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EFFECT OF CORM WEIGHT AT DIFFERENT NPK LEVELS ON GROWTH AND FLOWERING IN GLADIOLUS

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Abstract

The effect of mother corm weight and NPK levels was found to be significant on growth and flowering in gladiolus cv. American Beauty. The earliest sprouting and maximum number of sprouts per mother corm was obtained from the corms weighing above 35 g and NPK level of 40N : 30P : 13.5K g m^{-2}. The values of plant height and leaf area per plant were at highest with these treatment combinations only. Similarly, the high grade corms and the highest NPK level in the present study was earliest to initiate flowering, possessed prolonged duration of flowering and recorded maximum number of spikes per mother corm and per ha.

Key words : NPK level, plant height, gladiolus, leaf area per plant, factorial randomized block design.

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 (India) 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 x 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

Days taken for sprouting

There were significant differences among the various grades of corm weights and NPK levels and their interactions with respect to the number of days to sprouting of corms (table 1). The earliest sprouting (9.04

days) was recorded by S_3 (above 35 g corms) and the highest delay in sprouting (11.89 days) was noted in S_1 (15 g – 25 g corms). Among NPK levels, the earliest sprouting (9.96 days) was observed in D_3 (40N: 30P: 13.5K g m^{-2}) whereas, the highest delay in sprouting (11.04 days) was observed in D_1 (20N: 10P: 13.5K g m^{-2}). The combination of S_3 (above 35 g corms) + D_3 (40N: 30P: 13.5K g m^{-2}) was found to be the earliest to sprout (8.59 days).

Early sprouting in gladiolus was obtained by large sized corms probably because of the reason that they contain a large amount of stored food compared to small and medium sized corms thus may result in early sprouting by utilizing the available stored food for early sprouting. Early sprouting is the sign of vigour of the sprout which might have been supported by a greater quantum of energy metabolism being carried out relatively at a stronger level in the corms having more amount of respiratory substrates and thus larger corms were able to push out early sprouts.

At higher doses of nutrient application there was an earliest sprouting of corms, which might be because of higher nutrient availability. A high dose of nitrogen could have resulted in more cell division and cell elongation, high levels of available phosphorous could have supported better energy metabolism and potassium might have played a catalytical role and all these effects integrated and perhaps might have led to greater vigour in the sprouts. Similarly, Baral *et al*. (2012) observed early sprouting of gladiolus corms with the application of the highest dose of nitrogen. The results are in conformity with the reports of Sharma *et al*. (2003).

Number of sprouts per corm

There were significant differences among the various grades of corm weights and NPK levels and their interactions with respect to the number of sprouts per corms (Table 1). The maximum sprouts (4.09) were recorded by S_3 (above 35 g corms) and the least number of sprouts (1.20) was observed in S_1 (15 g – 25 g) corms. Among NPK levels, the maximum number of sprouts (3.22) was observed in D_3 (40N: 30P: 13.5K g m^{-2}), which was on par with D_2 (30:20:90 g m^{-2}) (3.06) whereas, the least number of sprouts (2.40) was recorded in D_1 (20N: 10P: 13.5K g m^{-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}) (4.35 sprouts).

The higher sprouts were obtained by planting bigger corms probably because of the reason that the large sized corms contain fairly a large amount of stored assimilated as compared to small and medium sized corms thus resulting in increased vigour of buds that in turn could have sprouted in large numbers. Numerous sprouts could be the sign of greater capacity supported by a greater quantum of energy metabolism being carried out relatively at a stronger level in the corms having more amount of respiratory substrates and thus larger corms were able to produce more sprouts.

At higher doses of nutrient application there were more sprouts per corm, which might be because of higher nutrient availability. A high dose of nitrogen could have resulted in more cell division and cell elongation; high levels of available phosphorous could have supported better energy metabolism. The beneficial role of potassium in catalyzing various metabolic activities and maintenance of osmotic potential in the cellular environment to keep translocation process at desirable rate, might have played a positive role in increasing the number of sprouts per corm.

Baral *et al*. (2012) reported that maximum number of sprouts per corm was produced with highest nitrogen dose as compared to control or no nitrogen in gladiolus cultivar American Beauty.

Plant height

Plant height differed significantly among the various grades of corm weights and NPK levels and their interactions at all stages of crop growth (table 2 and fig. 1). The mean plant height increased from 24.15 cm at 30 days after sowing (DAP) to 63.18 cm at 90 DAP. The maximum plant height (67.16 cm) at 90 DAP was recorded by S_3 (above 35 g corms) and the minimum (60.28 cm) was observed in S_1 (15 g – 25 g corms). Among NPK levels, the highest plant height (64.27 cm) at 90 DAP was observed in D_3 (40N: 30P: 13.5K g m^{-2}) whereas, the lowest plant height (61.70 cm) was recorded in D_1 (20N: 10P: 13.5K g m^{-2}). Among the combinations S_3 (above 35 g corms) + D_3 (40N: 30P: 13.5K g m^{-2}) was found to be the highest plant height (68.29 cm) and which was on par with the combination of S_3 (above 35 g corms) + D_2 (30N: 20P: 9K g m^{-2}) (67.53 cm) at 90 DAP.

The height of plant acquired over different growth stages indicates the vertical growth which is normally influenced by the phenomenon of apical dominance. More the vigour more will be plant height in general. Initial vigour of the plant is many a times the key for gaining maximum plant height at maturity. In the present study, the initial vigour was at a boosted level in the sprouts from larger corms compared to the vigour of the sprouts arising from small sized corms. Higher the plant height at 30 DAP, higher was the plant height at 60 DAP and in turn maintained at higher level at the final stage (90 DAP)

Table 1 : Number of days taken for sprouting and number of sprouts per corm as influenced by corm weight and NPK levels in gladiolus cv. American Beauty.

NPK levels (D) ($g\ m^{-2}$)	Number of days taken for sprouting				Number of sprouts per 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(10-15 g)	S_2(15-25 g)	S_3(>35 g)	
D_1 (20N: 10P: 4.5 K)	12.26	11.59	9.26	**11.04**	1.00	2.58	3.62	**2.40**
D_2 (300:200:90)	12.26	10.15	9.26	**10.56**	1.30	3.58	4.30	**3.06**
D_3 (400:300:135)	11.15	10.15	8.59	**9.96**	1.31	4.00	4.35	**3.22**
Mean	**11.89**	**10.63**	**9.04**	**10.52**	**1.20**	**3.39**	**4.09**	**2.89**
	SEm		CD at 5%		SEm		CD at 5%	
Corm weight	0.08		0.25		0.07		0.21	
NPK levels	0.08		0.25		0.07		0.21	
Interaction (S x D)	0.15		0.44		0.12		0.37	

Table 2 : Plant height (cm) as influenced by corm weight and NPK levels in gladiolus cv. American Beauty.

NPK levels (D) ($g\ m^{-2}$)	30 DAS				60 DAS				90 DAS			
	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: 4.5 K)	21.84	23.30	24.43	**23.19**	48.47	51.36	54.14	**51.32**	57.78	61.67	65.65	**61.70**
D_2 (30N:20P:9K)	22.88	23.57	26.43	**24.29**	50.72	51.75	56.11	**52.86**	61.19	61.96	67.53	**63.56**
D_3 (40N:30P:13.5K)	23.13	24.23	27.53	**24.96**	51.08	54.11	57.72	**54.31**	61.87	62.66	68.29	**64.27**
Mean	**22.61**	**23.70**	**26.13**	**24.15**	**50.09**	**52.41**	**55.99**	**52.83**	**60.28**	**62.10**	**67.16**	**63.18**
	SEm		CD at 5%		SEm		CD at 5%		SEm		CD at 5%	
Corm weight	0.16		0.48		0.19		0.56		0.25		0.76	
NPK levels	0.16		0.48		0.19		0.56		0.25		0.76	
Interaction (S x D)	0.21		0.83		0.32		0.96		0.44		1.32	

also. It is not only the initial vigour, but also the sustenance of such vigour over different growth interval which would was better done by the sprouts obtained from larger corms, perhaps by maintaining higher number of leaves and leaf area per plant.

Ahmed *et al.* (2015) reported a gradual increase in plant height with increase in size of mother corms. At 60 DAP the significantly tallest plant was observed from large sized corms, whereas the shortest plant was noticed from small sized corm. They attributed that large sized corm produced the highest plant height since they could ensure the supply of nutrient elements adequately to newly emergents. Singh (2000) found the tallest plants with larger corms. He felt this could be due to more food storage in larger corms. The findings of Farid *et al.* (2002), Kamal *et al.* (2002), Mukhopadhyay and Yadav (1984), Islam *et al.* (2000) and Abdul *et al.* (2013) supported the same.

Leaf area

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 3 and fig. 2). 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: 13.5K $g\ m^{-2}$) on par with D_2 (30N:20P:9K $g\ m^{-2}$) (708.33

Table 3 : 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	

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_3 (30N: 20P: 9K g m^{-2}) (775 cm^2), respectively.

More number of leaves and more leaf area was obtained by big sized corms probably because of the reason that the large sized corms contain 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 sign of vigorous nature of plant and they can contribute a large amount of photosynthetic assimilates.

Abdul *et al.* (2013) reported number of leaves per plant was significantly influenced by corm size. Large sized corms produced maximum number of leaves while minimum number of leaves was found in small sized corms. Similar trend was noted in leaf area per plant. The conclusions of Ahmed *et al.* (2015) were in the line that significant increase in the number of leaves per plant at final growth stage was observed on the plants produced from large sized corms.

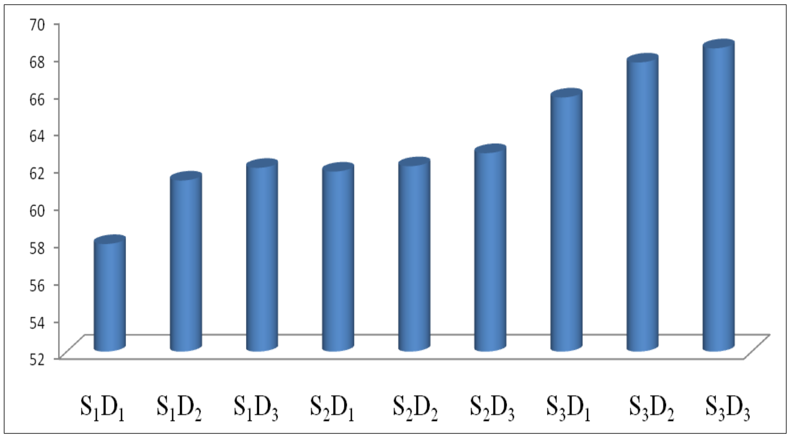
Number of days taken for initiation of spike, 50% flowering, complete flowering and duration

The data presented in table 4 indicated that the differences in days taken for initiation of spike, 50% flowering, complete flowering and flowering duration due to corm weight, NPK levels and their interactions were significant. The least number of days taken for initiation of spike (61.24) were recorded by S_3 (above 35 g corms) and the highest number of days taken for initiation of spike (66.85) was observed in S_1 (10 g – 15 g corms). The application of NPK at D_3 (40N: 30P: 13.5K g m^{-2}) recorded the least number of days taken for initiation of spike (63.05) as against the highest number of days taken for initiation of spike (65.21) with the application of NPK at D_1 level (20:10:4.5 g m^{-2}).

The minimum number of days taken for 50 percent flowering (74.5) was recorded by S_3 (above 35 g corms) and the maximum number of days taken for 50 percent flowering (79.9) was observed in S_1 (10 g – 15 g corms). Among NPK levels, the minimum number of days taken for 50 percent flowering (76.2) was observed in D_3 (40N: 30P: 13.5K g m^{-2}) and the maximum number of days taken for 50 percent flowering (78.7) was recorded in D_1 (20N: 10P: 13.5K g m^{-2}).

The minimum number of days taken for 100 per cent flowering (86.1) was recorded by S_1 (15 - 25 g corms) and the maximum number of days taken for 100 per cent flowering (89.2) was observed in S_3 (above 35 g corms). The minimum number of days taken for 100 per cent flowering (86.1) among NPK levels, was observed in D_1 (20N: 10P: 13.5K g m^{-2}) and the maximum number of days taken for 100 percent flowering (89.2) was recorded in D_3 (40N: 30P: 13.5K g m^{-2}).

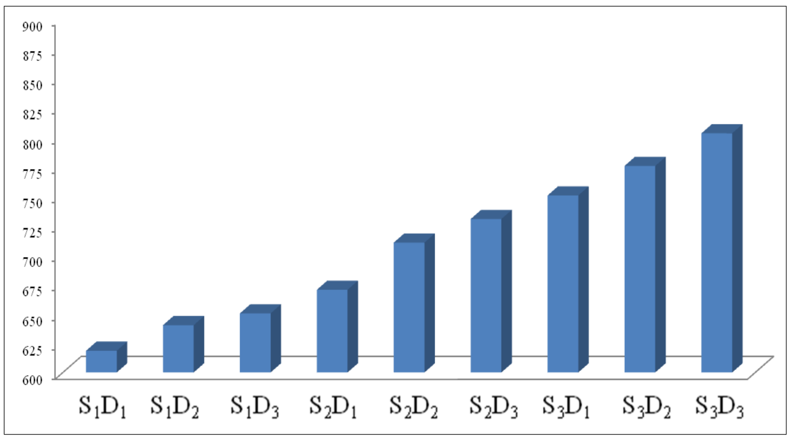
The shortest duration of flowering (17.51 days) was recorded by S_1 (10 g – 15 g corms) and the longest duration of flowering (28.98 days) was observed in S_3 (above 35 g corms). Among NPK levels, the shortest duration of flowering (20.92 days) was observed in D_1 (20N: 10P: 13.5K g m^{-2}) significantly earlier to D_2 (30:20:90 g m^{-2}) (22.64 days) and the longest duration of flowering (26.13



Legend

S_1D_1:Corm weight (15 g – 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 (15 g – 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 (15 g – 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 (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}

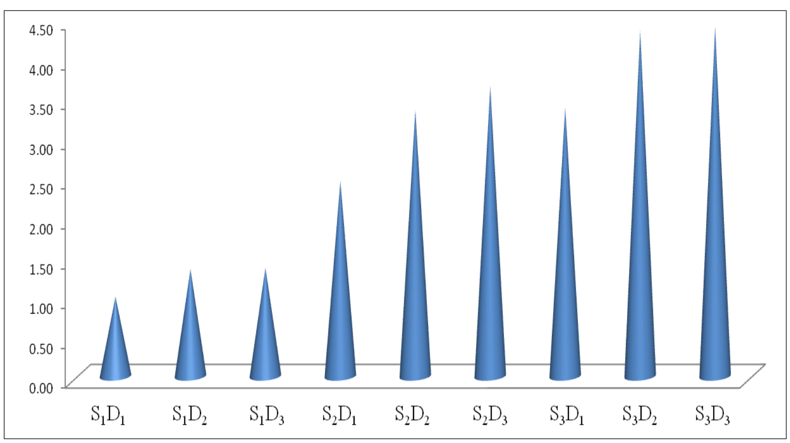
Fig. 1 : Plant height (cm) at 90DAP as influenced by corm weight and NPK levels.



Legend

S_1D_1:Corm weight (15 g – 25 g) + 20N: 10P: 4.5K g m^{-2}
S_3D_1:Corm weight (above 35 g) + 20N: 10P: 4.5K g m^{-2}
S_1D_2:Corm weight (15 g – 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 (15 g – 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 (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}

Fig. 2 : Leaf area (cm^2) 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 (15 g – 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}

Fig. 3 : Number of spikes per mother corm as influenced by corm weight and NPK levels.

days) was recorded in D_3 (40N: 30P: 13.5K g m^{-2}).

Flowering denotes the transition of plant from vegetative phase to reproductive phase. In general those individuals gained a better position in vegetative parameters exhibit a superior performance in reproductive parameters also. However, sometimes distressed plants flower early on account of stress induced pressure to complete life cycle. On the contrary, in the cases where plants attain physiological maturity to enter into flowering stage, well nourished plants also flower early. Early initiation of flowering and early attainment of 50% flowering stage is an indication of a relative perfectness in the plants health and strength for having ability to receive photo morphogenetic stimulus. Such superior

Table 4 : Number of days taken for initiation of spike, days taken for 50% flowering, days taken for 100% flowering and duration of flowering as influenced by corm weight and NPK levels in gladiolus cv. American Beauty.

NPK levels (D) (g m^{-2})	Number of days taken for initiation of spike				Days taken for 50 % flowering				Days taken for 100 % flowering				Duration of flowering			
	Corm weight (S)			Mean	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	S_2 (25-35	S_3 (>35 g)		S_1 (15-25	S_2 (25-35	S_3 (>35 g)		S_1 (15-25	S_2 (25-35	S_3 (>35 g)	
D_1 (20N:10P:4.5K)	67.50	65.48	62.67	**65.21**	81.8	79.0	75.4	**78.7**	83.2	86.6	88.6	**86.1**	15.67	21.16	25.93	**20.92**
D_2 (30N:20P:9K)	67.00	64.80	61.72	**64.51**	79.2	77.5	74.6	**77.1**	84.5	87.6	89.3	**87.1**	17.53	22.77	27.61	**22.64**
D_3 (40N:30P:13.5K)	66.06	63.76	59.33	**63.05**	78.5	76.5	73.6	**76.2**	85.4	89.4	92.7	**89.2**	19.34	25.64	33.40	**26.13**
Mean	**66.85**	**64.68**	**61.24**	**64.26**	**79.9**	**77.6**	**74.5**	**77.3**	**84.4**	**87.9**	**90.2**	**87.5**	**17.51**	**23.19**	**28.98**	**23.23**
Factor	SEm		CD at 5%		SEm		CD at 5%		SEm		CD at 5%		SEm		CD at 5%	
Corm weight	0.11		0.32		0.05		0.14		0.09		0.27		0.15		0.46	
NPK levels	0.11		0.32		0.05		0.14		0.09		0.27		0.15		0.46	
Interaction (S x D)	0.19		0.56		0.08		0.24		0.16		0.47		0.27		0.80	

condition was exhibited by the corms weighing above 35 g and application of nutrients at 40N: 30P: 13.5K g m^{-2} as well as their combination. Medium and small sized corms as well the application of NPK at lower levels rather delayed both the flower initiation and 50% flowering stages, which may be perhaps due to their relative weakness as compared to the earliest factors mentioned above.

Flowering was completed in all the individual plants positioned in a treatment plot at different time periods that varied significantly among the factors and their interactions. The time period between initiation of flowering and completion of the same in a treatment plot denotes the available period of time for elongation, floret opening, colour development and expansion of floret size which will ultimately decide the spike quality. Greater the time available, greater will be the quality of spike on account of brightly coloured, fully expanded and bold florets. It is appreciable to note the greatest delay in completion of flowering by larger mother corms (weighing above 35 g) and applied with nutrients at 40N: 30P: 13.5K g m^{-2} individually as well as in combination in spite of the fact that these treatments initiated flowering at the earliest leaving a large space in time for the greatest elongation, expansion and colour development in the rachis and florets. The forth coming results on spike quality parameters as well as dry matter accumulation in spike which was already presented are also in line with the above discussion. As it is observed right from the vegetative parameters, it is once again worthy to note that the application of nutrients at D_2 (30N: 20P: 9K g m^{-2}) level exhibited the duration of flowering at par with the highest dose.

Number of spikes per corm

The data (table 5 and fig. 3) revealed that there existed significant differences in respect of number of spikes per corm, per plot and per ha due to corm weight, NPK levels and their interactions. The maximum number of spikes per corm (4.04) was observed by S_3 (above 35 g) corms and the minimum number of spike per corm (1.24) was observed in S_1 (15 g – 25 g) corms. Among NPK levels, the maximum number of spikes per corm (3.14) was observed in D_3 (40N: 30P: 13.5K g m^{-2}) which was on par with D_2 (30:20:90 g m^{-2}) (3.01) and the minimum number of spike per corm (2.28) was recorded in D_1 (20N: 10P: 13.5K g m^{-2}).

The maximum number of spike per plot (39.30) were observed by S_3 (above 35 g corms) and the minimum number of spike per plot (31.79) was observed in S_1 (15 g – 25 g corms). Among NPK levels, the maximum

Table 5 : Number of spikes per corm, per plot and estimated spike yield per ha as influenced by corm weight and NPK levels in gladiolus cv. American Beauty.

NPK levels (D) (g m^{-2})	Number of spikes per corm				Number of spike per plot				Estimated spike yield per ha (Thousands)			
	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)	1.00	2.46	3.38	**2.28**	30.89	32.33	34.01	**34.31**	77.22	80.83	85.03	**81.03**
D_2 (30N:20P:9K)	1.35	3.35	4.35	**3.01**	32.11	33.67	41.78	**35.85**	80.28	84.17	104.44	**89.63**
D_3 (40N:30P:13.5K)	1.36	3.65	4.39	**3.14**	32.37	39.70	42.11	**38.06**	80.93	99.26	105.28	**95.15**
Mean	**1.24**	**3.15**	**4.04**	**2.81**	**31.79**	**35.23**	**39.30**	**35.44**	**79.48**	**83.34**	**98.25**	**88.60**
Factor	SEm		CD at 5%		SEm		CD at 5%		SEm		CD at 5%	
Corm weight	0.08		0.25		0.13		0.39		0.001		0.004	
NPK levels	0.08		0.25		0.13		0.39		0.001		0.004	
Interaction (S x D)	0.15		0.44		0.22		0.67		0.002		0.007	

number of spike per plot (38.06) was observed in D_3 (40N: 30P: 13.5K g m^{-2}) and the minimum number of spike per plot (32.41) was recorded in D_1 (20N: 10P: 4.5K g m^{-2}).

The maximum spike yield per ha (98.25 thousands) was estimated for S_3 (above 35 g) corms and the minimum spike yield (79.48 thousands) was observed in S_1 (15 g – 25 g) corms. Among NPK levels, the maximum spike yield per ha (95.15 thousands) was observed in D_3 (40N: 30P: 13.5K g m^{-2}) which was and the minimum spike yield per ha (81.03 thousands) was recorded in D_1 (20N: 10P: 13.5K g m^{-2}).

The yield of spikes in terms of number is the penultimate value next only to corm yield because gladiolus has economic value by virtue of both the parts. Heavy mother corms of above 35 g average weight in combination of the nutritional level at 40N: 30P: 13.5K g m^{-2} were found to record maximum number of spikes per corm on par with the combination of the same corms with the next lower nutritional level *i.e.* 30N: 20P: 9K g m^{-2}. The combination of medium sized mother corms + nutritional dose at 40N: 30P: 13.5K g m^{-2} followed them. Whatever the trend we got in terms of the spike number per mother corm, the same was also observed in terms of per plot and per hectare since the plant population was the same in all the plots with different treatment combinations. The yield happened to be the result of various growth attributes as well as yield contributing or attributing parameters like the weight of spike and its components as well as duration of flowering etc. The data on number of sprouts per mother corm on the above treatment combinations directly indicated that there were more sprouts per mother corm and therefore, would have contributed more spikes though variable in size, per mother corm. That is the reason why, heavier corms with nutrient application at 40: 30: 13.5 and 30: 20: 9 proportions could also show better number of spikes per corm followed by medium size corms applied with 40:30:13.5 of NPK g m^{-2}.

It is also elevating the worth of the above treatments, by noticing that they were showing taller plants with higher leaf area per plant as well as the values of leaf area index, crop growth rate etc. However, the accumulation of dry matter per gram of dry matter already present and the efficiency of photosynthetic apparatus per unit area as indicated by relative growth rate and net assimilation rate values were not increased with the high yielding treatments. It is clear with the analysis of growth indices that high yielding treatment combinations though not more efficient per unit of leaf area, they showed greater accumulation of dry matter as they were possessing a higher photosynthetic surface sustained over larger period of time. The dry matter assimilated to leaf, stem and spike components was found to be the greatest in heavy corms fed with the 40:30:13.5 and 30:20:9 NPK doses. Such a foundation in the vegetative growth made the plants to develop and transform into reproductive phase at an earliest point of time, but again taking an enlarged period of time to push all those assimilates into spike and/ or florets ultimately giving heavier florets in large numbers in the heavier and longer spikes. Thus the number of spikes as well as weight of spikes was significantly superior in the plants produced from the heaviest corms (above 35 g weight) receiving the nutrition at 30N: 20P: 9K and 40N: 30P: 13.5K g m^{-2} being on par with each other.

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