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Short communication

Effect of integrated nutrient management on vegetative growth and flowering characters of gladiolus

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ABSTRACT

An investigation was carried out to study the combined effect of integrated nutrient management on vegetative growth and flowering characters of gladiolus cv. Snow Princess with the application of *Azospirillum*, PSB, vermicompost and FYM with and without 100, 75 and 50% recommended dose of NPK. The results showed that plant height was maximum with application of 75% RDF + 20 t ha^{-1} FYM, while number of florets remaining open at a time was recorded maximum under 100% RDF + FYM, 20 tonnes/ha . Days to first floret opening and number of days for 50% plant to sprout were earliest under treatments 75% RDF + FYM,10 tonnes/ha + vermicompost, 10 tonnes/ha and vermicompost, 20 tonnes/ha, respectively. The application of 20 t ha^{-1} FYM produced maximum number of leaves. The components like diameter of 3rd florets, length of rachis, fresh weight of plant and vase-life of spike in tap water were maximum with 50% RDF (60: 40: 40 kg/ha NPK) + 10 tonnes/ha each of FYM and vermicompost; whereas days to first floret opening was minimum with 75% RDF (90:60:60 kg/ha NPK) + 10 tonnes/ha each of FYM and vermicompost. Application of integrated nutrients, i.e. 50% RDF (60:40:40 kg/ha NPK) + 10 tonnes/ha each of FYM and vermicompost + 2 g/plant each of *Azospirillum* and PSB produced significantly maximum length of spike, number of florets per spike, duration of flowering and yield of corms. The dry weight of plant was found maximum with the application of 75% RDF + 10 tonnes/ha each of FYM and vermicompost + 2 g/plant each of *Azospirillum* and PSB.

Key words: Gladiolus, *Azospirillum*, fertilizers, vermicompost.

Gladiolus (*Gladiolus hybridus* Hort.) belongs to the family Iridaceae. It is one of the most important ornamentals for cut flower trade in India and abroad. It is also ideal for garden display, floral arrangements and for bouquet. The yield and quality of flowers and corms can be improved by adopting integrated nutrient management practices which include the judicious and combined use of organic, inorganic and bio-fertilizers. In gladiolus too, *Azospirillum,* phosphorus solubilizing bacteria (PSB) are capable of mobilizing nutrient elements from non-usable form to usable form through biological processes (Bhalla *et al.*, 1).The research over conventional nutritional requirement (recommended dose of NPK fertilizers) has been standardized. However, for getting more quantity of flowers farmers are using chemical fertilizers unscrupulously, which are costly and create threat to soil health. Hence, there is a need to develop sustainable production system, wherein chemical fertilizers can be minimized by using alternative sources of nutrients. Use of organic and bio-fertilizers is one of the untapped means and can supplement nutritional requirement of gladiolus crop. Keeping the above facts in view, the present investigation has been planned to study the combined effect of integrated nutrient management on vegetative growth and flowering characters of gladiolus.

The experiment was conducted in loamy soil with pH 8.3**.** The experiment was laid out in a simple randomized block design with 11 treatments and three replications. Well decomposed farmyard manure, vermicompost, *Azospirillum* and PSB were applied treatment-wise before planting. Recommended fertilizer doses of 120:80:80 kg/ha NPK were also given treatment-wise as 100, 75 and 50%. These fertilizers were applied in the form of urea, single superphosphate and muriate of potash. Uniform size of gladiolus corms (4.0 to 5.0 cm) of cv. Snow Princess was planted on 11th October, 2010. The row to row distance of 40 cm and plant to plant distance of 20 cm in a plot size of 3.0 × 2.0 m. was maintained. The treatments imposed were: T_1: control, T_2 : 100% RDF (120:80:80 kg/ha NPK), T_3 : FYM, 20 tonnes/ha, T_4 : Vermicompost, 20 tonnes/ha, T_5 : 100% RDF + FYM, 20 tonnes/ha,T_6 : 75% RDF + FYM, 20 tonnes/ha, T_7 : 75% RDF + FYM,10 tonnes/ha + vermicompost,10 tonnes/ha, T_8 : 75% RDF + FYM 10 tonnes/ha + vermicompost,10 tonnes/ha + *Azospirillum* 2 g/plant and PSB, 2 g/plant, T9 : 50% RDF + FYM, 20 tonnes/ha, T_{10} : 50% RDF + FYM,10 tonnes/ha + vermicompost, 10 tonnes/ha, T_{11} : 50%

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RDF + FYM,10 tonnes/ha + vermicompost,10 tonnes/ha + *Azospirillum* 2 g/plant and PSB 2 g/plant. The observations on various growth, flowering characters and corm yield were recorded.

A perusal of data (Tables 1 & 2) revealed that all the growth and flowering characteristics of gladiolus were significantly affected by different treatments. Application of 100% recommended dose of fertilizers (RDF) + FYM (20 tonnes/ha) recorded 16 days for 50% plants to sprout which was at par with control, whereas, application of farmyard manure alone @ 20 tonnes/ha (T_3) had significantly increased the number of shoots per corm, number of leaves per plant and leaf area over control and other treatments. The treatment T_6 and T_{10} had recorded the maximum plant height and diameter of 3rd florets, respectively and varied from 79.66 to 115.0. cm and 9.75 to 12.33, respectively. A significant increase in plant height and diameter of 3rd florets of gladiolus in integrated nutrient over treatments recommended NPK dose

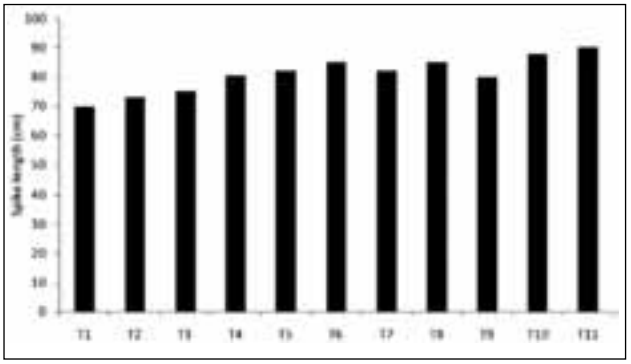
Table 1. Growth and flowering characters of gladiolus cv. Snow Princess as influenced by integrated nutrient management.

Treatment	No. of days for 50% corm to sprout	No. of shoots per corm	No. of leaves per plant	Plant height (cm)	3rd floret dia. (cm)	Days to first floret opening	Days required for 50% blooming
T_1	16.0	1.66	6.33	79.7	9.75	79.33	98.66
T_2	14.3	1.63	6.66	98.7	11.50	78.66	98.00
T_3	14.7	2.33	7.44	96.7	11.83	74.00	94.66
T_4	11.0	2.10	7.00	106	11.41	76.66	95.66
T_5	16.0	2.10	7.00	102	10.41	78.33	98.33
T_6	12.0	1.53	6.77	115	11.91	75.00	97.66
T_7	13.3	1.10	7.22	112	10.75	73.33	96.33
T_8	12.3	1.86	7.00	101	11.33	75.00	98.00
T_9	14.7	1.76	6.88	99	10.95	74.00	97.00
T_{10}	14.3	1.86	7.00	102	12.33	75.66	96.00
T_{11}	15.0	1.63	7.22	111	11.66	75.33	96.00
CD (P = 0.05)	2.49	NS	0.79	2.62	0.66	2.74	1.49

Table 2. Growth and flowering of gladiolus cv. Snow Princess as influenced by integrated nutrient management.

Treatment	Rachis length (cm)	No. of florets per spike	No. of florets remains open at a time	Days to last floret opening	Total fresh weight of plant (g)	Total dry weight of plant (g)	Duration of flowering (days)	Vase-life of spike in tap water (days)
T_1	40.00	13.77	6.33	100	88.7	18.00	20.66	9.33
T_2	45.00	14.55	7.22	109	106	17.66	30.66	10.00
T_3	47.33	16.11	7.77	115	106	19.33	51.00	10.00
T_4	50.00	14.99	6.77	106	120	27.33	40.33	11.00
T_5	50.66	13.99	7.88	106	125	22.33	49.33	9.66
T_6	58.33	15.99	7.00	114	106	26.00	49.00	9.66
T_7	58.00	15.11	7.55	106	101	29.33	47.00	10.66
T_8	61.00	17.55	7.44	119	119	29.66	50.33	10.00
T_9	55.33	16.44	7.66	116	106	21.00	39.00	11.00
T_{10}	63.00	14.88	7.77	115	146	22.00	50.00	11.33
T_{11}	56.00	17.55	7.55	119	110	24.00	54.33	11.33
CD (P = 0.05)	1.48	1.00	0.85	NS	17.30	5.84	11.40	1.41

and other treatments was observed. This might be due to a steady decomposition of farmyard manure and release of nutrients throughout the crop growth period coupled with better assimilation of nutrients. The treatment receiving 75% (RDF) + FYM 10 tonnes/ha + vermicompost 10 tonnes/ha recorded earliest (73.3 days) to first floret opening as compared to control (79.33 days). 50% bloom (94.66 days) after planting was recorded with the application of farmyard manure @ 20 tonnes/ha over control. Maximum spike length (90.00cm) was recorded in treatment (T_{11}) followed by T_{10} (87.66cm), whereas minimum spike length (69.66 cm) was recorded in control (Fig. 2). Length of rachis was also influenced by combined application of integrated nutrients and 50 % recommended dose of fertilizer + 10 tonnes/ha FYM + 10 tonnes/ha vermicompost recording significantly taller (63.00 cm) rachis length over control (40.00 cm). The maximum number of florets (17.55) was found similarly in treatment T_{10} and T_{11} followed by treatment T_9 (16.44) and control (13.72). Application of 100% recommended dose of fertilizers + 20 tonnes/ha farmyard manure resulted in maximum number of florets remaining open at a time (7.88). The results on the effect of combined application of integrated nutrients as days to last floret opening was non significant, however, application of 50% recommended dose of NPK + 10 tonnes/ha FYM+ 10 tonnes/ha vermicompost + 2 g/plant *Azospirillum* + 2 g/plant PSB recorded maximum day (119.00) to last floret opening was at par with treatment (T_8) and superior to control. Use of bio-fertilizers along with recommended doses of fertilizers or organic manures performed better than mere use of fertilizers. The maximum total fresh weight of plant (146.66 g) was received with the application of 50% recommended dose of fertilizer + 10 tonnes/ha farmyard manure + 10 tonnes/ha vermicompost, whereas in control plot it was 88.66 g only. The combined application of integrated nutrients significantly improved the total dry weight of plant and recorded maximum (29.66 g) in treatment ($T_{8)}$ followed by treatment (T_7) as compared to control. Combined application of 50% RDF + 10 tonnes/ha FYM + 10 tonnes/ha vermicompost + 2 g/plant *Azospirillum* + 2 g/plant PSB significantly improved the duration of flowering and vase-life of spike in tap water and it was 54.33 days and 11.33 days respectively, but vase-life of spike was at par with treatment T_{10}. Combined application of 50% RDF, *i.e.* 60:40:40 kg/ha NPK + 10 tonnes/ha FYM + 10 tonnes/ha vermicompost + 2 g/plant *Azospirillum* + 2 g/plant PSB) resulted in maximum corm yield (98.33 q/ha) was statistically at par with T_8 (94.44 q/ha) and T_3 (91.11 q/ha), whereas minimum corm yield (68.33 q/ha) was recorded under control (Fig. 3). The significant increase in corm yield might be due to combined application of 50% RDF and FYM, vermicompost and bio-fertilizers which had synergistic effects giving higher corm yield. Karthiresan and Venkatesh (4) reported that gladiolus cv. White Prosperity produced maximum plant height, number of leaves and leaf area with the application of *Azospirillum* along with recommended dose and 25% (75:45:60 kg/ha) reduced dose of NPK. Further, they found best results with 25% reduced dose of NPK, *i.e.* 75:45:60 kg NPK/ha + *Azospirillum*. Naik *et al.* (6) suggested that application of NPK with *Azospirillum*, phosphobacteria each at 2 g/plant significantly increased the number of leaves, flowers, leaf area and early flowering in anthurium. Dubey *et al*. (2) reported that combined application of *Azotobacter* + PSB was found best for all growth and flowering characters on gladiolus; while Patil and Chitra (7) concluded that treatment receiving *Azospirillum*, PSB, vermi-compost and 50% recommended dose of NPK recorded highest growth, flower yield and



Treatment

Fig. 1. Effect of INM on spike length in gladiolus.

Treatment

Fig. 2. Effect of INM on corm yield in gladiolus.

flower quality characters in China aster. They also suggested that net returns and B: C ratio was highest in the plots treated with *Azotobacter* + PSB + VC + 50% recommended dose of NPK. Gayithri *et al*. (3) reported that use of PSB and vermicompost along with 50% of recommended N, P and 100% K helped in realizing better plant growth, higher yield of quality spikes in statice. The present results are in close conformity with the findings of these workers. Mathew and Singh (5) reported increased plant height, number of flowers per plant and flower yield of marigold with the use of PSB + *Azospirillum*. Tien *et al*. (8), while working on bio-fertilizers like *Azospirillum* suggested that they synthesize growth promoting hormones like IAA, IBA, GA and vitamins, which may induce better growth of the plants. The results of the present investigation are in close conformity with above workers.

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