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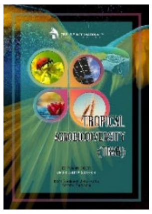

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***RESEARCH ARTICLE***

# GROWTH AND FLOWERING PERFORMANCE OF DIFFERENT COLOR ROSE VARIETIES IN KHAIRAHANI, CHITWAN, NEPAL

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**ABSTRACT**

An experiment was conducted to evaluate the growth and flowering performances of different colors of roses. Five different treatments, representing different rose colors, were tested: T1 (Red), T2 (Orange), T3 (Dark Pink), T4 (Yellow), and T5 (Light Pink). Each treatment was replicated five times using a Randomized Block Design. This setup allows for a systematic evaluation of how different rose colors impact plant development and flower production. The study monitored various growth parameters, including plant height, leaf number, branch number, bud number, and flower number, at different stages: 7, 14, 21, 28, 35, and 42 days after transplantation (DAT). The results indicated that plant height, leaf number, branch number, and bud number did not significantly vary among the different rose color treatments across most observation periods. Notably, the T3 (Dark Pink) treatment showed good results in plant height and leaf number at later stages. Significant difference was observed at 42DAT in bud numbers where T2(orange) was found to be highest. Significant differences were also observed in flower numbers at 14DAT and 21DAT, with T1 (Red) and T2 (Orange) treatments displaying higher flower counts compared to other treatments. These findings suggest that while certain rose colors may influence flower production and bud numbers at specific growth stages, the overall choice of rose color may not significantly affect other growth parameters like plant height, leaf number and branch number. This research provides insights for growers into selecting rose varieties based on flower color and highlights the need for further investigation into the physiological mechanisms driving these differences.

**KEYWORDS**

Rose, Growth, Performance, Colors, Varieties

## 1. INTRODUCTION

Rose (*Rosa indica*, 2n =14) are the most popular and widely cultivated ornamental plants in the world. They belong to the genus *Rosa* within the family Rosaceae, encompassing over 300 species and thousands of cultivars (Wissemann and Ritz, 2007). Roses are woody perennial shrubs or climbers with pinnate leaves, typically containing 5-9 leaflets (Wissemann and Ritz, 2007). Their flowers are generally composed of five petals, though many modern varieties are bred to have more (Foucher et al., 2008). The fruit of the rose, known as a hip, is a berry-like structure that contains numerous seeds (Roberts et al., 2018). Rose is considered as a symbol of beauty, fragrance and is used to convey the message of love (Arora, 2007). They are known for their beauty and fragrance and significantly spans across cultural, aesthetic, and economic domains. Rose is one of the nature's beautiful creations and is universally acclaimed as the Queen of Flower (Yadav et al., 1989). Roses are among the most popular and widely cultivated flowering plants globally, admired for their aesthetic appeal and historical significance (Roberts et al., 2018).

Roses are propagated through various methods, including seeds, cuttings, grafting, and layering. Seed propagation is often used for breeding purposes but is less common for maintaining specific cultivars (Wojtania et al., 2016). Vegetative propagation via cuttings is widely used to ensure genetic consistency with the parent plant (Wojtania et al., 2016). Cutting propagation is one of the most common methods, where a stem cutting from a healthy plant is encouraged to root in a suitable growing medium, allowing for the preservation and dissemination of desirable traits (Adams, 2022). Grafting, especially T-budding, is prevalent in commercial rose production to combine desirable traits, such as flower quality and disease resistance (Hartmann et al., 2014). Layering is another technique used, though it is more labor-intensive and less common in commercial settings (Hartmann et al., 2014).

Roses are cultivated in a staggering over 145 countries, showcasing their widespread popularity (Nagar, 2007). The Netherlands emerges as a major player, acting as a top exporter in the global rose trade (Leghari et al., 2016). Asia, led by China and India, plays a crucial role in rose cultivation. China is the world's largest producer of cut roses. Since, roses are cultivated globally, with major production hubs in countries like the Netherlands, Ecuador, Kenya, and Colombia, making them central to the international floriculture trade (Van der Veken et al., 2020). The global market for roses is substantial, driven by demand for cut flowers, essential oils, and cosmetic products (Roberts et al., 2018). The industry faces challenges such as pest and disease management, but innovations in breeding and sustainable practices continue to support its growth (Van der Veken et al., 2020).

Rose cultivation in Nepal has a rich history, beginning in the palace gardens of the Rana rulers and likely introduced during state visits abroad. Now it becomes commercialization with different cultivars. The modern-day cultivars are hybrids and can be of different classification such as Hybrid Tea, Floribunda, Climbers, Ramblers etc. The most commonly cultivated species for commercial purposes include *Rosa chinensis* (Chinese rose), *Rosa damascene* (Damask rose), and *Rosa gallica* (Gallic rose). In Nepal, *Rosa hybrid* (Hybrid tea rose) and *Rosa multiflora* (Japanese rose) are particularly popular (Shrestha and Koirala, 2018).

In the prosperous period of fiscal year 2019/20, Nepal's floriculture sector generated NPR 2600 million in revenue, with roses contributing NPR 450

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million (FAN, 2021). In the fiscal year 2019/20, Nepal's floriculture sector generated NPR 2600 million in revenue, with roses contributing NPR 450 million (FAN, 2021). Despite challenges in productivity and technological advancements, rose cultivation provides significant self-employment opportunities for small farmers and contributes to foreign currency earnings (Shrestha & Koirala, 2018). Strategic recommendations are necessary to enhance yield potential and sustain growth in this promising sector.

Despite governmental efforts to boost floriculture in Chitwan, Nepal, the industry faces challenges such as low productivity and reliance on traditional farming methods. Roses, valued for their ornamental, cultural, and medicinal significance, hold immense economic potential, as seen in a young farmer earning Rs 10 lakh in three months from rose sales in 2019 (Source: Chitwan Post). However, limited farmer awareness and insufficient research on how rose color influences growth and yield hinder progress. This study aims to evaluate the effects of rose color on plant growth, flower quality, and yield, identifying the most suitable varieties for sustainable cultivation in Chitwan.

This research seeks to fill a significant gap in our understanding of rose cultivation by investigating the effects of different rose color varieties on plant growth, flower quality, and overall yield. The primary objective is to determine which rose colors are most suitable for cultivation in the Chitwan region, considering both their aesthetic appeal and their agronomic performance. Specifically, the study aims to evaluate the influence of various rose color varieties on key growth parameters, including plant height, leaf count, flower production, and canopy development. These parameters are critical indicators of plant health and productivity, providing insights into how different rose varieties adapt to the climatic and soil conditions of Chitwan. By analyzing these growth characteristics and their relationship to flower quality and yield, the research will help identify the most effective rose varieties for sustainable cultivation in the region. The findings will not only support local rose growers in optimizing their production strategies but also contribute to enhancing the commercial viability of rose cultivation in Chitwan, potentially benefiting the floriculture industry as a whole.

## 2. Methodology (Materials and Methods)

The detail explanation of materials and methods used during research are described below in following headings:

### 2.1 Description of experimental site

#### *2.1.1 Geographic location and experimental site*

The research titled "Growth and Flowering Performance of Different Color Rose Varieties in Chitwan, Nepal" was conducted during the Spring season (Chaitra month) of the year 2024 at the Horticultural Research Farm, Institute of Agriculture and Animal Sciences (IAAS), Rampur Campus, located in Khairahani-06, Chitwan, Bagmati Province, Nepal. The experimental site features a tropical and sub-tropical climate conducive to horticultural research.

The research was conducted on an especially unirrigated land where the soil is mostly sandy loam. The geographic coordinates of the site are 27°608N latitude and 84°564E longitude, with an altitude of 202 meters above sea level (masl).

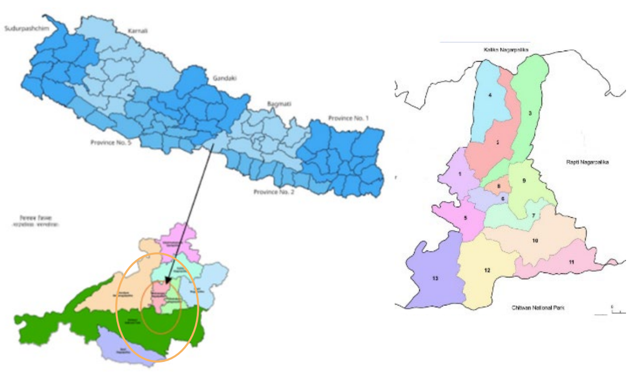

**Figure 1:** Map of experimental site

#### *2.1.2 Climatic Condition During Experimentation*

The experimental site is in a subtropical humid region of Nepal, where there are three main seasons: the monsoon season from June to October, the winter season from November to February, and the spring season from March to May. The figure below shows the weather data collected during the cropping season, which took place from March to June.

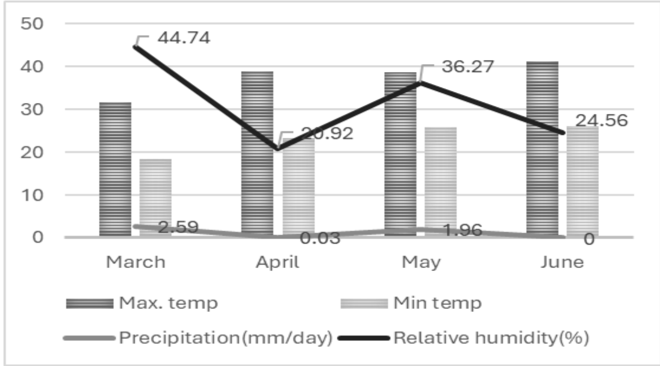


**Figure 2:** Climatic data during research period (*Source: NASA GISS, 2024)*

### 2.2 Experimental Design

The experiment was conducted in randomized complete block design (RCBD) with 5 numbers of treatments and 5 replications. The entire field was divided into five blocks with five treatments in each. All together there were 25 individual plots and also each plot contains two number of plants. Each individual plots measures 2.5 meters in length and 1 meter in breadth with net experimental plot area of 2.5m$^2$. Also, 0.5-meter distance was maintained between each replication block and another 0.5-meter distance was maintained between plot to plot. Thus, the total is for research was 101.5 m$^2$. Treatments were then randomly assigned to plots within each block, effectively minimizing any potential bias in the experiment.

### 2.3 Treatment and Experimental Details

Treatment consists of five different color rose varieties with the same spacing on each plot. The treatments are given in table below:

**Table 1:** Treatment details

| S. N | Experimental Details | Specification |
|---|---|---|
| 1 | Design | RCBD |
| 2 | No. of treatments | 5 |
| 3 | No. of replications | 5 |
| 4 | Total no. of plots | 25 |
| 5 | Season | Spring |
| 6 | Spacing | 0.6× 0.5 m |
| 7 | Distance between plots | 0.5 m |
| 8 | Distance between replications | 0.5 m |

**Table 2:** Experimental details

| S. N | Treatment | Notation |
|---|---|---|
| 1 | Red | **T1** |
| 2 | Orange | **T2** |
| 3 | Dark pink | **T3** |
| 4 | Yellow | **T4** |
| 5 | Light pink | **T5** |

### 2.4 Cultural operations

#### *2.4.1 Field Preparation*

Field preparation was carried out on March 20, 2024, using a hand spade, followed by planking to level the field. A light irrigation was applied, and the soil was made into a fine tilth. Ridge and furrow beds, with five beds in each block, were created.

#### *2.4.2 Manure and Fertilizer Application*

FYM was applied during field preparation at a rate of 250 kg per 101.5 Sq. m. area, with 50 kg per replication and 10 kg per plot. The chemical fertilizer urea was applied at a rate of 1.3 kg per 101.5 square meters for 50 plants. Each plant received 26 grams, with 13 grams applied as a basal dose, 6.5 grams at 7 days after transplanting, and the remaining 6.5 grams at 14 days after transplanting. Fertilizer was provided to each plant using the ring method. Additionally, vermicompost was applied to each plot at 35 days after transplanting.

#### *2.4.3 Transplantation*

A well-developed rose plant with flowers was transplanted at 30cm of depth by digging pits with a diameter of 30 cm at a plant spacing of 60 cm. Immediately after transplanting, watering was done to settle the soil around roots.

#### *2.4.4 Irrigation or Water Management*

Irrigation was done as per the requirement through the ring-basin method. As the land was unirrigated land with sandy loam soil, regular watering was then carried out in the evening hour to provide constant moisture to the plant and prevent from the heat stress.

#### *2.4.5 Weed Management*

For weed management, it was done by manually through hand weeding on every week. At the onset of second week following the transplantation, a meticulous manual hand weeding was meticulously executed. In a similar vein, the art of hand weeding was diligently practiced during the third and fourth week, and continued to be carried out on a consistent basis thereafter.

#### *2.4.6 Training and Pruning*

Pinching of apical buds using secateur was done at 3$^{rd}$ week of planting to promote horizontal growth of plant.

#### *2.4.7 Insect/ Pest Management*

During the second week after planting, we observed Rose Bud Borer (*Helicoverpa armigera*) larvae damaging buds, petals and leaves of the rose plant. To control the infestation, non-systemic insecticide containing Lambda-Cyhalothrin were applied. Subsequently, due to increased infestation, Fighter – 505 (Chlorpyriphos 50% + Cypermethrin 5%) @ 30ml per 16 liters of water were applied after 12 days of first insecticide application.

### 2.5 Parameters Under Study

All the observation (Biometrical Observations) were taken from all planted rose plants. The data were recorded at various growth stages over a period of six weeks following transplantation. All the observation were done at 7, 14, 21, 28, 35 and 48 days after transplantation (DAT).

#### *2.5.1 Plant height*

Plant height was taken from measured from ground surface to the top of the flower or buds at 7 DAT, 14 DAT, 21 DAT, 28 DAT, 35 DAT and 42 DAT through using ordinary measuring scale. Data were collected from all plants.

#### *2.5.2 Leaf number*

The number of leaves per plants were recorded by counting from all plants. Compound leaf was counted as one leaf.

#### *2.5.3 Branch number*

The number of branches per plants were recorded by counting from all plants. Both primary and secondary branches were counted and recorded.

#### *2.5.4 Bud number*

The number of buds per plants were recorded by counting from each plant of each plot.

#### *2.5.5 Flower number*

The number of flowers per plants were recorded by counting from all plants which was started recording from the day of transplantation of well-developed rose plant (plant with flower).

#### *2.5.6 Damage leave number*

The number of damage leaves per plants were recorded by counting from all plants. Damaged leaves were recorded at 14 DAT, 28 DAT and 42 DAT.

### 2.6 Statistical Analysis

The collected data was initially organized into tables using Microsoft Excel (MS-EXCEL) and subsequently subjected to statistical analysis using the GenStat program (GENSTAT 15$^{th}$ EDITION) from which ANOVA test and DMRT analysis of variance and other data analysis were done. Means were differentiated using Duncan's Multiple Range Test (DMRT) at a significance level of 5%, ensuring robust evaluation of the experimental results and identification of significant differences among treatments.

## 3. Result and Discussion

The findings from the study were analyzed and presented in this chapter, utilizing tables and figures as needed to illustrate and interpret the results effectively. The results have been carefully assessed, and explanations are provided, supported by available evidence, to help understand the variations in the observed parameters.

### 3.1 Plant Height

The lowest plant height was observed in the T5 treatment (Light Pink) at 7 DAT, measuring 28.48 cm. The highest plant heights were observed in the T3 treatment (Dark Pink) at 35 DAT and 42 DAT, measuring 37.04 cm and 37.20 cm, respectively. This result is in line with the findings by Roberts et.al (2018), who suggested that environmental conditions and genetic characteristics contribute significantly to the height of rose plants, regardless of flower color. Based on the F-Test results and LSD values, the differences observed in plant height among the different rose color treatments at each growth stage (7DAT, 14DAT, 21DAT, 28DAT, 35DAT, 42DAT) are statistically non-significant. Therefore, we accept the null hypothesis that there is no significant difference in plant height attributable to different rose color treatments.

**Table 3:** Effect of different color rose varieties on plant height at different growth stages of rose.

| Treatment(colors) | Plant Height(cm) | | | | | |
|---|---|---|---|---|---|---|
| | **7DAT** | **14DAT** | **21DAT** | **28DAT** | **35DAT** | **42DAT** |
| $T_1$=Red | 31.10$^a$ | 30.88$^a$ | 30.93$^a$ | 29.04$^a$ | 30.60$^a$ | 31.80$^a$ |
| $T_2$=Orange | 28.89$^a$ | 30.63$^a$ | 30.80$^a$ | 31.36$^{ab}$ | 32.65$^a$ | 34.27$^a$ |
| $T_3$=Dark pink | 34.44$^a$ | 35.93$^a$ | 34.47$^a$ | 36.51$^b$ | 37.04$^a$ | 37.20$^a$ |
| $T_4$=Yellow | 31.94$^a$ | 32.56$^a$ | 33.34$^a$ | 34.20$^{ab}$ | 35.30$^a$ | 34.45$^a$ |
| $T_5$=Light pink | 28.48$^a$ | 30.98$^a$ | 31.20$^a$ | 31.25$^{ab}$ | 30.13$^a$ | 31.79$^a$ |
| Grand Mean | 31.0 | 32.2 | 32.15 | 32.47 | 33.14 | 33.90 |
| LSD | 6.84 | 7.16 | 5.750 | 5.589 | 6.438 | 6.620 |
| SEM | 3.23 | 3.38 | 2.712 | 2.636 | 3.037 | 3.123 |
| CV% | 16.5% | 16.6% | 13.3% | 12.8% | 14.5% | 14.6% |
| F-Test (at 5%) | Ns | Ns | Ns | Ns | Ns | Ns |

Ns= non-significant, *= significant at P<0.05, LSD=Least significant Difference, SEM=Standard Error of the Mean,

CV= Coefficient of Variation Percentage

### 3.2 Leaf number

During the observation, the maximum number of leaves was observed in the T3 treatment (Dark pink) at 35DAT, with 32.70 leaves, followed by T3 at 42DAT, with 32.40 leaves. The minimum number of leaves was observed in the T5 treatment (Light pink) at 7DAT, with 17.02 leaves. The differences observed in the number of leaves among the different rose color treatments at various DAT (Days After Transplantation) are not statistically significant. Therefore, Null hypothesis is accepted and there is no significant difference in the number of leaves among the different color treatments of roses at any of the observed time points. This outcome aligns with existing research, where leaf number has shown limited correlation with flower color but is instead influenced by cultivar genetics and environmental factors (Pun and Ichimura, 2003).

| **Table 4:** Effect of different color rose varieties on leaf number on different growth stages. | | | | | | |
|---|---|---|---|---|---|---|
| **Treatment(colors)** | **No. of leaves per plant** | | | | | |
| | **7DAT** | **14DAT** | **21DAT** | **28DAT** | **35DAT** | **42DAT** |
| $T_1$=Red | 25.40[bc] | 25.10[ab] | 19.30[a] | 22.60[a] | 26.20[a] | 31.10[a] |
| $T_2$=Orange | 18.70[ab] | 22.30[ab] | 23.50[abc] | 26.10[a] | 29.00[a] | 31.40[a] |
| $T_3$=Dark pink | 25.70[bc] | 28.20[b] | 27.80[bc] | 29.10[a] | 32.70[a] | 32.40[a] |
| $T_4$=Yellow | 27.30[c] | 29.10[b] | 30.50[c] | 28.40[a] | 30.90[a] | 31.30[a] |
| $T_5$=Light pink | 17.02[a] | 21.25[a] | 21.25[ab] | 22.87[a] | 24.97[a] | 27.42[a] |
| Grand Mean | 22.8 | 25.19 | 24.5 | 25.9 | 28.8 | 30.7 |
| LSD | 6.72 | 6.398 | 7.73 | 7.71 | 7.54 | 7.58 |
| SEM | 2.24 | 2.134 | 2.58 | 2.57 | 2.51 | 2.53 |
| CV% | 22.0% | 18.9% | 23.6% | 22.2% | 19.6% | 18.4% |
| F-Test (at 5%) | Ns | Ns | Ns | Ns | Ns | Ns |

Ns= non-significant, *= significant at P<0.05, LSD=Least significant Difference, SEM=Standard Error of the Mean,

CV= Coefficient of Variation Percentage

### 3.3 Number of branches

The lowest number of branches was observed in the T5 treatment (Light Pink) at 7 DAT, measuring 3.266 branches. The highest number of branches was observed in the T2 treatment (Orange) at 42 DAT, with 6.60 branches. Despite, slight increases in branch count for orange roses, findings support the hypothesis that branch development is predominantly unaffected by flower color. Previous studies, such as those by Nagar et. Al (2007), attribute branch number variation more to genetics factors than to visual traits like flower color. Based on the F-Test results and LSD values, the differences observed in the number of branches among the different rose color treatments at each growth stage (7DAT, 14DAT, 21DAT, 28DAT, 35DAT, 42DAT) are statistically non-significant. Therefore, we accept the null hypothesis that there is no significant difference in branching patterns attributable to different rose color treatments.

| **Table 5:** Effect of different color rose varieties on branching pattern at different growth stages. | | | | | | |
|---|---|---|---|---|---|---|
| **Treatment(colors)** | **No. of branches** | | | | | |
| | **7DAT** | **14DAT** | **21DAT** | **28DAT** | **35DAT** | **42DAT** |
| $T_1$=Red | 4.200[a] | 4.300[ab] | 4.950[a] | 5.050[a] | 5.600[a] | 6.150[a] |
| $T_2$=Orange | 3.850[ab] | 4.250[ab] | 4.800[a] | 5.350[a] | 5.850[a] | 6.600[a] |
| $T_3$=Dark pink | 4.400[a] | 4.600[a] | 4.700[a] | 5.200[a] | 5.550[a] | 6.200[a] |
| $T_4$=Yellow | 3.850[a] | 4.050[ab] | 4.550[a] | 5.050a | 5.400[a] | 6.200[a] |
| $T_5$=Light pink | 3.266[a] | 3.550[b] | 4.250[a] | 4.850[a] | 5.400[a] | 6.300[a] |
| Grand Mean | 3.91 | 4.15 | 4.15 | 5.10 | 5.56 | 5.10 |
| LSD | 0.734 | 0.797 | 0.784 | 0.764 | 0.803 | 0.764 |
| SEM | 0.245 | 0.266 | 0.266 | 0.361 | 0.268 | 0.255 |
| CV% | 14.0% | 14.3% | 12.6% | 11.2% | 10.8% | 12.2% |
| F-Test (at 5%) | Ns | * | Ns | Ns | Ns | Ns |

Ns= non-significant, *= significant at P<0.05, LSD=Least significant Difference, SEM=Standard Error of the Mean,

CV= Coefficient of Variation Percentage

### 3.4 Number of buds

During the observation period, the highest number of buds was recorded in the T2 treatment (Orange) at both 35 DAT and 42 DAT, with 2.2 buds each. This was followed by the T1 treatment (Red) at 42 DAT, with 1.6 buds. The lowest number of buds was observed in the T5 treatment (Light Pink) at 7 DAT, with 0.31 buds. This finding aligns with research highlighting the influence of specific flower colors on bud formation, potentially due to distinct genetic and physiological traits associated with pigmentation and photosynthetic efficiency (Nagar et al., 2007; Debener and Linde, 2009). Orange varieties, in particular, may possess unique photosynthetic traits that support higher carbohydrate accumulation, which in turn fuels bud development (Nagar et al., 2007). Studies have also shown that the accumulation of specific sugars and auxins in rose plants can significantly impact bud formation, which is critical for achieving maximum flowering potential (Pun and Ichimura, 2003). Based on the F-Test results and LSD values, most differences in bud counts among treatments were statistically non-significant, implying that rose color treatments did not significantly affect bud numbers except at the 42DAT stage where a significant difference was noted.

| **Table 6:** Effect of different color rose varieties on bud number at different growth stages. | | | | | | |
|---|---|---|---|---|---|---|
| **Treatment(colors)** | **No. of buds** | | | | | |
| | **7DAT** | **14DAT** | **21DAT** | **28DAT** | **35DAT** | **42DAT** |
| $T_1$=Red | 0.700[a] | 1.200[a] | 1.200[a] | 0.900[a] | 1.400[ab] | 1.600[ab] |
| $T_2$=Orange | 0.550[a] | 0.920[a] | 1.400[a] | 1.000[a] | 2.200[b] | 2.200[b] |
| $T_3$=Dark pink | 0.420[a] | 1.050[a] | 1.200[a] | 0.200[a] | 0.800[a] | 0.800[a] |
| $T_4$=Yellow | 0.550[a] | 1.050[a] | 1.500[a] | 1.000[a] | 1.300[ab] | 1.100[a] |
| $T_5$=Light pink | 0.310[a] | 0.810[a] | 0.900[a] | 0.650[a] | 1.300[ab] | 0.850[a] |
| Grand Mean | 0.506 | 1.006 | 1.240 | 0.75 | 1.40 | 1.45 |
| LSD | 0.4305 | 0.4305 | 0.5844 | 0.195 | 1.209 | 1.455 |
| SEM | 0.1436 | 0.1436 | 0.1949 | 0.432 | 0.570 | 0.686 |
| CV% | 63.5% | 31.9% | 35.2% | 91.0% | 64.4% | 74.9% |
| F-Test (at 5%) | Ns | Ns | Ns | Ns | Ns | * |

Ns= non-significant, *= significant at P<0.05, LSD=Least significant Difference, SEM=Standard Error of the Mean,

CV= Coefficient of Variation Percentage

### 3.5 Number of flowers

The highest number of flowers was recorded in the T1 treatment (Red) at 42 DAT, with 2.200 flowers. The lowest number of flowers was observed in the T3 treatment (Dark Pink) at 21 DAT, with 0.100 flowers. Significant differences ($F_p < 0.05$) are observed at 14DAT and 21DAT, while the other time points (7DAT, 28DAT, 35DAT, 42DAT) show non-significant results. Significant differences at 14 and 21 DAT, with Red (T1) and Orange (T2) roses yielding higher flower counts than other colors. This finding is consistent with the studies by researchers which emphasize the appeal of red and orange varieties in floriculture due to their visual vibrancy and greater floral output (Shrestha et al., 1999; Sharin et al., 2015). Based on the F probability results and LSD values, there are statistically significant differences in the number of flowers among the different rose color treatments at 14DAT and 21DAT. However, at 7DAT, 28DAT, 35DAT, and 42DAT, the differences are not statistically significant. Therefore, we reject the null hypothesis for 14DAT and 21DAT, indicating that the number of flowers varies significantly due to different rose color treatments during these periods. Overall, there is no impact.

**Table 7:** Effect of different color rose varieties on flowers number at different growth stages.

| **Treatment(colors)** | **No. of flowers** | | | | | |
|---|---|---|---|---|---|---|
| | **7DAT** | **14DAT** | **21DAT** | **28DAT** | **35DAT** | **42DAT** |
| $T_1$=Red | $0.8000^{a}$ | $0.7000^{ab}$ | $0.8000^{ab}$ | $0.3000^{a}$ | $0.9000^{ab}$ | $2.200^{b}$ |
| $T_2$=Orange | $1.1000^{a}$ | $1.3000^{b}$ | $1.6000^{bd}$ | $0.9000^{ab}$ | $0.8000^{ab}$ | $1.100^{ab}$ |
| $T_3$=Dark pink | $0.6000^{a}$ | $0.4000^{a}$ | $0.1000^{a}$ | $0.2000^{a}$ | $0.4000^{a}$ | $0.700^{a}$ |
| $T_4$=Yellow | $1.1000^{a}$ | $1.1000^{b}$ | $0.8000^{abc}$ | $1.6000^{b}$ | $1.7000^{b}$ | $1.100^{ab}$ |
| $T_5$=Light pink | $0.9160^{a}$ | $1.0340^{ab}$ | $0.8660^{abcd}$ | $0.3334^{a}$ | $0.6000^{a}$ | $1.166^{ab}$ |
| Grand Mean | 0.9 | 0.907 | 0,83 | 0.67 | 0.88 | 1.25 |
| LSD | 0.718 | 0.6106 | 0.747 | 1.08 | 0.952 | 1.285 |
| SEM | 0.239 | 0.2037 | 0.249 | 0.36 | 0.317 | 0.429 |
| CV% | 49.70% | 63.00% | 50.05% | 47.60% | 51.70% | 35.80% |
| F -Test (at 5%) | Ns | * | * | Ns | Ns | Ns |

Ns= non-significant, *= significant at P<0.05, LSD=Least significant Difference, SEM=Standard Error of the Mean,

CV= Coefficient of Variation Percentage

### 3.6 Damaged leaves

The graph shows the average number of damaged leaves by insect/ pest for different color treatments over time. The red color treatment consistently had the fewest damaged leaves, starting at 5 at 14 DAT, 8.3 at 28 DAT, and 7 at 42 DAT, making it the best option for reducing leaf damage by insect pest. On the other hand, the yellow color treatment was the least effective and susceptible to the insects/ pests, with the highest number of damaged leaves at all stages, reaching up to 15 at 28 DAT. The susceptibility of yellow roses (T4) to leaf damage might be due to inherent chemical or structural properties that influence pest interaction, supporting findings by Ichimura et. Al (2006). Overall, the red color treatment performed the best in protecting the leaves, while the yellow color treatment performed the worst.

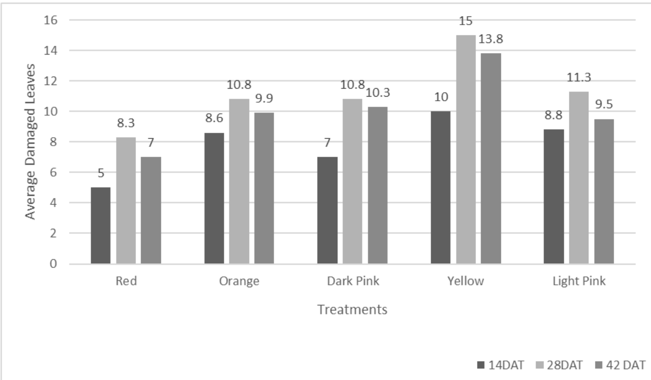


**Figure 3:** Average damaged leaves by insects/ pests in response to different color rose varieties at different growth stages.

## 4. Conclusion

The study concludes that plant height, leaf number, and branch number do not significantly vary among different rose color treatments, with Dark Pink (T3) showing a slight, non-significant advantage in these parameters. These findings suggest that rose color does not strongly influence these growth parameters, and as such, color choice may be made based on aesthetic preference rather than growth potential for these characteristics.

However, significant differences in bud and flower numbers were observed at specific growth stages. At 42 days after transplanting (DAT), the Orange treatment (T2) recorded the highest bud count, while Red (T1) and Orange (T2) treatments yielded the highest flower counts at 14 and 21 DAT. This indicates that certain rose colors may influence early-stage flower and bud production, which could be beneficial for growers aiming for higher flower yields in the initial growth period.

While the choice of rose color may not impact general growth traits, selecting Red or Orange varieties could be advantageous for flower production goals in Chitwan's climate. These findings could help inform growers' selection of rose varieties to maximize ornamental and economic value. Future research could explore the physiological mechanisms underlying these variations in bud and flower production across different rose colors to offer a more in-depth understanding of their implications for floriculture.

Also, future research should focus on the physiological mechanisms driving the differences in bud and flower production across rose varieties. Long-term trials are necessary to assess plant health, disease resistance, and year-round performance. Additionally, studies should explore the interaction of rose color with environmental factors, conduct economic analyses of production and profitability, and investigate genetic traits linked to flower color. Research on post-harvest qualities, such as vase life and transportability, will also be essential for improving the supply chain. These recommendations will contribute to sustainable floriculture practices and maximize the potential of rose cultivation in Nepal.

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