The present investigation was carried out at Horticulture farm, College of Horticulture, S. D. Agricultural University, Jagudan, Mehsana, Gujarat. The experiment was conducted for performance of different varieties of carrot (Daucus carota L.) during rabi season 2017-18, comprising four varieties of carrot, Patan Local (v1), Pusa Vasuda (v2), Pusa Rudhira (v3) and Gujarath Dantiwada Carrot 1 (GDC 1) (v4) which were analyzed statistically for growth, yield and quality parameters and summarized below. Data revealed that the variety Pusa Vasuda (v2) recorded maximum plant height (16.62, 39.19 and 65.10 cm) and number of leaves (3.54, 8.91 and 10.47) at 30, 60 DAS and at harvesting time respectively, minimum days taken for harvest (82.67 days), weight of root (70.24 g), root yield per plot (6.23 kg), root yield per ha (19.78 t), productivity per day (241.48 kg), root length (23.04 cm), collar diameter (37.96 mm), volume of root (71.12 cc), total soluble solid (8.21°B), reducing, non-reducing and total sugar (4.64, 3.49 and 8.13 %, respectively), carotene content (3.92 mg/100g) and chlorophyll a, b and total chlorophyll content (0.39, 0.93 and 1.32 mg/g, respectively).

Key word: Carrot varieties, growth, quality and yield

Materials and Methods

The present investigation, performance of different varieties on growth, yield and quality of carrot (Daucus carota L.) was carried out at Horticulture farm, College of Horticulture, S. D. Agricultural University, Jagudan, Mehsana, Gujarat during rabi season 2017-18, comprising four varieties Patan Local (v1), Pusa Vasuda (v2), Pusa Rudhira (v3) and Gujarath Dantiwada Carrot 1 (GDC 1) (v4). The experiment was laid out in randomized block design with three replications. The performance of different varieties was recorded on plant height (at 30, 60 DAS and at harvesting time), number of leaves (at 30, 60 DAS and at harvesting time), number of days taken for harvest, weight of root, root yield per plot, root yield per hectare, productivity per day, root length, collar diameter, volume of root, total soluble solid, reducing, non-reducing and total sugar, carotene content and chlorophyll a, b and total chlorophyll content. The mean data were subjected to statistical analysis following analysis of variance technique (Panse and Sukhatme, 1985).

Results and Discussion

Growth parameters

Plant height (cm) at 30, 60 DAS and at harvesting time

The performance of different varieties differed significantly with respect to plant height at 30, 60 DAS and at harvesting time (Table 1). Significantly maximum plant height at 30, 60 DAS and at harvesting time (16.62, 39.19 and 65.10 cm respectively) was recorded with treatment v2 (Pusa Vasuda) and found at par with v4 (Pusa Vasuda) which was at par with v3 (Pusa Rudhira). The significant differences thereafter could be attributed to the requirement of developing plants for more quantum of carbohydrates, which might have forced the plants of these varieties to produce more number of leaves, Dangarawar et al. (2018). The variation in number of leaves among different radish varieties was also reported by Chapagain et al. (2010) and Kumar et al. (2012) and which supports the results of present findings.

Yield parameter

Days taken for harvest

Significantly minimum days taken for harvest (82.67 days) was recorded with variety v2 (Pusa Vasuda) and it was found at par with v4 (87.67 days) and v1 (86.67 days), while maximum days taken for harvest (92.22 days) was observed in variety v3 (Pusa Rudhira). The significant difference in days taken for harvest by different varieties might be due to differences in their genetic characteristics, Patel et al. (2015). The result corroborate with finding of Evakordor and Mehera, (2016) in radish.

Weight of root

The data in Table 2 also showed that varieties differed significantly in respect their weight of root. The maximum weight (70.24 g) of root was obtained by v2 (Pusa Vasuda) which was at par with v1 and
Root yield per plot
It is clear from data of Table 2 different varieties had resulted significant variation with respect to root yield per plot. Among the varieties, maximum root yield per plot (6.23 kg) was recorded with treatment $v_2$ (Pusa Vasuda) which was at par with treatment $v_1$ and $v_4$ (6.14 and 5.69 kg) and minimum root yield per plot (5.24 kg) was observed in treatment $v_1$ (Pusa Rudhira). The root yield is a result of translocation of more quantum of carbohydrates from the source to the sink. As the varieties which have shown superior performance in yield have significantly more number of vigorous leaves on it and more plant height, which could have synthesized more food material and supplied to the roots, that might have resulted in increasing the weight and diameter of roots and ultimately resulted in getting higher root yield in these varieties, these results are inconformity with finding of Dongarawar et al. (2018) in radish.

Productivity per day
Productivity per day was found significantly varied among the varieties. Significantly maximum productivity per day (241.48 kg) was recorded with treatment $v_2$ (Pusa Vasuda) which was statistically at par with $v_3$ (Pusa Rudhira) (226.70 kg). While, minimum productivity per day (181.19 kg) was observed with treatment $v_3$ (Pusa Rudhira).

Quality parameter
Root length
Data in Table 3 showed that root length was significantly influenced by different varieties. Significantly maximum root length (23.04 cm) was observed in treatment $v_2$ (Pusa Vasuda) and minimum root length (19.13 cm) was found in $v_1$ (Pusa Rudhira). The root length of a cultivar is the factor which is of main concern to the research. Medium long root is an important character regarding root quality and it is useful to classify the varieties for consumer acceptability which might be due to genetical diversity in different varieties and ecological condition, Dongarawar et al. (2018). The difference between the two best root cultivars under study could be due to the difference in the genetic makeup and their response to the environmental conditions, Patel et al. (2015). Results of the present investigation are similar to that of Patel et al. (2015) in sugar beet and Dongarawar et al. (2018) in radish.

Collar diameter
The root was significantly influenced among the different varieties. Significantly maximum (37.96 mm) and minimum collar diameter of root (32.66 mm) was observed in variety $v_2$ (Pusa Vasuda) and $v_3$ (Pusa Rudhira), respectively. This denotes that these differences due to varietal response might be due to genetic composition in the expression of growth potentials, Latha et al. (2012) in carrot. The similar variations in collar diameter of root among different radish varieties have reported Dongarawar et al. (2018).

Volume of root
Significantly maximum volume of root (71.12 cc) was recorded treatment $v_2$ (Pusa Vasuda) which was at par with treatment $v_1$ (Patan Local) (68.36 cc) and minimum volume of root (63.81 cc) was recorded $v_3$ (Pusa Rudhira). The variation was found due to genetical different among the varieties. This similar result of genetical variation was observed by Karistsoval et al. (2013) in broccoli.

Total soluble solid
The data presented in Table 3 showed that different varieties exerted significant variation in TSS content. The variety $v_2$ (Pusa Vasuda) had highest TSS (8.21°B) but lowest TSS (7.27 °B) was found in $v_4$ (GDC 1). The variation in TSS might be due to genetic make-up of varieties, such kind of genetic differences for quality characters in different radish genotypes had also reported by Panwar et al. (2013) and Priyanka et al. (2018) in radish.

Reducing, non-reducing and total sugar content
Significantly maximum reducing sugar, non-reducing sugar and total sugar content (4.64, 3.49 and 8.13 %), respectively recorded in treatment $v_2$ (Pusa Vasuda) which was statistically at par with $v_3$ (Pusa Rudhira) in non-reducing sugar (3.38 %), whereas, minimum reducing, non-reducing and total sugar content (3.90, 3.06 and 6.96 %), respectively was recorded in treatment $v_1$ (Patan Local). However, different varieties exhibited differences in quality parameters which might be due to its genetic makeup; same results are close accordance with the findings of Refay (2010) in sugar beet.

Carotenoids content
Significantly highest (3.92 mg/100g) and lowest carotenoid content (3.30 mg/100g) was recorded in treatment $v_3$ (Pusa Vasuda) and $v_4$ (Pusa Rudhira), respectively. The difference of carotenoid content in different varieties occurred due to their genetic makeup. Carotenoid accumulation in carrot roots was related to carrot genotypes as per results finding of Matejkova and Petrikova (2010) in carrot.

Conclusions
It is concluded form the present investigation that, carrot variety “Pusa Vasuda” should be sown to obtain highest growth, yield and quality under North Gujarat condition.

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Table 1 Performance of varieties on growth parameters

| Treatment     | Plant height (cm) | Number of leaves | Days taken for harvest |
|---------------|-------------------|------------------|------------------------|
|               | At 30 DAS | At 60 DAS | At harvesting time | At 30 DAS | At 60 DAS | At harvesting time |               |
| v₁ : Patan Local | 15.28     | 38.24    | 58.26            | 3.43      | 8.33      | 9.91            | 86.67        |
| v₂ : Pusa Vasuda | 16.62     | 39.19    | 65.10            | 3.54      | 8.91      | 10.47           | 82.67        |
| v₃ : PusaRudhira | 13.83     | 34.81    | 57.90            | 3.18      | 7.82      | 9.40            | 92.22        |
| v₄ : GDC 1 | 14.56     | 36.85    | 56.21            | 3.34      | 8.07      | 10.00           | 87.67        |
| S. Em. ±       | 0.53      | 1.06     | 2.19             | 0.09      | 0.23      | 0.24            | 1.74         |
| C. D. at 5%    | 1.58      | 3.16     | 6.52             | 0.25      | 0.68      | 0.72            | 5.18         |

Table 2 Performance of varieties on yield parameters

| Treatment     | Weight of root (g) | Root yield per plot (kg) | Root yield per hectare (t) | Productivity per day (kg) |
|---------------|-------------------|--------------------------|---------------------------|--------------------------|
| v₁ : Patan Local | 68.43     | 6.14                     | 19.50                     | 226.70                   |
| v₂ : Pusa Vasuda | 70.24     | 6.23                     | 19.78                     | 241.48                   |
| v₃ : PusaRudhira | 62.05     | 5.24                     | 16.62                     | 181.19                   |
| v₄ : GDC 1    | 68.34     | 5.69                     | 18.07                     | 207.04                   |
| S. Em. ±      | 1.41      | 0.25                     | 0.78                      | 10.23                    |
| C. D. at 5%   | 4.20      | 0.73                     | 2.33                      | 30.41                    |

Table 3 Performance of varieties on quality parameters

| Treatment     | Root length (cm) | Collar diameter (mm) | Volume of root (cc) | TSS (°B) | Sugar (%) | Carotenoid Content (mg/100g) | Chlorophyll (mg/g) |
|---------------|------------------|----------------------|---------------------|----------|-----------|-----------------------------|-------------------|
|               |                  |                      |                     |          |           | Reducing Non-reducing Total sugar a b Total chlorophyll |
| v₁ : Patan Local | 19.56    | 35.02                | 68.36               | 7.29     | 3.90      | 3.06 6.96                 | 3.38 0.31 0.87 1.18 |
| v₂ : Pusa Vasuda | 23.04    | 37.96                | 71.12               | 8.21     | 4.64      | 3.49 8.13                 | 3.92 0.39 0.93 1.32 |
| v₃ : PusaRudhira | 19.13    | 32.66                | 63.81               | 7.70     | 4.21      | 3.38 7.59                 | 3.30 0.35 0.91 1.26 |
| v₄ : GDC 1     | 19.50    | 34.20                | 65.71               | 7.27     | 4.01      | 3.14 7.15                 | 3.49 0.36 0.92 1.28 |
| S. Em. ±      | 0.73      | 0.72                 | 1.72                | 0.10     | 0.04      | 0.04 0.07                 | 0.05 0.01 0.01 0.01 |
| C. D. at 5%   | 2.15      | 2.13                 | 5.10                | 0.28     | 0.13      | 0.13 0.21                 | 0.14 0.02 0.04 0.04 |