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Study on Yield and Quality of Rose as Effected by Cultivars and Planting Geometry

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ABSTRACT

A study was conducted in an open condition at Kittur Rani Channamma College of Horticulture, Arbhavi, located in the Belgaum District of Karnataka with the objective of determining the effect of cultivar, planting geometry and their interaction on yield and quality of Rose. The experiment was laid out in a 3 x 3 factorial arrangement using a Randomized Complete Block Design (RCBD) with three replications. The treatments consisted of three cultivars ('Sophia', 'Gladiator' and 'Divine') and three different planting densities viz., S_1 (0.90 x 0.90 m), S_2 (0.60 × 0.60 m) double row and S_3 (0.60 × 0.60 m) triple row. Data were collected on parameters pertaining to growth, yield and quality of Rose. The results of the study indicate a trend of rise in the flower yield as the plant density increased from S_1 (0.90 x 0.90 m) to S_3 (0.60 × 0.60 m) triple row. Conversely, flowers' shelf life and flower weight significantly decreased when planted densely. Among the cultivars, 'Sophia' was found to be more productive in terms of flower yield followed by 'Gladiator' and 'Divine'. Cultivars 'Sophia' and 'Gladiator' had better performance in many of the parameters than the 'Divine' cultivar. The highest and lowest planting density demonstrated a positive influence on the yield and quality parameters respectively and therefore can be recommended for use by commercial growers. However, further investigation is imperative on issues pertaining to the determination of nutrient supply for regulating the fresh weight of the product and other economic related topics.

Key words: *Rose, Rosa species, Planting density, Cultivar, Yield*

INTRODUCTION

Rose is the most beautiful among all the cut flowers with variety of shapes, sizes, colours and versatility and hence, it is rightly called as "queen of flowers". Rose is a symbol of love, adoration and innocence. It is one of the best known commercial cut flower that has become an integral part of our daily life. It belongs to the family Rosaceae and is native of temperate region of Northern hemisphere. There is an increasing demand for production and quality of roses all over the world. Hence there is urgent need to enhance the plant population level to meet out the recent demand.

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Plant density is one of the most influential factors in this study exerting early and significant effects in improving yield and quality of roses through high density planting with paired row system of planting. This system of planting in rose leads not only to increased production per unit area, but will also help the consumer to get better quality flowers and also helps in fetching higher income to growers. Under this system of high density planting it is worth testing cultivars of rose for their adoptability and performance in the different spacing. The planting distance depends on the types of roses, different purposes for which it is cultivated, type of irrigation system, cultivar and location.

Studies have revealed that a higher plant population accounts for the increased production of quality blooms per unit area and better land utilization[19]. A wide range of spacing has been used in Rose field production. Studies onplant density have already indicated the possibility of growing roses successfully at closer spacing[11]. Thus, finding out appropriate planting density and type of cultivars that brings better quality and yield which would be necessary to support growers to be competitive in the global market. To this aim, a study was initiated to determine the effects of cultivar, planting geometry and their interaction effect on yield and quality of Rose.

MATERIALS AND METHODS

Study area

The study was conducted in an open condition at Arabhavi . Geographically, the area is situated in Northern dry zone of Karnataka State at 16° 12' North latitude, 74° 54' East longitude and an altitude of 640 meters above the mean sea level. Arabhavi, which comes under the Zone-3 of Region-2 among the agro-climatic zones of Karnataka, has benefits of both the south-west and north-east monsoons. Arabhavi is situated in command areas which receives water from Ghataprabha Left Bank Canal from mid-July to mid-February

Materials

The seedlings of three *Rose cultivars*, namely 'Sophia', 'Gladiator' and 'Divine' were used for this study. Three blocks were then prepared with each having 9 experimental plots.

Experimental design and treatments

The experiment was laid out in a 3 x 3 factorial arrangement with Randomized Complete Block Design (RCBD). The treatments consisted of three cultivars ('Sophia', 'Gladiator' and 'Divine') and four different planting densities viz., S_1 (0.90 x 0.90 m), S_2 (0.60 × 0.60 m) double row and S_3 (0.60 × 0.60 m) triple row. The experiment was replicated three times. Then, the 9 treatments combinations were assigned randomly to the experimental units within a block. Fertilizer was applied as per the recommendation based on the result of soil analysis throughout the growing season and other management practices like weeding, raising the wire mesh, and removing of dry leaves were performed whenever necessary.

Measurements

Data were collected on parameters pertaining to growth, yield and quality of Rose. These parameters were studied from three to eight sample plants depending on the plant population size, except for yield parameters wherein data were recorded on whole plot bases. Accordingly, the number of flowers which have an upright stem length which are free from any mechanical and pest damage, with required fresh weight (5 to 10 g) were sorted. In addition, days to flowering was recorded as the number of days taken from the date of planting to the date on which 50% of plants in a plot started to open their flowers. The number of days taken for 50% of flowered plants to reach their harvestable stage was considered as days to first harvest. The first ten flowers harvested were used for quality analysis and measurements were continued for six consecutive months.

Data analysis

The data on various biometric parameters recorded during the crop growth period of this study was subjected to statistical analysis as per the procedures suggested by Panse and Sukhatamane. The experimental data were analyzed by using factorial RCBD design with three replication by adopting Fisher's method

of analysis of variance technique. The results are discussed at five per cent probability level.

RESULTS AND DISCUSSION

Growth and Quality parameters

Number of branches per plant.

Highly significant variation was observed among cultivars in terms of the number of branches produced. The number of branches gradually increased with growth period and resulted in to highest number of branches 18.51 at 210 DAP in S_1 (0.90X0.90 m) followed by S_3 (0.60X0.60 m triple row), whereas least number of branches 17.92 was observed at S_2 (0.60X0.60 m double row) 210 DAP. Mukhopadhyay *et al.*[11] and Sujata and Singh[19] have reported similar results.

Accor-dingly, The maximum number of branches per plant was recorded in cv. Sophia followed by cv. Gladiator at different growth period. The cv. Divine produced minimum number of branches per plant and less vigorous in growth, this may be attributed to genetic make up of the cultivar. Similar variations in number of branches per plant was reported by Chandrashekar[4], Bhattacharjee *et al.*[1] Nagaraja *et al*.[12] and Raheela *et al*[16].

Days to flowering

A highly significant variation was noticed among cultivars with respect to days to 50% flowering among the different planting densities and for the interaction effects between cultivars and planting densities. Accor-dingly, the mean comparison for cultivars revealed that cv. Sophia (113.74 days) and cv. Gladiator (121.53days) flowered earlier than the cv. Divine (125.96 days). This result possibly occurred due to the inherent variability that exists in the respective cultivars. Zizzo *et al*.[20] and Biruk *et al.*[3] reported similar types of results in varietal evaluations.

In case of interaction effects of planting densities and varietal levels with regard to days taken for 50 per cent flowering found to be significant. The treatment S_3V_3 (130.23 days) took maximum time for obtaining 50 per cent flowering which was on par with treatment S_2V_3 (125.67 days). Whereas treatment S_1V_1 (103.87) took the least number of days for 50 per cent flowering. These results are in confirmity with Dias and Patil[8].

Flower stalk length

The height of flower stalk length exhibited a highly significant variation among cultivars and planting densities. As a result, the treatment S_1 (0.90 m × 0.90 m) showed maximum flower stalk length (16.58 cm) which was on par with S_3 (0.60 × 0.60 m) triple row *viz.*, 16.53 cm. Whereas, S_2 (0.60 × 0.60m double row) showed minimum flower stalk length among all the treatments (16.36 cm). These results are contradictory to Niels *et al* [13] and Bhattacharya *et al.*[2] who reported the increased stalk length or superior results by increasing plant population density.

There was significant difference among the three rose cultivars with respect to flower stalk length. The cv. Gladiator observed with maximum stalk length (17.71cm) followed by cv. Sophia (16.47cm). Whereas cv. Divine has observed with minimum stalk length of 15.30cm. This was mainly due to the differences in the varietal character. Similar results with regard to varietal differences were studied by Patil and Kanamadi[15], Sooriannatha Sundaram *et al.*[18], Nagaraja *et al.*[12] and Polara *et al*[17].

Shelf life

The shelf life of fully opened flowers under room temperature showed significant differences as influenced by different planting systems. Among the treatments of plant populations S_1 (0.90 × 0.90 m) registered maximum shelf life (49.98 hr) followed by S_2 (0.60 × 0.60m double row) *viz.*, 45.14 hr. whereas the S_3 (0.60 × 0.60 m triple row) registered minimum shelf life 42.59 hr. These observations are in conformity with the result of Bhattacharya *et al.*[2].

Among the cultivars, the cv. Sophia recorded maximum shelf life (53.76 hours) followed by cv. Gladiator (47.64 hours). This may be due to genetic factors and varietal difference of respective cultivars.The interaction effects on planting systems and varietal levels (S x V) were found to be non significant with respect to shelf life. However, maximum shelf life was recorded in S_1V_1 (57.67 hr) followed by S_2V_1 (52.97 hr). Similar type of results was reported by Bhattacharya *et al*[2].

Table 1: Effect of planting density on yield parameters of rose cultivars

Treatments	Flower weight (g)	Flower yield/plant (kg)	Flower yield per ha (t)
S1	7.80	0.65	5.80
S2	8.93	0.83	10.80
S3	7.93	1.02	17.20
S.Em±	0.09	0.01	0.24
CD(P=0.05)	0.26	0.04	0.72
V1	7.96	0.90	11.87
V2	11.20	0.90	11.63
V3	5.50	0.70	10.30
S.Em±	0.09	0.01	0.24
CD(P=0.05)	0.26	0.04	0.72
S_1V_1	7.69	0.68	5.67
S_1V_2	9.84	0.73	6.17
S_1V_3	5.85	0.55	5.57
S_2V_1	8.70	0.89	10.97
S_2V_2	11.63	0.92	11.57
S_2V_3	6.47	0.68	9.87
S_3V_1	7.50	1.14	18.97
S_3V_2	12.13	1.04	17.17
S_3V_3	4.17	0.88	15.47
S.Em±	0.15	0.03	0.42
CD(P=0.05)	0.45	0.08	1.25

S_1: 0.90 × 0.90 m (Control) **S_2**: 0.60 × 0.60 m (Double row) NS: Non significant
S_3: 0.60 × 0.60 m (Triple row), **V_1**: Sophia, **V_2**: Gladiator, V3: Divine, DAP: Days after planting

Table 2: Effect of planting density on growth and quality parameters of rose cultivars

Treatments	Number of branches	Days taken for 50% Flowering	Flower stalk length(cm)	Shelf life of flowers (hours)
S1	18.51	113.48	16.58	49.98
S2	17.92	120.97	16.36	45.14
S3	18.01	126.79	16.53	42.59
S.Em±	0.12	1.16	0.24	0.80
CD(P=0.05)	0.36	3.47	NS	2.40
V1	18.52	113.74	16.47	53.76
V2	17.98	121.53	17.71	47.64
V3	17.94	125.96	15.30	36.31
S.Em±	0.12	1.16	0.24	0.80
CD(P=0.05)	0.36	3.47	0.73	2.40
S_1V_1	18.47	103.87	17.18	57.67
S_1V_2	18.60	114.60	18.31	51.27
S_1V_3	18.47	121.97	14.27	41.00
S_2V_1	18.43	113.10	16.21	52.97
S_2V_2	17.93	124.13	17.39	46.87
S_2V_3	17.40	125.67	15.49	35.60
S_3V_1	18.67	124.27	16.03	50.63
S_3V_2	17.40	125.87	17.43	44.80
S_3V_3	17.97	130.23	16.13	32.33
S.Em±	0.21	2.00	0.42	**1.38**
CD(P=0.05)	0.62	6.01	1.26	NS

S_1: 0.90 × 0.90 m (Control) **S_2**: 0.60 × 0.60 m (Double row) NS: Non significant
S_3: 0.60 × 0.60 m (Triple row), **V_1**: Sophia, **V_2**: Gladiator, V3: Divine, DAP: Days after planting

Yield parameters

Fresh weight

The data reveals that there was a significant difference with respect to weight of the individual flower in different planting systems. Among the planting systems S_2 (0.60 × 0.60 m double row) was recorded with highest weight of the flower (8.93 g) followed by S_3 (0.60 × 0.60 m triple row) *viz.,* 7.93 gram. Among the cultivars flower weight ranged from 5.50 g to 11.2 g. The cv. Gladiator registered maximum flower weight (11.20 g) which was found to be superior followed by cv. Sophia (7.96 g). This result is contradictory to Desai and Meman[6] who reported that flower weight and length of flower buds were significantly influenced by wider spacing (1.0X 1.0 m). And also this may be due genetic factor and agronomic practices.

The interaction effects between different planting systems and varietal levels (S x V) were found to be significant with respect to weight of the individual flower during the growth period. The treatment S_3V_2 was observed with maximum weight of the flower (12.13 g) followed by S_2V_2 (11.63 g). This may be due to production of more number of branches per plant under wider spaced plants.

Flower yield /plant (kg)

The results reveal that there was significant difference among various levels of planting systems with regard to flower yield per plant during the growth period. S_3 (0.60 × 0.60 m) triple row was recorded highest yield per plant (1.02 kg) followed by S_2 (0.60 × 0.60 m) double row *viz.,* 0.83 kg. This may be due to increased morphological parameters like plant height, more number of primary branches and plant spread which helps in production of more photosynthesis resulting in greater accumulation of dry matter which inturn directly or indirectly leads to production of more number of flowers per plant. These observations were in conformity with the result of Bhattacharya *et al*.[2] and Nagaraju *et al*[14].

Among the cultivars evaluated the cv. Sophia recorded maximum (0.90kg) flower yield per plant. Whereas cv. Divine (0.70kg) registered minimum flower yield per plant. Variation in flower yield was observed previously in rose by Nagaraja *et al*[12].

The interaction effects between different planting systems and varietal levels (S x V) were also found to be significant with respect to flower yield per plant during the growth period. The treatment S_3V_1 was observed with maximum flower yield per plant (1.14kg) followed by S_3V_2 (1.04 kg). These results are in conformity with the result of Bhattacharya *et al*.[2] and Nagaraju *et al*[14].

Total yield per hectare (tonnes)

The results reveal that there was significant difference among various levels of planting systems with regard to flower yield per hectare during the growth period. S_3 (0.60 × 0.60 m) triple row was recorded highest yield per hectare (17.20 tonne) followed by S_2 (0.60 × 0.60 m) double row *viz.,* 10.80 tonne. Whereas, the minimum (5.80 tonne) was recorded in S_1 0.90 ×0.90 m. This result was in conformation with Bhattacharya *et al*.[2]. This was mainly due to increase in number of plants which in turn resulted in increase in yield per hectare.

Among the cultivars evaluated, the cv. Sophia recorded maximum flower yield per hectare (11.87 tonne) and this found to be on par with cv. Gladiator with the yield of 11.63 tonnes per hectare.The treatment S_3V_1 was observed maximum flower yield per hectare (18.97 tonne) followed by S_3V_2 (17.17 tonne). These results may be due to increased morphological parameters like plant height, more number of leaves, more number of branches and leaf area which helps in production of more photosynthesis resulting in greater accumulation of dry matter which inturn directly or indirectly leads to production of more number of flowers per plant. Variation in flower yield was also observed previously in rose by Nagaraja *et al*[14].

CONCLUSION

On the data of the experiments obtained it is concluded that plant density had a major role on yield and flowering quality in rose. Planting density could improve some quality parameters. In this case planting density can be

effectively recommended and further research work is suggested to be done in this connection.

Among all the rose cultivars, Sophia produced highest flower yield, longevity and found to be superior. Gladiator gave maximum flower stalk length and flower weight.

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