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Comparative performance of some rose varieties under open and protected environment

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Abstract : The investigation was carried out during 2006-2007 to study the comparative performance of rose varieties *viz.* Gladiator, Minuparle and Montezuma under four growing environments *viz.*, openfield, 50 per cent and 75 per cent shade net and polyhouse condition. Montezuma performed very well with respect to several growth characters which recorded maximum plant height (60.94 cm), highest number of second order laterals (6.69) and maximum plant spread N-S (53.72 cm) and E-W (35.60cm) direction. Gladiator performed better with respect to various floral characters like stem length of flower (30.61 cm), largest flower bud (3.54 cm) and maximum bud diameter (3.52 cm) and number of petals per plant (44.37). It also took minimum time for bud appearance after pruning and maximum flower diameter (7.26 cm). Hence, it was judged as the most ideal variety for using as cut flower. On the other hand, month wise flower production as well as total yield of flowers (Nos. per plant) after pruning was highest in Montezuma followed by Minuparle. Among various growing environments performance of plants under polyhouse was most satisfactory which could improve growth, yield and quality of roses. Floral characters such as flower diameter and number of petals per flower in addition to month wise and total yield of flowers (Nos. per Plant) under polyhouse condition were found to be better as compared to other growing environments. Performance of plants under 50 per cent shades was better than open condition with respect to all the quality parameters of flowers. Interaction of variety with growing environment was found significant for some of the floral characters at certain stage of plant growth. Montezuma under poly house had a higher yield of flowers; whereas Gladiator under the same growing environment produced better quality flowers, most suitable for cut flower purpose.

Key words : Growth and floral characters, Photosynthesis, Growing environment, Protected environment

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Roses universally accepted as the queen of the flowers for its exquisite shape, different sizes, are witching colours and most delightful fragrance with varied uses. However, information available regarding their relative performance of rose varieties under the agro climatic situations of Orissa is meager. Besides the quality of the roses, which are produced in a limited scale in the state is also found inferior since these are produced in a under open condition. Hence, the present investigation was carried out to generate information on these aspects which would be of immense help to the rose growers of Orissa.

RESEARCH METHODS

Three rose varieties *viz.*, Gladiator, Minuparle, and Montezuma commercially grown in Orissa were selected for the experiment. Five months old healthy budded rose

plants were planted in 12th size earthen pots on 20th April, 2006 during afternoon hours. After planting, the pots were kept under semi shade condition with initial irrigation by rose cane. After one week, these were transferred to four growing environments *viz.*, open condition, 50 and 75 per cent shade nets and low cost naturally ventilated polyhouse for evaluation. The trial was conducted in form of a factorial experiment following completely randomized design with three replications. Relative humidity and light intensity under different growing environments were measured at weekly interval during the experimental period from May, 2006 to January 2007. Different cultural management practices followed for all the plants under different growing environments. Farm yard manure and vermicompost, a mixture of 5g urea, 15g superphosphate and 5g muriate of potash were applied to each pot as

basal dose after 30 days of planting and the same dose was again applied on 10th November 2006 after 10 days of pruning. Various floral characters like days to first flower bud appearance, stem length of flowers, bud length, bud diameter, diameter of flower and number of flowers per plant were recorded at monthly interval and the data so obtained were statistically analyzed.

RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation are summarized below :

Performance of growth parameters:

The data recorded in the month of February (*i.e.* after three months of pruning) revealed that there was significant variation among the three varieties with respect to various growth parameters. Among the three varieties Montezuma performed very well as it recorded maximum plant height (60.94 cm), highest number of second order laterals (6.69) and maximum plant spread in North – South (53.72 cm) and East west direction (35.60 cm). Minuparle was second in the order. However, it had better performance than Montezuma with respect to production of bottom breaks, first order laterals and number of leaves per plant. However, both the varieties were statistically comparable with respect to all most all the growth characters. On the other hand performance of Gladiator was poor in respect to all most all the vegetative parameter. Variation in growth performance among the varieties might be due to the difference in their genetical character which have played key role in expressions of various growth characters (Ponnuswamy *et al.*, 1985).

Effect of growing environment on growth parameters:

It was observed that (Table 1) the plants exhibited significantly greater height (71.48 cm) under poly house followed by 50 per cent shade (52.30 cm), while it was minimum (43.30) under 75 per cent shade. However, it was at par with open condition (47.11 cm).

Light is the most important factor influencing the growth and flowering in roses, (Moe, 1972). Increase in plant height under polyhouse as well as under 50 to 25 per cent shade nets was also reported by Malhotra and Kumar (2000) and Anderson (1993).

It was observed that various growing environments, under which the rose varieties were grown, had significant influence on different vegetative growth parameters. Very high light intensity has been reported to be detrimental to the rose plants, rather optimum light intensity favours better growth. The light intensity available under

polyhouse, as it observed in the present study ranged between 52-72 per cent. Optimum light intensity in combination with warmer environment and higher relative humidity (2.5-5.8% more than open condition) inside the poly house might have helped in quick vegetative growth and production of more number of bottom break, as compared to open condition and other shade environments.

The result indicated that the number of bottom breaks per plant was significantly influenced by growing environments. It was maximum (2.37) under poly house followed by open condition (2.10), the minimum was observed in 75 per cent shade condition (1.77).

It was interesting to notice that though number of bottom break was maximum under polyhouse condition followed by open condition, the number of first order laterals and second order laterals (6.66 and 7.35, respectively) were more under open condition followed by poly house (5.35 and 5.73, respectively) and 50 per cent shade (4.85 and 4.12, respectively). The reduction of light intensity under polyhouse as well as under shade nets might have resulted in production of less number laterals, due to lower photosynthetic activity as compared to open condition. The results are in conformity with earlier workers (Park and Lee, 1997).

Various growing environments had significant influence on spread of the plants in both N-S and E-W direction at all stages of plant growth. It was observed that plants under polyhouse had maximum spread (52.70cm and 37.14 cm), which was followed by open condition (35.27cm and 23.68 cm). The minimum was recorded under 75 per cent shade net (26.20 cm and 19.68 cm).

Reduction of light intensity to optimum condition, increased temperature and relative humidity under polyhouse might have favoured early sprouting of buds and increase in spread as compared to open condition. The present findings are in the same line as reported by Moe (1972). However, the spread under open and 50 per cent shade as well as under 50 and 75 per cent shade were at par with each other during some of the observations.

Interaction of variety with growing environments with respect to growth parameters:

Significantly greater plant height was observed in Montezuma under poly house (83.33 cm) followed Minuparle (73.11 cm) under the same environment. It is clear fact that Montezuma is the most vigorous one and poly house is the most suitable place. Hence, the combination recorded the maximum height. Plant spread was also maximum in Montezuma under poly house (79.66

cm and 45.11 cm) followed Minuparle (48.44 cm and 39.94 cm) under the same environment. Variety Gladiator has the minimum spread in 75 per cent shades net (11.5 cm and 8.60 cm).

Buttom break was maximum in Minuparle under polyhouse (2.66) followed by Montezuma (2.44) under the same environment.

Performance of rose varieties with respect to floral characters:

The result obtained in the present investigation (Table 2) revealed that the among the three varieties Gladiator performed very well with respect to various floral characters. It produced longest flower stem (30.61 cm), maximum bud length (3.54 cm), largest flower bud (3.52 cm), more number of petals per flower (44.37) with maximum diameter of flower (7.26 cm). Performance of Montezuma was second in the order with respect to stem length of flower (23.11 cm), and diameter of flower (5.81 cm), and number of flowers per plant (9.58) while

Minuparle had bud length (2.74 cm), bud diameter (2.51 cm) and more number of petals per flower (24.60) as compared to Montezuma (22.88). However, Montezuma and Minuparle were statistically comparable with respect to flower bud length, bud-diameter, petal number and diameter of flower.

For appearance of first flower bud after pruning Gladiator and Minuparle took more or less same time. It was slightly delayed in Montezuma. However, no significant variation was noticed among the varieties with respect to this character.

Significant variation also observed among the rose varieties with respect production of flower. Although performance of gladiator was better with respect to various quality parameters, Montezuma had highest production of flowers per plant (9.58) among the rose varieties tried. It was followed by Minuparle (8.21) and Gladiator recorded the lowest (2.5). The varietal difference with respect to various floral parameters can be attributed to the genetic makeup of the varieties (Hemlata *et al.*,

Table 1 : Various growth parameters of rose varieties as influenced by different growing environments

Treatments	Plant height (cm)	No of bottom breaks	No.of first order laterals	No.of second order laterals	Plant spread (N-S) cm	Plant spread (E-W) cm
Variety (V)						
V ₁	14.53	1.30	4.04	6.23	19.00	14.48
V ₂	41.16	2.36	6.66	5.22	35.88	26.52
V ₃	60.94	2.10	5.38	6.69	53.72	35.60
S.E. ±	1.85	0.16	0.35	0.45	2.13	1.50
C.D. (P=0.05)	5.41	0.48	1.03	1.33	6.22	4.39
Enviornment						
E ₁	47.11	2.10	6.66	7.35	35.27	23.68
E ₂	52.30	1.77	4.85	4.12	30.62	21.64
E ₃	43.30	1.48	4.55	2.98	26.20	19.68
E ₄	71.48	2.37	5.35	5.73	52.70	37.14
S.E. ±	2.14	0.19	0.40	0.52	2.46	1.74
C.D. (P=0.05)	6.24	0.55	1.19	1.54	7.18	5.07
Variety x environment						
V ₁ x E ₁	43.0	1.50	6.67	4.50	21.50	13.50
V ₁ x E ₂	53.33	1.00	3.00	2.70	13.00	9.5
V ₁ x E ₃	39.8	0.67	3.00	2.40	11.50	8.6
V ₁ x E ₄	58.0	2.0	3.5	3.33	30.00	26.33
V ₂ x E ₁	43.44	2.33	7.33	8.22	34.22	23.77
V ₂ x E ₂	47.78	2.33	6.44	3.67	32.22	22.55
V ₂ x E ₃	40.33	2.11	6.22	2.55	28.66	19.77
V ₂ x E ₄	73.11	2.66	6.66	6.44	48.44	39.99
V ₃ x E ₁	54.89	2.22	5.99	9.33	50.11	33.77
V ₃ x E ₂	55.78	2.00	5.11	6.00	46.66	32.88
V ₃ x E ₃	49.77	1.66	4.55	4.00	38.44	30.66
V ₃ x E ₄	83.33	2.44	5.88	7.44	79.66	45.11
S.E. ±	1.85	0.16	0.35	0.45	2.13	1.50

Performance of rose varieties with respect to floral characters

1992). The result indicated that among these three varieties Montezuma had better growth performance followed by Minuparle and Gladiator. It is clear fact that the production potential of any plants on the growth of the plant which is ultimately governed by genetic factor to a great extent.

Effect of growing environment on the floral characters:

Various growing environments had significant influence on time taken for flower buds appearance in the plants. After pruning plants in polyhouse took minimum times for appearance of bud which was followed by open condition and 50 per cent shade. On the other hand appearance of flower bud was significantly delayed in plants under 75 per cent shade. Optimum light intensity, favourable temperature and moist air inside the polyhouse might helped in the faster growth and early appearance

of flower buds as observed in the present study. Optimum light intensity, favourable temperature and moist air inside the polyhouse might have favoured accumulation of more carbohydrate than other growing environments. It is the tendency of plant to come to reproductive phase, if it has enough carbohydrate in it (Malhotra and Kumar, 2000).

Stem length was also significantly influenced by different environments. The longest flower stem was observed in poly house (29.01 cm) followed by 50 per cent shade net (27.73 cm) without showing significant variation from each other. The stem length was minimum in open condition (21.96 cm). Malhotra and Kumar (2000) also observed increment in stem length of Raktagandha roses under polyhouse and 25 per cent shading as compared to open condition.

Various growing environments had significant influence on size of flower buds with respect to length and diameter in the plants after pruning. It was observed

Table 2 : Various floral characters of rose varieties as influenced by different growing environments

Treatments	Days to first flower bud appearance	Stem length of flowers (cm)	Bud length (cm)	Bud diameter (cm)	Diameter of flower (cm)	No. of flowers
Variety (V)						
V ₁	30.27	30.61	3.54	3.52	7.26	2.5
V ₂	30.76	23.11	2.74	2.51	5.38	8.21
V ₃	30.69	23.04	2.87	2.47	5.81	9.58
S.E. (m) ±	1.38	1.11	0.10	0.11	0.15	0.42
C.D. (P=0.05)	NS	3.26	0.30	0.32	0.44	1.25
Environment						
E ₁	28.96	21.96	2.96	2.76	5.85	7.15
E ₂	31.51	27.73	3.08	2.93	6.32	6.28
E ₃	35.88	23.63	2.67	2.42	5.58	5.18
E ₄	27.27	29.01	3.47	3.24	6.87	8.43
S.E. (m) ±	1.60	1.29	0.11	0.12	0.17	0.49
C.D. (P=0.05)	4.68	3.77	0.34	0.37	0.51	1.44
Variety x Environment (V x E)						
V ₁ x E ₁	28.00	27.33	3.43	3.43	6.83	2.80
V ₁ x E ₂	30.00	31.83	3.43	3.6	7.43	2.22
V ₁ x E ₃	28.88	29.80	2.90	2.76	6.40	1.80
V ₁ x E ₄	31.00	33.46	4.40	4.30	8.40	3.20
V ₂ x E ₁	32.88	19.55	2.73	2.41	5.17	9.00
V ₂ x E ₂	30.66	26.55	2.79	2.74	5.33	8.66
V ₂ x E ₃	34.60	20.32	2.50	2.10	5.03	6.00
V ₂ x E ₄	34.50	26.00	2.94	2.83	5.98	9.22
V ₃ x E ₁	38.55	19.00	2.73	2.44	5.50	9.66
V ₃ x E ₂	27.50	24.81	3.02	2.44	6.19	8.00
V ₃ x E ₃	25.66	20.77	2.63	2.42	5.32	7.77
V ₃ x E ₄	28.66	27.57	3.09	2.61	6.26	12.88
S.E. (m) ±		NS	NS	NS	NS	NS
C.D. (P=0.05)		1.11	0.06	0.11	0.15	0.42

Interaction of rose varieties with growing environments with respect to floral character

NS=Non-significant

that plants under poly house produced the longest buds (3.47 cm) followed by 50 per cent shade (3.08 cm), while the buds with shortest length was produced under 75 per cent shade (2.67 cm).

The diameter of the flower was also maximum under poly house condition (6.87 cm) followed by 50 per cent shade net (6.32 cm), open condition (5.85 cm) and 75 per cent shade net condition (5.58 cm).

Besides, other floral characters like, number of petals per flower and diameter of individual flowers were also significantly influenced by growing environments. It was observed that these two parameters also recorded highest value under polyhouse followed by 50 per cent shade and opens condition, while the lowest value for these two characters were recorded under 75 per cent shade nets.

So far as number of flowers per plant was concerned, it was maximum under polyhouse condition (8.43). Open condition (7.15) and 50 per cent shade (6.28), while the minimum was recorded under 75 per cent shade (5.18).

Interaction of rose varieties with growing environments with respect to floral character:

Various combination of rose varieties and growing environments had significant influence on length of flower buds. It was observed that Gladiator under polyhouse condition produced buds with maximum length, while Minuparle under 75 per cent shade recorded the minimum, during both the observation.

Interaction effect of variety and environment was also observed to be significant with respect to diameter of the flower buds. The same trend was observed with respect to bud diameter, as found in case of length of flower bud.

Combined effect of variety and growing environments also had significant influence on petal number. It was found that Gladiator under polyhouse condition recorded maximum number of petals per flower, on the other hand, Montezuma under 75 per cent shade recorded minimum numbers of petals. It may be seen that performance of Montezuma and Minuparle under 75 per cent shade were comparable with each other.

It was found that Gladiator, under polyhouse condition produced largest flower diameter (8.40) closely followed by same variety under 50 per cent shade (7.43). The flower with minimums flower diameter was produced in Minuparle under 75 per cent shade (5.17). However, more or less similar effect was produced by the same variety under open condition, with respect to the above floral characters.

Performance of Gladiator with respect to afore

mentioned floral characters (*viz.*, length and diameter of flower bud, number of petal per flower and flower diameter) was excellent in addition to producing significantly longer flower stem. Poly house is most favourable condition for flowering. Therefore, performance of Gladiator was further improved under the polyhouse condition. Performance of all rose varieties with respect to floral character were poor under 75 per cent shade, where reduced light intensity is a problem.

It was observed that Montezuma under polyhouse, produced significantly higher number of flowers, where as Gladiator under 75 per cent shade, produced the minimum number. However, performance of this cultivar *i.e.* Gladiator under 75, 50 per cent shade and open condition were statistically comparable with each other.

As already been pointed out in the discussion, among the different varieties under trial, highest flower production was observed in Montezuma while gladiator had poor performance with lowest production of flowers. Under polyhouse the flower production of Montezuma was further increased because of favourable microclimatic situation. whereas under 75 per cent shade, lowest flower production was observed in Gladiator, due to inherent capacity of this variety to produce low yield as well as much reduction of light intensity in shade net which is a limiting factor.

Improvement of all the floral characters including higher flower production under poly house, as compared to open condition was due to the fact that under polyhouse condition, availability of optimum light intensity (52-72 % of incidence light) maintained higher chlorophyll content, which could produce and maintain higher carbohydrate reserve that was diverted for flower production while in open condition there was destruction of chlorophyll content due to its photo oxidation thus the reserved food material was less.

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