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Research Article

# Comparative Assessment of Physico-Chemical Characteristics among Different Peach Cultivars under Mid Hill Conditions of Uttarakhand

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**Abstract**

An experiment was conducted in Nainital district of Uttarakhand for evaluation of physico-chemical characteristics in different peach cultivars. The physical characteristics of fruits were found superior in Red June and Paradelux. The highest T.S.S. was recorded in Flordasun (12.17 °B), while lowest in Red Nectarine (8.77 °B). The maximum acidity was recorded in Asariya (1.21%), while minimum in Sharbati (0.49%). The highest ascorbic acid content was recorded in Red June (12.92 mg/100 g), while lowest in Paradelux (5.42 mg/100 g). Total sugars (4.16%) and reducing sugars (3.03%) were recorded highest in Flordasun, while lowest total sugars (2.65%) and reducing sugars (1.85%) were recorded in Paradelux. The maximum carotene content was recorded in Golden Monarch (584.98 µg/100 g), while minimum in Flordaking (101.82 µg/100 g). The highest total anti-oxidant activity was recorded in Red June (34.63 mMTE/L), while lowest in Paradelux (20.87 mMTE/L). The most of the chemical characteristics of fruits were found superior in Red June and Flordasun as compared to other peach cultivars.

**Keywords:** Peach, cultivars, physico-chemical and quality

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## Introduction

Peach (*Prunus persica* Batsch) is an important and widely cultivated stone fruit crops of temperate regions of the world. In India, it is cultivated mostly in Himalayan region starting from the Jammu and Kashmir extending up to North-Eastern hills at an altitude of 1000 to 2000 m above mean sea level [1]. The annual production of peach is 93.52 thousand metric tonnes from an area of 18.20 thousand hectares with productivity of 5.17 metric tonnes per hectare. Uttarakhand ranked first in area (8.00 thousand hectares) and production (45.30 thousand metric tonnes); however, maximum productivity (17.64 metric tonnes per hectare) was recorded in Punjab [2]. Nainital, Pithoragarh, Almora and Chamoli districts are the major peach producing belts in Uttarakhand. Most of the peach cultivars are regional in their adaptation, performing well in one region and poorly in other and some of their qualitative characters are bound to change with respect to prevailing environmental conditions [3]. Characterization and evaluation studies of peach in high-hills and plains were attempted by few workers [4-6] but in mid hills like Nainital, similar reports are lacking. Hence, the present study was attempted for evaluation of peach cultivars being grown in this region for their utilization either directly or for improvement work through breeding.

## Materials and Methods

The present investigation was carried out at I.C.A.R.-C.I.T.H., Regional Station, Mukteshwar, Nainital (Uttarakhand) during 2016 on 11 peach cultivars. Ten years old healthy fruit bearing trees of these cultivars planted at a spacing of 5 × 5 m and trained on open centre system were selected for the study. Uniform cultural operations were followed during the course of investigation and the fruits were picked after attaining full maturity. The experiment was laid out in randomized block design with three replications comprising four trees per replication.

The fruit's physical properties in terms of weight (g), volume (cc), specific gravity (g/cc), size (cm) and fruit firmness (lb/in$^2$) were recorded by calculating the mean of ten fruits at final harvesting stage. The fruit firmness was measured with the help of a penetrometer (Model FT-327, Italy) using 8 mm stainless steel probe. The chemical characteristics of the fruits *viz.* T.S.S., acidity, ascorbic acid, total sugars, reducing sugars, non-reducing sugars and carotene content were recorded by using the methods described by [7] and total anti-oxidant activity was recorded by using the method described by [8]. The data were computed for statistical analysis following the procedure described by [9].

## Results and Discussion

A close perusal of data presented in **Table 1** exhibited significant variation in most of the fruit physical characteristics of different peach cultivars. The highest fruit weight (188.92 g), fruit volume (189 cc), fruit diameter (7.60 cm), pulp weight (179.56 g) and pulp: stone ratio (20.78) was recorded in Red June, while the highest fruit length (7.31 cm) and seed weight (12.47 g) were recorded in Paradelux. The lowest fruit weight (64.96 g), fruit volume (65.00 cc), fruit length (4.75 cm), pulp weight (60.67 g) and seed weight (4.29 g) was recorded in Flordaking. However, the lowest fruit diameter (4.43 cm) and pulp: stone ratio (8.21) was recorded in Asariya. The variation in fruit size (length and diameter), weight, volume and pulp: stone ratio with respect to different peach cultivars are mainly attributed to the inter-varietal differences associated with genetic make-up of the cultivars and governed mainly by the cell size and intercellular spaces of the fruit tissues. The results obtained in the present investigation are found to be close conformity with the [3, 10-12].

**Table 1** Variability in physical characteristics of fruits in different peach cultivars

| Cultivars | Fruit weight (g) | Fruit volume (cc) | Specific gravity (g/cc) | Fruit length (cm) | Fruit diameter (cm) | Fruit firmness (lb/inch$^2$) | Pulp weight (g) | Seed weight (g) | Pulp: stone ratio |
|---|---|---|---|---|---|---|---|---|---|
| Red June | 188.92 | 189.00 | 1.00 | 6.25 | 7.60 | 4.27 | 179.56 | 9.36 | 20.78 |
| Flordaking | 64.96 | 65.00 | 1.00 | 4.75 | 4.93 | 4.03 | 60.67 | 4.29 | 15.68 |
| Flordasun | 72.91 | 80.00 | 0.91 | 4.81 | 5.35 | 12.90 | 66.84 | 6.07 | 11.43 |
| Fla-16-33 | 82.42 | 88.33 | 0.94 | 5.10 | 5.53 | 11.87 | 76.70 | 5.72 | 13.98 |
| Sharbati | 82.83 | 95.67 | 0.87 | 5.14 | 5.47 | 10.60 | 78.11 | 4.72 | 16.53 |
| Golden Monarch | 85.14 | 89.67 | 0.95 | 5.76 | 5.39 | 6.93 | 76.88 | 8.26 | 9.62 |
| Reliance | 93.83 | 96.67 | 0.98 | 5.90 | 5.82 | 5.67 | 88.99 | 4.85 | 18.40 |
| Red Nectarine | 147.56 | 153.67 | 0.96 | 5.87 | 6.20 | 4.97 | 139.53 | 8.03 | 17.69 |
| Arkansas | 139.06 | 148.33 | 0.94 | 6.06 | 6.02 | 2.73 | 131.88 | 7.18 | 18.54 |
| Asariya | 69.53 | 72.00 | 0.96 | 5.66 | 4.43 | 5.70 | 61.91 | 7.62 | 8.21 |
| Paradelux | 160.63 | 171.67 | 0.94 | 7.31 | 6.60 | 6.00 | 148.16 | 12.47 | 12.11 |
| SEM± | 6.58 | 7.15 | 0.03 | 0.17 | 0.17 | 1.47 | 6.35 | 0.96 | 2.31 |
| CD at 5% | 19.55 | 21.25 | NS | 0.52 | 0.50 | 4.36 | 18.88 | 2.85 | 6.86 |

The highest specific gravity (1.00 g/cc) was recorded in Red June and Flordaking, while the lowest in Sharbati (0.87 g/cc). The variation in specific gravity may probably be due to corresponding changes in fruit weight and volume. The increase in intercellular spaces in the fruit flesh, with the advancement of maturity affects the specific gravity of the fruits. The highest fruit firmness was recorded in Flordasun (12.90 lb/inch$^2$), while lowest in Arkansas (2.73 lb/inch$^2$). A change in fruit firmness is primarily attributed to break down of insoluble protopectins to soluble pectin compounds, which ultimately affect the cell wall consistency and thus varied at different stages of fruit growth and ripeness. These findings are in agreement with the prior records of [13-15]. The preliminary study indicated that the variability in various fruits physical characteristics in different peach cultivars may be due to environmental factors and genetic makeup of the cultivars.

The data pertaining to the chemical characteristics of fruits showed considerable variations among the different peach cultivars (**Table 2**). From perusal of the data presented in Table 2, the highest T.S.S. was recorded in the Flordasun (12.17 °B), while lowest in Red Nectarine (8.77 °B). The appreciable differences with respect to T.S.S. among different peach cultivars may be explained on the basis of genetic differences with respect to various cultivars, which subsequently affect the synthesis of photosynthates and their further breakdown in to simple metabolites. The results of the present study are in agreement with the findings of [14, 16]. The highest acidity was recorded in Asariya (1.21%), while lowest in Sharbati (0.49%). The differences in the acidity level of fruits are attributed to the presence

of varying amount of organic acids in them. The overall range of titrable acidity found in our findings was closely related to the results reported by [17-19].

In the present study, results revealed significant differences among the cultivars for their ascorbic acid content. The highest ascorbic acid content was recorded in Red June (12.92 mg/100 g), while lowest in Paradelux (5.42 mg/100 g). These results are agreement with that of reported by [17, 20]. The synthesis of ascorbic acid in the fruits depends on adequate supply of hexose sugar, which decline at ripening stage might be due to decrease in acidity, which could be attributed to oxidation of ascorbic acid [21].

**Table 2** Variability in chemical characteristics of fruits in different peach cultivars

| Cultivars | TSS (°B) | Acidity (%) | Ascorbic acid (mg/100 g) | Total sugar (%) | Reducing sugar (%) | Non-Reducing sugar (%) | Total anti-oxidant activity (mMTE/L) | Carotene content (µg/100 g) |
|---|---|---|---|---|---|---|---|---|
| Red June | 9.70 | 0.78 | 12.92 | 3.86 | 2.46 | 1.32 | 34.63 | 129.60 |
| Flordaking | 12.07 | 0.84 | 6.67 | 3.81 | 2.46 | 1.28 | 34.05 | 101.82 |
| Flordasun | 12.17 | 0.86 | 10.00 | 4.16 | 3.03 | 1.08 | 24.47 | 110.05 |
| Fla-16-33 | 9.40 | 0.75 | 7.08 | 3.13 | 2.15 | 0.93 | 24.23 | 111.08 |
| Sharbati | 10.40 | 0.49 | 6.67 | 3.90 | 2.53 | 1.30 | 31.25 | 318.85 |
| Golden Monarch | 10.73 | 0.85 | 7.08 | 3.65 | 2.34 | 1.25 | 33.67 | 584.98 |
| Reliance | 9.90 | 0.77 | 6.67 | 3.91 | 2.51 | 1.32 | 34.11 | 457.18 |
| Red Nectarine | 8.77 | 0.64 | 6.25 | 3.11 | 2.12 | 0.94 | 27.96 | 170.74 |
| Arkansas | 9.97 | 0.50 | 7.08 | 3.43 | 2.58 | 0.81 | 31.96 | 316.02 |
| Asariya | 10.93 | 1.21 | 6.25 | 3.29 | 2.29 | 0.94 | 32.55 | 415.27 |
| Paradelux | 9.60 | 0.64 | 5.42 | 2.65 | 1.85 | 0.76 | 20.87 | 156.59 |
| SEM± | 0.38 | 0.09 | 1.22 | 0.10 | 0.15 | NS | 0.87 | 3.18 |
| CD at 5% | 1.12 | 0.27 | 3.63 | 0.30 | 0.45 | 0.16 | 2.58 | 9.46 |

Total sugars (4.16%) and reducing sugars (3.03%) were recorded highest in Flordasun, while lowest total sugars (2.65%) and reducing sugars (1.85%) were recorded in Paradelux. The highest non-reducing sugar (1.32%) was recorded in Red June and Reliance, while lowest in Paradelux (0.76%). Sugar is a vital constituent of fruits which directly related with sweetness and is fundamental feature of fruit quality (aroma, flavour and texture). The extent of variation in sugars in different peach cultivars may be due to different agro-climatic conditions influencing synthesis of biochemical constituents in the developing fruits and the duration of fruit development period [22]. The results of the current study were in agreement with the previous study of [23-25].

The highest carotene content was recorded in Golden Monarch (584.98 µg/100 g), while lowest in Flordaking (101.82 µg/100 g). The results obtained in the present investigation are in close conformity with the studies of [26]. Total anti-oxidant activity was recorded highest in Red June (34.63 mMTE/L), while lowest in Paradelux (20.87 mMTE/L). The results obtained in the present investigation are found to be in close conformity with the studies of [26, 27]. In the present study, antioxidant activity was due to presence of high ascorbic acid and carotene contents in fruits of the peach cultivars. Genotypic variation for antioxidant activity also exists, depending upon ascorbic acid and carotene contents in fruits. The antioxidants are mainly scavengers that reduce the various free radicals and serving in the avoidance of cellular injury and other disease. Likewise, fruit antioxidants have ability to produce resistance in tissues against disease and stress conditions. However, plant genotypes may differ in their antioxidant capacity [28]. The most of the physico-chemical characteristics were found superior in Red June and Flordasun as compared to other peach cultivars.

## Conclusion

From the present study, it can be inferred that the physico-chemical performance of Red June and Flordasun are better under changing climatic conditions of this region, hence would be popularized in the future. However, further evaluation with some more strains in multi-location trials is to be done for validation of the results. Moreover, these strains could also be used for further breeding/improvement programme for achieving better yield and quality and to harness plant potential in fullest under the changing climatic conditions in the Himalayan region.

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