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Effect of Planting Geometry and Nutrient Levels on Flowering, Yield and Quality of Rose cv. Charisma

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Investigations were carried out on spacing and optimum nutrition required for rose cv. Charisma at GKVK, Bangalore, in a factorial randomized complete block design with 12 treatment combinations comprising of three different plant densities *viz.,* S_1(0.75 x 0.75 m), S_2(1.50 × 1.00 m) and S_3(1.80 × 1.00 m) and four levels of nutrients *viz.,* N_1(20:20:30 g NPK/plant), N_2(30:30:45 g NPK/plant), N_3(40:40:60 g NPK/plant) and N_4(50:50:75 g NPK/plant). It was found that plant density S_2(1.50 × 1.00 m) and nutrient level N_2(30:30:45 g NPK/plant) had showed superiority in the flowering and yield attributes *viz.,* early flowering (45.67 days), maximum number of flowers per plant (123.78), the highest yield per plant (0.83 kg), and maximum shelf life (39.72 hr). While, plant density S_1(0.75 × 0.75 m) and nutrient level N_1(20:20:30 g NPK/plant) recorded late flowering (50.67), minimum number of flowers per plant (85.92), the lowest total yield per plant (0.39 kg) and minimum shelf life (31.47 hr). Whereas, plant density S_1(0.75 × 0.75 m) and nutrient levels N_4(50:50:75 g NPK/plant) recorded higher yield per hectare (10.83).

Key words: Rose cv. Charisma, Plant density and Nutrient levels

The rose cv. Charisma belong to the floribunda group, which is known for producing large quantity of better shaped flowers with perpetual flowering habit for a longer period. In Karnataka, rose cv. Charisma is mainly concentrated in and around Bangalore, Chikkaballapura, Kolar and other adjoining districts of Bangalore for loose flower purpose. These districts are having good climate for growing rose flowers round the year. The fully opened flowers are used for making garland, also in religious and ceremonial functions. Majority of Charisma rose growers are practicing varied spacing with nutritional levels. Excess use of fertilizers may result in wastage of money apart from damage to plant and soil properties.

Materials and Methods

The field experiment on rose cv. Charisma was laid out at Regional Horticultural Research and Extension Centre, UHS (Campus), GKVK, Bangalore, during 2011-2012. The soil of the experimental site was sandy loam rich in organic matter. The trial was replicated thrice with two factorial randomized complete block design with 12 treatment combinations comprising of three different plant densities *viz.,* S_1(0.75 x 0.75 m), S_2(1.50 × 1.00 m) and S_3(1.80 × 1.00 m); and four levels of nutrients *viz.,* N_1(20:20:30 g NPK/plant), N_2(30:30:45 g NPK/plant), N_3(40:40:60 g NPK/plant) and N_4(50:50:75 g NPK/plant). The plot size was 7.2 ×4.2 m. Six month old budded plants were planted during kharif season of 2011 after the application of 20 kg farm yard manure per pit, the plants were allowed for vegetative growth for a period of three months and pruning was done. Half the dose of nitrogen and potash, and full dose of phosphorus were applied as basal dose and remaining dose of nitrogen and potash were applied 45 days after first application. All other recommended agronomic package and practices were followed to grow a successful crop. Data on flowering, yield and quality parameters *viz*., early flowering, flower length, flower diameter, flower weight, 100 flower weight, number of flowers per plant, number of flowers per bunch, weight of the flowers per plant, total yield per plant, yield per hectare and shelf life were recorded.

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Results and Discussion

The effect of spacing and nutrition on flowering and yield characters of rose cv. Charisma indicated significant response to varied levels of spacing and nutrients.

Effect of plant density on flowering

Planting density had significant effect on flowering of rose cv. Charisma (Table.1). The minimum days to 50 per cent flowering (47.92) was recorded in S_2 (1.50 x 1.00 m). Likewise, the maximum flower diameter (4.65 cm), the highest flower length (2.62 cm), maximum flower weight (2.46 g) and the highest number of flowers per bunch (12.77) were recorded under S_2(1.50 x 1.00 m), and it was minimum in S_1(0.75 x 0.75 m). This may be due to production of more number of branches per plant at optimum spacing, and also due to presence of fairly more number of well developed petals.

Table 1. Effect of planting geometry and nutrient levels on flowering character of rose cv. Charisma

Treatment	Flowering parameters				
	Days taken for 50 per cent flowering	Flower diameter (cm)	Flower length (cm)	Flower weight (g)	Number of flower per bunch
Spacing					
S_1	50.00	4.45	2.45	2.34	11.31
S_2	47.92	4.65	2.62	2.46	12.77
S_3	50.17	4.50	2.48	2.34	12.42
S.Em±	0.19	0.05	0.03	0.039	0.172
CD(P=0.05)	0.58	0.15	0.09	NS	0.505
Nutrient levels					
N_1	50.44	4.13	2.22	2.07	10.73
N_2	48.55	4.67	2.66	2.48	12.69
N_3	49.11	4.62	2.60	2.46	12.63
N_4	49.33	4.71	2.59	2.50	12.60
S.Em±	0.22	0.06	0.03	0.045	0.172
CD(P=0.05)	0.67	0.17	0.11	0.133	0.505
Interactions (S × N)					
S_1N_1	50.67	4.08	2.15	2.03	10.56
S_1N_2	50.33	4.58	2.57	2.38	11.38
S_1N_3	49.67	4.56	2.53	2.44	11.54
S_1N_4	49.33	4.59	2.65	2.50	11.75
S_2N_1	50.00	4.17	2.23	2.07	10.83
S_2N_2	45.67	4.87	2.87	2.66	13.54
S_2N_3	47.67	4.77	2.68	2.62	13.44
S_2N_4	48.33	4.79	2.72	2.51	13.27
S_3N_1	50.67	4.14	2.29	2.13	10.78
S_3N_2	49.67	4.57	2.56	2.34	13.00
S_3N_3	50.00	4.55	2.53	2.41	12.84
S_3N_4	50.33	4.77	2.53	2.49	13.05
S.Em±	0.39	0.10	0.06	0.078	0.344
CD(P=0.05)	1.16	NS	NS	NS	NS
CV (%)	1.39	3.97	4.53	5.72	4.90

S_1: 0.75 × 0.75 m ; S_2: 1.50 × 1.00 m; S_3: 1.80 × 1.00 m ; N_1: 20:20:30g NPK/Plant/Year ; N_2: 30:30:45g NPK/Plant/Year; N_4: 50:50:75g NPK/Plant/Year; N_3: 40:40:60g NPK/Plant/Year; NS: Non-significant

Similar results were obtained by Brijendra singh and Dadlani (1988) and Bhattacharya *et al*. (2000). Whereas, duration of flowering showed non significant results.

Effect of nutrient levels on flowering

The nutrient levels showed significant variations for all the flowering parameters studied during crop growth period. Among the different nutrient levels N_2 (30:30:45 g NPK/plant) flowers were produced early (48.55 days). Likewise, maximum flower length (2.66 cm) and the highest number of flowers per bunch (12.69) were noticed in N_2(30:30:45 g NPK/ plant). While, it was minimum in N_1(20:20:30 g NPK/ plant). Similar results were obtained by Bhattacharya *et al*. (2001). However, N_4(50:50:75 g NPK/plant) recorded maximum flower diameter (4.71 cm) and maximum flower weight (2.50 g) and it was minimum in N_1(20:20:30 g NPK/plant). Similar results were recorded by Viradia and Singh (2004).

Interaction between plant density and nutrient levels on flowering

The interaction between plant density and nutrient levels had significant effect on days to 50 per cent flowering and it was recorded minimum in S_2N_2(45.67). Whereas, it was maximum in S_1N_1 (50.67) and other flowering parameters had non significant effect.

Effect of plant density on yield

Planting density had significant effect on yield of rose cv. Charisma (Table.2). Among the plant density, S_2 (1.50 × 1.00 m) produced the maximum number of flowers per plant (112.74), weight of the flowers per plant (280.38 g) and total yield per plant (0.70 kg). Whereas, minimum was recorded in S_1(0.75 × 0.75 m). These observations were in conformity with the result of Bhattacharya *et al*. (2000) and Nagaraju *et al*. (2003). However, yield per hectare (9.59 tonnes) was the highest in S_1(0.75 × 0.75 m) and the lowest (3.27 tonnes) in S_3(1.80 × 1.00 m). The flower production per unit area per annum was increased with close spacing by Sujatha and Singh, 2003, Viradia and Singh (2003) and Bhattacharya *et al*. (2001) in rose. Whereas, 100 flowers weight recorded non significant results.

Effect of nutrient levels on yield

The nutrient levels showed significant variations for all the yield parameters studied during crop growth. Among the different nutrient levels, N_2

Table 2. Effect of planting geometry and nutrient levels on yield character of rose

Treatment	Yield parameters				
	100 flowers weight (g)	Number of flowers per plant	Weight of the flowers per plant	Total yield per plant (kg)	Total yield per hectare (tonnes)
Spacing					
S_1	240.33	100.34	236.00	0.54	9.59
S_2	254.30	112.74	280.38	0.70	4.67
S_3	239.32	102.97	241.56	0.58	3.27
S.Em±	6.14	1.99	6.89	0.012	0.14
CD(P=0.05)	NS	5.85	20.230	0.037	0.43
Nutrient levels					
N_1	221.69	93.52	194.45	0.45	4.35
N_2	245.01	111.35	275.22	0.66	6.23
N_3	255.57	108.45	270.35	0.65	6.38
N_4	256.32	108.0	270.57	0.65	6.40
S.Em±	7.09	2.30	7.96	0.014	0.17
CD(P=0.05)	20.80	6.75	23.36	0.043	0.49
Interactions (S × N)					
S_1N_1	217.27	85.92	175.07	0.39	7.07
S_1N_2	233.73	104.08	247.25	0.54	9.73
S_1N_3	253.27	105.28	256.83	0.60	10.74
S_1N_4	257.07	106.07	264.86	0.60	10.83
S_2N_1	222.17	96.65	199.77	0.48	3.26
S_2N_2	270.23	123.78	329.57	0.83	5.56
S_2N_3	264.70	117.40	307.22	0.77	5.15
S_2N_4	260.10	113.12	284.97	0.70	4.73
S_3N_1	225.63	98.00	208.51	0.49	2.74
S_3N_2	231.07	106.18	248.85	0.61	3.40
S_3N_3	248.77	102.67	247.01	0.59	3.28
S_3N_4	251.80	105.03	261.88	0.65	3.66
S.Em±	12.28	3.99	13.79	0.025	0.29
CD(P=0.05)	NS	11.70	NS	0.075	0.86
CV (%)	8.70	6.56	9.45	7.21	8.72

S_1: 0.75 × 0.75 m ; S_2: 1.50 × 1.00 m; S_3: 1.80 × 1.00 m ; N_1: 20:20:30g NPK/Plant/Year; N_2: 30:30:45g NPK/Plant/Year ; N_4: 50:50:75g NPK/Plant/Year; N_3: 40:40:60g NPK/Plant/Year; NS: Non-significant

(30:30:45 g NPK/plant) produced the maximum number of flowers per plant (111.35), the highest flower weight (275.22) and total yield per plant (0.66 kg). While, it was minimum in N_1(20:20:30 g NPK/ plant). Similar observations have also been recorded by Mukesh and Chattopadhyay (2001), Nagaraju *et al.* (2003) and Singh *et al*. (2004). However, 100 flowers weight (256.32 g) and yield per hectare (6.40 tonnes) was high in treatment N_4 (50:50:75g NPK/plant) and low in N_1(20:20:30g NPK/plant). Similar results were recorded by Viradia and Singh (2004) and Yeo *et al.* (2011).

Interaction between plant density and nutrient levels on yield

The interaction between plant density and nutrient levels had significant effect on yield parameters. Among the interactions S_2N_2recorded the maximum total yield per plant (0.83 kg). While, it was the lowest in (0.39 kg) in S_1N_1. Similar trend was observed by Mukesh and Chattopadhyay (2001), Nagaraju *et al*. (2003) and Singh *et al*. (2004). However, the maximum yield per hectare (10.83 tonnes) was noticed in S_1N_4. While, S_3N_1recorded the lowest yield (2.74 tonnes). Higher yield per hectare recorded at close spacing accrued was primarily due to the increased plant population, despite compromise in per plant yield. Similar trend was observed by Viradia *et al*. (2004) and Yeo *et al.* (2008)

Effect of plant density on quality

Dense planting caused significant differences in weight loss for every 24 hours (Table.3). The minimum weight loss (28.33 g) and maximum shelf life (36.86 hr) were recorded in S_2 (1.50 × 1.00 m). These observations were in conformity with the results of Bhattacharya *et al*. (2001).

Effect of nutrient levels on quality

The nutrient levels also significantly influenced the weight loss of flowers and shelf life for every 24 hours. The minimum weight loss (31.56 g) and maximum shelf life (36.18 hr) were recorded in N_2 (30:30:45 g NPK/plant).

Interaction between plant density and nutrient levels on quality

The interaction effect between plant density and nutrient levels (S x N) was found to be significant

Table 3. Effect of planting geometry and nutrient levels on quality of rose cv. Charisma

Treatment	Weight loss (g) of flower for every 24 hours	Shelf life (hour)
Spacing		
S_1	37.06	33.08
S_2	28.33	36.86
S_3	32.27	35.48
S.Em±	0.10	0.31
CD(P=0.05)	0.29	0.92
Nutrient levels		
N_1	34.49	32.10
N_2	31.56	36.18
N_3	31.79	36.15
N_4	32.36	36.12
S.Em±	0.11	0.31
CD(P=0.05)	0.34	0.92
Interactions (S × N)		
S_1N_1	40.67	31.47
S_1N_2	38.67	32.67
S_1N_3	34.57	33.19
S_14_4	34.33	35.00
S_2N_1	31.30	31.40
S_2N_2	25.47	39.72
S_2N_3	28.26	39.05
S_2N_4	28.30	37.25

with loss of flower weight and shelf life for every 24 hours. The minimum weight loss (25.47 g) and maximum shelf life (39.72 hr) were observed in S_2N_2.

It can be concluded that the application NPK at 30:30:45g/plant with spacing of 1.5 x 1.0m significantly influence all the flowering and yield parameters in rose cv. Charisma.

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