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Effect of Spacing, Nutrient Levels and Method of Application on Growth, Flowering and Quality of Floribunda Rose cv Charisma

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ABSTRACT: The field experiment was conducted at UHS Bagalkot. The experiment was replicated thrice with three factorial randomized complete block design with 12 treatment combinations comprising of two different plant density *viz.*, S_1 (0.9 × 0.9 m) and S_2 (1.50 × 0.75 × 0.60 m) and three levels of nutrient *viz.*, F_1 (7.5:7.5:11.25 g NPK/plant), F_2 (10:10:15 g NPK/plant) and F_3 (12.5:12.5:18.75 g NPK/plant) and two methods of nutrient applications *viz.*, M_1 (fertigation) and M_2 (soil application). It was found that, treatment combination of $S_1M_1F_2$ showed superiority in the growth attributes *viz.*, maximum number of branches (7.60), number of leaves (268.33), north to south plant spread (45.33 cm) and east to west plant spread (47.33 cm). $S_2M_2F_1$ recorded minimum days to 50 per cent flowering and days to first harvest (49.00 and 64.00 days respectively).

Keywords: Rose, Charisma, Fertigation, Nutrients.

INTRODUCTION

Rose is the largest traded flower both in the domestic and the international market. The cut flowers with long stem belong to hybrid tea and are commonly cultivated by the farmers for cut flower purpose. For loose flower purpose, Floribunda posses the character of producing flowers in clusters and few varieties of floribunda are highly suitable for garland preparation, poojas and other social functions and cultivar Charisma is one among them.

The commercial cultivation of rose cv. Charisma needs improved technology, such as optimum plant density, application of required quantity of manures and fertilizers as well as method of fertilizer application. For cv. Charisma, no specific recommendation is available on spacing and nutritional requirement. Majority of rose growers are practicing varied spacing with different nutritional levels. Excess use of fertilizers may result in wastage of money apart from damage to plant and soil properties and similarly under nutrition leads to low production of flowers and quality. Hence the present study was carried out to know the effect of plant density and nutrient levels and method of nutrient application on growth and yield of rose cv. Charisma.

MATERIALS AND METHODS

The experiment was conducted under open field condition at University of Horticultural Sciences, Bagalkot. The soil of experimental site possesses sandy loam texture.

The treatments comprised two planting densities $S_1$and S_2 (0.9 × 0.9 and 1.5 × 0.75 × 0.60 m respectively), three nutrient levels F_1 (7.5-7.5-11.25g NPK/Plant/Year), F_2 (10-10-15g NPK/Plant/Year) and F_3 (12.5-12.5-18.75g NPK/Plant/Year) and two methods of nutrient applications M_1 (fertigation) and M_2 (soil application). The twelve treatment combinations were laid out in a factorial randomized block design with three replications. FYM @ 20 t ha^{-1} was applied uniformly at the time of land preparation. In case of soil application nutrients, nitrogen application was done in two split doses. Half dose of nitrogen and full dose of phosphorus and potassium were applied as basal dose at the time of planting. Remaining dose of nitrogen was applied after 90 days after planting. Urea is applied to supply Nitrogen, SSP as a source of Phosphorus and MOP is applied to supply Potassium. While, in case of fertigation, Major nutrients (N, P & K) as per the recommendations were supplied by fertigation in the morning hours (2 times in a week). 19:19:19 is applied to supply Nitrogen, Phosphorus and Potassium and remaining potassium is applied in the form of sulphate of potash (SOP). All other field operations were performed as per recommended package of practices.

RESULT AND DISCUSION

Growth parameters. Closer spacing (1.5 × 0.75 × 0.60 m) enhanced the plant height significantly whereas wider spacing (0.9 × 0.9 m) increased the other growth parameters like number of branches per plant, stem girth and spread of plant (Table 1). This may be

because of widely spaced plants faced less competition for space, moisture, light and thereby received more nutrition over narrowly spaced plants to satisfy their requirement for better growth. Similar results were obtained by Bhattacharjee (1992) in rose.

Plants in which nutrients are applied through drip were recorded maximum plant height, number of branches per plant, stem girth and spread of plant when compare to soil application of nutrients. Better results with fertigation may be due to frequent application of fertilizers at convenient intervals, which increases the available nutrient status in the root zone thus increasing the uptake of nutrients and further influencing the growth of the plant reported by Kozhushka and Romanets (1994).

Nutrient levels showed marked effect in increasing the number of leaves, stem girth, plant spread which is evident from the fact that low F_1 (7.5-7.5-11.25g NPK/Plant/Year) and higher F_3 (12.5-12.5-18.75g NPK/Plant/Year) dose of nutrient showed poor performance for all the said parameters. This because of excessive and lower dose of application of nutrients caused imbalance between the nutrient uptake by the plant reported by Anamika and Lavanya (1990); Mukesh and Chattopadhyay (2001).

Non-significant results were obtained for interaction between plant density, method of application of nutrients and nutrient levels (S × M × F) with respect to plant height, stem girth, plants spread, but in contrast to that, significant result was obtained with respect to number of leaves, number of branches and it was maximum in $S_1M_1F_2$ (Table 2).

Flowering parameter. Number of days to 50 per cent flowering and days to first harvest significantly varied among spacing levels. Flowering delayed significantly by increasing the spacing levels from S1 (0.90 × 0.90 m) and S_2 (1.5 × 0.75 × 0.60). Plants spaced widely, remained in vegetative phase on account of lesser competition from the adjacent plants for space and light, thus delaying flowering. Similar results were observed by Dorajeerao *et al*. (2012) in annual chrysanthemum (Table 3).

Method of nutrient application also influenced the days to 50 per cent flowering and days to first harvest and was less in nutrient levels M_2 (soil application). Whereas, maximum was noticed in M_1 (fertigation). This is because of continues supply of nutrients leads plant to remain in vegetative phase, thus delaying in the flowering in case of plants treated with fertigation (Table 3).

Generally, nutrition in excess promotes vegetative growth and delays flowering, while deficient nutrition causes thrifty growth and leads to early flowering. In chrysanthemum, Wodsworth and Butters (1973) reported similar findings. In the present study increasing levels of nutrition significantly delayed the days to 50 per cent flowering and days to first harvest (Table 3).

Quality parameter. Different plant density had significant effect on flower diameter, maximum flower diameter was recorded in S_1 (0.90 × 0.90 m). This has been due to the fact that optimum quantum of nutrients might have not available for quality production of flowers at lower plant density. Similar results were obtained by Brijendra Singh and Dadlani (1988) ; Bhattacharya *et al*. (2000). Non-significant results were obtained for plant density with respect to shelf life (Table 3).

Fertigation registered significantly higher flower diameter and shelf life which might be due to frequent application of fertilizers at convenient intervals, which increases the available nutrient status in the root zone thus increasing the uptake of nutrients and further influencing the better growth of the flower reported by Kozhushka and Romanets (1994) (Table 3).

Non-significant results were obtained for nutrient levels with respect to flower diameter. The nutrient levels also significantly influenced the shelf life of flowers for 48 hours. Shelf life of loose flowers is dependent on carbohydrate reserves and water absorption capacity (Table 3). This may be due to increased flower weight associated with the number of petals. Sindhu and Yamdagni (1992) reported that the higher level of 40 g N per m^2 improved the vase life (141.20 h) of cut flowers rose cv. Super Star. Similar results were found with Maharana and Pradhan (1976).

Interaction (S × M × F). Closer spacing with soil application of nutrients in lower dose was taken minimum days to flower and days to harvest. When compare to other treatment combinations. This may be because, Plants spaced widely, remained in vegetative phase on account of lesser competition from the adjacent plants for space and light and even better nutrients available through fertigation, thus delaying flowering. Similar results were observed by Dorajeerao *et al*. (2012) in annual chrysanthemum (Table 2).

Significant effect was observed when spacing, method of application of nutrients and nutrient levels were considered as single but interaction of these three factors has shown non-significant results with respect to flower diameter and shelf (Table 4).

Table 1: Growth of rose cv. Charisma as influenced by plant densities, nutrient levels and method of nutrient application.

Treatments	Plant height (cm)	Number of branches	Number of leaves	Stem girth (cm)	Plant spread (cm) N-S	Plant spread (cm) E-W
Spacing						
S_1	47.94	5.97	241.33	2.09	37.94	40.56
S_2	48.89	5.11	225.17	1.92	36.78	39.22
S.Em±	0.30	0.20	1.68	0.04	0.31	0.41
CD at 5%	0.88	0.60	4.93	0.12	0.92	1.20
Method						
M_1	53.11	6.56	253.28	2.35	39.78	42.72
M_2	43.72	4.53	213.22	1.66	34.94	37.06
S.Em±	0.30	0.20	1.68	0.04	0.31	0.41
CD at 5%	0.88	0.60	4.93	0.12	0.92	1.20
Nutrient levels						
F_1	47.75	5.43	228.58	1.94	36.50	38.75
F_2	48.42	5.53	234.92	2.13	39.58	41.83
F_3	49.08	5.67	236.25	1.95	36.00	39.08
S.Em±	0.37	0.25	2.06	0.05	0.38	0.50
CD at 5%	NS	NS	6.04	0.14	1.12	1.47

S_1: 0.9 × 0.9 m, **S_2**: 1.50 × 0.75 × .60 m, **F_1**: 7.5:7.5:11.25 g NPK/Plant/Year,. **F_2**: 10:10:15 g NPK/Plant/Year, **F_3**: 12.5:12.5:18.75g NPK/Plant/Year, **M_1:** Fertigation, **M_2:** Soil application**, NS**: Non-significant

Table 2: Growth of rose cv. Charisma as influenced by treatment interactions (Spacing × Method × Nutrient levels).

Treatments	Plant height (cm)	Number of branches	Number of leaves	Stem girth (cm)	Plant spread (cm) N-S	Plant spread (cm) E-W
$S_1M_1F_1$	53.67	7.40	256.00	2.47	38.00	43.33
$S_1M_1F_2$	52.67	7.60	268.33	2.70	45.33	47.33
$S_1M_1F_3$	52.33	6.00	267.33	2.37	38.67	40.33
$S_1M_2F_1$	41.00	4.33	215.67	1.57	34.67	36.67
$S_1M_2F_2$	43.00	4.50	218.00	1.80	36.33	38.33
$S_1M_2F_3$	45.00	6.00	222.67	1.67	34.67	37.33
$S_2M_1F_1$	54.00	6.33	245.67	2.10	40.67	40.33
$S_2M_1F_2$	53.00	5.67	246.00	2.30	41.00	44.00
$S_2M_1F_3$	53.00	6.33	236.33	2.17	35.00	41.00
$S_2M_2F_1$	42.33	3.67	197.00	1.63	32.67	34.67
$S_2M_2F_2$	45.00	4.33	207.33	1.70	35.67	37.67
$S_2M_2F_3$	46.00	4.33	218.67	1.60	35.67	37.67
S.Em±	0.73	0.50	4.12	0.13	0.76	1.00
CD at 5%	NS	1.46	12.08	NS	2.24	NS

S_1: 0.9 × 0.9 m, **S_2**: 1.50 × 0.75 × .60 m, **F_1**: 7.5:7.5:11.25 g NPK/Plant/Year, **F_2**: 10:10:15 g NPK/Plant/Year, **F_3**: 12.5:12.5:18.75g NPK/Plant/Year, **M_1:** Fertigation, **M_2:** Soil application**, NS**: Non-significant

Table 3: Flowering and quality of rose cv. Charisma as influenced by plant densities, nutrient levels and method of nutrient application.

Treatment	Days to 50% flowering	Days to first harvest	Shelf life (hr)	Weight loss in 48 hours (g)	Flower diameter (cm)
Spacing					
S_1	57.11	72.11	34.91	32.94	4.37
S_2	55.78	70.61	34.47	33.17	4.27
S.Em±	0.21	0.25	0.20	0.31	0.04
CD at 5%	0.62	0.72	NS	NS	NS
Method					
M_1	60.22	75.06	37.59	31.00	4.80
M_2	52.67	67.67	31.78	35.11	3.84
S.Em±	0.21	0.25	0.20	0.31	0.04
CD at 5%	0.62	0.72	0.60	0.91	0.11
Nutrient levels					
F_1	53.33	68.17	33.09	34.58	4.26
F_2	56.00	70.92	35.50	32.75	4.35
F_3	60.00	75.00	35.47	31.83	4.36
S.Em±	0.26	0.30	0.25	0.38	0.05
CD at 5%	0.76	0.88	0.74	1.11	NS

S_1: 0.9 × 0.9 m, **S_2**: 1.50 × 0.75 × .60 m, **F_1**: 7.5:7.5:11.25 g NPK/Plant/Year,. **F_2**: 10:10:15 g NPK/Plant/Year, **F_3**: 12.5:12.5:18.75g NPK/Plant/Year, **M_1:** Fertigation, **M_2:** Soil application**, NS**: Non-significant

Table 4: Flowering and quality of rose cv. Charisma as influenced by treatment interactions (Spacing × Method × Nutrient levels).

Treatment	Days to 50% flowering	Days to first harvest	Shelf life (hr)	Weight loss in 48 hours (g)	Flower diameter (cm)
Interactions (S × M × F)					
$S_1M_1F_1$	57.33	72.33	37.10	31.33	4.90
$S_1M_1F_2$	58.33	73.33	38.33	30.33	5.00
$S_1M_1F_3$	68.00	83.00	38.33	31.00	4.77
$S_1M_2F_1$	49.67	64.67	30.00	37.00	3.73
$S_1M_2F_2$	54.33	69.00	32.33	35.00	3.80
$S_1M_2F_3$	55.00	70.33	33.33	33.00	4.03
$S_2M_1F_1$	57.33	71.67	36.27	32.67	4.77
$S_2M_1F_2$	58.00	73.00	38.00	30.00	4.80
$S_2M_1F_3$	62.33	77.00	37.53	30.67	4.57
$S_2M_2F_1$	49.00	64.00	29.00	37.33	3.63
$S_2M_2F_2$	53.33	68.33	33.33	35.67	3.80
$S_2M_2F_3$	54.67	69.67	32.67	32.67	4.07
S.Em±	0.52	0.60	0.50	0.76	0.09
CD at 5%	1.53	1.76	NS	NS	NS

S_1: 0.9 × 0.9 m, S_2: 1.50 x 0.75 x .60 m, F_1: 7.5:7.5:11.25 g NPK/Plant/Year,. F_2: 10:10:15 g NPK/Plant/Year, F_3: 12.5:12.5:18.75g NPK/Plant/Year, M_1: Fertigation, M_2: Soil application, NS: Non-significant

CONCLUSIONS

The overall growth, flowering and Quality of the plant is better in case of wider spacing with nutrient level of F_2 (10:10:15 g NPK/Plant/Year) which is supplied through fertigation. However still research is needed to study the effect of irrigation interval on growth, quality and yield of the plant.

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