4.5K g m^{-2}).

Joshi *et al*. (2011) revealed that highly significant variation was recorded for number of daughter corms among the different sized corms planted. Large sized corms yielded the maximum number of daughter corms and lowest numbers of daughter corms were produced by smallest corms.

Number of cormels per mother corm

The data (table 2) revealed that there existed significant differences in respect of number of cormels per mother corm due to corm weight, NPK levels as well as their interactions. The highest number of cormels per mother corm (50.41) was observed by S_3 (above 35 g) corms and the least number of cormels per mother corm (30.54) was observed in S_1 (15 g – 25 g) corms. The maximum number of cormels per mother corm (41.72) was observed in D_3 (40N: 30P: 13.5K g m^{-2}) among NPK levels studied, and the least number of cormels per mother corm (38.35) was recorded in D_1 (20N: 10P: 4.5K g m^{-2}). Among interactions S_3 (above 35 g) corms + D_3 (40N: 30P: 13.5K g m^{-2}) recorded maximum number of cormels per mother corm (51.83) and which was on par with S_3 (above 35 g) corms + D_2 (30N: 20P: 9K g m^{-2}) (51.26).

Table 1 : Leaf area (cm^2) as influenced by corm weight and NPK levels in gladiolus cv. American Beauty.

NPK levels (D) ($g\ m^{-2}$)	30 DAP				60 DAP				90 DAP			
	Corm weight (S)			Mean	Corm weight (S)			Mean	Corm weight (S)			Mean
	S_1 (15-25 g)	S_2 (25-35 g)	S_3 (>35 g)		S_1 (15-25 g)	S_2 (25-35 g)	S_3 (>35 g)		S_1 (15-25 g)	S_2 (25-35 g)	S_3 (>35 g)	
D_1 (20N:10P:4.5K)	129.85	140.70	157.50	**142.68**	133.75	144.92	162.23	**146.96**	618.33	670.00	750.00	**679.44**
D_2 (30N:20P:9K)	136.96	151.94	165.85	**151.58**	143.81	159.54	174.14	**159.16**	640.00	710.00	775.00	**708.33**
D_3 (40N:30P:13.5K)	139.75	156.95	172.00	**156.23**	147.44	165.58	181.46	**164.83**	650.00	730.00	802.67	**727.56**
Mean	**135.52**	**149.86**	**165.12**	**150.17**	**141.66**	**156.68**	**172.61**	**156.98**	**636.11**	**703.33**	**775.89**	**705.11**
	SEm		CD at 5%		SEm		CD at 5%		SEm		CD at 5%	
Corm weight	2.96		8.83		3.10		9.23		9.99		29.80	
NPK levels	2.96		8.83		3.10		9.23		9.99		29.80	
Interaction (S x D)	5.62		16.78		5.88		17.55		18.97		56.61	

Table 2 : Number of corms and cormels per mother corm as influenced by corm weight and NPK levels in gladiolus cv. American Beauty.

NPK levels (D) ($g\ m^{-2}$)	Number of corms per mother corm				Number of cormels per mother corm			
	Corm weight (S)			Mean	Corm weight (S)			Mean
	S_1 (15-25 g)	S_2(25-35 g)	S_3(>35 g)		S_1(15-25 g)	S_2(25-35 g)	S_3(>35 g)	
D_1 (20N:10P:4.5K)	1.00	2.59	3.05	**2.21**	28.74	38.15	44.15	**37.01**
D_2 (30N:20P:9K)	1.85	2.85	3.85	**2.85**	31.26	41.26	51.26	**41.26**
D_3 (40N:30P:13.5K)	1.87	3.10	3.89	**2.96**	31.61	45.12	51.83	**42.85**
Mean	**1.57**	**2.85**	**3.60**	**2.67**	**30.54**	**41.51**	**49.08**	**40.38**
	SEm		CD at 5%		SEm		CD at 5%	
Corm weight	0.032		0.095		0.518		1.546	
NPK levels	0.032		0.095		0.518		1.546	
Interaction (S x D)	0.061		0.181		0.984		2.937	

Weight of corms per mother corm (g)

The data presented in table 3 indicated that the differences in weight of corms per mother corm due to corm weight, NPK levels and their interactions were significant. The maximum weight of corms (39.33 g) was observed by S_3 (above 35 g) corms and the minimum weight of corms (23.89 g) was observed in S_1 (15 g – 15 g) corms. Among NPK levels, the maximum weight of corms (35.17 g) was observed in D_3 (40N: 30P: 13.5K g m^{-2}) and the minimum weight of corms (29.11 g) was recorded in D_1 (20N: 10P: 4.5K g m^{-2}). The interaction between S_3 (above 35 g) corms + D_3 (40N: 30P: 13.5K g m^{-2}) recorded the heaviest corms per mother corm (43.33 g) and the lightest corm was obtained with the combination of S_1 (15 g - 25 g) corms + D_1 (20N: 10P: 4.5K g m^{-2}) (21.50 g).

Weight of cormels per mother corm (g)

The effect of mother corm weight and NPK levels and their interactions was found significant on weight of cormels per mother corm (table 3). The maximum weight of cormels (26.28 g) was observed by S_3 (above 35 g) corms and the minimum weight of cormels (12.87 g) was observed in S_1 (15 g – 25 g) corms. Among NPK levels, the maximum weight of cormels (22.50 g) was observed in D_3 (40N: 30P: 13.5K g m^{-2}) and the minimum weight of cormels (16.53 g) was recorded in D_1 (20N: 10P: 4.5K g m^{-2}). Among interactions, S_3 (above 35 g) corms + D_3 (40N: 30P: 13.5K g m^{-2}) produced the maximum weight of cormels per mother corm (30.17 g) and the lowest weight of cormels per mother corm was recorded with the combination of S_1 (15 g - 25 g) corms + D_1 (20N: 10P: 4.5K g m^{-2}) (9.93 g).

Table 3 : Weight of corms per mother corm and weight of cormels per mother corm as influenced by corm weight and NPK levels in gladiolus cv. American Beauty.

NPK levels (D) (g m^{-2})	Weight of corms per mother corm (g)				Weight of cormels per mother corm (g)			
	Corm weight (S)			Mean	Corm weight (S)			Mean
	S_1 (15-25 g)	S_2(25-35 g)	S_3(>35 g)		S_1(15-25 g)	S_2(25-35 g)	S_3(>35 g)	
D_1 (20N:10P:4.5K)	21.50	29.50	35.01	**28.67**	9.93	16.33	21.24	**15.84**
D_2(30N:20P:9K)	23.67	31.67	38.33	**31.22**	13.67	18.83	25.33	**19.28**
D_3 (40N:30P:13.5K)	26.50	36.25	43.33	**35.36**	15.00	22.33	30.17	**22.50**
Mean	**23.89**	**32.47**	**38.89**	**31.75**	**12.87**	**19.17**	**25.58**	**19.20**
	SEm		CD at 5%		SEm		CD at 5%	
Corm weight	0.470		1.404		0.353		1.054	
NPK levels	0.470		1.404		0.353		1.054	
Interaction (S x D)	0.894		2.667		0.671		2.002	

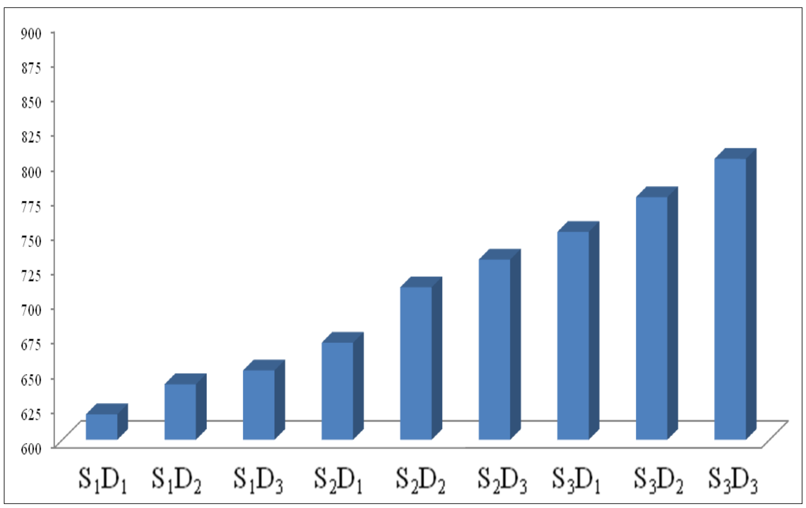

Fig. 1 : Leaf area (cm²) as influenced by corm weight and NPK levels.

Legend

S_1D_1: Corm weight (15g – 25 g)+20N: 10P: 4.5K g m^{-2}
S_3D_1: Corm weight (above 35 g)+20N: 10P: 4.5K g m^{-2}
S_1D_2:Corm weight (15g – 25 g) + 30N: 20P: 9K g m^{-2}
S_3D_2:Corm weight (above 35 g) + 30N: 20P: 9K g m^{-2}
S_1D_3:Corm weight (15g – 25 g)+40N: 30P: 13.5K g m^{-2}
S_3D_3:Corm weight (above 35 g)+40N: 30P: 13.5K g m^{-2}
S_2D_1:Corm weight (25g – 35 g) + 20N: 10P: 4.5K g m^{-2}
S_2D_2:Corm weight (25g – 35 g) + 30N: 20P: 9K g m^{-2}
S_2D_3:Corm weight (25g–35g)+40N: 30P: 13.5K g m^{-2}

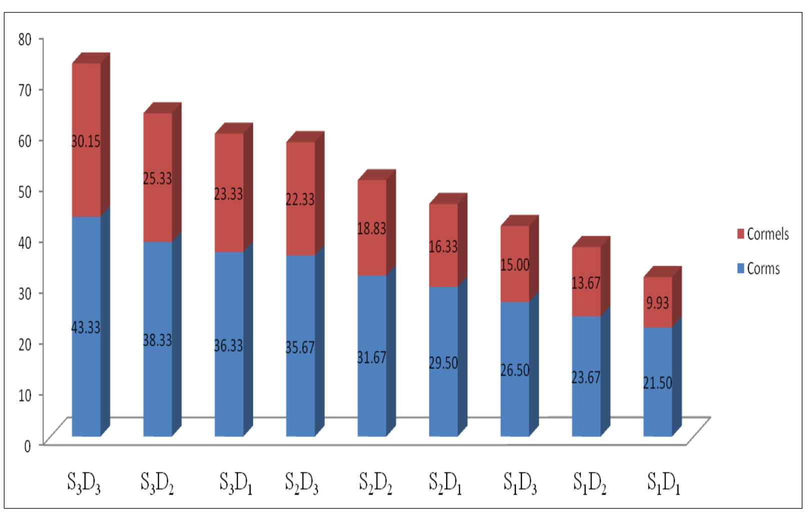

Fig. 2 : Weight of corms and cormels as influenced by corm weight and NPK levels.

Legend

S_1D_1:Corm weight (15 g–25 g) + 20N: 10P: 4.5K g m^{-2}
S_1D_2: Corm weight (15 g – 25 g) + 30N: 20P: 9K g m^{-2}
S_1D_3:Corm weight (15g–25 g) + 40N: 30P: 13.5K g m^{-2}
S_2D_1:Corm weight (25 g–35 g) + 20N: 10P: 4.5K g m^{-2}
S_2D_2: Corm weight (25 g – 35 g) + 30N: 20P: 9K g m^{-2}
S_2D_3:Corm weight (25 g–35 g) + 40N: 30P:13.5K g m^{-2}
S_3D_1:Corm weight (above 35 g) + 20N: 10P: 4.5K g m^{-2}
S_3D_2: Corm weight (above 35 g) + 30N: 20P: 9K g m^{-2}
S_3D_3:Corm weight (above 35 g)+40N: 30P: 13.5K g m^{-2}

Corm diameter (cm)

The effect of corm weight and NPK levels along with their interactions was found to be significant on corm diameter (table 4). The maximum diameter of corm (5.65 cm) was observed by S_3 (above 35 g) corms and the minimum diameter of corm (4.71 cm) was observed in S_1 (15 g – 25 g) corms. Among NPK levels, the maximum diameter of corm (5.32 cm) was observed in D_3 (40N: 30P: 13.5K g m^{-2}) and the minimum diameter of corm (5.07 cm) was recorded in D_1 (20N: 10P: 4.5K g m^{-2}). Among interactions S_3 (above 35 g) corms + D_3 (40N: 30P: 13.5K g m^{-2}) recorded the maximum diameter of corm (5.77 cm) and minimum was recorded with combination of S_1 (15 g - 25 g) corms + D_1 (20N: 10P: 4.5K g m^{-2}) (4.53 cm).

Largest cormel diameter (cm)

The data presented in table 4 indicated that the differences in largest diameter of cormel due to corm weight, NPK levels and their interactions were significant. The maximum diameter of largest cormel (0.97 cm) was observed by S_3 (above 35 g) corms and the minimum diameter of largest cormel (0.43 cm) was observed in S_1 (15 g – 25 g) corms. Among NPK levels, the maximum diameter of largest cormel (0.78 cm) was observed in D_3 (40N: 30P: 13.5K g m^{-2}) and the minimum diameter of the largest cormel (0.56 cm) was recorded in D_1 (20N: 10P: 4.5K g m^{-2}). Among the combinations, S_3 (above 35 g) corms + D_3 (40N: 30P: 13.5K g m^{-2}) recorded the maximum diameter of cormel (1.23 cm) and minimum was recorded with the combination of S_1 (15 g - 25 g) corms + D_1 (20N: 10P: 4.5K g m^{-2}) (0.37 cm).

Weight of corms and cormels per mother corm (g)

Significant differences were observed in the weight of corms and cormels per mother corm due to various grades of corm weights and NPK levels as well as their interactions (table 5 and fig. 2). The maximum weight of corms and cormels per mother corm (64.47 g) was observed in S_3 (above 35 g) corms and the minimum weight of corms and cormels (36.76 g) was observed in S_1 (15 g – 25 g) corms. Among NPK levels, the maximum weight of corms and cormels per mother corm (57.86 g) was observed in D_3 (40N: 30P:13.5K g m^{-2}) and the minimum weight of corms and cormels per mother corm (44.51 g) was noticed in D_1 level (20N: 10P: 4.5K g m^{-2}). The combination of S_3 (above 35 g) corms + D_3 (40N: 30P: 13.5K g m^{-2}) recorded maximum weight of and corms and cormels (73.50 g) and minimum weight was recorded with combination of S_1 (15 g - 25 g) corms + D_1 (20N: 10P: 4.5K g m^{-2}) (31.13 g).

Weight of corms and cormels produced per plot (g)

The effect of corm weight and NPK levels as well as their interactions was found to be significant on weight of corms and cormels per plot (table 5). The maximum weight of corms and cormels produced per plot (1450.63 g) was recorded by S_3 (above 35 g) corms and the minimum weight of corms and cormels produced per plot (827.00 g) was observed in S_1 (15 g – 25 g) corms. Among NPK levels, the heaviest corms and cormels produced per plot (1301.88 g) was observed in D_3 (40N: 30P: 13.5K g m^{-2}) and the lightest weight of corms and cormels per plot (1001.38 g) was recorded by D_1 (20N: 10P: 4.5K g m^{-2}). Among all interactions, S_3 (above 35 g) corms + D_3 (40N: 30P: 13.5K g m^{-2}) recorded maximum weight of and corms and cormels per plot (1653.75 g) and minimum weight was obtained with the combination of S_1 (15 g - 25 g) corms + D_1 (20N: 10P: 4.5K g m^{-2}) (707.25 g).

Weight of corms and cormels per ha (t)

The data presented in table 5 indicated that the differences in weight of corms and cormels per ha due to corm weight, NPK levels and their interactions were significant. The maximum weight of corms and cormels per ha (3.63 t) were observed by S_3 (above 35 g corms) and the minimum weight of corms and cormels per ha (2.07 t) was observed in S_1 (15 g – 25 g corms). Among NPK levels, the maximum weight of corms and cormels per ha (3.25 t) was observed in D_3 (40N: 30P: 13.5K g m^{-2}) and the minimum weight of corms and cormels per ha (2.50) was recorded by D_1 (20N:10P:4.5K g m^{-2}). Among all interactions S_3 (above 35 g) corms + D_3 (40N: 30P: 13.5K g m^{-2}) recorded maximum weight of and corms and cormels per ha (4.13 t) and the minimum weight was recorded with combination of S_1 (15 g - 25 g) corms + D_1 (20N: 10P: 4.5K g m^{-2}) (1.77 g).

From the above results, it can be inferred that the heaviest corms were able to produce largest corms and cormels in huge numbers and also recorded the highest combined weight of corms and cormels. The dry matter assimilation ability of the heaviest corms was found to be significantly superior as compared to other grades of corms right from the beginning of plant growth, which is evident from the results obtained in respect of dry weight of different plant parts. Such a capacity to assimilate more was supported by its capacity to synthesize mor e as evident from its total leaf area per plant when compared to other grades of corms. Therefore, the plants could maintain vigour from the beginning and were able to synthesis as well assimilate more quantum of dry matter in its plant parts. In spite of producing a much enlarged flower stems with larger florets, the underground

Table 4 : Corm diameter and diameter of largest cormel as influenced by corm weight and NPK levels in gladiolus cv. American Beauty

NPK levels (D) (g m^{-2})	Corm diameter (cm)				Diameter of largest cormel (cm)			
	Corm weight (S)			Mean	Corm weight (S)			Mean
	S_1 (15-25 g)	S_2(25-35 g)	S_3(>35 g)		S_1(15-25 g)	S_2(25-35 g)	S_3(>35 g)	
D_1 (20N:10P:4.5K)	4.53	5.16	5.53	**5.07**	0.37	0.53	0.68	**0.53**
D_2 (30N:20P:9K)	4.73	5.23	5.64	**5.20**	0.44	0.58	0.88	**0.63**
D_3 (40N:30P:13.5K)	4.87	5.54	5.77	**5.40**	0.49	0.69	1.23	**0.80**
Mean	**4.71**	**5.31**	**5.65**	**5.22**	**0.43**	**0.60**	**0.93**	**0.65**
	SEm		CD at 5%		SEm		CD at 5%	
Corm weight	0.030		0.089		0.014		0.042	
NPK levels	0.030		0.089		0.014		0.042	
Interaction (S x D)	0.056		0.168		0.027		0.080	

Table 5 : Weight of corms and cormel per mother corm , weight of corms and cormels per plot and weight of corms and cormels per ha (t) as influenced by corm weight and NPK levels in gladiolus cv. American Beauty.

NPK levels (D) (g m^{-2})	Weight of corms and cormels per mother corm (g)				Weight of corms and cormels per plot (g)				Weight of corms and cormels per ha (t)			
	Corm weight (S)			Mean	Corm weight (S)			Mean	Corm weight (S)			Mean
	S_1 (15-25 g)	S_2 (25-35 g)	S_3 (>35 g)		S_1 (15-25 g)	S_2 (25-35 g)	S_3 (>35 g)		S_1 (15-25 g)	S_2 (25-35 g)	S_3 (>35 g)	
D_1 (20N:10P:4.5K)	31.43	45.83	56.25	**44.51**	707.25	1031.25	1265.63	**1001.38**	1.77	2.58	3.16	**2.50**
D_2 (30N:20P:9K)	37.33	50.50	63.67	**50.50**	840.00	1136.25	1432.50	**1136.25**	2.10	2.84	3.58	**2.84**
D_3 (40N:30P:13.5K)	41.50	58.58	73.50	**57.86**	933.75	1318.13	1653.75	**1301.88**	2.33	3.30	4.13	**3.25**
Mean	**36.76**	**51.64**	**64.47**	**50.96**	**827.00**	**1161.88**	**1450.63**	**1146.50**	**2.07**	**2.90**	**3.63**	**2.87**
	SEm		CD at 5%		SEm		CD at 5%		SEm		CD at 5%	
Corm weight	0.867		2.587		17.339		51.734		0.043		0.129	
NPK levels	0.867		2.587		17.339		51.734		0.043		0.129	
Interaction (S x D)	1.674		4.915		32.944		98.295		0.082		0.246	

storage organs were also made to puff up significantly as compared to other grades of corms which can be attributed to its high capacity to assimilate photosynthates. That is the reason why such corms also produced the maximum combined weight of corms and cormels per plant, per plot and per ha, since there was equal amount of plant population in every treatment. The extended period of sustenance of leafiness as evident by better leaf area duration which was effective over large period of time, could produce not only better sized floral organs but also the additional assimilates were diverted to underground.

It is also evident that higher doses of nutrients could produce higher numbers of corms and cormels, weights of corms and cormels individually as well in combination. Unlike in case of floral parameters, the additional increment above D_2 (30N: 20P: 9K g m^{-2}) *i.e.* application of 40N: 30P: 13.5K g m^{-2} produced significantly superior combined as well as individual weights of corms and cormels per plant, per plot and per ha. This indicates that the quantity of nutrients absorbed might have got diverted maximum to the underground storage organs rather than to the floral parts though it also took place simultaneously. That could be the reason why there might be a non-significant increase in spike size or weight by the application of 40N: 30P: 13.5K g m^{-2} as compared to 30N: 20P: 9K g m^{-2}.

Similar discussion on individual effects of corm size and nutritional level could be also attributed for the interaction effect between these two in that the heavier corms applied with the maximum level of nutrients could maintain more vigour growth right from the beginning; maintain the efficiency of photosynthesizing surface over an extended period of time; diverted the assimilates to a maximum extent to the floral organs as well as underground storage organs and thus being able to record a significantly superior individual and combined weights of corms and cormels per mother corm, per plot and per hectare.

Joshi *et al*. (2011) revealed that highly significant variation was recorded for number of daughter corms among the different sized corms planted. Large sized corms yielded the maximum number of daughter corms and lowest numbers of daughter corms were produced by smallest corms. Kareem *et al.* (2013) reported that corm size was increased with increase in mother corm size. Maximum corm size was observed on mother corms of larger size and *vice versa*.

Joshi *et al*. (2011) revealed that highly significant variation was recorded on weight of daughter corms among the different sizes of corms planted. Bigger size of mother corms produced daughter corms with higher weight and *vice versa*. Large size of daughter corms from larger mother corms was attributed as the reason for higher weight of daughter corms.

Noor *et al*. (2009) observed that the total weight of corms and cormels plant^{-1} was at maximum in response to large sized corms. Significant reduction was observed in the weight of corms and cormels in response to small and medium sized corms. Kareem *et al.* (2013) published the results signifying the importance of medium or large sized corms for propagation of gladiolus since they could produce more number of cormels which could increase the net profit.

Khan *et al.* (2012) noticed maximum number of corms (120,000) with the application of highest dose of N and K and indicated that an optimum fertilizer dose encouraged plants to grow more vigorously and produce more metabolites.

Mahadik and Neha *et al*. (2015) recorded similar significant influence of NP and K on corms and cormels per plant, per plot and per ha The favorable effect of higher levels of nitrogen in promoting corms and cormels yield was attributed to be due to the fact that the higher level of nitrogen provided better growth and development of plant and helped in translocation of photosynthates from source to sink (corms). Yield of corms and cormels in gladiolus was increased with every increment of potassium application, which was attributed to the fact that better vegetative growth could have increased photosynthesis resulting in assimilation of more carbohydrates and their translocation in to the corms leading to increased number of corms and cormels yield. Similar increase in corm yield due to higher dose of potassium was also reported by Barman *et al.* (2005) and Zubair (2011) in gladiolus.

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