# Studies on Performance of Elite Dutch Rose Varieties Under Naturally Ventilated Polyhouse for Northern Dry Zone Of Karnataka, India

**Abstract**

A study on the performance of elite Dutch rose varieties under naturally ventilated polyhouse for Northern dry zone of Karnataka was carried out during 2022-23 at the experimental block, Department of Floriculture and Landscape Architecture, College of Horticulture, University of Horticultural Sciences, Bagalkot. The experiment was laid out in Randomized Block Design (RBD) with seven varieties and three replications. The varieties were Top Secret, Jumilia, Solar, Revival, Rock Star, Arka Pride and Arka Ivory. Various growth, flowering and yield parameters were recorded during experimental period (September 2022 – September 2023).Among all the varieties studied, the variety Jumilia was superior with respect to plant height (81.22 cm), plant spread (E -W: 46.19 cm and N -S: 45.24 cm), number of branches per plant (4.52), leaf area per plant (2893.28 $cm^2$), stem girth (1.43 cm), days taken for first flower bud initiation (35.67 days), days taken for first flowering (60.00 days),number of flowers per plant (23.98) and number of flower stalks per $m^2$(216.79).

**Keywords:** Dutch Rose, Naturally Ventilated Polyhouse, Growth, Flowering and Yield



## 1. Introduction

Rose is the oldest flower under cultivation and top ranking cut flower in international market followed by carnation and chrysanthemum (Darras, 2021) It is widely known as 'Queen of flowers' due to its variability in size, diverse colour and shape. Rose belongs to Rosaceae family and is indigenous to the temperate Northern Hemisphere. The genus *Rosa* is composed of 120 species, only eight of which are widely cultivated *viz., R. chinensis, R. damascena, R. gallica, R. foetida, R. moschata, R. gigantea, R. multiflora and R. wichuriana*(Muthulakshmi*et al.*, 2022). Rose is a well-known flower to symbolize love, peace, adoration, innocence, friendship, passion and affection.Among the diverse varieties, the Dutch rose stands out for its exquisite beauty, vibrant colors and superior quality, making it a preferred choice for both ornamental and commercial purposes.

Dutch roses are considered as important cut flower varieties with commercial importance. These flowers are exclusively grown in polyhouse in India because of their high demand in foreign countries during various occasions like valentine`s day, new year, Christmas and marriage ceremonies as cut flowers. These roses have high demand in national and international marketsbecause they produce flowers of uniform size, attractive flower colour, better stalk length and good vase life. These roses are mainly cultivated in four Indian states *viz.,* West Bengal, Karnataka, Gujarat and Chhattisgarh(Reddy, 2016). Majorly produced for export purpose and to meet out the local demands, which helps the farmers to earn higher returns. The cultivation of these rosesis gaining importance in Karnataka due to its relative ease in cultivation, high net returns and increasing market demand (Hosur and Patil, 2014).

Climate change isone of the major impacting factors affecting the crop production in India through a number of ways, including high temperature, drought, typhoon damage, flooding due to excessive rainfall and emerging pests and diseases etc.Several new biotic and abiotic stresses have emerged as a great challenge(Vijayalaxmi *et al.*, 2017). Protected cultivation technique reduces these stresses by providing complete controlled condition. Performance of rose varieties depends on region, season and other environmental conditions. Even though some work has been carried out to know the performance of Dutch rose varieties under naturally ventilated polyhouse, new varieties are added to list whose performance is not assessed particularly for Northern dry zone of Karnataka as the high temperature is the limiting factor to grow roses under polyhouse particularly during summer season.Keeping this in view the present study was conducted to assess the performance of Dutch rose varieties for their growth, flowering and yieldunder naturally ventilated.

## 2. Materials and Methods

An experiment entitled “Studies on performance of elite Dutch rose varieties under naturally ventilated polyhouse for Northern dry zone of Karnataka” was carried out at experimental block, Department of Floriculture and Landscape Architecture, College of Horticulture, Bagalkot, Karnataka during the academic year 2022-23. The experiment was laid out in Randomized Block Design (RBD) with seven varieties and three replications byplanting the one to two months old budded plants with 50cm × 20cm spacing accumulating 10 plants per square meter of area. Seven varieties used for study were Top Secret, Jumilia, Solar, Revival, Rock Star, Arka Pride and Arka Ivory (Plate 1).The experiment was set up in a naturally ventilated polyhouse which is oriented in North – South direction (560 $m^2$). The frame of polyhouse is made up of galvanized iron pipe and UV stabilized polythene film of 800 gauge as cladding material. By operating the foggers and side

rollable flaps, the temperature and humidity were maintained. All the recommended practices like irrigation, fertigation and weeding were carried out.Different plant protection chemicals were applied against different pests and diseases. Other special horticultural practices like bending, pruning and bud capping were followed. Five plants were randomly selected from each replication for carrying out performance studies. The data on various growth, floweringat 120 DAP and yield parameters were recorded (November 2022 – September 2023) and statistically analysed.


**Plate 1**. Varieties Evaluated for the Experiment

## 2.1 Growth parameters

### 2.1.1 Plant height (cm)

The plant height of labelled plants was recorded by measuring from ground level to peak growing shoot at 120 days after planting. Average plant height was then calculated in centimetres.

### 2.1.2Plant spread (cm)

The plant spread of labelled plants was measured at 120 days after planting by taking width in East – West and North – South direction at right angle to each other. Average plant spread was then calculated in centimetres.

### 2.1.3Number of branches per plant

Number of branches growing from the main stem of labelled plants were counted and recorded at 120 days after planting. Average was worked out and expressed in numbers. The number of branches were maintained not more than four as it is used for cut flower purpose.

**2.1.4Stem girth (cm)**

Stem girth of labelled plants was measured by Vernier Callipers at 120 days after planting. Average was worked out and indicated in centimetres.

**2.1.5Leaf area per plant ($cm^2$)**

Leaf area per plant of labelled plant was estimated by using graphical method. It was recorded at 120 days after planting and expressed in $cm^2$.

Leaf area = 1× (Number of complete squares) $cm^2$ + ½ × (Number of half or more than half squares) $cm^2$ + ¼ × (Number of less than half squares) $cm^2$(Gao., 2012)

**2.2 Flowering parameters**

**2.2.1Days taken for first flower bud initiation**

Number of days taken for first flower bud initiation from date of planting was recorded from each plant in all the varieties. Average was worked out and expressed in terms of days.

**2.2.2Days taken for first flowering**

Number of days taken from date of planting to the stage at which the first flower bud blooms fully was recorded from each plant of all the varieties. Average was worked out and expressed in terms of days.

**2.3 Yield parameters**

**2.3.1.1 Number of flowers per plant**

Number of flower stalks per plant in all the varieties was recorded throughout the study and indicated in terms of number.

#### 2.3.1.2 Number of flowers per $m^2$

The total number of flowers harvested from the plants accommodated in one sq. m area throughout the study was recorded in each variety and expressed in number.

#### 2.3.1.3 Number of flowers per month per $m^2$

The total number of flower stalks obtained from one sq. m area from all varieties was recorded month wise throughout the study and expressed in terms of number.

## 3. Results and Discussion

### 3.1 Growth parameters

Plant height varied significantly among the varieties at 120 days after planting (Table 1).The variety Jumilia was significantly superior with maximum plant height of 81.22 cm followed by the variety Top Secret (78.99 cm) and Solar (69.54 cm). While the variety Arka Pride recorded minimum plant height (57.65 cm) which was on par with the variety Arka Ivory (59.82 cm). This variation with respect to plant height may be due to genetic nature of varieties that lead variation in meristematic activity resulting in cell division and elongation during the tender growth phase, variation in synthesis of phytohormonesand influence of external environmental conditions. Similar kind of results were obtained by Pradhan*et al*., 2017, Joshna and Sarkar, 2018,Atal *et al*., 2020.

Plant spread (E -W and N -S direction) was gradually increased during subsequent growth stages of plant (Table 1). At 120 DAP, significantly maximum plant spread (E -W and N -S direction) was exhibited by the variety Jumilia (46.63 cm and 45.24 cm, respectively) followed by the variety Top Secret (44.71 cm and 43.35 cm). Whereas the variety Arka Ivory (32.96 cm and 28.87 cm, respectively) recorded minimum plant spread (E -W and N -S direction). The variations may be due to genetic potential of varieties leading to production of more or less number of branches and influence of climatic conditions. Similar outcomes were obtained by Adhikary *et al*. (2019).

During the first two months of planting because of slow vegetative growth, there was no significant difference in the number of branches per plant. Whereas all varieties exhibited significant difference with respect to number of branches per plant at 120 DAP (Table 1). The variety Jumilia produced maximum number of branches (4.52) which was on par with the variety Top Secret (4.33) while minimum number of branches were observed in the variety Revival (3.22). This may be due to genetic makeup of variety that resulted variation with respect to rate of

photosynthesis thereby producing varying number of branches and effect of external environment leading to variation in light interception. Similar results were reported by Philip *et al.* (2020) and Shamanth *et al.* (2016).

Leaf area per plant was gradually increased during subsequent growth stages of plant. The highest leaf area per plant (2893.28 $cm^2$) was recorded in the variety Jumilia at 120 DAP (Table 1). Whereas it was lowest in the variety Arka Pride (1209.57 $cm^2$). The variation in leaf area per plant may be due to genetic constitution of the varieties that produced varying number of branches per plant leading to varying number of leaves thereby showing variation and also varied leaf length and breadth lead to variation in leaf area per plant. Similar outcomes were obtained by Pradhan *et al.* (2017) and Adhikary *et al*. (2019).

There was an increasing trend in measurements of stem girth at various growth phases. At 120 DAP, stem girth was highest in the variety Jumilia (1.43 cm) followed by the variety Top Secret (1.10 cm). Whereas it was minimum in the variety Arka Pride (0.77 cm). This variation may be due to genetic nature of the varieties that increased or decreased cell division in lateral meristem, adaptability of varieties to climate and increased number of branches. Similar results were observed by Soujanya *et al*. (2018) and Pawar *et al.* (2023).

**Table 1: Growth parameters of different varieties of Dutch rose under naturally ventilated polyhouse at 120 DAP**

| Sl. No. | Variety | Plant height (cm) | Plant Spread (cm) | | Number of branches | Leaf area per plant ($cm^2$) | Stem girth (cm) |
|---|---|---|---|---|---|---|---|
| | | | E -W | N -S | | | |

**DAP- Days after planting**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **1** | Top Secret | 78.99 | 44.71 | 43.35 | 4.33 | 2794.65 | 1.10 |
| **2** | Jumilia | 81.22 | 46.63 | 45.24 | 4.52 | 2893.28 | 1.43 |
| **3** | Solar | 69.54 | 42.75 | 42.07 | 3.88 | 2105.96 | 0.88 |
| **4** | Revival | 65.36 | 37.51 | 38.52 | 3.22 | 1543.10 | 0.80 |
| **5** | Rock Star | 67.20 | 39.54 | 40.92 | 3.55 | 2102.81 | 0.94 |
| **6** | Arka Pride | 57.65 | 35.53 | 37.06 | 3.43 | 1209.57 | 0.77 |
| **7** | Arka Ivory | 59.82 | 32.96 | 28.87 | 3.68 | 1774.82 | 0.90 |
| | **S. Em±** | **0.97** | **0.56** | **0.64** | **0.12** | **25.67** | **0.03** |
| | **CD at 5%** | **3.00** | **1.73** | **1.97** | **0.36** | **79.10** | **0.10** |

### 3.2 Flowering parameters

Significantly early flower bud initiation was observed in the variety Jumilia (35.67 days) which was statistically on par with the variety Top Secret (37.00 days), but late flower bud initiation was observed in the variety Revival (42.08 days). Among the varieties, delayed first flowering was noticed in the variety Jumilia (60.00 days) followed by Top Secret (57.34 days) and advanced first flowering was noticed in the variety Arka Pride(47.77 days). The variations may be mainly due to genetic potential of varieties and also influence of external climatic conditions. Similar reports were obtained byShivaprasad *et al.* (2017) and Chauhan *et al.* (2014) (Table 2).

**Table 2. Flowering parameters of different varieties of Dutch rose under naturally ventilated polyhouse**

| Sl. No. | Variety | Days taken for first flower bud initiation (days) | Days taken for first flowering (days) |
|---|---|---|---|
| **1** | Top Secret | 37.00 | 57.34 |
| **2** | Jumilia | 35.67 | 60.00 |
| **3** | Solar | 39.69 | 54.53 |
| **4** | Revival | 42.08 | 50.24 |
| **5** | Rock Star | 40.66 | 52.38 |
| **6** | Arka Pride | 41.08 | 47.77 |
| **7** | Arka Ivory | 39.73 | 49.16 |
| | **S. Em±** | **0.50** | **0.35** |
| | **CD at 5%** | **1.55** | **1.09** |

### 3.3 Yield parameters

The variety Jumilia produced maximum number of flowers per plant (23.98) followed by the variety Top Secret (20.09) but least number of flowers per plant were produced by the variety Revival (11.59). This may be due to differences in number of branches per plant, higher rate of

accumulation of photosynthates due to increased photosynthesis, variation in leaf area per plant and genetic variations among the varieties. This variation is confirmed by Abid Mahmood *et al*. (2013), Wasnik *et al*. (2015) and Anand *et al*.(2017).

Similarly, highest number of flowers per $m^2$ were produced by the variety Jumilia (216.79) followed by the variety Top Secret (186.87) whereas, lowest number of flowers per $m^2$ were obtained by the variety Revival (109.34). The genetic makeup of varieties, favourable climatic condition and variation in leaf area contributed for this variation. Parallel reports of Dalal *et al*. (2009) and Shivaprasad *et al.* (2016) (Table 3).

**Table 3. Yield parameters of different varieties Dutch rose grown under naturally ventilated polyhouse**

| Sl. No. | Variety | Number of Flowers per plant | Number of Flowers per $m^2$ |
|---|---|---|---|
| **1** | Top Secret | 20.09 | 186.87 |
| **2** | Jumilia | 23.98 | 216.79 |
| **3** | Solar | 19.52 | 170.43 |
| **4** | Revival | 11.59 | 109.34 |
| **5** | Rock Star | 18.56 | 168.45 |
| **6** | Arka Pride | 13.66 | 124.23 |
| **7** | Arka Ivory | 14.80 | 135.20 |
| | **S. Em±** | **1.22** | **13.60** |
| | **CD at 5%** | **3.76** | **41.93** |

The data regarding flower yield per month per $m^2$ was recorded during months from November of 2022 to September of 2023 which varied significantly among the varieties and represented in Table 4 and Fig 1. During the months from December of 2022 and January, February, July, August and September of 2023, almost all the varieties produced maximum number of flowers per $m^2$. The variety Jumilia produced maximum number of flowers during these months (20.48, 22.45, 31.33, 13.93, 29.29 and 32.11, respectively) followed by the variety Top Secret (16.28, 20.46, 20.88, 18.10, 25.33 and 22.90, respectively). But during the months from November of 2022, March, April and May, the variety Revival produced lowest number of flowers per $m^2$ (2.33, 6.00, 8.82 and 8.38, respectively). During the month of June 2023, pruning operation was carried out due to which yield is nil in that month. These results were may be due to congenial climatic conditions during particular months of crop growth stage such as favourable temperature, relative humidity and light

which lead to increased growth and development with more yield. These findings were in accordance with results of Singh andMandhar(2004), Maitra*et al.* (2020) in gerbera.

**Table 4. Flower yield per month per $m^2$ of different varieties Dutch rose grown under naturally ventilated polyhouse**

| Sl. No. | Variety | November 2022 | December 2022 | January 2023 | February 2023 | March 2023 | April 2023 | May 2023 | June 2023 | July 2023 | August 2023 | September 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | Top Secret | 7.90 | 16.28 | 20.46 | 20.88 | 5.12 | 9.89 | 9.12 | Nil | 18.10 | 25.33 | 22.90 |
| **2** | Jumilia | 5.00 | 20.48 | 22.45 | 31.33 | 10.67 | 12.48 | 12.23 | Nil | 13.93 | 29.29 | 32.11 |
| **3** | Solar | 3.00 | 14.83 | 19.28 | 18.71 | 8.00 | 9.42 | 8.71 | Nil | 9.87 | 22.49 | 24.36 |
| **4** | Revival | 2.33 | 5.17 | 7.50 | 13.00 | 6.00 | 8.82 | 8.38 | Nil | 9.34 | 15.23 | 9.85 |
| **5** | Rock Star | 4.33 | 10.91 | 16.62 | 17.72 | 9.00 | 10.76 | 11.90 | Nil | 14.00 | 20.88 | 21.39 |
| **6** | Arka Pride | 3.02 | 11.32 | 19.09 | 10.15 | 9.70 | 9.73 | 8.12 | Nil | 9.84 | 19.63 | 12.46 |
| **7** | Arka Ivory | 3.93 | 15.24 | 22.29 | 14.33 | 7.67 | 8.87 | 9.26 | Nil | 8.52 | 20.54 | 18.54 |
| | **S. Em±** | **0.62** | **1.00** | **0.79** | **2.06** | **0.72** | **0.55** | **0.94** | Nil | **0.90** | **2.15** | **2.47** |
| | **CD at 5%** | **1.92** | **3.09** | **2.45** | **6.34** | **2.24** | **1.70** | **2.92** | Nil | **2.78** | **6.63** | **7.62** |

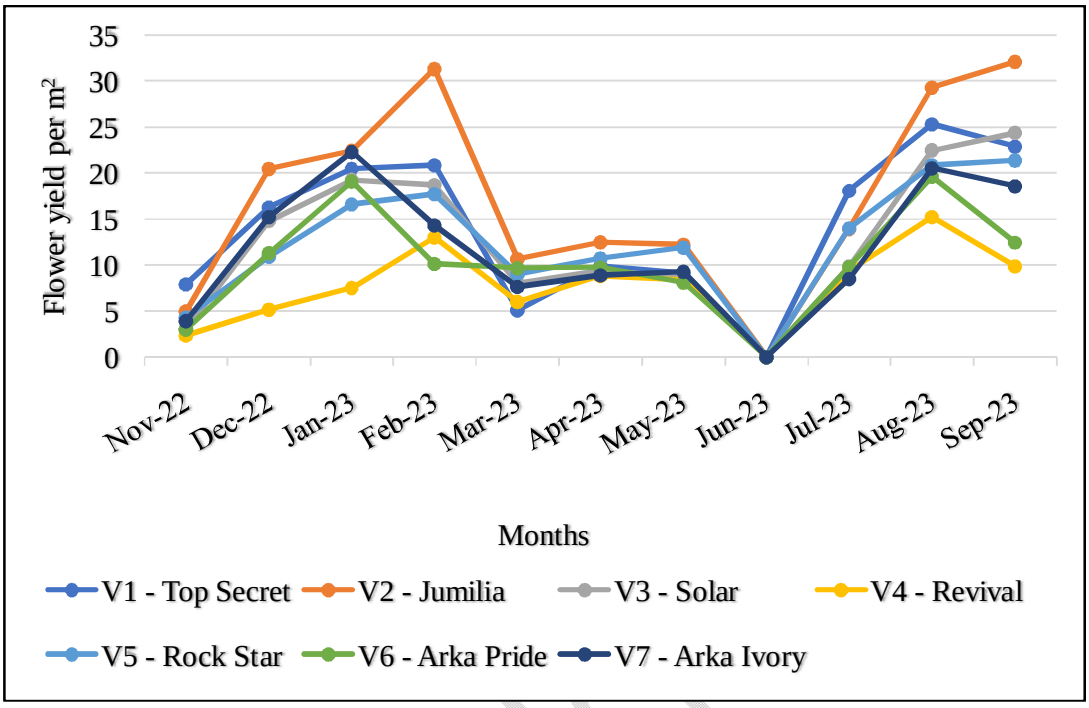


**Fig 1. Flower yield per month per $m^2$ of different varieties of Dutch rose grown under naturally ventilated polyhouse**

## Conclusion

The demand for roses has been steadily increasing, driven by changing consumer preferences, cultural practices and economic growth. This has encouraged more farmers to venture into floriculture. Advances in technology, including greenhouse technology and irrigation systems have made it more feasible to grow roses in controlled environments. Growing rosesis advantage of higher returns compared to traditional crops.Among the seven varieties of Dutch rose studied, the variety Jumilia found to be superior when compared with other varieties based on its growth, flowering and yield parameters, followed by the variety Top Secret. As well as the varieties Solar and Rock Star performed better with respect to growth and yield parameters. Hence the varieties of Dutch rose Jumilia and Top Secret found to be best suitable to grow under Northern dry zone of Karnataka in naturally ventilated polyhouse and the varieties Solar and Rock Star are in next order.

**Disclaimer (Artificial intelligence)**

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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**Appendix I: Meteorological data during the study period from September 2022 to September 2023 at the meteorological observatory of MHREC, UHS, Bagalkot and under polyhouse conditions was as below recorded**

| Month | Rainfall (mm) | External environment | | | Polyhouse condition | | |
|---|---|---|---|---|---|---|---|
| | | Temp (°C) | | Relative humidity | Temp (°C) | | Relative humidity |
| | | Max | Min | | Max | Min | |
| Sept-2022 | 183.8 | 30.4 | 19.35 | 81.23 | 34.75 | 21.36 | 52.45 |
| Oct- 2022 | 202.2 | 30.5 | 20.2 | 79.48 | 35.21 | 23.14 | 68.00 |
| Nov- 2022 | Nil | 30.15 | 17.23 | 68.58 | 34.6 | 19.54 | 50.65 |
| Dec- 2022 | 1.1 | 30.6 | 16.07 | 68 | 34.0 | 19.54 | 46.81 |
| Jan- 2023 | Nil | 31.89 | 14.37 | 69.35 | 36.47 | 15.36 | 36.63 |
| Feb- 2023 | Nil | 34.3 | 15.43 | 46.85 | 39.65 | 17.69 | 30.48 |
| Mar- 2023 | Nil | 35.70 | 17.27 | 46.24 | 40.74 | 19.36 | 46.4 |
| Apr- 2023 | 37.8 | 38.51 | 21.62 | 52.23 | 41.91 | 25.14 | 50.87 |
| May- 2023 | 12 | 38.37 | 24.20 | 56.48 | 41.62 | 27.65 | 43.51 |
| Jun- 2023 | 65.4 | 32.6 | 23.7 | 56.46 | 36.34 | 26.51 | 52.67 |
| Jul- 2023 | 32.0 | 28.4 | 20.6 | 57.68 | 32.84 | 23.41 | 46.21 |
| Aug- 2023 | 36.9 | 30.3 | 21.6 | 60.6 | 33.57 | 25.34 | 52.1 |
| Sep- 2023 | 105.9 | 31.2 | 20.6 | 62.7 | 35.67 | 23.47 | 60.14 |
| Average | 56.42 | 35.24 | 21.02 | 61.99 | 36.72 | 23.08 | 53.07 |