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Meshram PD
Student, College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

Dr. BR Salvi
Head & Associate Dean, College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra, India

Dr. RG Khandekar
Professor, College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra, India

Dr. VG Salvi
Professor, Department of Soil Science & Agril. Chem., College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra, India

Dr. CD Pawar
Professor, Department of Horticulture, College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra, India

Dr. NB Gokhale
Professor (CAS) MCAER, Dr. B.S. K. K. V. Dapoli, Maharashtra, India

Dr. KV Malshe
Associate Professor, College of Horticulture, Dapoli, Ratnagiri, Maharashtra, India

Corresponding Author
Meshram PD
Student, College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

Impact of pinching, disbudding and bending on rose cv. Gladiator

Meshram PD, Dr. BR Salvi, Dr. RG Khandekar, Dr. VG Salvi, Dr. CD Pawar, Dr. NB Gokhale and Dr. KV Malshe

Abstract
A field investigation entitled "Effect of rose varieties under shade net and open condition in konkan" was carried out at College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli-415 712, Dist. Ratnagiri, Maharashtra (India) during the year 2018-2019 and 2019-2020 by considering the commercial importance of rose to maximize the production of farmers throughout the year. The experiment was "Effect of pinching, disbudding and bending on rose cv. Gladiator" which consisted eight treatments *viz.*, T_1 – Pinching, T_2 – Disbudding, T_3 – Bending, T_4 – Pinching + Disbudding, T_5 – Disbudding + Bending, T_6 – Pinching + Bending, T_7 – Pinching + Disbudding + Bending, T_8 – Control and experiment was laid out in Randomized Block Design and replicated three times.
The significantly maximum plant height (129.90 cm), minimum days taken for first flower bud initiation (25.73 days), minimum days for tight bud stage (31.61 days), minimum days for opening of first flower (35.35 days), maximum number of flower per plant (25.86), maximum number of flower per sq m. (95.66), maximum yield of flower per ha. (16.47 ton) and highest B: C ratio (3.80) were recorded maximum in the treatment T_8 i.e. Control. Maximum total leaf area (8409.42 cm^2) was recorded in the treatment T_1 i.e. Pinching. Maximum vase life (11.74 days) was recorded in the treatment T_3 i.e. Bending.

Keywords: Pinching, disbudding, bending, rose cv. Gladiator

Introduction
In today's modern world, rose is the highest demanded cut flower and it ranks first in international flower trade. Roses are grown for cut flowers, for making garlands, bouquets, in flower arrangement, vase decoration for worshipping to prepare gulkand, pankhuri and to extract essential oil, perfume and rose water. They can be used as a bushes, standards, climbers, hedges and edges, hangers and in rock gardens. Rose is the top ranking cut flower in the flower trade on the basis of average production and consumption in India, Rose has always been admired for its beauty and fragrance. Rose is one of the natures beautiful creations and is universally known as "Queen of Flower" and belongs to the family Rosaceae. It is a shrub plant and has more than hundreds of species (Horn, 1992) [12] and over 2000 cultivars (Kim *et al*., 2003) [15], out of which only eight species are cultivated *viz.*, *Rosa chinensis*, *Rosa damascena*, Rosa foetida, Rosa gallica, Rosa gigantea, Rosa moschata, Rosa multiflora and Rosa wichuriana.
For the maximization of yield and quality of rose flower crop there should be selection of suitable variety and many cultural operations. The optimum yield of roses is 25-50 stems/m^2/year in open field and 150-200 stems/m^2/year in shade net. Pinching is an important operation to encourage the side branches and to make plant bushy and dense, but it should be done at an appropriate stage when the plants are well established to a height nearly 15-20 cm (6-8 inch) with 3-4 pairs of leaves. The disbudding operation is an important factor in the maintenance of high-quality product (Yassin and Pappiah, 1990) [34]. This practice is reported to be a standard operation in the cultivation of roses, carnations, chrysanthemums and celosias (Machin and Scopes, 1978; Janick, 1986; Norman, 2004) [17, 13, 20]. Shoot-bending has become a standard cultural practice in cut flower rose (*Rosa hybrida* L.) production. It has been reported that bending of the primary shoot promotes the formation of axillary shoots by breaking apical dominance (Cline, 1991) [6]. Ohkawa and Suematsu (1999) [21] reported that bending resulted in higher shoot quality but less harvestable shoots per plant in commercial greenhouses.

Material and Methods

The experiment was conducted at the High-tech Nursery, College of Horticulture, Dapoli, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist-Ratnagiri (M.S) during 2018-19 and 2019-20 respectively. The experiment was "Effect of pinching, disbudding and bending on rose cv. Gladiator" which consisted eight treatments *viz.*, T_1 - Pinching, T_2 - Disbudding, T_3 – Bending, T_4 - Pinching + Disbudding, T_5 - Disbudding + Bending, T_6 - Pinching + Bending, T_7 - Pinching + Disbudding + Bending, T_8 – Control and experiment was laid out in Randomized Block Design and replicated three times.

Results and Discussion

The data in respect with growth, flowering, yield and vase life in rose as a influenced by pinching, disbudding and bending is presented in Table 1. Significantly maximum plant height in rose was noticed with the treatment T_8 i. e. Control (129.90 cm). From the results it is noticed that, maximum plant height was observed in the treatment T_8 i. e. Control in rose. This might be due to the difference in genotypic constitution of the varieties. These results are in close agreement with findings of Lundstad (1975) [16] in rose. He found maximum plant height in cultivar Scarlet Elizabeth.

From the data it was found that T_8 i.e. Control took significantly minimum days (25.73 days) for emergence of first flower bud. From above result it was found that the treatment T_8 i.e. Control shows the early flowering whereas the treatment T_7 i.e. Pinching + Disbudding + Bending shows delay flowering. The delay in flowering by pinching was due to removal of mature portion and new shoots which emerged out from pinched plants took more time to become physiological inductive to produce flowers than non-pinched plants. These results are in close agreement with the findings of Khandelwal *et al.* (2003) and Sehrawat *et al.* (2003) [14, 29] in marigold.

From the data noticed that T_8 i.e. Control took significantly minimum days (31.61 days) for tight bud stage. The result showed that the days taken for tight bud stage in rose were observed in the treatment T_8 i.e. Control. This might be due to the inherent genetic factors and production of plant growth hormones like auxins, cytokinins, gibberellins and ethylene in plant. Similar findings were observed by Bhattacharjee *et al.* (1993) and Fascella and Zizzo (2007) [3, 10].

The data with respect to day opening of first flower revealed that T_8 i.e. Control took significantly minimum days (35.35 days) for opening of first flower. From above result it was recorded that T_8 i.e. Control took minimum days for flower opening whereas the treatment T_7 i.e. Pinching + Disbudding + Bending took maximum days for opening of first flower. The delayed in flowering by pinching due to removal of mature portion and new shoots which emerged out from pinched plants took more time to become physiological inductive to produce flower than non-pinched plant. These results are in close agreement with findings of Pawar (2001) [25] in chrysanthemum, Bhat and Shephered (2007) [2] in African marigold.

Maximum number of flower per plant (25.86) in rose was noted with the treatment T_8 (Control) however, the treatment T_7 i.e. Pinching + Disbudding + Bending recorded minimum number of flower per plant. Maximum number of flowers plant^{-1} were recorded in variety Gladiator. The results are in conformity with the Pradhan *et al.* (2017) [26]. This must be due to the varietal characters of the different varieties.

Significantly maximum number of flower per sq m. (95.66) was recorded with the treatment T_8 (Control). This implies that variety Gladiator has genetic constitution that stimulates to produce more number of flowers. The above results are similar with the investigations of Fascella and Zizzo (2005) [9] in rose.

It was revealed that, treatment T_8 (Control) obtain significantly maximum yield of flower per ha. (16.47 ton). From the above results it is noticed that maximum yield of flower per ha was observed in T_8 (Control). This must be due to difference in genetic constitution in different varieties. The above results are similar with the investigations of Sharma and Sharma (2003) [30] in rose. 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 in turn directly or indirectly leads to production of more number of flowers per plant Subiya *et al.* (2017) [31]. Variation in flower yield was also observed previously in rose by Bhattacharjee *et al.* (1993) and Nagaraja *et al.* (1996) [3, 19].

During the investigation of two year it was noticed that, the treatment T_8 i.e. Control recorded significantly maximum B: C ratio (3.80) in rose. Higher net return of rose could be assured by increasing the production and productivity by adopting judicious management practices. Again, the better quality flowers fetched higher price in the market. This might be due to higher demand during marriage and Valentine's Day celebration. Similar effect of increased benefit cost ratio in treatments over control was observed by several workers *viz.*, Man Bihari *et al.* (2010), Chaudhari et al. (2010) and Patil *et al.* (2012) in rose, Swapna (2010) in marigold, Bini sundhar in jasmine (2011) and Palanisamy in gerbera (2011) [18, 5, 24, 32, 4, 22].

The treatment T_1 i.e. Pinching recorded significantly maximum total leaf area (8409.42 cm^2). Above result indicated that the treatment T_1 i.e. Pinching shows better result with respect of total leaf area of plant, whereas treatment T_3 i.e. Bending shows the lowest leaf area among all the treatments. In pinching practice, apical dominance of plant, branch and leaf may get more sunlight which increased leaf area due to pinching. Similar results were observed by (Dorajeerao and Mokashi., 2012) [8] in Garland chrysanthemum, Salve *et al.* (2016) [27] in Chrysanthemum. Salyh (2013) [28] found that leaf area was decreased in non-pinched plants compared with pinched once and pinched twice in Geranium plants.

During the investigation of two year it was noticed that, the treatment T_3 i. e. Bending recorded significantly maximum vase life (11.74 days). The vase life of the tested cultivar was clearly increased when flower bud was removed from the bent stems and bending was performed at junction and lower buds. This truth may be attributed due to the presence of higher amount of assimilates in the bottom portion of the shoots that would ensure vigorous growth and development of the newly emerged stems.

Dole and Wilkins (2005) [7] stated that the carbohydrate status of the crop should be high to maximize post-harvest life of cut flower. The observed results suggest once again the importance of redirecting the reserved food sources to newly developing flowering shoots rather than investing them on unusable flower (Anonymous, 2009) [1]. Likewise, Parvez *et al.* (2000) [23] reported that removal of floral buds resulted in highly significant increase in accumulation dry matter**.** Similar explanations were also given by Halevy and Mayak (1974) and Van Doom *et al.* (1991).

Table 1: Plant height of rose cv. Gladiator at 30 days interval as influenced by pinching, disbudding and bending (Pooled)

Treatments	Plant height (cm)	Total leaf area (cm^2)	Days taken for first flower bud initiation	Days taken for tight bud stage of flower	Days taken for opening of first flower	Number of flower per plant	Number of flower per sq m.	Yield of flower per ha. (ton)	Vase life (days)	B:C ratio
T_1	91.75	8409.42	31.50	36.91	39.83	25.34	93.77	15.34	6.89	3.29
T_2	123.53	6321.08	26.86	31.87	36.03	22.97	84.99	12.28	4.55	2.94
T_3	107.00	5585.51	28.27	33.97	37.53	19.73	72.99	9.69	11.74	2.44
T_4	85.20	8247.11	36.18	40.96	43.30	24.71	91.43	14.75	5.73	2.24
T_5	114.04	5997.27	27.78	33.89	36.25	18.28	67.64	7.70	11.18	1.60
T_6	78.11	8365.91	37.47	42.86	47.17	23.73	87.79	13.70	10.82	2.10
T_7	68.71	6848.88	38.26	44.50	49.26	16.90	62.52	6.78	8.53	1.16
T_8	129.90	7780.93	25.73	31.61	35.35	25.86	95.66	16.47	10.35	3.80
Mean	99.78	7194.51	31.50	37.07	40.59	22.19	82.10	12.09	8.72	2.45
'F' Test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
S .Em ±	2.07	207.08	1.90	2.33	2.32	1.99	7.36	2.04	1.32	0.23
CD at 5%	6.26	628.12	5.77	7.06	7.04	6.03	22.31	6.19	4.01	0.71

*DAP - Days after Planting

Treatment details
T1: Pinching
T2: Disbudding
T3: Bending
T4: Pinching + Disbudding
T5: Disbudding + Bending
T6: Pinching + Bending
T7: Pinching+ Disbudding + Bending
T8: Control

Conclusion

The study of effect of pinching, disbudding and bending on rose cv. Gladiator, the treatment T_8 i.e. Control was found significantly maximum plant height, minimum days taken for first flower bud initiation, minimum days for tight bud stage, minimum days for opening of first flower, maximum number of flower per plant, maximum number of flower per sq m., maximum yield of flower per ha and highest B:C ratio (3.80). The maximum total leaf area was recorded in the treatment T_1 i.e. Pinching. However significantly maximum vase life was recorded maximum in the treatment T_3 i.e. Bending.

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