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Evaluation of hybrid tea roses (*Rosa hybrida*) under Prayagraj agroclimatic conditions

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Abstract
The experiment entitled "Evaluation of hybrid tea roses (*Rosa hybrida*) under Prayagraj agroclimatic conditions" was carried out in the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj from December 2020 to April 2021. The experiment was conducted in Randomized Block Design (RBD) with 10 different hybrids replicated 3 times each. The hybrid tea rose cultivars used were: Harrogate (V_1), Lace (V_2), Wedding Bells (V_3), Pascali (V_4), Sheer Elegance (V_5), Achutananda (V_6), Morning Star (V_7), Breathless (V_8), Pride of Midinipur (V_9) and Fragrant Cloud (V_{10}). Several morphological (No. of flower buds per plant, Flower bud diameter, Flower stalk length) and quality parameters (No. of days taken from bud emergence to tight bud stage, No. of days taken from tight bud stage to full bloom, Blooming period) of the flower were taken for the above study. Results showed that hybrid var. Pride of Midinipur (V_9) was observed to be best performing in terms of No. of flower buds per plant (5) and No. of days taken from tight bud stage to full bloom (6 days) whereas the hybrid var. Harrogate (V_1) was observed to be best performing in terms of Flower bud diameter (3.1 cm) and Achutananda (V_6) was best for Blooming period (56 days). The hybrid var. Pascali (V_4) was observed to be best performing in terms of No. of days taken from bud emergence to tight bud stage (4 days) and Sheer Elegance (V_5) was performed best in Flower Stalk length (35.6 cm).

Keywords: Hybrid tea, rose, evaluation, growth, flowering

Introduction
Due to the increasing demand for flower and floricultural products floriculture has emerged as one of the important commercial trades in agriculture. Commercial floriculture has been discovered to be a potential money-maker and a financially viable agri-business. As a result, commercial floriculture has become involved in high-tech activities that take place in greenhouses under controlled climatic conditions. The Indian floriculture sector has shifted in the current period from traditional loose flowers to cut flowers for export (Chawla *et al.* 2016) [5]. Indian floriculture industry comprises flowers such as Rose, Tuberose, Carnation, Gladiolus, Anthurium, Marigold, etc. Cut flowers are a significant export-oriented floriculture commodity among them. Among all the floricultural crops, roses occupy a pre-eminent position both as garden plants and cut flowers. Rose is the most favorite and unchallenged flower which is universally known as "Queen of Flowers", and represents love, companionship, sincerity, romance, grace, and spirituality (Hummer and Jenick, 2009) [14]. It contributes 95% to the total cut flower export from India. The global demand for rose products is increasing at a pace of 17% each year (Reddy, 1996). Rose occupies an area of 29.41 thousand ha with the production of 301.95 thousand MT in India. The success of rose cultures, however, depends on the proper choice of type and cultivars of roses. The genus *Rosa* consists of about 120 species with more than 30,000 cultivars that are extensively distributed throughout the temperate and subtropical parts of the northern and southern hemispheres (Dhua, 1999). The cut flower with long stems belonging to hybrid tea and commonly cultivated by the farmers for cut flower purposes. For loose flower purposes, Floribunda possesses the character of producing flowers in clusters, and cultivars of Floribunda are highly suitable for garland preparation and other social functions. There are several major classes of garden roses. The best known and most popular class of rose is that of the hybrid tea, which accounts for the majority of roses grown in greenhouses and gardens, sold in florist shops, and also used for export purposes. The first modern rose was the hybrid tea, which was derived from the crosses between hybrid perpetual and tea roses thus contained genes from *R. damascene, R. moschata, R. gigantea, R. canina, R. chinensis,* and *R. gallica* (Mariott, 2003).

The Hybrid Perpetuals achieved great popularity until they were replaced by hybrid teas in the early 20th century. The hybrid tea flowers are well-formed with large, high-centered buds, supported by long, straight, and upright stems. Each flower can grow to 8-12.5 cm wide. Hybrid teas are the world's most popular type of rose by choice due to their attractive color and elegant flower form. They are grown specifically by commercial flower growers for the cut-flower market and they are also used for home and industrial building and landscaping. Their flowers are usually born singly at the end of long stems which makes them popular as cut flowers. They have erect stems that usually form plants that are 1-2 m tall. They are perennial woody shrubs that continuously produce new shoots (Roberts *et al*. 2003) [26]. The first hybrid tea was a pink rose cultivar named 'La France,' discovered in France in 1867 by rosarian Jean-Baptist Andre Gulliot. It is assumed to be the result of a natural cross between unknown parents, yet it became the template for a new class of roses. The hybrid tea class (*Hybrids de The*) was first recognized in approximately 1880 by the French people, but it was not until 1893 that the British National Rose Society officially recognized the class (Filiberti, 2005) [11]. The selection of varieties is an important aspect of successful rose cultivation. Presently there are many varieties with several new hybrids every year. It is very much essential to access the performance of suitable varieties of rose with maximizing the production and cost-effective cultivation.

Materials and Methods

The experiment was conducted at the Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj from December 2020 to April 2021. Prayagraj is located at 28.8º North latitude and 81.5º East longitude, at a height of 78 meters above mean sea level. It is part of India's sub-humid Ganga-Yamuna alluvial plains agroclimatic zone. The design of the experiment was Randomized Block Design (RBD) with ten different hybrids with three replications. Ten different hybrids used were Harrogate (V_1), Lace (V_2), Wedding Bells (V_3), Pascali (V_4), Sheer Elegance (V_5), Achutananda (V_6), Morning Star (V_7), Breathless (V_8), Pride of Midnipur (V_9) and Fragrant Cloud (V_{10}). Six months old grafted plants of ten different hybrids were planted within the pit. Before planting Bonemeal and FYM were applied within the pit at the ratio of 2:1. Row to row and plant to plant spacing were 1 m × 75 cm. After planting irrigation was applied at a regular interval according to weather conditions. After the survival of plants weeding, disbudding, and other intercultural operations were practiced at different intervals within the crop field. Different plant protection chemicals were applied against different pests and diseases. After flowering came flowers were harvested at the tight bud stage.

Results and Discussions

Morphological parameters

Significant variations were observed amongst the Ten hybrid tea rose cultivars for different morphological characters. Different Morphological parameters like Number of flower buds per plant, Flower bud diameter and Flower stalk length were presented in Table 1. and illustrated in Fig. 1. The Number of flower buds per plant was recorded highest in Pride of Midnipur (V_9) (5) which was statistically at par with Harrogate (V_1) (4) whereas the lowest number of flower buds per plant (1) was recorded in Sheer Elegance (V_5). The number of buds per plant depends upon genetic factors and climatic conditions. A similar type of research was obtained from Chandrashekaraiah (1973) [6] and Fascella and Zizzo (2005) [12] in rose. Significantly the highest flower bud diameter (3.1cm) was obtained in Harrogate (V_1), followed by (2.4 cm) in Wedding Bells (V3), while the lowest flower bud diameter (1.8 cm) was obtained in Pascali (V4). The variation in flower bud diameter might be mainly attributed due to the genetic makeup of the cultivar. A similar result in bud diameter has also been reported by Singh (1995) [29] in rose. The longer flower stalk length (35. 6 cm) was recorded in Sheer Elegance (V_5) which was statistically at par with Lace (V_2) (34.2 cm) and Fragrant Cloud (V_{10}) (33.6 cm) whereas shorter flower stalk length (19.6 cm) was recorded in Morning Star (V_7). Longer stem length in cut flower is an important character for export purposes or distant market and shorter stalk length in rose is for the local market. However, it is a genetic character and differs from variety to variety. Similar results in flower stalk length have been reported by Murugesan *et al*. (1991) [23], Bhattacharjee *et al.* (1993) [4], Sundaram *et al.* (1996) [35], Ramzan *et al*. (2014), Mantur *et al*. (2005) [19], Fascella and Zizzo (2005) [12].

Quality parameters

Different Quality parameters like Number of days from emergence of a flower bud to tight bud stage, Number of days taken from tight bud stage to full bloom and Blooming period were presented in Table 1. and illustrated in Fig. 1. Significantly less number of days taken from the emergence of a flower bud to tight bud stage was recorded in Pascali (V_4) (4 days) which was statistically at par with Achutananda (V_6) (6 days), (7 days) in Breathless (V_8) and (8 days) in Harrogate (V_1) whereas more number of days taken from the emergence of a flower bud to tight bud stage was recorded in Harrogate (V_1) (8 days). It indicates that the early or late flowering habit of any of the cultivars. It is a genetically controlled character of the cultivars. Similar results have also been reported by (Harshvardhan, 2009) [13], Nagaraja (1996), Manjula (2005), and Bhattacharjee *et al*. (1993) [4] in rose. Significantly the less number of days (6) taken from tight bud stage to full bloom was recorded in Pride of Midinipur (V_9) and the more number of days (9) taken from tight bud stage to full bloom was recorded in Wedding Bells (V_3). The variation among these varieties is due to the genetic and environmental character. A similar result was obtained by Chandrashekaraiah (1973) [6] in rose. Significantly more number of days of flowering was recorded in Achutananda (V_6) (56 days) which was statistically at par with Wedding Bells (V_3) (54 days) and Pascali (V_4) (55 days) whereas the less number of days for flowering was recorded in Breathless (V_8) (48 days). Variation in blooming period among the cultivars could be attributed to variation in genetic makeup of the plant.

Table 1: Morphological and Quality parameters of different hybrid tea roses

Hybrid	Number of days taken from bud emergence to tight bud stage	Number of flower buds per plant	Flower bud diameter (cm)	Number of days taken from tight bud stage to full bloom	Flower Stalk length (cm)	Blooming period (days)
Harrogate (v_1)	8	4	3.1	7	28.3	49
Lace (v_2)	5	3	2.2	8	34.2	52
Wedding bells (v_3)	5	2	2.4	9	27.4	54
Pascali (v_4)	4	2	1.8	7	22.1	55
Sheer elegance (v_5)	5	1	2.1	7	35.6	25
Achutananda (v_6)	6	2	2.4	9	22.1	56
Morning star (v_7)	5	2	2.0	7	19.6	52
Breathless (v_8)	7	2	2.1	8	24.0	48
Pride of midinipur (v_9)	4	5	2.3	6	23.3	48
Fragrant cloud (v_{10})	5	2	2.3	7	23.3	48
F-test	S	S	S	S	S	S
C.d. At 5%	1.455	1.576	0.312	1.161	4.454	2.596
Se(d)±	0.687	0.745	0.147	0.548	2.576	1.226
C.v.	15.229	34.109	8.078	8.803	11.609	2.919

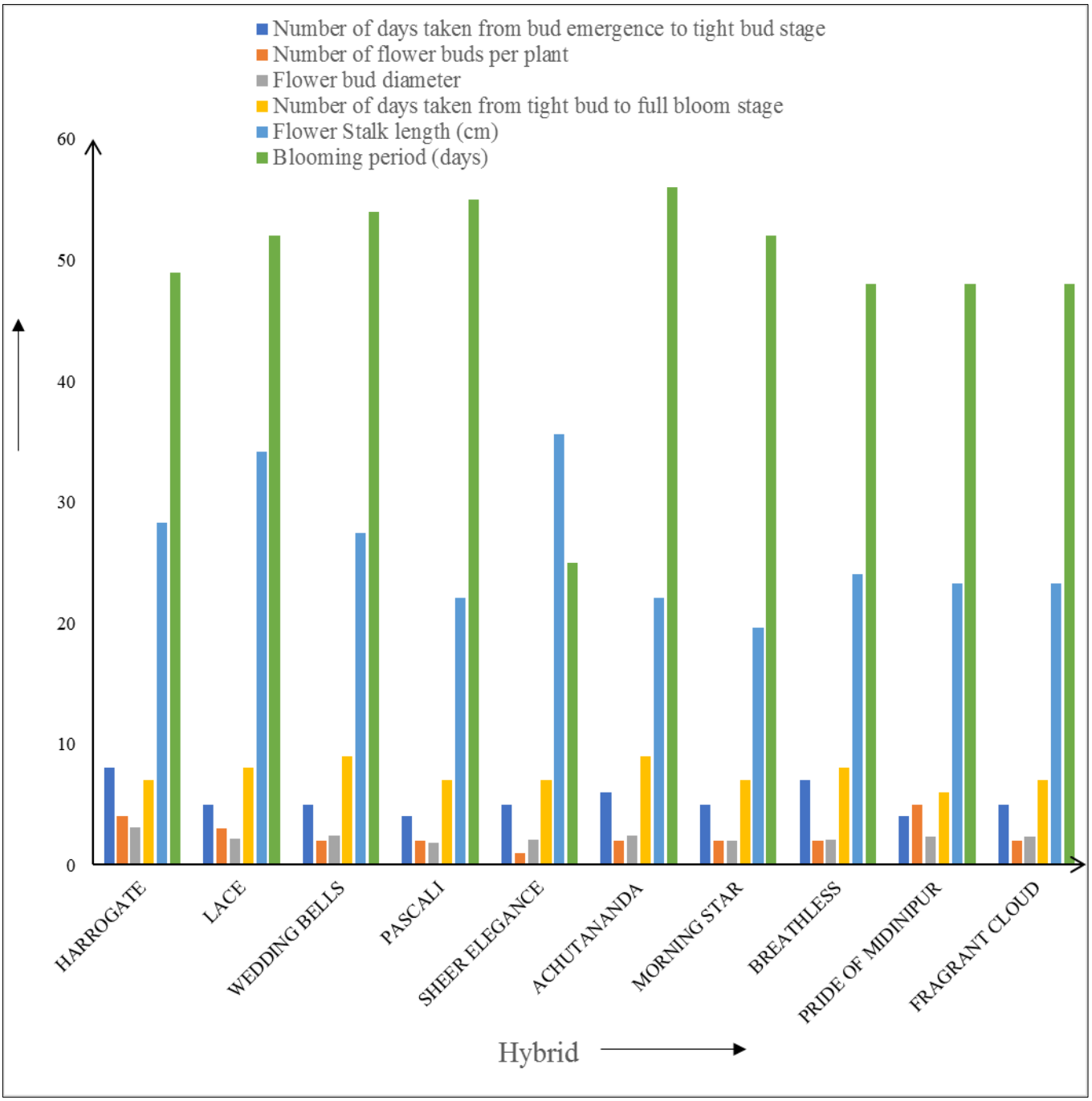

Fig 1: Morphological and Quality parameters of different hybrid tea roses

Conclusion

Based on the present investigation, it is concluded that more number of days taken for blooming Period were recorded in Achutananda (V_6) (56 days). When longer flower stalk length (35.6 cm) was recorded in Sheer Elegance (V_5) and less number of days taken from bud initiation to tight bud stage was recorded in Pascali (V_4) (4 days). The less number of days (6) taken from tight bud stage to full bloom and highest number of flower buds per plant (5) was recorded in Pride of Midinipur (V_9). Highest flower bud diameter was recorded in Harrogate (V_1) (3.1 cm). Hence the best hybrid in combination with all parameters were Achutananda, Sheer Elegance and Pride of Midinipur which can be recommended for Prayagraj agroclimatic conditions.

Future scope

As hybrid tea rose is a perennial crop so farmers invest at a time and can get profit up to 7-8 years. It is used as a cut flower and has more demand in the international flower market. So, growers can get good number of foreign exchanges from it.

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